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Do wealth shocks matter for the life satisfaction of the elderly? Evidence from the health and retirement study

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Abstract

We study the importance of wealth shocks as a determinant of life satisfaction for the elderly and near-elderly. With data from the U.S. Health and Retirement Study, we specify an econometric analysis exploiting the 2008-09 financial crisis as a source of exogenous variation in wealth, caused by a long-lasting decrease in asset prices. Although absolute changes in wealth are not found to systematically affect individual well-being, losing 60% or more of the pre-crisis wealth negatively impacted measures of life satisfaction. The results are shown to hold also in a number of robustness checks. The financial crisis wealth shock is found to have a persistent detrimental effect on the well-being of the American elderly. Finally, we argue that the simultaneity bias arising from neglecting the endogeneity of wealth accumulation can be substantial.

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1 Introduction

An influential literature, e.g. Blundell, Pistaferri and Preston (2008), Blundell and Preston (1998), and Krueger and Perri (2006), assesses if income shocks are transmitted to individual welfare, stressing the role of partial insurance in shaping the distribution of consumption. The consensus is that income shocks are important, which provides a rationale for several public programs, such as unemployment insurance, food stamps, and redistributive taxation. However, little is known regarding the role of wealth shocks, and whether they translate into changes in measures of individual well-being. Filling this gap is important, as sizable welfare consequences of wealth shocks can provide a rationale for a different set of public programs, such as generous public pensions. This conclusion stems both from the fact that the retirees rely heavily on asset income and financial wealth decumulation to pay for their expenditures, and from the absence of market mechanisms for trading between current and future generations (therefore, Auerbach et *al.* (2018) argue that social security can smooth intergenerationally aggregate shocks, including wealth ones). As for the first mechanism, quantitative equilibrium models with incomplete insurance markets and overlapping generations that abstract from wealth shocks, such as Imrohoroglu, Imrohoroglu and Joines (1995), find the optimal social security replacement rate to be well below the actual ones, with the implication that pensions might be inefficiently provided in most economies. The presence of sizable and persistent welfare effects of wealth shocks would justify more generous pensions, as the expenditures of the retirees would become less reliant on the accumulation of risky assets. As for the second mechanism, the welfare costs of the great recession are believed to be substantial, and Glover et *al.* (2020) use a quantitative model to compute the welfare losses for the elderly, finding that they are about 10% of lifetime consumption. Using a longitudinal dataset, the Health and Retirement Study (HRS, hereafter), we analyze the importance of wealth shocks as a determinant of life satisfaction for both the elderly and the near-elderly.[1] Our analysis provides empirical underpinnings for simulation studies, together with some testable implications.

A major obstacle to this line of inquiry is the endogeneity of the saving decisions, which determine the stock of accumulated wealth collected in several datasets. To help identifying the causal effect of wealth shocks on the life satisfaction of the elderly in the U.S., we exploit the aftermath of the so-called "financial crisis," arguably an exogenous source of variation. The great recession represented an unexpected, large, and long-lasting aggregate shock to asset prices, which mitigates the simultaneity issues in the econometric analysis.[2] Bricker et *al.* (2015) use the Survey of Consumer Finances to document that, between 2007 and 2009, 60% of American households experienced a decline in wealth. The HRS data for our study include information on both Subjective Well-Being (SWB) and wealth holdings over time for a representative sample of elderly Americans.

The consequences of the financial crisis for the value of assets typically held in household portfolios are clearly visible in Figure (1): the top panel displays a house price index, while the bottom panel shows the behavior of the U.S. stock market, as represented by the NYSE composite index. The dark shaded areas highlight the data collection time windows of the 2008 and 2010 HRS waves, which form the basis for our main analysis. Given both the house price dynamics and the incomplete –and volatile– recovery of the stock market, we conjecture that households viewed the shock as being highly persistent.[3]

