Old Age Risks, Consumption, and Insurance
Online Appendix

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Online Appendix A: The HRS and CAMS data

Our data comes from the Health and Retirement Study (HRS) and its Consumption and Activities Mail Survey (CAMS). The HRS is a longitudinal survey that is representative of U.S. household heads over the age of 50 and their spouses. The CAMS questionnaire is completed by a subset of HRS households every other year since 2001. The same households received the questionnaire in all subsequent waves.

We merge information from CAMS and HRS when they refer to the same household and to the same calendar year. This amounts to merging each CAMS wave to the subsequent HRS wave, because in the HRS income refers to the previous calendar year. In the CAMS, interviews are always conducted in September or October. In the HRS, households are interviewed between March of the regular interview year and March of the next year. This means that a fraction of households are interviewed in the year following the regular interview year. We drop these households with a late interview, because their income cannot be matched to the consumption year in CAMS. Note that, in most years, only about half percent of interviews were conducted in the following year among households interviewed in both CAMS and HRS—wave 10 is an exception, with a higher fraction of late interviews. After the death of a spouse, we consider the remaining single person as a new, different household. Our merged sample is biennial and covers the years 2001 to 2013.

Table A1 presents our sample selection. Combining information from the core interviews (that is the HRS) and from CAMS that refer to the same household and

Sample Selection	**Selected out**	**Selected in**
Answering to CAMS & HRS		24,981
Interview in subsequent year	1,014	23,967
Head's age less than 50 or more than 90	695	23,272
Missing demographic variables	100	23,172
Income, consumption, wealth or medical expense outliers	1,596	21,576
Missing health	228	21,348
Head's age less than 65	8,321	13,255
Medicaid recipient	1,266	11,826
First differencing data		8,124
Future health and income changes not observed	3,942	4,999

Table A1: Sample Selection, after merging to HRS main data.

calendar year, we obtain a sample of 24,981 household-year observations. We then remove households whose head is above age 90 or below 50, and observations with missing demographic or health information. After this screening, we are left with 23,172 household-year observations. Of these, about 30% of observations have at least one missing item in consumption. For these, we impute consumption items as described later in this online Appendix. After imputing consumption items, we remove outliers. To do so, we first, we drop observations with non-durable consumption or household income less than 50$ (in 2015 prices) and then drop the top and bottom 1% of the change in log consumption, income, medical expenses, and of the level of wealth. After this cleaning, there were 30 observations with log income growth larger than 6, and we drop those too. We are left with 21,576 observations, 228 of which do not report health information and we thus drop them. Finally, we select households whose head is 65 or above and who are not Medicaid recipients. Our final sample contains 11,826 observations. After taking first differences and dropping those observations whose future health or income change is not observed, we are left with 4,999 observations that are used in the estimation of the pass-through coefficients.

Since the questions about consumption items change a little in the first year of the CAMS, Table A2 lists which consumption items are observed in which year of the CAMS.

Year	2001	2003	2005-2013	Consumption	Med exp.
Utilities	Yes	Yes	Yes	Included	
Housekeeping Supplies	Combined	Yes	Yes	Combined	
Yard Supplies		Yes	Yes		
Housekeeping Services	n.a.	Yes	Yes	Included	
Gardening/Yard Services	n.a.	Yes	Yes	Included	
Clothing	Yes	Yes	Yes	Included	
Personal care	n.a.	Yes	Yes	Included	
Vacations - tickets	Yes	Yes	Yes	Included	
Hobbies	Combined	Yes	Yes	Combined	
Sports Equipment		Yes	Yes		
Contributions - gifts	Yes	Yes	Yes	Included	
Food/Drink Grocery	Yes	Yes	Yes	Included	
Dining Out	Yes	Yes	Yes	Included	
Health Insurance	Yes	Yes	Yes		Not included
Drugs	Yes	Yes	Yes		Included
Health Services	Yes	Yes	Yes		Included
Medical Supplies	Yes	Yes	Yes		Included
Auto Insurance	Yes	Yes	Yes	Included	
Vehicle Services	Yes	Yes	Yes	Included	
Gasoline	Yes	Yes	Yes	Included	

Table A2: Nondurable categories of consumption and medical expenses in CAMS. Not available (n.a.) items are imputed.

Table A3 shows that almost 70% of the consumption questionnaires were fully completed, 14% have 1 missing item, 5% have 2 missing items, and 9% have 4 or more missing items. Considering the missing patterns over time for the same household, 80-85% of missing values are missing for just one year, while 90-95% are missing for just one or two years for the same household. Hence, it is very unusual that the same household has many missing values over the years on the same item.

Number of missing items	**year** 2001	**2003**	**2005**	**2007**	**2009**	**2011**	**2013**	**Total**
0	66.9	68.3	67.6	70.8	70.9	70.8	71.2	69.5
1	14.6	14.9	14.8	12.9	15.5	14.2	12.1	14.1
2	5.4	5.1	4.6	4.5	4.4	4.6	4.1	4.7
3	2.6	2.7	3.1	2.3	2.7	2.6	2.0	2.6
4+	10.5	9.0	9.9	9.4	6.5	7.8	10.6	9.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table A3: Percentage of households by number of missing items by year.

Imputation procedure

We impute each consumption item using fixed-effect regressions. To compute these fixed-effect regressions, we pool all years to estimate, for each item m, $Item^m = z\beta^m + f^m + \epsilon^m$, and compute $\widehat{Item}^m_{it} = z_{it}\hat{\beta}^m + \hat{f}^m_i$, for each household i and year t. We then use the estimated fixed effect to compute the prediction for the same household in a different time period s: $\widehat{Item}^m_{is} = z_{is}\hat{\beta}^m + \hat{f}^m_i$. If a household appears with a non-missing item only once, and no $\hat{f}^m_i$ can be estimated, we impute the missing items with a similar, year by year, OLS regression.

The explanatory variables used in the regressions are: dummies for age of the head, dummies for age of the spouse (if present), self-reported health status, self-reported health status interacted with education of the head, region of residence, region of residence interacted with education of the head, marital status (married, partnered, never married, separated, divorced), marital status interacted with education of the head, total household income (real), social security of the spouse (real), pension of the spouse (real), total household wealth (real), total household income interacted education of the head, total wealth interacted with education of the head and with year, price index for non-durable expenses, price index for the commodity to which the regression refers.

We impute each item separately and construct non-durable expenses as the sum of the relevant items with imputed values replacing missing values. The model predicts a small number of negative expenses amounts, that we set to zero.

Online Appendix B: Our variables and some facts about them

Definitions

Consumption		
Necessities	Food	Food at home, food away from home
	Utilities	Electricity, water, heat, phone and internet
	Car-related	Car insurance, car repairs, gasoline
Luxuries	Leisure	Trips and vacations, tickets, sport equipment, hobbies equipment, contributions to charities, gifts
	Equipment	House supplies, house services, yard/garden supplies, yard/garden services, clothing, personal care equipment and services
Medical exp.		
	Drugs	Drugs
	Medical serv. and sup.	Medical services Medical supplies

Table B1: Consumption and medical expenses categories.

Non-durable consumption includes 21 items: electricity, water, heating, phone and house supplies, house and garden supplies and services, food, dining out, clothing, vacations, tickets, hobbies, sport equipment, contributions and gifts, personal care, auto insurance, vehicle services, and gasoline. Because the data on personal care, housekeeping services, and gardening services were not collected in 2001, we impute them for that year. The top panel of Table B1 lists these 21 items that we include in non-durable consumption and shows how we construct non-durable consumption subcategories by aggregating the original 21 categories. We deflate expenses on each item by its item-specific price index from the Bureau of Labor Statistics (BLS).

Food is the sum of expenses on food and beverages, including alcoholic, and dining and/or drinking out, and includes take out food.

Leisure activities is the sum of expenses on trips and vacations; tickets to movies, sporting events, and performing arts; sports, including gym, exercise equipment such as bicycles, skis, boats, etc.; hobbies and leisure equipment, such as photography, stamps, reading materials, camping, etc.

Equipment is the sum of expenses on housekeeping supplies, cleaning and laundry products; housekeeping, dry cleaning and laundry services, hiring costs for housekeeping or home cleaning, and amount spent at dry cleaners and laundries; gardening and yard supplies and services; clothing and apparel, including footwear, outerwear, and products such as watches or jewelry; personal care products and services.

Utilities is the sum of expenses on electricity; water; heating fuel for the home; telephone, cable, internet.

Car, gasoline and other is the sum of expenses on vehicle insurance; vehicle maintenance; gasoline; contributions to religious, educational, charitable, or political organizations; cash or gifts to family and friends outside the household.

Medical expenses includes two items: drugs, and medical services and supplies. We construct this variable from the raw CAMS data set. The bottom panel of Table B1 lists these items that we include in out-of-pocket medical expenses and show that we aggregate the last two into a single subcategory. Expenses on each item are deflated by the item-specific index provided by the BLS.

Drugs is expenses on prescription and nonprescription medications: out-of-pocket cost, not including what is covered by insurance.

Medical services and supplies is the sum of expenses on health care services (out-of-pocket cost of hospital care, doctor services, lab tests, eye, dental, and nursing home care) and medical supplies (out-of-pocket cost, not including what is covered by insurance).

Household Income. Income is observed in the core part of the HRS. Our baseline measure of income includes earnings, that is wages, salaries, and bonuses; capital income, which includes business or farm income, self-employment, rents, dividend and interest income, and other asset income; pensions, that is income from employer pension or annuity; benefits, including social security retirement income, income from transfer programs and workers' compensations; and other income, which includes alimony, other income, lump sums from insurance, pension, and inheritance, referring to both the head and the spouse if present. All income variables refer to calendar year prior to the HRS main interview. Income is deflated using the price index for total consumption provided by BLS.

Income Tax is taken from the RAND files, which use the NBER TAXSIM to impute the income tax.

Wealth. Net worth comes from the RAND files and refers to the time of the interview. It includes all assets—primary residence, secondary residence, real estate other than primary and secondary residence, vehicles, businesses, Individual Retirement Account (IRA) and Keogh accounts, stocks, mutual funds, and investment trusts, checking, savings, or money market accounts, Certificate of Deposit (CD), government savings bonds, and T-bills, bonds and bond funds, and all other savings—minus all debts—all mortgages/land contracts on primary and secondary residence, other home loans, other debt—of the head and spouse (if present) of the household. Assets are deflated using the price index for total consumption provided by BLS. For couples, wealth is divided by the square root of 2 to take into account family size.

Demographic and health variables come from the RAND files and refer to the time of the interview.

Health index

To construct our health index, we first attribute a numerical value from five to one to the possible answers on health status, going from excellent to poor health. Then, as Blundell, Britton, Costa Dias, French (2016), we instrument self-reported health with objective measures. More specifically, our health index is the predicted value from a regression of self-reported health status on age dummies, year dummies, education dummies, initial health, health as a child, labor market status, objective health measures such as difficulties in activities of daily living (ADL) or Instrumental Activities of Daily Living (IADL), and illnesses diagnosed by a doctor (the complete list is in Table B2). We impute ADLs and IADLs when their values are missing for just one period by taking the average of the two adjacent values for the same individual. The regressions are run separately for single and married men and women. To obtain a household health index for couples, we average the two instrumented self-reported health indices computed for husbands and wives separately.

Health variables	
Difficulties in ADLs	
	walking across room
	getting dressed
	bathing or showering
	eating
	getting in-out of bed
	using the toilet
Difficulties in IADLs	
	walking several blocks
	walking one block
	sitting for two hours
	getting up from a chair
	climbing several flt of stairs
	climbing one flight of stairs
	stooping, kneeling, crouching
	lifting or carrying 10 lbs
	picking up a dime
	extending arms
	pushing or pulling large objects
Doctor reported	
	cancer
	diabetes
	high blood pressure
	arthritis
	psychiatric problems
	lung disease
	heart problems
	stroke

Table B2: Objective health variables used in the analysis. All variables are 0/1 (No/Yes).

