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Mitigating the consequences of a health condition: The role of intra- and interhousehold assistance☆,☆☆

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ABSTRACT

The behavior of noncoresident family members motivates much of the literature on consumption smoothing, risk-sharing, and informal networks, yet little is known empirically on the topic due to a lack of data simultaneously observing multiple households in an extended family. This study utilizes genealogically linked longitudinal data to examine how extended family networks insure against financial risks from severely limiting health conditions. We find that nonhealth consumption of unmarried households declines in response to worsening health, whereas married households smooth expenditures in a way that is consistent with full insurance. Families mitigate losses by reallocating home production, drawing down home equity, holding formal health insurance, collecting social security, and receiving transfers from noncoresident relatives. We illustrate that the costs of health shocks are transmitted throughout family networks, and that noncoresident children draw down their assets and consumption when responding to a parent's health decline.

1. Introduction

Deteriorating health can have serious short- and long-term economic consequences for those most at risk. While previous literature has examined the extent to which individuals rely on formal and informal insurance channels to overcome health risk, little is known empirically about the full set of mechanisms extended families in developed settings use to respond to health shocks. This is despite the fact that the behavior of noncoresident family members motivates much of the literature on risk-sharing and informal insurance. Beginning from a well-established consumption-smoothing framework, we exploit genealogically linked data from the 1999 to 2011 waves of the Panel Study of Income Dynamics (PSID) to examine how severely limiting health conditions impact individuals, their households, and their noncoresident family members. The results emphasize the connectedness of families across space and highlight the importance of informal family support.

The framework for this study is based on models of family interaction and informal insurance (e.g. Mace, 1991; Cochrane, 1991; Altonji et al., 1992). Where past work has focused on testing the ability of households to fully insure consumption against income shocks, we extend the literature by also examining how particular coping mechanisms respond to health risk. These mechanisms include formal labor supply, home production, depletion of specific assets, and receipt of public and private transfers. The analysis serves to connect evidence of the important role of intergenerational exchange in the United States (e.g. Cox, 2003; Wiemers et al., 2017) with a rich literature from developing-country settings that documents a relationship between health shocks and informal insurance from one's noncoresident family (e.g. Fafchamps and Lund, 2003; Genoni, 2012).

Our work contributes to the literature in a number of ways. We benefit from the longitudinal design and detailed health data of the PSID to identify plausibly exogenous health transitions that carry significant financial risk. We focus on the severity of limitations to daily activities measured through a series of questions that elicit

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the incidence and level of limitations from each of eleven different acute, chronic, and psychosocial conditions. Due to the survey's long-running nature, we are able to track individuals who experience severely limited health as well as observe those who recover in subsequent periods.

Second, we utilize the PSID's genealogical following rule that retains and interviews split-off family members after they move out of root households to provide new evidence on the nature of informal insurance provided by both coresident and noncoresident family members. We directly examine responses of genealogically related households to characterize how providing informal insurance might vary within an extended family by gender and relationship.

The results reveal that the onset of a severely limiting health condition leads to an approximate 15 percent reduction in individual labor income and a 20 percent increase in health expenditure. Income losses are partially passed through to consumption, which falls by approximately 10 percent, suggesting that households are only able to partially insure nonhealth expenditures against poor health. The ability to smooth consumption is improved, but still incomplete, for those covered by formal health insurance. However, we find stark heterogeneity in consumption insurance by marital status and fail to reject that married households are able to smooth expenditures across health declines while unmarried households experience 16 percent reductions in nonhealth expenditures.

The stark heterogeneity linked to marital status motivates a further exploration of the different responses between married and unmarried households. For married households experiencing a severely limiting condition, we find evidence of responses in home production, depletion of home equity, and increases in social security receipt. In contrast, while unmarried households draw from home equity as well, they appear to have a wider range of insurance channels outside of the household, including increases in receipt of social security and monetary transfers from extended family members. We find that drawing from home equity and formal health coverage appear to be the primary sources of partial consumption insurance.