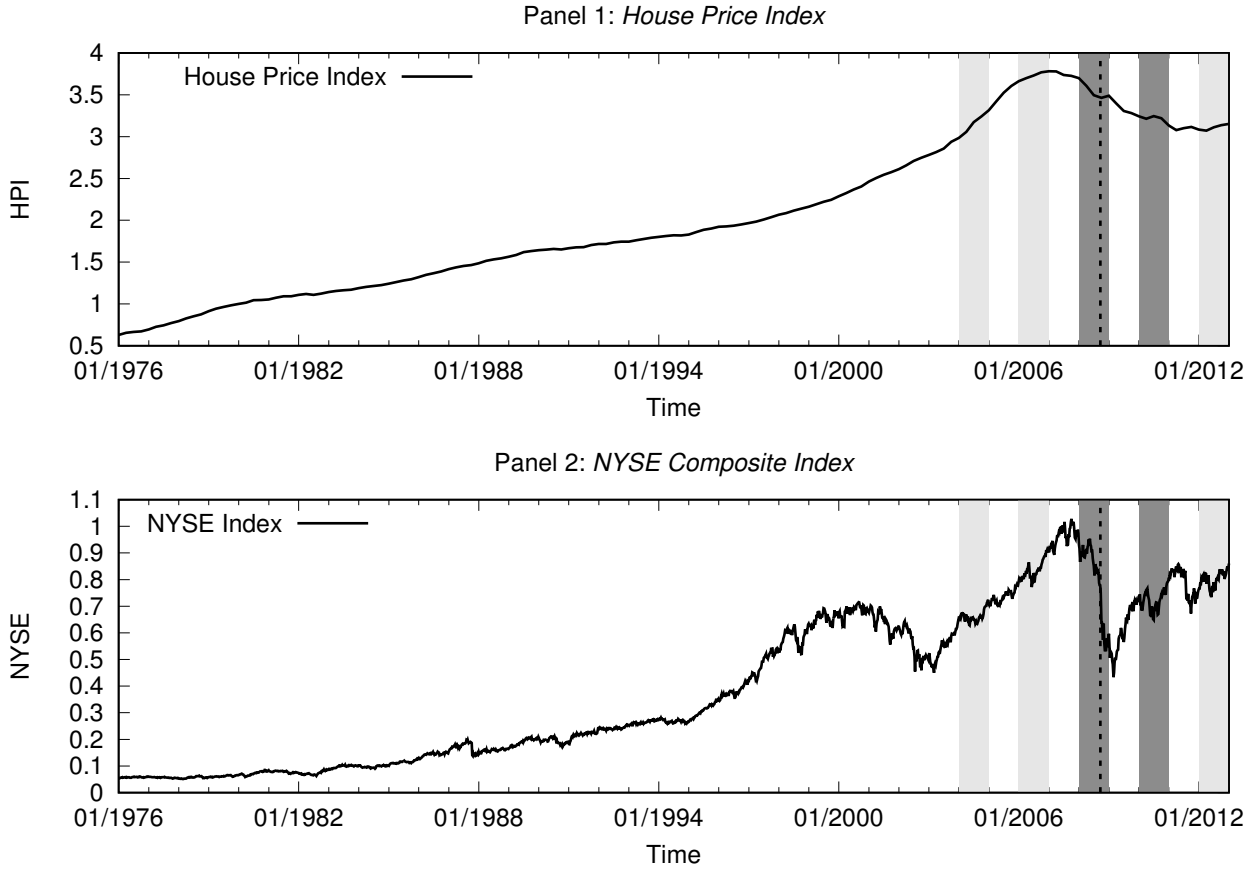
Our regression analysis shows that wealth shocks in levels do not systematically affect measures of individual well-being, while percentage wealth shocks do matter. Losing 60% or more of the pre-crisis wealth has a negative and sizable impact on measures of life satisfaction. These findings suggest that the welfare calculations in Glover et *al.* (2020) might be overstated. The results hold also in a number of robustness checks. The financial crisis wealth shock is found to have a persistent detrimental effect on the well-being of the American elderly. Finally, we argue that the simultaneity bias arising from the endogeneity of wealth accumulation can be sizable, as regressions on the pre-crisis data display no significant relationship between percentage wealth changes and life satisfaction.

[1] We refer to individuals older than 65 as elderly, and between 50 and 65 as near-elderly. For brevity's sake, in the remainder of the paper we are often going to omit the near-elderly qualifier.

[2] Standard difference-in-differences techniques cannot be applied, because the financial crisis was a macroeconomic shock, which prevents identifying a valid control group.

[3] In the sample, we select respondents that were at least 50 year old in 2010. They could all legally work, and start gathering economically relevant information, already in the mid 70's.

Figure 1: House Price Index (HPI), U.S. Federal Housing Finance Agency, and NYSE Composite Index (Bottom panel), 01/1976-01/2013.



Notes: The dashed vertical lines represent the bankruptcy of Lehman Brothers, the dark (light) shaded areas are the HRS data collection periods of the 2008 and 2010 (2004, 2006, and 2012) waves.

1.1 Related Literature

The field of happiness economics has stressed the importance of economic conditions on SWB, often finding non-linear effects in income.[4] Headey and Wooden (2004) is one of the few studies focusing on the role of wealth. Using Australian data, they find a statistically significant and sizable effect of wealth holdings on SWB. This is not always the case for the HRS data, which is perhaps surprising, given the older average age in our sample. Moreover, their data do not allow to study of the role of wealth shocks. Finally, some of their results are somewhat complicated to generalize, because the size of their marginal effects partially stems from a data transformation they implement.[5]

The relationship between health and wealth is analyzed by Michaud and van Soest (2008), among others. They run a battery of causality tests to disentangle the direction of causation, using HRS couples aged 51-61 in the initial 1992 wave. Their results provide strong evidence of causal effects of either spouse's health on household wealth. This motivates some of our specifications, because controlling for health status is important when estimating the link between wealth changes and life satisfaction.

[4]Some recent and exhaustive surveys are Clark (2018), Clark, Frijters and Shields (2008), Deaton (2008), Frey and Stutzer (2002), Layard (2011), and MacKerron (2012).

[5]Headey and Wooden (2004) perform a log transformation of wealth, which affects the standardized coefficients' magnitude. Following their procedure, by both selecting only the HRS households with positive wealth and running linear regressions, reveals that in the HRS sample the (standardized) beta coefficients of log wealth are almost seven times as large as their counterparts for wealth in levels.

Hasegawa (2009) considers the role of income and savings for the SWB of young Japanese women, relying on Panel Survey of Consumers data. Dynamic ordered probit models are estimated with Bayesian methods. The posterior distributions of the parameters show that income and savings have positive effects on life satisfaction, unlike marriage and labor force participation. However, there is no attempt to deal with the endogeneity of saving decisions, or to consider the role of wealth shocks.