Composition of consumption and medical expenses

	All	Low wealth	High wealth
All nondurables, mean	24279	14944	26857
Food, mean	6478	4770	6949
Food, share	28.7%	32.8%	27.6%
Utilities, mean	5498	4187	5864
Utilities, share	24.7%	28.3%	23.7%
Car maintenance, mean	3466	2507	3718
Car maintenance, share	16.1%	17.5%	15.7%
Leisure activities, mean	6196	1846	7400
Leisure activities, share	20.1%	11.5%	22.5%
Equipment, mean	2678	1725	2948
Equipment, share	11.1%	11.8%	10.8%
All medical expenses, mean	3024	2515	3131
Drugs, mean	1397	1333	1419
Drugs, share	53.8%	59.2%	52.2%
Services and supplies, mean	1633	1188	1717
Services and supplies, share	49.5%	45.9%	50.4%
Medical insurance expenses, mean	2646	1698	2914

Table B3: Consumption and medical expenses composition, means in 2015 dollars and shares in percentages.

Table B3 presents the level and composition of various expenses subcategories. The average level of yearly expenses in nondurable consumption is 24,279 (expressed in 2015 dollars). We break it down into five subcategories, each of which represents at least ten percent of nondurable household expenses. The two largest subcategories make up for a little more than one quarter of nondurable expenses each. They are food and leisure activities.

Among lower-wealth households, expenses in food, utilities, and car maintenance are higher than in the whole sample, which confirms that they are necessities. Among higher-wealth households, expenses in luxuries represent a larger share of the budget than in the whole sample (and that of expenses in equipment is no lower than that in the whole sample), which confirms that they are luxuries.

The middle part of the table reports medical expenses. Their average level is 3,024 dollars per year, and is evenly split between drugs and medical services and supplies.

Finally, the bottom part reports the expenses on medical insurance. Higher-wealth households spend almost twice as much as higher-wealth households on private medical insurance.

Composition of income and its evolution

We now turn to studying how income components vary by age and wealth. To do so, we categorize as lower-wealth the households whose equivalized wealth is below 75,000 in 2015$. This corresponds to lowest 20 percentiles of the wealth distribution. We categorize as higher-wealth the remaining households. Figure B.1 shows the evolution of various income components by age and for our two wealth groups. It highlights that, while benefits (which include social security and other government transfers programs) are the most important income component for households over age 65, earnings and pensions are also substantial, and especially so for higher-wealth households.

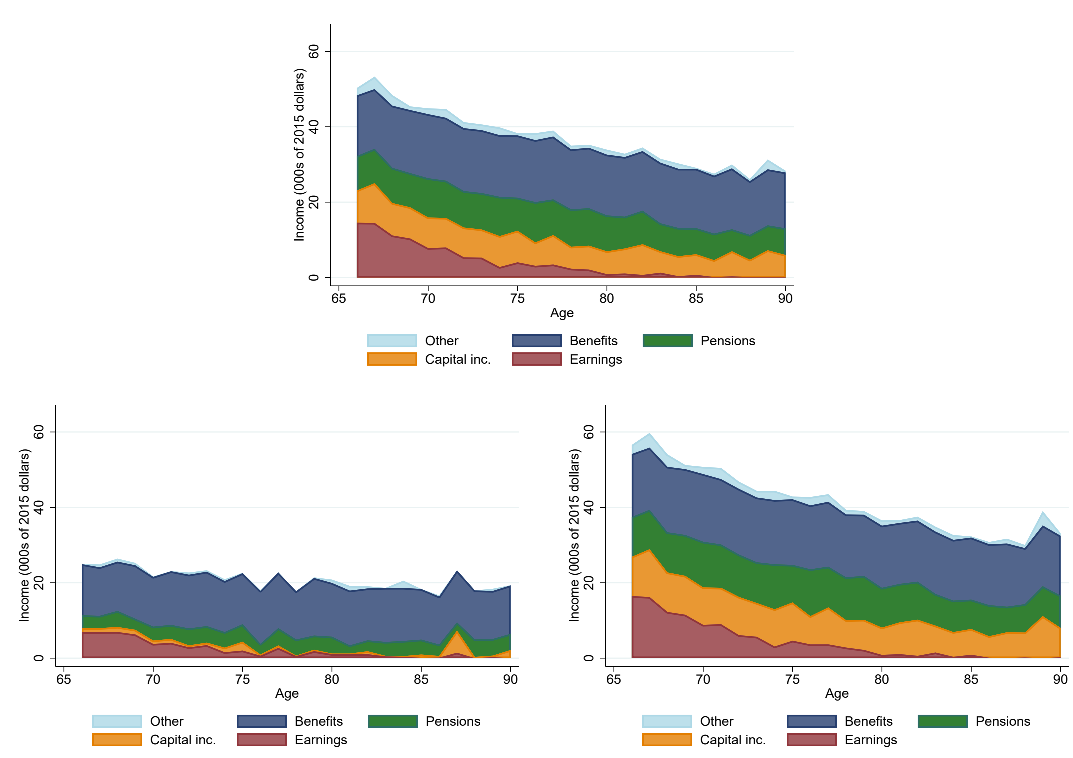

Figure B.1: Equivalized income components by age, in thousands of 2015 dollars. Top panel: whole sample. Bottom left panel: lower-wealth households (< 75k equivalized wealth); bottom right panel: higher-wealth households (≥ 75k equivalized wealth).

Evolution of our main variables with age and wealth

We start with some data descriptives to put our results in context. In this section, for easier interpretation, all variables are equivalized but not detrended.

Figure B.2 displays the mean and 25th, 50th and 75th percentiles of equivalized consumption, by age (left graph) and wealth decile (right graph). It shows that consumption decreases with age and increases with wealth. For instance, median consumption declines from 18,000 to 11,000 dollars from age 66 to age 90, but increases from 8,000 to 27,000 dollars from the bottom to the top net worth decile.

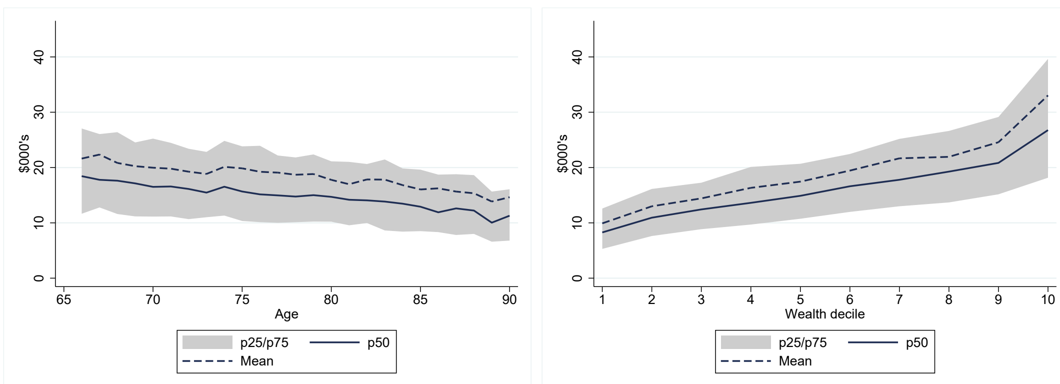

Figure B.2: Equivalized consumption by age (left graph) and wealth (right graph). In 2015 dollars.

Figure B.3 displays the mean and 25th, 50th and 75th percentiles of equivalized medical expenses, by age (left graph) and wealth decile (right graph). The left graph highlights that equivalized out-of-pocket medical expenses are quite a flat function of age. For instance, their median ranges from 1,200 to 1,500 dollars from age 66 to age 90. This reflects two countervailing effects. On one hand, health deteriorates and medical expenses increase with age. On the other hand, healthier households have lower medical expenses and live longer, hence there are more of them at older ages. The right graph documents that out-of-pocket medical expenses sharply increase with wealth. For instance their median ranges from 600 to 1,700 dollars from the bottom to the top net worth decile. It also shows that average out-of-pocket medical expenses are close to (and sometimes higher than) the 75th percentile, indicating that a few households have large out-of-pocket medical expenses.

Figure B.4 reports our health index by age (left graph) and wealth (right graph). To better understand its magnitude, it is worth noting, for instance, that values of 3

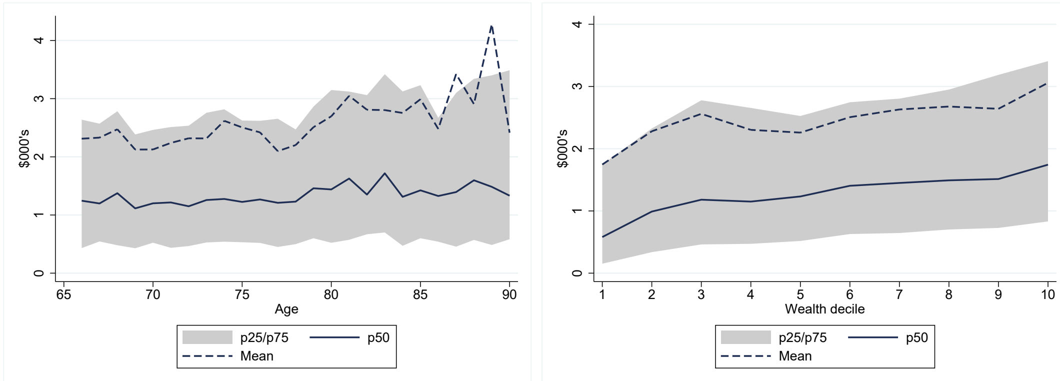

Figure B.3: Equivalized out-of-pocket medical expenses by age (left graph) and wealth (right graph). In 2015 dollars.

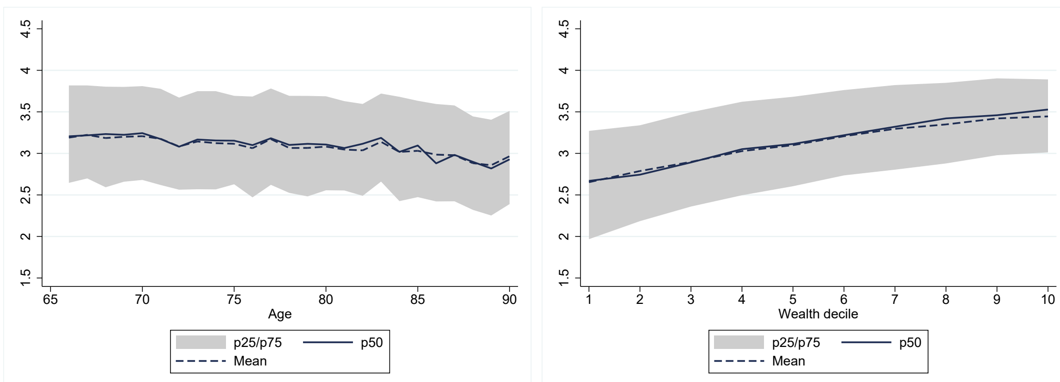

Figure B.4: Health index by age (left graph) and wealth (right graph).

and 4 correspond to a self-reported value of being in "good" and "very good" health, respectively.

The left graph of Figure B.4 reveals several interesting patterns. First, although there is wide dispersion in health at each age, its distribution is symmetrical, hence its mean and median almost coincide. Second, health only decreases modestly by age. For instance, median health goes from 3.2 at age 66 to 2.9 at age 90. This, again, is partly related to the fact that healthier households live longer, but can also reflect that a large share of the changes in health are transitory, rather than permanent. Hence, they do not contribute to generating a sustained decrease in health over the life-cycle.

The right graph of Figure B.4 shows that there is more variation in health with wealth than with age. For instance, median health rises from 2.6 to 3.5 from the bottom to the top wealth decile. This variability and the possibility that poorer households might be less able to self-insure against shocks, highlights the importance of examining whether richer and poorer households respond to shocks differently. This figure also helps us put in context the changes in our health index. That is, a one unit change in health is equivalent to moving from the average health of the bottom wealth decile to that of the top wealth decile.