Due to the connectedness of families, it is possible that the cost of a shock to one member are borne throughout one's family network. Drawing on the tracking design of the PSID, we illustrate that outcomes from child[1] households respond to the declining health of their parents, and find differential effects by gender. Households headed by male children reduce home equity and savings while female children reduce their own consumption and increase health expenditure. The results suggest the economic costs of health shocks spread far beyond an individual's household, and that informal networks play an important, but incomplete, role in covering gaps left by formal insurance.

Our approach is consistent with the large literature examining the impact of health status on outcomes related to risk sharing and consumption smoothing that defines health through self-reported symptoms, new diagnoses, or limitations on daily activities.[2] This includes work examining the onset of physical disabilities (e.g. Currie and Madrian, 1999; Stephens, 2002; Charles, 2003; Meyer and Mok, 2013; Ball and Low, 2014; Low and Pistaferri, 2015). Severely limiting health conditions and reduced physical ability are similar in that there are formal insurance systems in place to deal with anticipated and unanticipated realizations of the events, and both can negatively impact labor supply and earnings while increasing health expenditures. By focusing on diagnosis-linked limitations, we avoid some concerns related to confounding labor supply and health present in measures of health shocks linked to work-limiting disabilities. Due to the nature of the representative sampling of the PSID, we are also able to extend our analysis beyond health shocks to prime-age males that have been the focus of much of this literature.

The following section motivates the empirical analysis that follows by outlining a conceptual framework for studying financial risks, informal consumption insurance, and the behavioral responses of family members. Throughout the paper we discuss threats to identification and the implications of viewing the results through a lens of incomplete insurance versus state-dependent preferences. The patterns we show are consistent with insurance interpretations in all cases and provide rich insights on the impact of health shocks to individuals, their households, and families.

2. Conceptual framework and empirical strategy

In standard models of full insurance, permanent household resources determine contemporaneous consumption rather than idiosyncratic fluctuations in income (e.g. Deaton, 1992). Households have access to state-contingent means of insurance to equate marginal utility across time despite facing a number of stochastic states with varying potential consumption realizations. Under separable preferences that ensure the marginal utility of consumption does not change with the onset of a health shock, income fluctuations brought on by poor health are smoothed away and have no effect on the realized change in consumption between periods.

Given the large literature detailing the testing and rejecting of the full-insurance model, we utilize the framework as a starting point for a more nuanced analysis of how households and family networks respond to declining health.[3] This approach is in line with prior work that examines the formal and informal mechanisms used as insurance against deteriorating health in Indonesia (Gertler and Gruber, 2002; Genoni, 2012) and China (Liu, 2016).

2.1. Empirical implementation

The regression analog to the baseline test of full insurance examines how a change in health status for a given individual impacts a series of outcomes. Given longitudinal data for individual i in household h and survey-wave t, we estimate the following within-person model:

$$Y_{iht} = \beta\theta_{iht} + X_{iht}\gamma + \mu_i + \varepsilon_{iht} \quad (1)$$

where Y_{iht} is the outcome of interest, including financial resources and nonhealth percapita expenditure. Health status of individual i is captured by θ_{iht}, and measures the severity of limitations in daily activities due to specific acute, chronic, and psychosocial conditions. Respondents are classified into severe, moderate, little, or no limitations. Time-varying factors related to the individual and household are controlled in X_{iht} and include flexible controls for age and education of the household head and spouse, household size and composition, survey-wave fixed effects, an indicator for whether the interview was provided by a proxy respondent, and indicators for if the individual is covered by health insurance in the current interview and the previous interview.[4] As age and the

[1] References to noncoresident children specifically refer to financially independent children living in a household separate from their parent. In the PSID, both the parent and the child will be sample members.

[2] Examples include Cochrane (1991), Townsend (1994), Smith (1999), Gertler and Gruber (2002), Fafchamps and Lund (2003), Wu (2003), de Weerdt and Dercon (2006), Wagstaff (2007), Islam and Maitra (2012) and Sparrow et al. (2014).