Deaton (2012) uses daily Gallup surveys to analyze the response of SWB to stock market fluctuations during the financial crisis. In the 2008–10 period, the well-being measure tracks closely the stock market outcomes. The proposed explanation posits that the stock market acted as a leading indicator, and movements in SWB captured a "fear factor" reflecting, for example, expectations of reduced employment prospects. Since housing represents the most important wealth category for the majority of households, using total net worth, as we do, improves upon Deaton (2012). Focusing on an older population is also an advantage, as the elderly are less reliant on labor market outcomes. Moreover, exploiting the answers to the life satisfaction questions collected after February of 2010 bypasses Deaton's argument, as the NBER dates the end of the recession to June of 2009. Finally, his high frequency aggregate data have limitations, because they constrain the number of available control variables.

McInerney, Mellor and Nicholas (2013) use HRS data to study the relationship between health and wealth. There are some key differences between our contributions. First, there is a distinction in the main focus of the analysis, as they consider if the stock market crash of 2008 caused a worsening of the mental health of the American elderly. Second, the identification strategy is different: borrowing from Hudomiet, Kezdi and Willis (2011), they rely on the timing of the survey responses relative to the onset of the financial crisis, while we exploit the persistence of the drop in asset prices. Finally, although they control for time-invariant fixed effects, there are some limitations their sample suffers from: arguably, their treatment and control groups differ in some crucial dimensions, and there are few treated respondents.[6]

Liu et *al.* (2020) use the China household finance survey to understand the relationship between debt and happiness. They find that total household debt negatively affects SWB, and that different types of debt have heterogeneous effects, with housing and education debt representing the driving factors of this negative relationship. Their cross-sectional dataset does not allow to address the endogeneity of household debt, or analyze wealth shocks.

The rest of the paper is organized as follows. Section 2 briefly describes the HRS data. Section 3 outlines the empirical framework, and discusses the main results together with some extensions. Section 4 concludes.[7]

2 The Health and Retirement Study Data

The HRS is a biennial survey designed to obtain information on a representative sample of American individuals over the age of 50. Data collection started in 1992 and, since 2004, the respondents have been asked a series of questions about their life satisfaction. These psychosocial variables have been gathered in every wave from a rotating sub-sample, each consisting of an initial random 50% split of the core panel participants. This induced a one-wave gap in the longitudinal dimension of life satisfaction, as the SWB questions are administered to the same respondent every four years. To focus the analysis on the elderly and near-elderly, in terms of sample selection rules, we keep in the sample only the individuals that in 2010 were between the ages of 50 and 100.[8]

In the HRS, both the wealth and income measures are reported in nominal dollars, and we adjust them for inflation using the CPI index. Our inflation-adjusted wealth variable represents the value of net worth. It is calculated as the sum of all wealth components (except the value of Individual Retirement Accounts and Keogh plans), minus the value of all debts. The wealth components consist of the value of real estate (including the respondent's primary residence), vehicles, business assets, stocks and mutual funds, checking and savings accounts, government bonds and treasury bills, bonds and bond funds, and all other savings.

[6] The post-crash sample has higher average wealth ($521k vs. $409k). Moreover, it is not observationally equivalent in average income (they earn 34% more, $79k vs. $59k), average age (they are 3 years younger, 66.8 vs. 69.7), and location (they are 6 percentage points more likely to live in the South). Notably, less than 10% of the sample was interviewed after the bankruptcy of Lehman Brothers.

[7] Two supplementary appendixes report the full regression results, and describe the data in more detail.

[8] This excludes the 9 individuals older than 100, and the younger individuals that, over time, entered the panel.

The debt components consist of the value of all mortgages, all other home loans plus the balance on equity lines of credit, and other debts.[9]

The SWB measures refer to individual information, while income and wealth are household-level variables. Following standard procedures, and for comparability with Headey and Wooden (2004), we transform the last two variables into their equivalized counterparts, dividing them by the square root of the household size. Finally, to facilitate marginal effects comparisons, we divide both equivalized variables by $100,000$.

The longitudinal nature of the HRS allows to compute the change in wealth that occurred between the 2008 and 2010 waves. This change is used as an explanatory variable, whose main source of variation we argue to be the exogenous and persistent change in asset prices. We are going to interpret the difference in accumulated wealth as a shock, because at the onset of the financial crisis both the initial wealth and the portfolio composition were predetermined, inducing dispersion randomly. The variation in wealth is computed both in levels and in percentage terms, the latter being relative to the 2008 wealth holdings.

We drop from the sample all respondents with a missing value to either the life satisfaction question or wealth holdings.[10] These restrictions lead to 4898 individual observations, labeled as Sample C, the largest sample that is used to check the robustness of the benchmark regressions.

Since large medical expenditures can be the cause of substantial wealth changes, they can induce a simultaneity problem, as deteriorating health conditions lower both wealth and measures of SWB. To control for this separate cause of decreases in wealth, starting from Sample C, we only keep the individuals whose number of medical conditions did not increase between the 2008 and 2010 HRS waves. This restriction leads to a sample with 3843 individual observations, labeled Sample A, which is used in our baseline regressions.