Figure B.5 displays the mean and the 25th, 50th and 75th percentiles of equivalized net income, by age (left graph) and wealth decile (right graph). Similar to the pattern displayed by consumption, income decreases as household age: its median goes from 35,000 to 19,000 dollars from age 66 to age 90. In contrast, net income sharply increases with wealth: it rises from 15,000 to 52,000 dollars from the bottom to the top wealth decile.

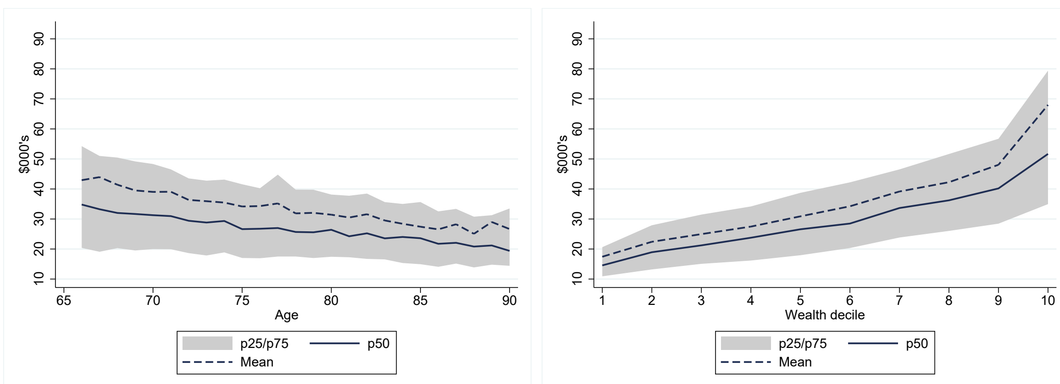

Figure B.5: Equivalized net income by age (left graph) and wealth (right graph). In 2015 dollars.

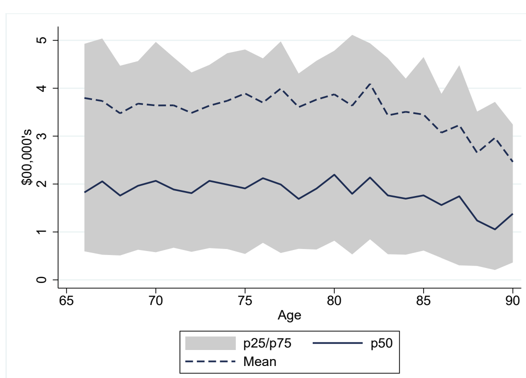

Figure B.6: Equivalized wealth by age. In 2015 dollars.

Figure B.6 reports the 25th, 50th and 75th percentiles for equivalized wealth by age and shows that they are rather flat until households are in their mid eighties.

Online Appendix C: Detrending and additional moments

For most of our analysis, and with the exception of the descriptives in Section B, we use "detrended" values for health, income, medical expenses, and consumption, and their subcategories whenever appropriate. That is, as standard in the consumption insurance literature, we remove the effects of observed characteristics. We do so, by running ordinary least square (OLS) regressions of each of the these variables on year dummies, year of birth, education, race, employment status, whether there are income recipients other than the head and the spouse in the household, region, marital status, and number of household residents. We also add interactions terms (education and year, race and year, education and employment status) and we interact all variables with a binary variable picking up the age group (less than 65 and above 65). We run the regressions separately for couples, single men, and single women, allowing the effect of the observed characteristics to vary across these categories.

Additional autocovariances

	$\Delta ln(y_{t+1})$	$\Delta ln(y_{t+2})$	$\Delta ln(y_{t+3})$
$cov(\Delta h_t, .)$	-.002	-.002	-.002
	(.002)	(.002)	(.003)
Obs.	4999	3079	1910
	Δh_{t+1}	Δh_{t+2}	Δh_{t+3}
$cov(\Delta ln(y_t), .)$	-.002	.003	.003
	(.002)	(.002)	(.003)
Obs.	4999	3045	1882

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table C1: Covariance of current health and income growth with future income and health growth.

The top panel of Table C1 shows that the cross-autocovariances between health growth and subsequent income growth are relatively small and not statistically significant. The bottom panel shows that the same is true of the autocovariances between income growth and subsequent health growth. This is consistent with our assumption that transitory income and health shocks are not correlated.

	$\Delta ln(y_t)$	$\Delta ln(y_{t+1})$	$\Delta ln(y_{t+2})$	$\Delta ln(y_{t+3})$
$cov(\Delta ln(m_t), .)$	.007	-.011	-.006	.004
	(.009)	(.009)	(.011)	(.014)
Obs.	4999	4999	3079	1910
	Δh_t	Δh_{t+1}	Δh_{t+2}	Δh_{t+3}
$cov(\Delta ln(m_t), .)$	-.012***	.01**	-.01*	.003
	(.005)	(.005)	(.006)	(.007)
Obs.	4999	4999	3045	1882

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table C2: Covariance of current medical expenses growth with current and future income and health growth.

The top panel of Table C2 reveals no significant covariance between medical expenses growth and contemporaneous and future income growth. In the case in which transitory income shocks affect medical expenses, the first two of these covariances should be significant and large. The first one (0.07) is also small compared with both the contemporaneous covariance between consumption growth and income growth and the contemporaneous covariance between medical expenses growth and health growth. The second one, while not significant, is not small. For this reason, online Appendix D relaxes the assumption that income shocks do not affect medical expenses and shows this increases the importance of the marginal utility channel.

The bottom panel shows that the covariance between medical expenses growth and contemporaneous health growth is significant and negative. Under a transitory-permanent specification of health, it corresponds to $cov(\Delta ln(m_t), \eta_t^h + \varepsilon_t^h - \varepsilon_{t-1}^h)$. Thus, a negative value is in line with a decrease in health raising medical expenses. The covariance between medical expenses growth and next period's health growth, instead, is significant and positive. Under a transitory-permanent specification of health, it corresponds to $cov(\Delta ln(m_t), \eta_{t+1}^h + \varepsilon_{t+1}^h - \varepsilon_t^h)$. The fact that this moment is positive indicates that a negative transitory health shock $-\varepsilon_t^h$ raises contemporaneous medical expenses, and their effect dominates that of the future (possibly anticipated) shocks $\eta_{t+1} + \varepsilon_{t+1}$ (and conversely that a positive transitory health shock reduces them). The covariance between medical expenses growth and income growth two periods ahead turns negative and significant at the 10% level. Under a transitory-permanent specification of health, it corresponds to $cov(\Delta ln(c_t), \eta_{t+2}^h + \varepsilon_{t+2}^h - \varepsilon_{t+1}^h)$ This is suggestive of an anticipation of future permanent health changes two periods ahead, as also revealed by the cross-covariances of consumption growth and health growth. Online Appendix J shows that this would at most reduce our estimate of the effect of health shocks on consumption growth.

Standard deviations of the different components of income

Table C3 reports the standard deviation of the change of various income components (upper panel) and of total income excluding some income components (bottom panel). In both cases, the income components are detrended from the effect of demographic characteristics (we consider changes in the unexplained part of these income components) and their changes are pooled over all observations with non-zero values. The upper panel of the table shows that benefits display, unsurprisingly, very little variation, and that the vast majority of households in our sample receive them (8,677 out of a total of 8,941). Pensions have more variation than benefits and less than half of our households receive them. Capital income displays the largest variation and is received by over half of our households. The standard deviations of most income sources differ little among lower-wealth and higher-wealth households, except for the "other income" component. This indicates that this "other income" component, which captures lump sums and includes inheritances can be a substantial source of risk for some higher-wealth households. The bottom panel of the table shows that removing various income components one at a time, tends to raise the variation in gross income, with the exception of "other income". This means that the various income components might offset each others' fluctuations. For the rows referring to gross income and gross income net of some income components, we do not report the number of observations, because they are the same as those for total net (and gross) income.

Skewness and kurtosis of the shocks

We estimate the third and fourth moments of the distribution of our transitory shocks following Commault (2022) (online Appendix B, footnote 3).

	Total	Lower wealth	Higher wealth
Benefits	0.42	0.44	0.41
	(8,677)	*(2,308)*	*(6,369)*
Pensions	0.78	0.69	0.80
	(4,170)	*(734)*	*(3,436)*
Capital income	2.28	2.51	2.25
	(5,131)	*(492)*	*(4,639)*
Earnings	1.10	1.03	1.11
	(1,673)	*(362)*	*(1,311)*
Other	1.19	0.46	1.26
	(103)	*(14)*	*(89)*
Total gross income	0.52	0.46	0.54
Gross income excluding Benefits	0.56	0.54	0.57
Gross income excluding Pensions	1.39	1.47	1.36
Gross income excluding Capital	0.51	0.45	0.53
Gross income excluding Earnings	0.66	0.57	0.69
Gross income excluding Other	0.50	0.46	0.52
Net income including capital	0.47	0.43	0.49
	(8,941)	*(2,382)*	*(6,559)*

Table C3: Standard deviation of the change of unexplained (log) income components. Upper panel: income components. Lower panel: gross income minus various income components. Number of observations with non-zero income in parentheses.

	All	Lower wealth	Higher wealth
$E[(\varepsilon_t^y)^2](= var(\varepsilon_t^y))$	.087***	.066***	.093***
	(.005)	(.009)	(.005)
$E[(\varepsilon_t^y)^3]$	.006	.004	.006
	(.004)	(.008)	(.005)
$E[(\varepsilon_t^y)^4]$	.096***	.059***	.103***
	(.008)	(.014)	(.009)
Obs.	4999	970	4029

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table C4: Moments of the transitory income shocks distribution.

The first line of Table C4 reports the variance of the distribution of our transitory income shocks, which is the moment that we present and discuss in the main body of our paper. The second line shows that the third moment of the distribution of transitory income shocks is not significant, hence their distribution is not significantly skewed. The third line shows that the fourth moment is, instead, significant. It is also larger than what would be implied by a normal distribution: under a normal distribution, the fourth moment is $3 * E[(\varepsilon_t^y)^2]^2$, which given our estimate of $E[(\varepsilon_t^y)^2]$ is .023. An estimate of .096 is therefore more than four times what a normal distribution would imply (given our variance estimate).

	All	Lower wealth	Higher wealth
$E[(\varepsilon_t^h)^2](var(\varepsilon_t^h))$	.02***	.033***	.017***
	(.001)	(.004)	(.001)
$E[(\varepsilon_t^h)^3]$	0	.002	0
	(.001)	(.003)	(.001)
$E[(\varepsilon_t^h)^4]$	.007***	.015***	.005***
	(.001)	(.003)	(.001)
Obs.	4999	970	4029

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table C5: Moments of the transitory health shocks distribution.

The first line of Table C5 reports the variance of the distribution of our transitory income shocks, which is the moment that we present and discuss in the main body of our paper. The second line shows that the third moment of the distribution of the transitory health shocks is not significant, hence their distribution is not significantly skewed. The third line shows that the fourth moment is significant. It is also larger than what would be implied by a normal distribution: under a normal distribution, the fourth moment is $3 * E[(\varepsilon_t^h)^2]^2$, which given the estimate of $E[(\varepsilon_t^h)^2]$ would be .0012. The estimate of .008 is therefore more than five times what a normal distribution would imply.