Another sample, labeled Sample B, is obtained by imposing a further restriction concerning the interview date in 2008. In this case, the respondents interviewed after the bankruptcy of Lehman Brothers are dropped, because they likely had already experienced a fall in their financial wealth. In Sample B, there are 3372 individual observations.[11]

3 Econometric Analysis

The main econometric analysis models the responses to a life satisfaction question in 2010. The respondents rated their agreement with the following statement: "The conditions of my life are excellent." We opted to focus on this measure of SWB as we believe it is more likely to capture the instantaneous, rather than the lifetime, assessment of life satisfaction.[12] The values taken by the dependent variable are seven possible ordered responses, from "strongly disagree" to "strongly agree". Table I tabulates the life-satisfaction answers for the samples used in the regressions. Overall, almost 50% of the respondents selected categories 6 and 7, which represent the two highest degrees of life satisfaction. The distribution of answers for our dependent variable is relatively stable across the A, B, and C samples. The last two rows in the Table refer to two age sub-samples of Sample A, divided into the $50-65$ and $66-100$ age groups, which are meant to capture pre-retirement and post-retirement individuals. This split highlights a more pronounced difference in the distribution of the life satisfaction answers, as older respondents opted for the "strongly agree" category more often, mainly compensated by a lower proportion of the "slightly disagree" category. This well-known fact motivates the inclusion of a polynomial in age in the set of regressors.

Given the qualitative and ordered nature of the dependent variable, we specify and estimate ordered logit regressions.[13] Denoting with y^* a latent variable, with y the observable response category of life satisfaction,

[9] Net worth is the sum of the wealth variables HwAHOUS, HwARLES, HwATRAN, HwABSNS, HwASTCK, HwACHCK, HwACD, HwABOND, HwAOTHR, minus the sum of the debt variables HwAMORT, HwAHMLN, HwADEBT. For more details, see supplementary appendix A and the HRS documentation.

[10] We further restrict the sample by trimming the top and bottom 1% of the wealth change variable in percentage terms. These are clear outliers, likely induced by measurement error. These observations are mainly due to respondents reporting a value of wealth close to zero in 2008, and a relatively large (positive or negative) wealth value in 2010. Neglecting the trimming of this variable does not affect the main results.

[11] In the three sub-samples, the correlation between income and wealth is around 0.4. This statistic is broadly consistent with what Diaz-Gimenez, Glover and Rios-Rull (2007) find in the Survey of Consumer Finances data.

[12] We repeated the analysis with two other life-satisfaction statements: "In most ways my life is close to ideal," and "So far, I have gotten the important things I want in life." The results, included in supplementary appendix B, are similar to those reported here. For a discussion of the time horizon underlying SWB responses see Kimball and Willis (2006).

[13] We also ran ordered probit regressions. The results, included in supplementary appendix B, are similar.

Table I: Tabulations of the life-satisfaction answers (%) in the 2010 HRS wave.

	(1) *Strongly dis.*	(2) *Somewhat dis.*	(3) *Slightly dis.*	(4) *Neit. ag. nor dis.*	(5) *Slightly ag.*	(6) *Somewhat ag.*	(7) *Strongly ag.*
Sample A	7.07	9.03	9.03	9.17	16.84	31.92	16.95
Sample B	6.87	8.64	9.11	8.98	17.06	32.14	17.19
Sample C	7.83	9.11	9.40	9.25	16.89	31.47	16.04
Age 50-65	7.11	9.35	10.66	8.82	15.80	33.51	14.75
Age 66-100	7.01	8.89	8.05	9.47	17.07	30.96	18.55

Notes: The rows refer to the distribution of the dependent variable for each sample used in the regression analysis. The two age sub-samples result from splitting Sample A into two age groups.

with $\boldsymbol{\beta} = [\beta_j]_{j=1}^{3}$, $\boldsymbol{\gamma}$, and $\boldsymbol{\mu} = [\mu_j]_{j=1}^{5}$ the vectors of parameters to be estimated, and with ε the error term, the econometric model can be represented as follows:

$$\begin{aligned} y^* &= \beta_1 income + \beta_2 wealth + \beta_3 \Delta wealth + \boldsymbol{\gamma}'\mathbf{X} + \varepsilon \\ y = 1 \text{ if } y^* \leq 0; y = 2 \text{ if } 0 < y^* \leq \mu_1; y = 3 \text{ if } \mu_1 < y^* \leq \mu_2; ...; y = 7 \text{ if } y^* > \mu_5 \end{aligned} \quad (1)$$

In the baseline specification, the regressors of interest are income, wealth and the wealth change that occurred between 2008 and 2010.[14] Since the financial crisis was long-lived, individuals hit by a large negative wealth shock were left with a lower present discounted value of lifetime resources. According to the permanent income hypothesis, this should have driven them to revise downward their consumption expenditures, leading to a deterioration in their life satisfaction. We consider seven specifications, presented in Table II. Each column refers to a different definition of the regressor $\Delta wealth$, which represents the wealth loss (i.e., a gain is a negative value). The regression in column (1) omits $\Delta wealth$ as an explanatory variable. In column (2), $\Delta wealth$ stands for the total wealth loss in levels, while in column (3) for the percentage wealth loss. In columns (4)-(7), $\Delta wealth$ is defined as a dummy variable representing whether the respondents' wealth loss was larger than the displayed percentage.

3.1 Baseline Estimation Results

The benchmark regression results are reported in the top panel of Table II, denoted with the label Sample A. The estimated parameters on both income and wealth are always highly significant, and with the expected signs. Economic theory predicts that only under complete and frictionless asset markets the marginal utility of one dollar of income would be the same as the marginal utility of one dollar of wealth. Many asset categories, such as long-term bonds and housing, are characterized by high transaction costs and limited liquidity. These elements, together with the consumption services of housing and differential taxation of income and wealth, can drive a wedge between the two marginal utilities. We run formal tests for the equality of the two regression coefficients, and the null hypothesis is always rejected at the 1% level of statistical significance. To better understand the implications of these estimates, Figure (2) plots the average (conditional) marginal effects, with their 95% confidence intervals.[15] Each of the four graphs refers to the marginal effects of a specific regressor, made explicit in the labels at the top of each plot. The horizontal axis displays the seven choice categories of the dependent variable, while the vertical axis the change in the related probability, expressed in percentage points. For instance, a variable affecting positively life satisfaction would be associated with a shift of the probability mass away from lower categories in favor of higher ones. This would typically be displayed as a negative marginal effect for the lower categories (i.e., a decrease in their choice probability), and a positive marginal effect for the higher categories (i.e., an increase in their choice probability). The magnitude of each marginal effect can be gauged by comparing them to the shares of each choice category, reported in Table I above.

[14] All regressions use the matrix $\mathbf{X}$ of exogenous controls, which includes: geographical dummies, number of children, educational attainment dummies, a gender dummy, race dummies, a home ownership dummy, self-reported health dummies, number of health conditions, and a quadratic polynomial in age. The full estimation results are in supplementary appendix B.

[15] We also computed the marginal effects with the other regressors evaluated at their means, and they are very similar.

Table II: Ordered logit regressions for life-satisfaction, parameter estimates.

	(1) *No w-loss*	(2) *w-loss*	(3) *w-loss%*	(4) *w-loss>20%*	(5) *w-loss>40%*	(6) *w-loss>60%*	(7) *w-loss>80%*
Sample A (N=3843):							
income	0.301***	0.300***	0.298***	0.301***	0.305***	0.308***	0.303***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
wealth	0.0290***	0.0290***	0.0272***	0.0284***	0.0265***	0.0248***	0.0261***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.007)	(0.005)
Δ*wealth*	–	-0.00632	-0.0679***	-0.0260	-0.131*	-0.302***	-0.352***
		(0.735)	(0.008)	(0.662)	(0.066)	(0.001)	(0.002)
log-likelihood	-6539.7	-6539.6	-6536.3	-6539.6	-6537.9	-6533.9	-6534.7
Sample B (N=3372):							
income	0.308***	0.303***	0.306***	0.308***	0.313***	0.317***	0.310***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wealth	0.0248***	0.0247**	0.0231**	0.0245**	0.0224**	0.0208**	0.0226**
	(0.009)	(0.010)	(0.015)	(0.010)	(0.019)	(0.028)	(0.017)
Δ*wealth*	–	-0.0197	-0.0707**	-0.0132	-0.130*	-0.316***	-0.318**
		(0.331)	(0.010)	(0.837)	(0.093)	(0.002)	(0.014)
log-likelihood	-5706.9	-5706.3	-5703.9	-5706.9	-5705.4	-5701.6	-5703.5
Sample C (N=4898):							
income	0.323***	0.323***	0.321***	0.323***	0.325***	0.326***	0.325***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wealth	0.0340***	0.0340***	0.0326***	0.0341***	0.0324***	0.0310***	0.0319***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ*wealth*	–	-0.00133	-0.0466*	0.00598	-0.0749	-0.205***	-0.243**
		(0.934)	(0.077)	(0.910)	(0.231)	(0.009)	(0.018)
log-likelihood	-8360.5	-8360.5	-8358.7	-8360.5	-8359.8	-8357.1	-8357.5
Controls	YES	YES	YES	YES	YES	YES	YES

Notes: The definition of the regressor Δ*wealth* changes across specifications: in column *w-loss* it stands for the total wealth loss, in *w-loss%* for the percentage wealth loss, in *w-loss>x%* for a dummy variable equal to 1 for the respondents whose wealth loss was greater than *x%*. Income and wealth are equivalized (and in \$100k). All regressions include the same controls, listed in footnote 14. p-values in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