Online Appendix D: Non-zero effect of transitory income shock on medical expenses

In our data, the pass-through of transitory income shocks to medical expenses is not statistically significant. That is why our baseline identification strategy assumes it is zero. We now relax this assumption and let $\frac{dm_t}{d\varepsilon_t^h}$ be strictly non-zero. As before, the expressions of the consumption pass-through are the same as (**??**) and (**??**) in the paper, but we can no longer simplify them as (??) and (??) in the paper:

$$\frac{dln(c_t)}{d\varepsilon_t^y} = \underbrace{f_m^{c,t}\frac{dm_t}{d\varepsilon_t^y}}_{\text{Marginal utility}} + \underbrace{f_R^{c,t}\left\{p_t y_t - p_t^m \frac{dm_t}{d\varepsilon_t^y}\right\}}_{\text{Resources}} \tag{D.1}$$

$$\frac{dln(c_t)}{d\varepsilon_t^h} = \underbrace{f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h} + f_h^{c,t}}_{\text{Marginal utility}} - \underbrace{f_R^{c,t} p_t^m \frac{dln(m_t)}{d\varepsilon_t^h} m_t}_{\text{Resources}}. \tag{D.2}$$

Recall that $f_h^{c,t}$ denotes the effect on consumption of the shift in marginal utility caused by a transitory health shock (holding medical expenses constant), and $f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h}$ the effect on consumption of the shift in marginal utility caused by the response of medical expenses to the transitory health shock (holding health constant): if breaking one's leg decreases the utility of going out (captured by $f_h^{c,t}$), medical expenses on crutches might restore some of that utility (captured by $f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h}$). We denote k their relative sizes, with k such that

$$f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h} = -k \times f_h^{c,t}, k \in [0, 1[.$$

When k is positive, the two components of the shift in marginal utility, $f_h^{c,t}$ and $f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h}$, take opposite signs (a decrease in health reduces marginal utility while a decrease in health raises medical expenses, which partly raises back marginal utility). When k is between 0 and 1, medical expenses can soften the decrease in marginal utility caused by an adverse health shock but not compensate it by more than the initial decrease. The equations become

$$\frac{dln(c_t)}{d\varepsilon_t^y} = \underbrace{-k f_h^{c,t}\left(\frac{dm_t}{d\varepsilon_t^h}\right)^{-1}\frac{dm_t}{d\varepsilon_t^y}}_{\text{Marginal utility}} + \underbrace{f_R^{c,t}\left\{p_t y_t - p_t^m \frac{dm_t}{d\varepsilon_t^y}\right\}}_{\text{Resources}} \tag{D.3}$$

$$\frac{dln(c_t)}{d\varepsilon_t^h} = \underbrace{(1-k) f_h^{c,t}}_{\text{Marginal utility}} - \underbrace{f_R^{c,t} p_t^m \frac{dln(m_t)}{d\varepsilon_t^h} m_t}_{\text{Resources}}. \tag{D.4}$$

Making assumptions on the value of k (which we can vary to test a large range of values), we are back to a situation with two unknowns, $f_h^{c,t}$ and $f_R^{c,t}$ and two identifying equations.

	Baseline	Relaxing the assumption that $\frac{dm_t}{d\varepsilon_t^y} = 0$					
		$k = 0$	$k = 0.15$	$k = 0.30$	$k = 0.45$	$k = 0.60$	$k = 0.75$
Resources	.003*	.003*	.003	.003	.002	.002	-.000
	(.002)	(.002)	(.002)	(.002)	(.002)	(.003)	(.004)
Marginal utility	.170*	.170*	.170*	.170*	.171*	.172*	.174*
	(.088)	(.088)	(.089)	(.089)	(.089)	(.089)	(.090)
Obs.	4999	4999	4999	4999	4999	4999	4999

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table D1: Decomposition.

Table D1 presents the estimates of the decomposition of the pass-through of transitory health shocks to consumption. The first column shows the results in our baseline case where we impose that transitory income shocks have no effect on medical expenses spending. The following columns show the results in the cases where we relax this assumption, for different values of k. The estimates are all very similar. A comparison of the first two columns indicates that our baseline assumption is virtually identical to the cases in which the ability to use medical expenses to compensate a loss in marginal utility caused by a decrease in health reduces the effect of the loss by 30% or less ($k \leq 0.30$). When the ability to use medical expenses to compensate a loss in marginal utility reduces the effect of the loss by more than 30% ($k > 0.30$), the shift in marginal utility explains a larger share of the pass-through of transitory health shocks to consumption than in the baseline case, and the effect of resources a smaller share. Above $k = 0.75$, the point estimates of the contribution of the shift marginal utility to the pass-through gets even slightly larger than the point estimate of the pass-through itself (the point estimate of the resources channel is slightly negative). Since our main finding is that the shift in marginal utility explains most of the effect of transitory health shocks on consumption, this result appears very robust to relaxing our assumption that transitory income shock have no effect on medical expenses.

Intuitively, when transitory income shocks are allowed to affect medical expenses, it reduces the magnitude of the resources multiplier $f_R^{c,t}$: part of the effect of transitory income on consumption $\frac{dln(c_t)}{d\varepsilon_t^y}$ is now explained by the marginal utility channel (an increase in transitory income raises medical expenses, which increases the marginal utility of consumption). As a result, the resources channel is estimated to be smaller, while the shift in marginal utility channel becomes larger. Since the contribution of the shift in marginal utility to the total value of the pass-through is already very high in the baseline, moving to a framework that makes it bigger barely affects our findings.

Online Appendix E: Correlated income and health shocks

In our data, transitory income and health shocks are essentially uncorrelated (the covariance is small and not statistically significant). But if transitory income and health shocks were highly correlated, the interpretation of the response to income and health shocks would become more difficult. To discuss this more general case, here, we assume that the transitory components of income and health are the results of underlying income-related and health-related events. These events are uncorrelated but the health-related events can affect both health and income, inducing some correlation between the two.

We denote ε^{yy} and ε^{hh} these underlying pure income and pure health events, which are themselves uncorrelated. We assume that

$$\begin{aligned} \varepsilon_t^y &= \varepsilon^{yy} + \alpha\varepsilon^{hh} \\ \varepsilon_t^h &= \varepsilon^{hh}. \end{aligned}$$

Note that we need to take a stand on what part of the covariance between the transitory shocks is explained by pure transitory health events affecting the transitory income component and what part is explained by pure transitory income events affecting the transitory health component. Here we assume that all of the covariance comes from pure health events affecting income. This is because the literature that we cite in Section 2 in the paper suggests that after age 65, conditional on earlier investments and behavior, health resembles an exogenous process that is not much influenced by additional out-of-pocket medical expenses that supplement what social insurance already provides. On the contrary, this literature suggests that health-related events have consequences in terms of earnings (see e.g. Britton and French 2020). However, we could re-estimate the process under different assumptions about the share of the covariance explained by pure health events affecting income versus pure income events affecting health.

We derive consumption with respect to the underlying pure income and health events ε^{yy} and ε^{hh}. In this case, equation (**??**) in the paper is unchanged, but equation (**??**) in the paper changes and now includes the effect of ε_t^h on y_t

$$\frac{dln(c_t)}{d\varepsilon^{yy}} = \underbrace{f_m^{c,t}\frac{dm_t}{d\varepsilon^{yy}}}_{\text{Marginal utility}} + \underbrace{f_R^{c,t}\left\{p_t\frac{dy_t}{d\varepsilon^{yy}} - p_t^m\frac{dm_t}{d\varepsilon^{yy}}\right\}}_{\text{Resources}} \tag{E.5}$$

$$\frac{dln(c_t)}{d\varepsilon^{hh}} = \underbrace{f_m^{c,t}\frac{dm_t}{d\varepsilon^{hh}} + f_h^{c,t}\frac{dh_t}{d\varepsilon^{hh}}}_{\text{Marginal utility}} + \underbrace{f_R^{c,t}\left\{p_t\frac{dy_t}{d\varepsilon^{hh}} - p_t^m\frac{dm_t}{d\varepsilon^{hh}}\right\}}_{\text{Resources}} \tag{E.6}$$

Noting that $\frac{dy_t}{d\varepsilon^{yy}} = \frac{dln(y_t)}{d\varepsilon^{yy}} \times y_t = 1 \times y_t$, that $\frac{dy_t}{d\varepsilon^{hh}} = \frac{dln(y_t)}{d\varepsilon^{hh}} \times y_t = \alpha \times y_t$, that $\frac{dh_t}{d\varepsilon_t^{hh}} = 1$, and that $\frac{dm_t}{d\varepsilon_t^h} = \frac{dln(m_t)}{d\varepsilon_t^h}m_t$, as well as using the result that $\frac{dm_t}{d\varepsilon_t^{yy}} \approx 0$, we can then simplify (E.5) and (E.6) as

$$\frac{dln(c_t)}{d\varepsilon^{yy}} = \underbrace{f_R^{c,t}p_t y_t}_{\text{Resources}} \tag{E.7}$$

$$\frac{dln(c_t)}{d\varepsilon^{hh}} = \underbrace{f_m^{c,t}\frac{dm_t}{d\varepsilon^{hh}} + f_h^{c,t}}_{\text{Marginal utility}} + \underbrace{f_R^{c,t}\left\{\alpha p_t y_t - p_t^m\frac{dln(m_t)}{d\varepsilon_t^h}m_t\right\}}_{\text{Resources}} \tag{E.8}$$

Around the same approximation point as in the uncorrelated case, we have:

$$\phi_c^{yy} \approx \frac{dln(c_t)}{d\varepsilon^{yy}}|_0 = \overbrace{f_R^{c,t}|0}^{\text{Multiplier}}\ p_t\ \underbrace{y|_0}_{E[y_t]} \tag{E.9}$$

$$\phi_c^{hh} \approx \frac{dln(c_t)}{d\varepsilon_t^{hh}}|_0 = \overbrace{f_m^{c,t}|_0\frac{dm_t}{d\varepsilon_t^{hh}}|_0 + f_h^{c,t}|_0}^{\text{Contribution of marginal utility}} + \overbrace{f_R^{c,t}|0}^{\text{Multiplier}}\left\{\alpha p_t\ \underbrace{y|_0}_{E[y_t]} - p_t^m\ \underbrace{\frac{dln(m_t)}{d\varepsilon_t^h}|_0}_{\approx\phi_m^{hh}}\ \underbrace{m_t|_0}_{\approx E[m_t]}\right\} \tag{E.10}$$

As before, we have two unknown terms to measure, $f_R^{c,t}|0$ and $f_m^{c,t}|_0\frac{dm_t}{d\varepsilon_t^{hh}}|_0 + f_h^{c,t}|_0$, and two expressions.

The identification of the variance of the underlying events ε^{yy} and ε^{hh} and of the effect α of health on income is

$$cov(\Delta ln(y_t), -\Delta ln(y_{t+1})) = var(\varepsilon_t^{yy}) + \alpha^2 var(\varepsilon_t^{hh}) \tag{E.11}$$
$$cov(\Delta h_t, -\Delta h_{t+1}) = var(\varepsilon_t^{hh}) \tag{E.12}$$
$$cov(\Delta h_t, -\Delta ln(y_{t+1})) = \alpha var(\varepsilon_t^{hh}) \tag{E.13}$$
$$cov(\Delta ln(y_{t+1}), -\Delta h_t) = \alpha var(\varepsilon_t^{hh}) \tag{E.14}$$

The identification of the pass-through of the underlying events on consumption is from

$$cov(\Delta ln(c_t), -\Delta ln(y_{t+1})) = cov(\Delta ln(c_t), \varepsilon_t^{yy} + \alpha\varepsilon_t^{hh}) = \phi_c^{yy} var(\varepsilon_t^{yy}) + \alpha\phi_c^{hh} var(\varepsilon_t^{hh}) \tag{E.15}$$
$$cov(\Delta ln(c_t), -\Delta ln(h_{t+1})) = cov(\Delta ln(c_t), \varepsilon_t^{hh}) = \phi_c^{hh} var(\varepsilon_t^{hh}) \tag{E.16}$$

Finally, the identification of the two unknown terms $f_R^{c,t}|_0$ and $f_m^{c,t}|_0 \frac{dm_t}{d\varepsilon_t^{hh}}|_0 + f_h^{c,t}|_0$ in the decomposition is

$$f_R^{c,t}|_0 = \frac{\phi_c^{yy}}{p_t E[y_t]} \tag{E.17}$$
$$f_m^{c,t}|_0 \frac{dm_t}{d\varepsilon_t^{hh}}|_0 + f_h^{c,t}|_0 = \phi_c^{hh} + \frac{\phi_c^{yy}}{p_t E[y_t]}\left(\alpha p_t E[y_t] - \phi_m^{hh} p_t^m E[m_t]\right) \tag{E.18}$$

	All	Lower wealth	Higher wealth
$var(\Delta ln(y_t))$	.213***	.165***	.225***
	(.007)	(.013)	(.008)
$var(\varepsilon_t^y)$	.087***	.066***	.093***
	(.005)	(.009)	(.005)
Obs.	4999	970	4029
$var(\eta_t^y)$	.029***	.017*	.031***
	(.006)	(.01)	(.006)
Obs.	3401	623	2778

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table E1: Variance of the transitory and permanent income shocks.