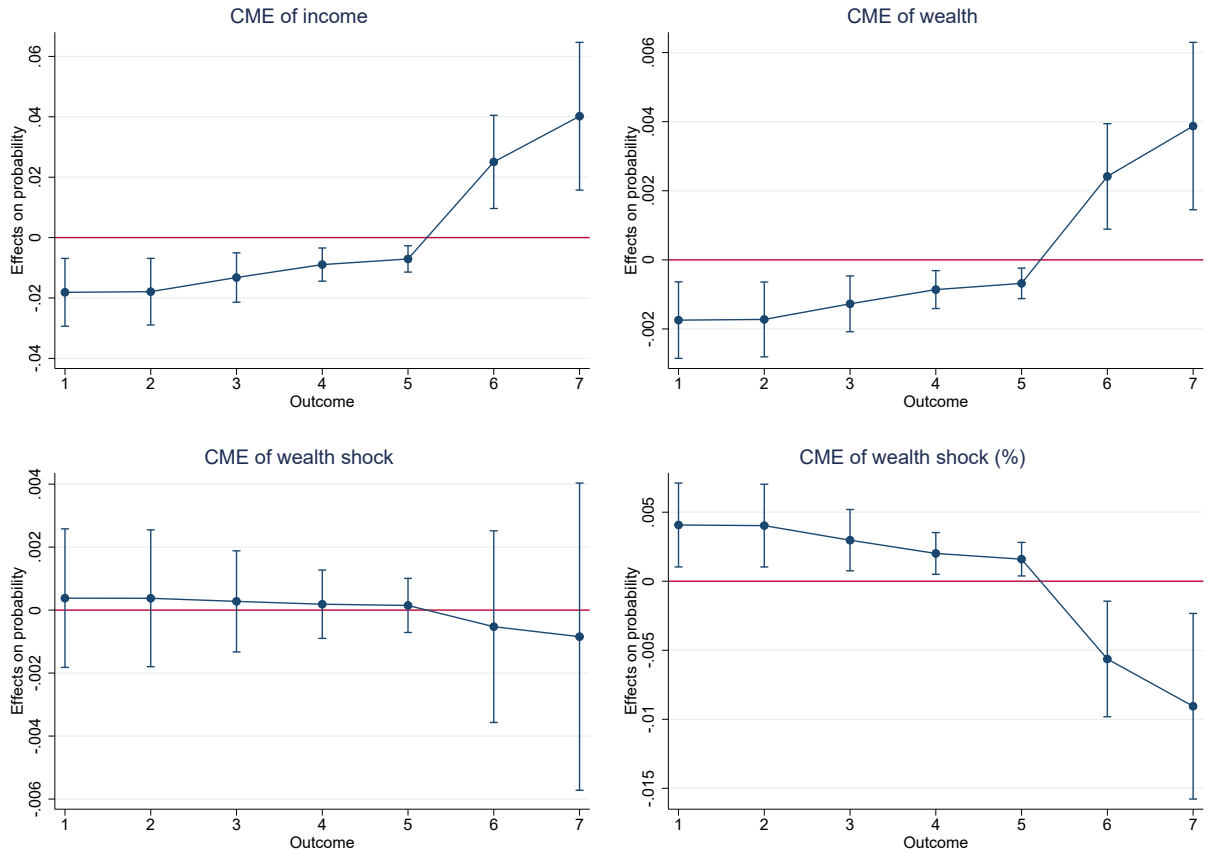
The results confirm some of the findings in Headey and Wooden (2004): income and wealth do play a positive role in the determination of people's life satisfaction, and they appear to be quantitatively different. However, in our sample the relative magnitudes of the related marginal effects are reversed, as the influence of income on SWB is considerably stronger. The shape of the two marginal effects curves is virtually identical (first negative, then positive), but the marginal effects of income are 10 times as much.[16] For instance, the marginal effect of income on category n.7 (the "strongly agree" answer) is 4 percentage points, while the marginal effect of wealth for the same category is only 0.4 percentage points. These results are consistent with the theoretical arguments outlined above.

Columns (2) and (3) in Table II reveal two noteworthy results. The parameter associated with the wealth shocks in levels is not statistically different from zero. In contrast, wealth losses in percentage terms do affect negatively SWB. The marginal effects for these two versions of the wealth shock are displayed in the bottom row of Figure (2). Each marginal effect of the wealth shock in levels is not statistically different from zero. Differently, the marginal effects curve for the relative wealth shock is positive for the first five choice categories, becoming negative for the last two. To further explore the relationship between percentage wealth losses and SWB, we run a series of regressions that include a dummy variable representing whether the respondents' wealth loss was larger than a given percentage. The results in columns (4)-(7) show that the larger the percentage loss, the more negative (and significant) the associated estimate. This provides empirical evidence that only substantial relative wealth shocks, 60% and higher, matter for the determination of SWB.

A plausible economic channel that can explain these results, complementary to a drop in consumption

[16] Recall that, by construction, income and wealth are expressed in the same units.

Figure 2: Average Conditional Marginal Effects (CME), 2010 HRS Data.



Notes: CMEs of income, wealth, wealth shock in levels, wealth shock as a percentage, with 95% Confidence Intervals. These CMEs are derived from regressions (2) and (3) in Table II.

expenditures, is that seniors might become relatively more vulnerable. During their life-cycle, they accumulated wealth also to partially insure against the costs of health risks, such as hefty medical bills and expensive treatments. A substantial percentage reduction in their wealth might render some costly therapies and better equipped nursing homes no longer affordable, contributing to a decrease in life satisfaction.

The threshold effect found in the regressions can be partially interpreted as a manifestation of the adaptation phenomenon described by Clark, D'Ambrosio and Ghislandi (2016), Clark et *al.* (2008) and Kahneman and Krueger (2006), among others. If wealth losses are not too pronounced, relative to the previous equivalized wealth holdings, the respondents' lifestyle might not be affected too heavily (if at all), and they can easily adapt to their new circumstances. Whenever the wealth loss is substantial, life satisfaction is negatively affected, as the respondents might consider this change as too drastic. Another conceivable mechanism might be related to the role of inheritances. Elderly parents typically plan to leave part of their wealth as bequests and inter-vivos transfers. Following an exogenous negative wealth shock, elderly individuals might reassess the planned inheritances, allowing them to partially mitigate the direct harmful effects of the shock. Given that the decline in wealth was caused by forces outside of their control, they might not feel responsible for the decrease in intergenerational transfers, unless the drop becomes sizable.

From the perspective of quantitative analysis, these findings offer insights on how to specify and test theoretical models, as done by Bayer and Juessen (2015) and Frijters et *al.* (2015). In particular, standard dynamic models with time-separable preferences imply that, controlling for labor or pension income (and other individual characteristics), current wealth is a sufficient statistic for both explaining consumption

expenditures and capturing the dispersion of individual welfare. The regression results are not consistent with this notion, as large (non-permanent) wealth shocks negatively affect well-being, while standard models predict that this term should not be statistically significant. This result seems to support models of habit formation. These, on the other hand, typically entail that *any* negative wealth shock should decrease welfare, irrespective of its size.[17]

Table II also reports some robustness analysis. In Panel B, we show that the results are robust to the interview date in 2008. The results are virtually unaffected, presumably because housing represents the largest fraction of asset holdings for the vast majority of households. In Panel C, we kept all respondents in the sample, irrespective of their health changes. Also in this case the results are robust. However, not controlling for deteriorating health conditions does affect both the size and the significance of the parameters related to the percentage loss dummies. The estimates for the wealth shock are consistently lower compared to the benchmark. This is to be expected, as in this sample more than $1,000$ respondents experience a worsening of their health status, forcing them to decumulate part of their wealth.

We close this subsection with a few caveats, as our estimates might be biased. On the one hand, the wealth shock is not entirely exogenous, because of both selection on unobservables and wealth losses induced by increased vulnerabilities during the aging process. On the other hand, on the basis of standard omitted variable bias arguments, our estimated effects of wealth shocks could represent lower bounds.[18]

3.2 Further Results

In this subsection, we extend the analysis by considering additional HRS data, namely the 2006 and 2012 waves, in turn. These supplementary regressions provide insights on two important aspects: how planned changes in wealth affect SWB, and whether the 2008-2010 wealth shock had a short-lived effect.

Using the SWB variable collected in 2006 allows us to understand the response of SWB when the wealth change observed between two HRS waves is not driven by an exogenous shock. Moreover, using the SWB responses collected in 2012 as the dependent variable, we are able to use wealth changes that occurred in both the 2008-2010 and the 2010-2012 time windows as regressors. This accomplishes the goal of showing whether the effect of the 2008-2010 wealth shock was transitory or long-lasting.

3.2.1 The Irrelevance of Planned Wealth Changes on Subjective Well-Being

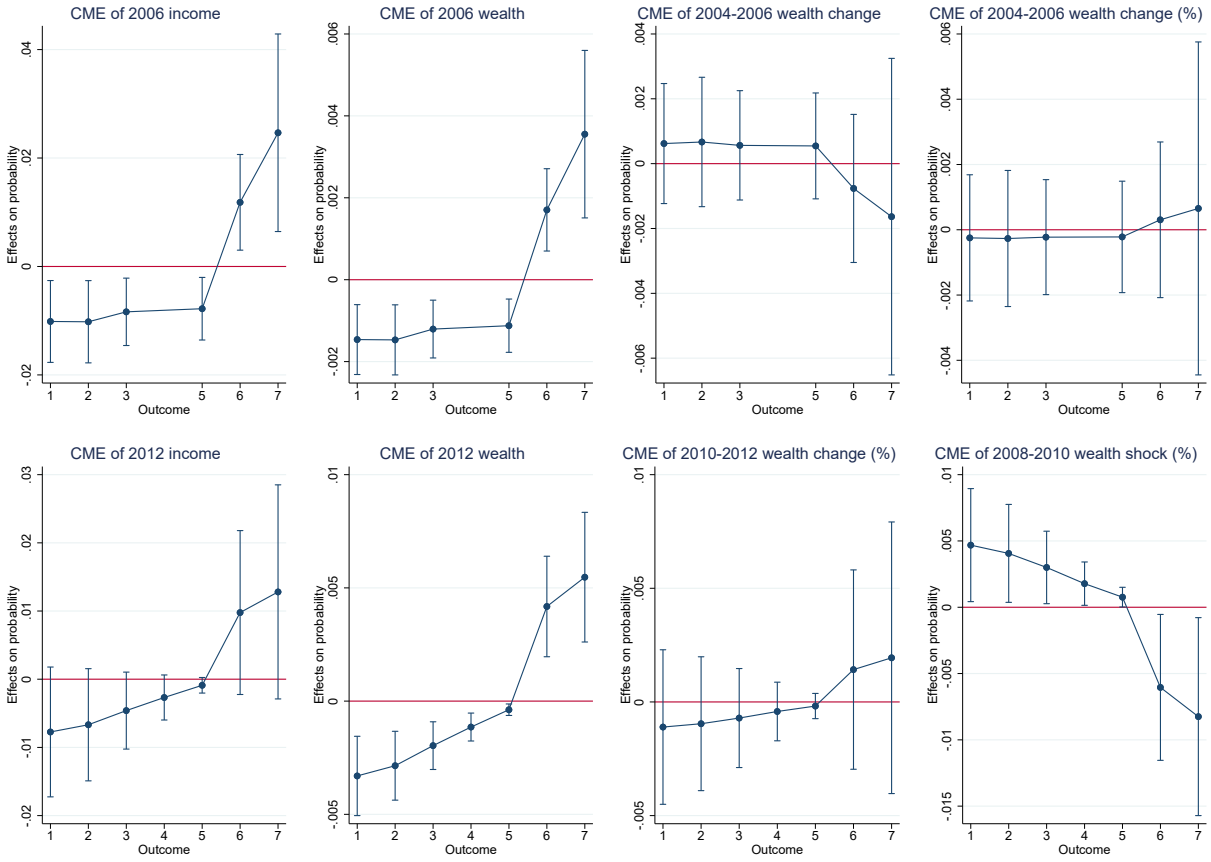
We repeat the analysis by considering the 2006 HRS wave, such that the respondents to the SWB questions are the same as in the 2010 wave used in the main analysis above.[19] These additional regression results provide insights on how planned changes in wealth affect SWB. Evidently, the wealth change that took place between 2004 and 2006 was not affected by the financial crisis. In this case, unlike the subsequent wealth changes, the variation in wealth holdings cannot be considered to be mainly driven by a shock. The wealth changes that occurred between 2004 and 2006 were for the most part planned or, on average, predictable by the respondents. For instance, some decreases in wealth are explained by inter-vivos transfers to children. Such a change in wealth holdings is intended, and should not affect negatively the SWB. This kind of mechanism is supported by the plots reported in the top row of Figure (3). The marginal effects on each of the six life satisfaction categories of either version of the wealth change are not statistically different from zero. This finding demonstrates why a panel data analysis is not warranted, as it would conflate the effects of exogenous and endogenous wealth changes. Although controlling for unobserved heterogeneity in SWB studies is typically desirable, as pointed out by Ferrer-i-Carbonell and Frijters (2004), a full-blown panel data analysis would suffer from important limitations, which would invalidate our identification strategy. Furthermore, the regressions could rely only on a short panel, as the SWB questions were asked to the same respondents only twice, and every other wave (i.e., every 4 years).