Tables (E1) and (E2) show that the estimates of the variance of the underlying transitory shocks are very close to those the of transitory components (differences only appear at the 4th digit). This is because the estimate of the effect of a transitory

	All	Lower wealth	Higher wealth
$var(\Delta h_t)$	.064***	.098***	.056***
	(.002)	(.006)	(.002)
$var(\varepsilon_t^h)$	.02***	.033***	.017***
	(.001)	(.004)	(.001)
α	.096	.097	.096
	(.063)	(.09)	(.081)
Obs.	4999	970	4029
$var(\eta_t^h)$	.02***	.026***	.018***
	(.002)	(.005)	(.002)
Obs.	3401	623	2778

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table E2: Variance of the transitory and permanent health shocks.

	Income shock			Health shock		
	Total	Lower w.	Higher w.	Total	Lower w.	Higher w.
Consumption ϕ_c^ε	.124***	.189*	.113***	.175**	.304***	.114
	(.036)	(.1)	(.038)	(.088)	(.13)	(.113)
Medical exp. ϕ_m^ε	.142	.289	.116	-.492**	-1.173***	-.177
	(.102)	(.27)	(.107)	(.232)	(.364)	(.286)
Obs.	4999	970	4029	4999	970	4029

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table E3: Pass through estimates.

health shock on the transitory component of income is $\alpha = 0.096$, not significant. This magnitude means that, after age 65, on average, 10% of a shock to health converts into a transitory income change. Since the variance of the transitory health shocks is four times smaller than that of the transitory income component, this effect generates very small changes to the variance of transitory income.

Tables (E3) shows that the correlation-adjusted pass-through estimates are very similar to the baseline results as well. The pass-through of income shocks is now 0.124 pass-through (compared with 0.127 in our baseline model). The pass-through of health shocks is now 0.175 pass-through (compared with 0.173 in our baseline model).

Online Appendix F: Results by liquid wealth

Table F1 reports the results when we further decompose the group of higher-wealth

	Income shock			Health shock		
	Higher w.	Low liq.	High liq.	Higher w.	Low liq.	High liq.
Consumption ϕ_c^ε	.115***	.232***	.07*	.112	.022	.197
	(.038)	(.076)	(.042)	(.114)	(.15)	(.169)
Medical exp. ϕ_m^ε	.114	.034	.144	-.177	.101	-.442
	(.107)	(.2)	(.124)	(.286)	(.41)	(.394)
Obs.	4029	1354	2675	4029	1354	2675

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table F1: Pass through estimates by liquid wealth.

households into those with low liquid wealth and those with high liquid wealth (in the spirit of distinguishing between the wealthy-hand-to-mouth and the non-hand-to-mouth). It shows that the higher-wealth households with low liquid wealth are those driving the response of this category: their pass-through is significant at 1% and the point estimate is 0.232. In contrast, among the higher-wealth households with high liquid wealth, the pass-through is only significant at the 10% level and the point estimate is small, at 0.070.

Online Appendix G: Results by marital status

In this online appendix, we break down our sample in two sub-samples: that of single households (2,255) and that of couples (2,744). Separately looking at couples and singles is interesting because being in a couple is both a source of risks (the health and resource risks of both partners) and insurance (pooling risks, economies of scale, and potentially being able to help each other in case of sickness). Table G1 shows that the point estimates of the pass-through coefficients for income shocks to consumption are 0.143 for singles and 0.113 for couples. Those for health shocks are 0.183 for singles and 0.160 for couples. This is consistent with couples's consumption being a little less affected by transitory income and health shocks. However, breaking down the sample reduces statistical power. As a result, we cannot reject that they are statistically different for couples and singles. Consistent with our overall sample, the pass-through of income to medical expenses is small and not significant. Finally, the pass-through of health shocks to medical expenses is -0.342 for singles and -0.704 for couples, which indicates that couples react to transitory health shocks by spending more in medical goods and services compared with singles. Only the latter pass-through coefficient is statically significant and the two are not statistically different.

	Income shock			Health shock		
	Total	Lower w.	Higher w.	Total	Lower w.	Higher w.
Singles						
Consumption ϕ_c^ε	.143***	.184	.133***	.183	.3*	.119
	(.052)	(.129)	(.055)	(.121)	(.179)	(.161)
Medical exp. ϕ_m^ε	.147	.516	.049	-.342	-1.318***	.193
	(.14)	(.351)	(.146)	(.306)	(.46)	(.394)
Obs.	2255	639	1616	2255	639	1616
Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%						
Couples						
Consumption ϕ_c^ε	.113**	.238	.101*	.16	.317*	.103
	(.049)	(.153)	(.051)	(.127)	(.177)	(.159)
Medical exp. ϕ_m^ε	.118	-.329	.163	-.704**	-.899	-.634
	(.146)	(.451)	(.153)	(.352)	(.605)	(.412)
Obs.	2744	331	2413	2744	331	2413
Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%						

Table G1: Pass through estimates for singles and couples.

Tables G2 and G3 report the results of our demand system estimation for singles and couples. Singles have in general higher budget elasticities than couples (except for the one on equipment). Their health elasticities are higher, in absolute value, for food and car-related expenses (which are linked to activities that can be easier to be undertaken when in a couple because, if one is sick, the other one can drive and take the lead).

	Food	Utilities	Car	Leisure	Equipment
Budget shares	0.270 ***	0.255 ***	0.149 ***	0.180 ***	0.146 ***
	(0.010)	(0.010)	(0.007)	(0.010)	(0.007)
Budget elasticities	0.794 ***	0.614 ***	0.958 ***	1.906 ***	0.977 ***
	(0.033)	(0.035)	(0.045)	(0.049)	(0.046)
Health elasticities					
Whole sample	-0.165 ***	-0.070 ***	0.210 ***	0.329 ***	-0.192 **
	(0.038)	(0.040)	(0.052)	(0.056)	(0.053)
Lower wealth	-0.177 ***	-0.089 ***	0.349 ***	0.491 ***	-0.207 ***
	(0.034)	(0.039)	(0.054)	(0.091)	(0.059)
Higher wealth	-0.159 ***	-0.172 ***	0.205 ***	0.338 ***	-0.082 *
	(0.041)	(0.042)	(0.053)	(0.053)	(0.053)

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table G2: Predicted shares, budget and health elasticities, for disaggregated categories. Singles.

	Food	Utilities	Car	Leisure	Equipment
Budget shares	0.272 ***	0.209 ***	0.169 ***	0.235 ***	0.116 ***
	(0.008)	(0.008)	(0.006)	(0.009)	(0.005)
Budget elasticities	0.774 ***	0.545 ***	0.611 ***	1.838 ***	1.221 ***
	(0.033)	(0.042)	(0.039)	(0.045)	(0.053)
Health elasticities					
Whole sample	-0.086 ***	-0.127 ***	0.025	0.338 ***	-0.292 **
	(0.034)	(0.043)	(0.040)	(0.046)	(0.055)
Lower wealth	-0.085 ***	-0.076 *	0.032	0.563 ***	-0.242 ***
	(0.031)	(0.035)	(0.034)	(0.093)	(0.057)
Higher wealth	-0.134 ***	-0.181 ***	-0.056 *	0.395 ***	-0.134 ***
	(0.035)	(0.045)	(0.041)	(0.045)	(0.055)

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table G3: Predicted shares, budget and health elasticities, for disaggregated categories. Couples.

Online Appendix H: Differentiated impact of a shift in marginal utility at different levels of consumption

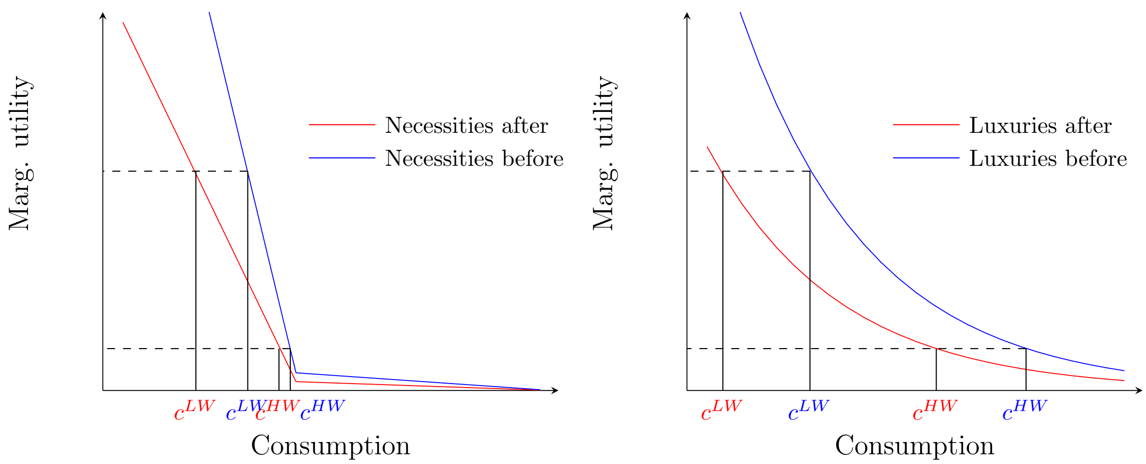

Figure H.1: Effect of a shift in the weight put on utility for a linear and an exponential utility functions and for low-wealth and high-wealth households.

Figure H.1 illustrates that the effect of a shift in marginal utility can be different at different levels of consumption and for different types of utility functions.

The panel on the left considers a piecewise linear marginal utility function, with a kink that can be interepreted as a satiation point. The blue line presents the initial marginal utility function, and the red line the marginal utility function following a negative health shock that multiplies the marginal utility function by a constant smaller than one. The figure shows that, with this linear marginal utility function, a multiplicative shift implies that consumption must adjust much more at low levels of consumption than at high levels of consumption, to keep marginal utility the same. This can explain why, for instance, the contribution of the shift in marginal utility, and not just the contribution of the resources effect, is larger for lower-wealth households, whose consumption is relatively low, than for the higher-wealth households.

The panel on right considers an exponential utility function. The blue line is the initial function, while the red line is the same function multiplied by a constant smaller than one. With this type of utility, contrary to the one on the left, a multiplicative shift implies that consumption must adjust by exactly the same amount at low levels of consumption and at high levels of consumption to keep marginal utility the same. Thus, if for instance the marginal utility of luxury goods is closer to an exponential function than to a linear function with a kink, the contribution of the shift in marginal utility can be large for both lower-wealth and higher-wealth households.

Online Appendix I: Demand system

We use the quadratic almost-ideal demand system (QUAIDS) introduced by Banks, Blundell, and Lewbel (1997). It is a flexible specification that also allows for non-separabilities in preferences. More specifically, we estimate its linearized version, conditional to a Stone price index and restricting the coefficients on expenses and expenses squared to be independent of prices, as done by Blundell, Pashardes, and Weber (1993). Our estimating equation is given by

$$w_k^i = \boldsymbol{\alpha}_{0k}' \boldsymbol{s_i} + \alpha_{1k} h^i + \boldsymbol{\gamma}_k' \boldsymbol{p} + \beta_{0k} \tilde{x}^i + \beta_{1k} h^i \tilde{x}^i + \lambda_{0k} (\tilde{x}^i)^2 + \lambda_{1k} h^i (\tilde{x}^i)^2 + u_k^i \qquad \text{(I.19)}$$

where w_k^i is the budget share for good $k = 1, ..., K$ and household $i = 1, ..., N$, x^i is log expenses; $\boldsymbol{s}_i$ is a set of demographic variables (which include age and age squared, a time trend, dummies for race, education, marital status, labor force status, and the number of household members), and h^i is the health index for individual i. The term $\tilde{x}^k = x^k - a(.)$ refers to real log expenses, where the Stone price index given by $a(.) = \bar{\mathbf{w}}'\mathbf{p}$ and $\bar{\mathbf{w}}$ is the K-vector containing the sample average budget shares and $\mathbf{p}$ is the vector of prices.