[17] A similar state-dependent argument is developed in Finkelstein, Luttmer and Notowidigdo (2013), who estimate how the marginal utility of consumption varies with health.

[18] Since it is reasonable to expect a negative relationship between life satisfaction and poor health, if the unobservables were to determine a negative relationship between wealth losses and poor health (obtained, for example, if a precautionary saving motive to prevent health deterioration were to be strong enough), our estimated parameters on the wealth shocks would be biased upward.

[19] Notice that the 2006 HRS survey did not include the "Neither agree nor disagree" response, and in this case there are only six SWB categories.

Figure 3: Average Conditional Marginal Effects (CME), 2006 and 2012 HRS Data.



Notes: CMEs of income, wealth, wealth shock in levels, wealth shock as a percentage, with 95% Confidence Intervals. The top (bottom) row refers to a regression with the 2006 (2012) SWB question as the dependent variable. Note that the 2006 HRS wave included only six SWB categories.

3.2.2 The Persistent Effects of Wealth Shocks on Subjective Well-Being

The longitudinal structure of the HRS data allows us to consider if the effects of the wealth shock caused by the financial crisis are persistent. To this end, we turn the attention to the other rotating group of respondents, that answered the life satisfaction questions in 2012. For the second rotating group, two wealth change variables can be constructed. In this regression, we keep the same explanatory variables considered in the previous analysis (at their 2012 values), with an important extension to the econometric specification. In this version of the statistical model, the wealth shock that occurred between 2008 and 2010 is coupled with the wealth change that occurred between 2010 and 2012, which is more likely to have been planned. This formulation allows us to understand if exogenous, and uninsurable, wealth shocks mainly lead to transitory changes in individual well-being, or if these effects can be persistent.

The marginal effects of the explanatory variables of interest are reported in the bottom row of Figure (3). The financial crisis wealth shock retains a negative and significant estimate, and the associated marginal effects on each choice probability are still sizable. In line with the results based on the 2006 data, the marginal effects of the 2010-2012 wealth change are not statistically different from zero. This finding provides evidence of long-lasting detrimental effects of large percentage drops in wealth holdings. It can be interpreted as a further manifestation of state dependence, whereby large shocks might have disrupted the lifetime plans of some respondents, such as the ability to retire early or move to a new location with more amenities intended to be enjoyed by seniors.

4 Conclusions

In this paper, we provided empirical evidence showing that large proportional wealth shocks, relative to the respondents' previous equivalized net worth, lower the life satisfaction of elderly individuals for an extended period of time. A plausible economic channel that can explain this result is that seniors with deteriorating wealth holdings become extremely vulnerable to other shocks, as they might become poorly insured against a number of risks, and the associated costs. The marginal effects of the wealth shocks are found to be quantitatively larger than the marginal effects of wealth. However, they are consistently smaller than the marginal effects of income. Data limitations do not allow us to consider the complex role of expectations about the future, and the individual beliefs about the possibility for asset prices to recover.[20] A possible advantage of working with the two-year window implicit in the HRS data is that the respondents had more time to collect financial information, and seemingly their wealth losses could be accurately assessed.

In terms of public policy recommendations, since large wealth losses are detrimental and their negative effects are long-lasting, our main results can justify the introduction of budget-neutral fiscal incentives favoring safer household investments. Taking for granted that aggregate risks are virtually uninsurable, incentivizing portfolio diversification would decrease the likelihood of catastrophic wealth losses, which should prove beneficial. Finally, the arguments presented in the Introduction support generous social security benefits.

Future work could try to assess whether the empirical findings are a puzzle, or if they can be rationalized by a stochastic life-cycle model, featuring habit formation, and shocks to income, wealth and health.

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[20] An added issue is that soon after the financial crisis was over in North America, the public debt crisis started unfolding in Europe, raising concerns about a further correction in the stock market, and another recession.

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