To account for endogeneity, we instrument total expenses with the logarithm of income and its square, the logarithm of the consumer price index (CPI), also interacted with log income, and all demographic characteristics included the system of Equations (I.19) and then include the residuals of this regression in our demand system in Equations (I.19).

The demand elasticities with respect to expenses are given by

$$e_k = \left(\frac{\partial w_k}{\partial \tilde{x}} \frac{1}{w_k}\right) + 1$$

where, from Equation (I.19), we have

$$\frac{\partial w_k}{\partial \tilde{x}} = \beta_{0k} + \beta_{1k} h + 2(\lambda_{0k} + \lambda_{1k} h) \tilde{x},$$

and $\tilde{x}$ is average real log expenses in the sample, h is average health and w_k is the average budget share of item k. Health elasticities are computed conditionally on total expenses, where

$$\frac{\partial \tilde{X} w_k}{\partial h}\frac{h}{\tilde{X} w_k} = (w_k \frac{\partial \tilde{X}}{\partial h} + \tilde{X}\frac{\partial w_k}{\partial h})\frac{h}{\tilde{X} w_k},$$

$\tilde{X}$ is the average level of real expenses. Assuming $\partial \tilde{X}/\partial h = 0$, then

$$e_{hk} = \frac{\partial w_k}{\partial h}\frac{h}{w_k},$$

where, from I.19

$$\frac{\partial w_k}{\partial h} = \alpha_{1k} + \beta_{1k}\tilde{x} + \lambda_{1k}\tilde{x}^2$$

where, as before, $\tilde{x}$, h and w_k are sample averages.

Online Appendix J: Robustness

In this online appendix, we discuss the effects of relaxing some key assumptions.

With AR(1) permanent component ($\rho = 0.98$)						
	Income shock			Health shock		
	Total	Lower w.	Higher w.	Total	Lower w.	Higher w.
Consumption ϕ_c^ε	.127***	.201**	.114***	.173**	.306**	.112
	(.036)	(.101)	(.038)	(.088)	(.132)	(.114)
Medical exp. ϕ_m^ε	.133	.234	.116	-.493**	-1.171***	-.177
	(.103)	(.291)	(.109)	(.232)	(.364)	(.286)
Obs.	4999	970	4029	4999	970	4029

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

With measurement error $\xi_{i,t}$ ($var(\xi_{i,t}^y) = 0.46 * var(\varepsilon_{i,t}^y)$, $var(\xi_{i,t}^h) = 0.46 * var(\varepsilon_{i,t}^h)$)						
	Income shock			Health shock		
	Total	Lower w.	Higher w.	Total	Lower w.	Higher w.
Consumption ϕ_c^ε	.186***	.295**	.167***	.253**	.447**	.163
	(.052)	(.146)	(.055)	(.129)	(.192)	(.166)
Medical exp. ϕ_m^ε	.192	.342	.166	-.719**	-1.71***	-.258
	(.149)	(.42)	(.157)	(.338)	(.532)	(.417)
Obs.	4999	970	4029	4999	970	4029

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

With uniformly distributed shocks						
	Income shock			Health shock		
	Total	Lower w.	Higher w.	Total	Lower w.	Higher w.
Consumption ϕ_c^ε	.19***	.222*	.185***	.429***	.545***	.387***
	(.044)	(.114)	(.047)	(.095)	(.163)	(.115)
Medical exp. ϕ_m^ε	.15	.38	.11	-1.047***	-1.957***	-.719**
	(.112)	(.279)	(.121)	(.261)	(.449)	(.309)
Obs.	3401	623	2778	3401	623	2778

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table J1: Pass-through estimates under different hypotheses.

AR(1) permanent income

Following Kaplan and Violante (2010), we examine whether our results are robust to assuming that permanent income evolves as an AR(1) process instead of a random walk. Indeed, although our data seem to supports the random walk assumption, it could be that the true process evolves as an AR(1) with a coefficient close to one and that the data cannot detect it as being different from one (because it cannot detect the correlation between income growth at t and at $t + 2$ or $t + 3$ as being different from zero). We denote with ρ the AR(1) coefficient of the permanent income process. Under the assumption that $\rho \neq 1$, we obtain identification by substituting income growth $\Delta ln(y_t)$ with quasi-differenced income growth $ln(y_t) - \rho ln(y_{t-1})$. The top panel in Table J1 presents the results for $\rho = 0.98$. They shows almost no difference compared to our baseline estimates.

Measurement error

The presence of classical measurement error ξ in income, health, and consumption (not serially correlated nor correlated between income, health, and consumption) would result in the typical attenuation effect. Indeed, it would lead to overestimate the variance of the transitory shocks and thus to underestimate the true pass-through coefficients:

$$\widehat{\phi}_c^{\varepsilon^h} = \frac{cov(\Delta ln(c_{i,t}), -\Delta h_{i,t+1})}{cov(\Delta h_{i,t}, -\Delta h_{i,t+1})} = \phi_c^{\varepsilon^h} \underbrace{\frac{var(\varepsilon_{i,t}^h)}{var(\varepsilon_{i,t}^h) + var(\xi_{i,t}^h)}}_{\leq 1} < \phi_c^{\varepsilon^h} \tag{J.20}$$

$$\widehat{\phi}_c^{\varepsilon^y} = \frac{cov(\Delta ln(c_{i,t}), -\Delta ln(y_{i,t+1}))}{cov(\Delta ln(y_{i,t}), -\Delta ln(y_{i,t+1}))} = \phi_c^{\varepsilon^y} \underbrace{\frac{var(\varepsilon_{i,t}^y)}{var(\varepsilon_{i,t}^y) + var(\xi_{i,t}^y)}}_{\leq 1} < \phi_c^{\varepsilon^y} \tag{J.21}$$

The middle panel in Table J1 presents the estimates obtained assuming that $var(\xi_{i,t}^y) = 0.46 * var(\varepsilon_{i,t}^y)$ (which is the ratio implied by the results of Meghir and Pistaferri (2004) in the PSID), and correcting for such a degree of measurement error. The pass-through of transitory income shocks in this case is 0.186 instead of 0.127. If we were to assuming that the ratio of variance of measurement error over the variance of the shocks is the same for health, and correct for it, the true pass-through of transitory health shocks would be 0.253 instead of 0.173.

Uniformly distributed income shocks

We now consider a situation in which shocks no longer occur at one deterministic point in time every year. Rather, we follow Crawley (2020) in assuming that income shocks are uniformly distributed. Hence, they can occur at any point in time within a year (although the reality probably lies in between the two assumptions: they occur with a higher probability at certain periods). In that case, our identification strategy underestimates the true pass-through. Indeed, given that we observe variables every two years, the moment that we use to identify the pass-through of transitory income shocks becomes:[1]

$$\widehat{\phi}_c^{\varepsilon^y} = \frac{cov(\Delta ln(c_{i,t}), -\Delta ln(y_{i,t+1}))}{cov(\Delta ln(y_{i,t}), -\Delta ln(y_{i,t+1}))} = \phi_c^{\varepsilon^y} - \frac{1}{2}\frac{(3\phi_c^{\eta^y} - \phi_c^{\varepsilon^y})var(\eta_t^y)}{6var(\varepsilon_t^y) - var(\eta_t^y)} < \phi_c^{\varepsilon^y} \tag{J.22}$$

Thus, this gives rise to a downward bias. For given values (or given ranges of values) of the pass-through of permanent shocks we can re-estimate our pass-through of transitory shocks under this assumption of uniformly distributed shocks. The bottom panel in Table J1 presents the estimates obtained under the assumption that $\phi_c^{\eta^y} = 0.338$ (as in Crawley (2020)), $\phi_c^{\eta^h} = 0.520$ (chosen to keep equal the ratios $\frac{\phi_c^{\eta^y}}{\phi_c^{\varepsilon^y}} = \frac{\phi_c^{\eta^h}}{\phi_c^{\varepsilon^h}}$), $\phi_m^{\eta^y} = 0.241$ (chosen to keep equal the ratios $\frac{\phi_c^{\eta^y}}{\phi_c^{\varepsilon^y}} = \frac{\phi_m^{\eta^y}}{\phi_m^{\varepsilon^y}}$), and $\phi_m^{\eta^h} = 1$. With this radically different assumption about the distribution of the shocks over time, the estimates increase. The pass-through to transitory income shocks becomes 0.190 instead of 0.127, and the pass-through to transitory health shocks is 0.429 instead of 0.173.

Imperfect overlap of health and consumption

So far we have considered that a period, the difference between t and $t+1$, is two years. To allow for an imperfect overlap of health and consumption, we now shift notation. We consider that one period is one year and we assume that health is observed one year after consumption, rather than at the same point in time. This is because while, in our data, consumption is observed around October, health is typically observed between April and December of the following year, that is 6 to 14 months later.

Given that the transitory component of health is an MA(0) process when a period is two years, we assume that it is an MA(1) process when a period is one year: $h_{i,t} = \pi_{i,t}^h + \varepsilon_{i,t}^h + \theta\varepsilon_{i,t-1}$

The estimator of the pass-through coefficient of transitory health shocks to con-

[1]This corresponds to Eq. (9) Crawley (2020), except for the $\frac{1}{2}$ coefficient in front of the bias, because we only aggregate income over one of the two year periods that we use.

sumption that we use rewrites as

$$\widehat{\phi}_c^{\varepsilon^h} = \frac{cov\big(ln(c_{i,t}) - ln(c_{i,t-2}), -(h_{i,t+3} - h_{i,t+1})\big)}{cov\big(h_{i,t+1} - h_{i,t-1}), -(h_{i,t+3} - h_{i,t+1})\big)} = \frac{cov\big(ln(c_{i,t}) - ln(c_{i,t-2}), \theta\varepsilon_{i,t}\big)}{var\big(\varepsilon_{i,t+1} + \theta\varepsilon_{i,t}\big)} \tag{J.23}$$

$$\neq \frac{cov\big(ln(c_{i,t}) - ln(c_{i,t-2}), \varepsilon_{i,t} + \theta\varepsilon_{i,t-1}\big)}{var\big(\varepsilon_{i,t} + \theta\varepsilon_{i,t-1}\big)} = \phi_c^{\varepsilon^h} \tag{J.24}$$

The exact sign of the bias is ambiguous. On the one hand, $cov\big(ln(c_{i,t}) - ln(c_{i,t-2}), \varepsilon_{i,t}\big)$ is indexed by θ (likely to be smaller than one) in our estimator, and it does not include the term $cov\big(ln(c_{i,t-1}) - ln(c_{i,t-2}), \varepsilon_{i,t-1}\big)$ (likely to be positive). On the other hand, it does not include the term $cov\big(ln(c_{i,t}) - ln(c_{i,t-1}), \varepsilon_{i,t-1}\big)$, that is, the effect of the shock in between the two years on subsequent consumption growth (likely to be negative because of precautionary behavior: a good shock reduces precautionary needs thus subsequent consumption growth).

Anticipation

Because Table **??** in the paper and Table C2 in this online Appendix show that people may have some advance information about future permanent health shocks, we now turn to allowing those shocks to be partly anticipated as follows

$$\begin{aligned} &\eta_t^h = \eta_t^{h,ant,t-2} + \eta_t^{h,ant,t-1} + \eta_t^{h,surp}, \\ &\quad \text{with } cov(\eta_t^{h,ant,t-2}, \eta_t^{h,ant,t-1}) = cov(\eta_t^{h,ant,t-2}, \eta_t^{h,surp}) = cov(\eta_t^{h,ant,t-1}, \eta_t^{h,surp}) = 0, \\ &\quad \text{and } cov(\eta_t^{h,ant,t-2}, \eta_{t'}^{h,ant,t'-2}) = cov(\eta_t^{h,ant,t-1}, \eta_{t'}^{h,ant,t'-1}) = cov(\eta_{t'}^{h,surp}, \eta_t^{h,surp}) = 0. \end{aligned} \tag{J.25}$$

The term $\eta_t^{h,ant,t-2}$ denotes the part of η_t^h that is anticipated two periods ahead, the term $\eta_t^{h,ant,t-1}$ the part anticipated one period ahead, and the term $\eta_t^{h,surp}$ denotes the surprise part, which is not anticipated. Each new bit of information about the value of η_t^h is a surprise. Thus, all those terms are uncorrelated with each other,[2] and not serially correlated. As before, the innovations to the permanent component do not correlate with the innovations to the transitory component.

[2]The lack of correlation with each another is without loss of generality: if $\eta_t^{h,ant,t-1}$ predicted $\eta_t^{h,surp}$, we can remove from $\eta_t^{h,surp}$ the part that is predicted by $\eta_t^{h,ant,t-1}$ and integrate it in this part anticipated at $t-1$.

To determine how this anticipation affects our estimate of the pass-through of transitory health shocks to consumption, we plug expression (J.25) in our estimator. More precisely, we substitute $\Delta h_{t+1} = \eta^h_{t+1} + \varepsilon^h_{t+1} - \varepsilon^h_t$, we replace the term η^h_{t+1} with its expression (J.25) that incorporates the anticipation terms, and we drop the terms $-\eta^{h,surp}_{t+1}$ and $-\varepsilon^h_{t+1}$ whose covariance with consumption growth at t is zero

$$\widehat{\phi}^{\varepsilon^h}_c = \frac{cov(\Delta ln(c_t), -\eta^{h,ant,t-1}_{t+1} - \eta^{h,ant,t}_{t+1} - \eta^{h,surp}_{t+1} - \varepsilon^h_{t+1} + \varepsilon^h_t)}{cov(\Delta h_t, -\Delta h_{t+1})} \tag{J.26}$$

$$= \frac{cov(\Delta ln(c_t), -\eta^{h,ant,t-1}_{t+1} - \eta^{h,ant,t}_{t+1} + \varepsilon^h_t)}{cov(\Delta h_t, -\Delta h_{t+1})} \leq \phi^{\varepsilon^h}_c \tag{J.27}$$

Our claim is that the autocovariances we observe empirically suggest that the term $-\eta^{h,ant,t-1}_{t+1} - \eta^{h,ant,t}_{t+1}$ covaries negatively with consumption growth at t. In addition, despite anticipations, we still have $cov(\Delta h_t, -\Delta h_{t+1}) = var(\varepsilon^h_t)$. As a result, in the presence of anticipations, our estimator $\widehat{\phi}^{\varepsilon^h}_c$ underestimates the true value of the elasticity of consumption to transitory health shocks $\phi^{\varepsilon^h}_c$.

The detailed reasoning is as follows. We substitute $\Delta ln(c_t) = ln(c_t) - ln(c_{t-1})$ in the right-hand side expression of inequality (J.27) and drop the term $cov(ln(c_{t-1}), -\eta^{h,ant,t}_{t+1})$, which is equal to zero

$$\begin{aligned}
\widehat{\phi}^{\varepsilon^h}_c &= \frac{\overbrace{cov(ln(c_t), -\eta^{h,ant,t-1}_{t+1})}^{\leq 0} - cov(ln(c_{t-1}), -\eta^{h,ant,t-1}_{t+1}) + cov(ln(c_t), -\eta^{h,ant,t}_{t+1}) + cov(\Delta ln(c_t), \varepsilon_t)}{cov(\Delta h_t, -\Delta h_{t+1})} \\
&\leq \frac{\overbrace{-cov(ln(c_{t-1}), -\eta^{h,ant,t-1}_{t+1}) + cov(ln(c_t), -\eta^{h,ant,t}_{t+1})}^{\approx 0} + cov(\Delta ln(c_t), \varepsilon_t)}{cov(\Delta h_t, -\Delta h_{t+1})} \\
&\leq \frac{cov(\Delta ln(c_t), \varepsilon_t)}{\underbrace{cov(\Delta h_t, -\Delta h_{t+1})}_{=var(\varepsilon^h_t)}} \\
&\leq \frac{cov(\Delta ln(c_t), \varepsilon_t)}{var(\varepsilon^h_t)} = \phi^{\varepsilon^h}_c
\end{aligned}$$

We move from the first to the second line using that $cov(ln(c_t), -\eta^{h,ant,t-1}_{t+1}) \leq 0$. This inequality means that receiving at $t-1$ a good signal about one's permanent health shock at $t+1$ raises consumption at t. We obtain this inequality from the information implied by Table 1 in the paper. Indeed, the results in Table 1 suggest that people have some advance information about their future permanent health shocks and that the information they receive moves their current consumption growth in the same direction as that of the shock: $cov(\Delta ln(c_t), \eta_{t+2}^{h,ant,t}) \geq 0$. It thus moves the current consumption level in the same direction, since previous consumption is unchanged: $cov(\Delta ln(c_t), \eta_{t+2}^{h,ant,t}) = cov(ln(c_t), \eta_{t+2}^{h,ant,t}) \geq 0$. Shifting period to $t = t-1$, this yields $cov(ln(c_{t-1}), \eta_{t+1}^{h,ant,t-1}) \geq 0$. From the Euler equation, if an information received at $t-1$ raises consumption at $t-1$, it must also raise consumption at t (though not necessarily by the same amount): $cov(ln(c_t), \eta_{t+1}^{h,ant,t-1}) \geq 0$. The opposite of this covariance is thus negative

$$cov(ln(c_t), -\eta_{t+1}^{h,ant,t-1}) \leq 0. \tag{J.28}$$

We move from the second to the third line using that a piece of information about the future (period $t+1$) should have a broadly similar impact on contemporaneous consumption when received at $t-1$ as when received at t, so

$$cov(ln(c_{t-1}), -\eta_{t+1}^{h,ant,t-1}) \approx cov(ln(c_t), -\eta_{t+1}^{h,ant,t}). \tag{J.29}$$

Finally, we move from the third to the fourth line using that, because the innovation components are not serially correlated, the information gradually received about the future innovation at t only helps predict this innovation, and does not help predict the subsequent innovation at $t+1$

$$\begin{aligned} & cov(\Delta h_t, -\Delta h_{t+1}) \qquad \text{(J.30)} \\ & = cov(\eta_t^{h,ant,t-2} + \eta_t^{h,ant,t-1} + \eta_t^{h,surp} + \varepsilon_t^h - \varepsilon_{t-1}^h, -\eta_{t+1}^{h,ant,t-1} - \eta_{t+1}^{h,ant,t} - \eta_{t+1}^{h,surp} - \varepsilon_{t+1}^h + \varepsilon_t^h) \\ & = var(\varepsilon_t^h). \end{aligned}$$

Intuitively, consumption does not increase as much with a decrease in health next period $-\Delta h_{t+1} = -\eta_{t+1}^{h,ant,t-1} - \eta_{t+1}^{h,ant,t} + \varepsilon_t$ because such a decrease now captures both a positive realization of the transitory health shock at t (the term ε_t) and negative signals about future permanent health at $t+1$ (the terms $-\eta_{t+1}^{h,ant,t-1}$ and $-\eta_{t+1}^{h,ant,t}$).

A similar reasoning applies when transitory shocks are anticipated. In that case, our estimate of the pass-through of transitory shock to consumption is given by

$$\widehat{\phi}_c^{\varepsilon^h} = \frac{cov(\Delta ln(c_t), -\varepsilon_{t+1}^{h,ant,t-1} - \varepsilon_{t+1}^{h,ant,t} + \varepsilon_t + \varepsilon_t^{h,ant,t-1} + \varepsilon_t^{h,ant,t-2})}{cov(\Delta h_t, -\Delta h_{t+1})} < \phi_c^{\varepsilon^h}. \quad \text{(J.31)}$$

The terms $-\varepsilon_{t+1}^{h,ant,t-1} - \varepsilon_{t+1}^{h,ant,t}$ can be thought of in the same way as the anticipated component of permanent shocks. The new terms $\varepsilon_t^{h,ant,t-1} + \varepsilon_t^{h,ant,t-2}$ correspond to past signals about the current transitory health shock. Theoretically, their effect on consumption growth should be zero in the absence of precautionary savings and negative in its presence. Empirically, Commault (2022) finds past transitory shocks to negatively affect subsequent consumption growth among working age households.

Online Appendix K: Decomposition for finer subcategories

	All	Lower wealth	Higher wealth
Necessities $\phi^h_{necessities}$	.076	.344***	-.046
	(.09)	(.141)	(.112)
Resources channel	-.005	.019	-.007
	(.004)	(.016)	(.005)
Change in med. exp. $-\phi^h_m E[p_m m]$	-1117.91**	-2137.017***	-420.397
	(528.194)	(690.707)	(679.599)
Change in luxuries $-\phi^h_{luxuries} E[p_{lux} luxuries]$	3074.428***	679.949	4219.22**
	(1271.419)	(730.863)	(1863.372)
Multiplier $f_3^{necessities}\|_0$ (10^{-6})	2.707***	12.656***	1.712*
	(.96)	(4.498)	(.924)
Marginal utility channel	.081	.326**	-.04
	(.091)	(.142)	(.113)
Luxuries $\phi^h_{luxuries}$	.366***	.206	.438**
	(.15)	(.22)	(.193)
Resources channel	0.001	.01	.004
	(.004)	(.017)	(.006)
Change in med. exp. $-\phi^h_m E[p_m m]$	-1117.91**	-2137.017***	-420.397
	(528.194)	(690.707)	(679.599)
Change in necessities $-\phi^h_{necessities} E[p_{nec} necessities]$	977.49	3297.646***	-634.37
	(1159.97)	(1342.11)	(1533.279)
Multiplier $f_3^{luxuries}\|_0$ (10^{-6})	2.775*	-8.782	3.612***
	(1.588)	(8.386)	(1.495)
Marginal utility channel	.365***	.196	.434***
	(.151)	(.218)	(.194)
Obs.	4994	966	4028

Standard errors in parentheses. * at 10%, ** at 5%, *** at 1%

Table K1: Decomposition of pass through estimates (finer subcategories).

Table K1 presents the decomposition of the pass-through of transitory health shocks to necessities and luxuries into the resources and marginal utility channel. The method is the same as the one we use to decompose the pass-through of transitory health shocks to total non-durable consumption. However, the underlying assumption is now that period utility is separable in the consumption of necessities and luxuries. Thus, the consumption of one only affects the other by reducing the resources available to consume it. Note that resources available for the consumption of one category of goods and services can now be reduced by a health shock because of two things: a change in the consumption of medical expenses, and a change in the consumption of the other category of consumption.

Results are less precise but the Table suggests that, among lower-wealth households, the resources channel seems more important for necessities than for luxuries. Among higher-wealth households, the resources channel is close to zero in both cases, and only the marginal utility channel for luxuries explains their response.

Online Appendix L: Mapping between partial derivatives of the consumption function and of the utility function

Derivation of the marginal utility. Here, we express the pass-through of transitory shocks to consumption in terms of the partial derivatives of the utility function (instead just in terms of the partial effects f_m, f_h, and f_R that we define in Section 2). Let us start from the same Euler equation

$$\begin{aligned}
&u_c(c_t, \tilde{m}(m_t), h_t) \geq \\
&\quad E_t\Bigg[u_c\Bigg(c_{t+1}\big(((1+r_t)p_t a_t + p_t y_t - p_t^m m_t - p_t^c c_t)/p_{t+1}, \pi_t^y + \eta_{t+1}^y, \varepsilon_{t+1}^y, \pi_t^h + \eta_{t+1}^h, \varepsilon_{t+1}^h\big), \\
&\quad \tilde{m}\big(m_{t+1}\big(((1+r_t)p_t a_t + p_t y_t - p_t^m m_t - p_t^c c_t)/p_{t+1}, \pi_t^y + \eta_{t+1}^y, \varepsilon_{t+1}^y, \pi_t^h + \eta_{t+1}^h, \varepsilon_{t+1}^h\big)\big), \\
&\quad \pi_t^h + \eta_{t+1}^h + \varepsilon_{t+1}^h\Bigg)\tilde{s}_{t+1}(\pi_t^h + \eta_{t+1}^h)R_{t+1}\Bigg]. \qquad (9)
\end{aligned}$$

Because transitory shocks have no effects on the future distribution of income and health, nor on people's survival probability, they only influence consumption and medical spending through the first two channels: the marginal utility channel and the resources channel. To see this, note that when we take the derivative of the Euler equation (**??**) in the paper with respect to transitory income and health shocks, only the terms in red and blue are affected. More precisely, deriving both sides with respect to a transitory income shock and rearranging yields

$$\frac{dc_t}{d\varepsilon_t^y}u_{cc}^t + \frac{dm_t}{d\varepsilon_t^y}\tilde{m}'(m_t)u_{c\tilde{m}}^t + \frac{dh_t}{d\varepsilon_t^y}u_{ch}^t = \left(\frac{d((1+r_t)p_t a_t + p_t y_t - p_t^m m_t)}{d\varepsilon_t^y} - p_t^c\frac{dc_t}{d\varepsilon_t^y}\right)\xi_t$$
$$\frac{dc_t}{d\varepsilon_t^y} = \underbrace{\left(-\frac{dm_t}{d\varepsilon_t^y}\tilde{m}'(m_t)u_{c\tilde{m}}^t - \frac{dh_t}{d\varepsilon_t^y}u_{ch}^t\right)\frac{1}{\vartheta_t}}_{\text{Marginal utility (=0 when } u_{c\tilde{m}}^t = u_{ch}^t = 0)} + \underbrace{\left(p_t\frac{dy_t}{d\varepsilon_t^y} - p_t^m\frac{dm_t}{d\varepsilon_t^y}\right)\frac{\xi_t}{\vartheta_t}}_{\text{Resources}},$$

and deriving both sides with respect to transitory health shock similarly yields

$$\frac{dc_t}{d\varepsilon_t^h}u_{cc}^t + \frac{dm_t}{d\varepsilon_t^h}\tilde{m}'(m_t)u_{c\tilde{m}}^t + \frac{dh_t}{d\varepsilon_t^h}u_{ch}^t = \left(\frac{d((1+r_t)p_t a_t + p_t y_t - p_t^m m_t)}{d\varepsilon_t^h} - p_t^c\frac{dc_t}{d\varepsilon_t^h}\right)\xi_t$$
$$\frac{dc_t}{d\varepsilon_t^h} = \underbrace{\left(-\frac{dm_t}{d\varepsilon_t^h}\tilde{m}'(m_t)u_{c\tilde{m}}^t - \frac{dh_t}{d\varepsilon_t^h}u_{ch}^t\right)\frac{1}{\vartheta_t}}_{\text{Marginal utility (=0 when } u_{c\tilde{m}}^t = u_{ch}^t = 0)} + \underbrace{\left(p_t\frac{dy_t}{d\varepsilon_t^h} - p_t^m\frac{dm_t}{d\varepsilon_t^h}\right)\frac{\xi_t}{\vartheta_t}}_{\text{Resources}},$$

with $u_{cc}^t = u_{cc}(c_t, \tilde{m}(m_t), h_t)$, $u_{c\tilde{m}}^t = u_{c\tilde{m}}(c_t, \tilde{m}(m_t), h_t)$ and $u_{ch}^t = u_{ch}(c_t, \tilde{m}(m_t), h_t)$ the partial derivatives of u_c, $\xi_t \equiv E_t\left[\frac{1}{p_{t+1}}\left(c_a^{t+1}u_{cc}^{t+1} + \tilde{m}_a^{t+1}u_{c\tilde{m}}^{t+1}\right)\tilde{s}_{t+1}R_{t+1}\right]$[3] the effect of a one dollar change in current resources on the right hand side of the Euler equation (holding other terms constant), $\vartheta_t \equiv u_{cc}^t + p_t^c\xi_t$ the effect of a change in consumption on the left hand side of the Euler equation, so that $\frac{\xi_t}{\vartheta_t}$ measures by how much current consumption should change to absorb the effect of a change in resources in the Euler equation, holding constant the $\tilde{m}_t$ and h_t in the marginal utility function. Using the lack of correlation between the transitory shocks to set $\frac{dh_t}{d\varepsilon_t^y} = 0$ and also $\frac{dy_t}{d\varepsilon_t^h} = 0$ (i.e. noting that available resources to consume and save only change because of the impact of the health shock on medical expenses but not on income), using the definitions of

[3] In that expression, c_a^{t+1} and $\tilde{m}_a^{t+1}$ are the partial derivatives of $c^{t+1}(a_{t+1}, \pi_{t+1}^y, \pi_{t+1}^h, \varepsilon_{t+1}^y, \varepsilon_{t+1}^h)$ and $\tilde{m}(m^{t+1}(a_{t+1}, \pi_{t+1}^y, \pi_{t+1}^h, \varepsilon_{t+1}^y, \varepsilon_{t+1}^h))$ with respect to their first argument.

our shocks which imply $\frac{dy_t}{d\varepsilon_t^y} = \frac{dln(y_t)}{d\varepsilon_t^y} y_t = y_t$ and also $\frac{dh_t}{d\varepsilon_t^h} = 1$ and rearranging

$$\frac{dc_t}{d\varepsilon_t^y} = \underbrace{\left(- \frac{dm_t}{d\varepsilon_t^y} \tilde{m}'(m_t) u_{c\tilde{m}}^t \right) \frac{1}{\vartheta_t}}_{\text{Marginal utility}} + \underbrace{\left(p_t y_t - p_t^m \frac{dm_t}{d\varepsilon_t^y} \right) \frac{\xi_t}{\vartheta_t}}_{\text{Resources}}$$

$$\frac{dc_t}{d\varepsilon_t^h} = \underbrace{\left(- \frac{dm_t}{d\varepsilon_t^h} \tilde{m}'(m_t) u_{c\tilde{m}}^t - u_{ch}^t \right) \frac{1}{\vartheta_t}}_{\text{Marginal utility}} + \underbrace{\left(- p_t^m \frac{dm_t}{d\varepsilon_t^h} \right) \frac{\xi_t}{\vartheta_t}}_{\text{Resources}}$$

Using our empirical finding that, after age 65, people do not adjust their out-of-pocket medical expenses when experiencing transitory income changes (that is, $\frac{dm_t}{d\varepsilon_t^y} \approx 0$),[4] there is no effect of a transitory income shock through the marginal utility channel. We obtain

$$\frac{dc_t}{d\varepsilon_t^y} = \underbrace{\left(p_t y_t - p_t^m \frac{dm_t}{d\varepsilon_t^y} \right) \frac{\xi_t}{\vartheta_t}}_{\text{Resources}}$$

$$\frac{dc_t}{d\varepsilon_t^h} = \underbrace{\left(- \frac{dm_t}{d\varepsilon_t^h} \tilde{m}'(m_t) u_{c\tilde{m}}^t - u_{ch}^t \right) \frac{1}{\vartheta_t}}_{\text{Marginal utility}} + \underbrace{\left(- p_t^m \frac{dm_t}{d\varepsilon_t^h} \right) \frac{\xi_t}{\vartheta_t}}_{\text{Resources}}$$

Moving to logs

$$\frac{dln(c_t)}{d\varepsilon_t^y} = \underbrace{\left(p_t y_t - p_t^m \frac{dm_t}{d\varepsilon_t^y} \right) \frac{\xi_t}{c_t \vartheta_t}}_{\text{Resources}}$$

$$\frac{dln(c_t)}{d\varepsilon_t^h} = \underbrace{\left(- \frac{dm_t}{d\varepsilon_t^h} \tilde{m}'(m_t) u_{c\tilde{m}}^t - u_{ch}^t \right) \frac{1}{c_t \vartheta_t}}_{\text{Marginal utility} = \text{MU}^{c,t}} + \underbrace{\left(- p_t^m \frac{dm_t}{d\varepsilon_t^h} \right) \frac{\xi_t}{c_t \vartheta_t}}_{\text{Resources} = \text{R}^{c,t}}$$

Mapping. Now, we map the expressions of the marginal utility and resources channel

[4] We estimate our income pass-through coefficient for medical expenses to income, ϕ_m^y to be ≈ 0. This implies $E[\frac{dln(m_t)}{d\varepsilon_t^y}] = E[\frac{dm_t}{d\varepsilon_t^y} m_t] \approx 0$. We also find that m_t is strictly positive for most of people in our sample (only 137 out of the 5,019 are below 100$). If the sign of $\frac{dm_t}{d\varepsilon_t^y}$ is the same across all households, it must actually be zero for everyone for $E[\frac{dm_t}{d\varepsilon_t^y} \underbrace{m_t}_{>0}] = 0$. Else $E[\frac{dm_t}{d\varepsilon_t^y} m_t]$ would be strictly non-zero and of the sign of $\frac{dm_t}{d\varepsilon_t^y}$.

obtained above, which are in terms of the partial derivatives of the utility function, with the expressions of the marginal utility and resources channel obtained in the paper, which are in terms of the partial derivatives of the function $f^{c,t}$

$$\mathrm{MU}^{c,t} = f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h} + f_h^{c,t} = \big(-\tilde{m}'(m_t)u_{c\tilde{m}}^t\frac{dm_t}{d\varepsilon_t^h} - u_{ch}^t\big)\frac{1}{c_t\vartheta_t} \tag{L.32}$$

$$\mathrm{R}^{c,t} = -f_R^{c,t}p_t^m\frac{dm_t}{d\varepsilon_t^h} = -\frac{\xi_t}{c_t\vartheta_t}p_t^m\frac{dm_t}{d\varepsilon_t^h} \tag{L.33}$$

This means that:

$$f_m^{c,t} = \frac{\tilde{m}'(m_t)(-u_{c\tilde{m}}^t)}{c_t\vartheta_t} \tag{L.34}$$

$$f_h^{c,t} = \frac{(-u_{ch}^t)}{c_t\vartheta_t} \tag{L.35}$$

$$f_R^{c,t} = \frac{\xi_t}{c_t\vartheta_t} \tag{L.36}$$

Going one step further, when medical expenses do not respond to a change in income, the partial effect of assets—holding health and income constant—coincides with the partial effect of resources holding marginal utility identical, that is, with the multiplier on the resources channel $c_a^t = \frac{\xi_t}{\vartheta_t} = \frac{\xi_t}{u_{cc}^t + p_t^c\xi_t}$. Plugging this (taken at $t+1$) into the expression of ξ_t:

$$\xi_t = E_t\Bigg[\Big(\underbrace{c_a^{t+1}}_{=\frac{\xi_{t+1}}{u_{cc}^{t+1}+p_{t+1}^c\xi_{t+1}}} u_{cc}^{t+1} + \underbrace{\tilde{m}_a^{t+1}}_{\substack{\text{Response of med.}\\ \text{exp. to a change}\\ \text{in resources}\\ =0}} u_{c\tilde{m}}^{t+1}\Big)\frac{\tilde{s}_{t+1}R_{t+1}}{p_{t+1}}\Bigg] = E_t\Bigg[\frac{\xi_{t+1}}{u_{cc}^{t+1} + p_{t+1}^c\xi_{t+1}}u_{cc}^{t+1}\frac{\tilde{s}_{t+1}R_{t+1}}{p_{t+1}}\Bigg]$$

By backward induction, if $u_{cc} \leq 0$ at all periods, then $\xi \leq 0$ and $\vartheta = u_{cc}^t + p_t^c\xi_t \leq 0$ at all periods as well. As a result

$$sign(f_m^{c,t}\frac{dm_t}{d\varepsilon_t^h} + f_h^{c,t}) = sign(\tilde{m}'(m_t)u_{c\tilde{m}}^t\frac{dm_t}{d\varepsilon_t^h} + u_{ch}^t) \tag{L.37}$$

If we find that the marginal utility channel is positive, it means that the effect of a change in health on the marginal utility of consumption (including its effect through medical expenses) is positive.