[3] For early tests of the independence of consumption growth and income fluctuations in the United States see Hall and Mishkin (1982), Cochrane (1991), Mace (1991), and Hayashi et al. (1996).

[4] Results from models excluding contemporaneous insurance coverage due to concerns of simultaneity bias are consistent with those shown below.

likelihood of experiencing a severely limiting health condition are closely linked, we non-parametrically control for the age of the individual and spouse with full vectors of single year of age indicators for each.

Along with including time-varying controls, Eq. (1) captures additive, time-invariant characteristics of the individual with individual-level fixed effects, μ_i. A common concern with identifying the effect of health status is whether individuals prone to experiencing negative health events are permanently different from healthy individuals in other, unobserved ways. For example, poorer health might be related to permanent income or attitudes that affect consumption choices in a way that is separate from an actual health shock. The individual fixed effects control for such cases where reporting severe limitations is due to permanent, unobserved characteristics of the individual, and isolates identifying variation to the effect of changes in an individual's limitations over time. The fixed effects ensure that our estimated effect of interest is the severity and timing of one's limitations; those who are always healthy or always in poor health provide no identifying information. For example, the effects also control for perceptions or expectations of mortality if expectations remain constant over time. As in the underlying theory, the focus is therefore on how the outcome of interest deviates from the average for that household when individual *i* experiences a health decline.

2.2. Threats to identification

Examining how changes in health status are related to changes in the outcomes of interest for the same individual identifies our parameter of interest, β. When (log) consumption is the outcome under consideration, and given the conditions of the model, β will be zero if households are fully insured, as fluctuations in health and financial resources would not be passed through to nonhealth expenditures. If full insurance fails, comparing the losses from decreased labor income and increased health expenditures to the estimated β from Eq. (1) can help approximate the extent that nonhealth expenditures are partially insured.

The proposed empirical approach follows directly from the insurance and risk-sharing literature. However, the interpretation of a non-zero β as representing a failure of full-insurance is subject to the structure of the underlying model. The two primary concerns that would cloud this interpretation are the exogeneity of health transitions and nonseparability between health and consumption in the utility function.

First, the within estimator in model (1) requires strict exogeneity of health limitations in order to estimate unbiased tests of complete insurance. In our application, this means that after controlling for health status today, additional time-varying controls, and fixed, individual characteristics, health in prior or future periods can have no partial effect on contemporaneous consumption.

As a preliminary step, we explicitly test the strict exogeneity of health in our consumption smoothing framework following Chamberlain (1982, 1984) who proposes tests of strict exogeneity based on a first differenced version of Eq. (1). Under the null, the contemporaneous level of health should be unrelated to the change in consumption conditional on the change in health and additional controls. We fail to reject the null of strict exogeneity, supporting the validity of our approach. When focusing solely on an indicator for severe limitations as the measure of contemporaneous health, we estimate a coefficient of −0.007 with a standard error of 0.014. The *p*-value for the test of strict exogeneity is then 0.637, and we fail to reject the null. When allowing contemporaneous health to include the vector of indicators for severe, moderate, and little limitations, the coefficient on severe limitations is −0.008 with a standard error of 0.014. None of the three indicators are individually significant and the *p*-value on the joint significance test is 0.390. We again fail to reject strict exogeneity.

It is also possible to test if severely limiting health conditions are unexpected by examining their link with lagged indicators of household resources. This is another form of test illustrating the exogeneity of health transitions, as it is possible that a third factor such as prior job loss could cause both income, consumption, and health to worsen (Liu, 2016). To assess whether this is the case we test for a relationship between severe limitations today and lagged values of consumption, income, and wealth and find no meaningful links.

Columns 1 through 4 of Appendix Table A1 report results from individual fixed effects models of the likelihood of reporting severe limitations today on lagged household resources. Additional time-varying controls remain in the models as in the baseline. The estimated relationships are quite small in magnitude, and none are statistically significant. For example, an additional one thousand dollars in labor income in the prior period leads to a 0.006 percentage point decrease in the likelihood of having severe limitations today. The joint model in column 4 also fails to reject the null that there is no such intertemporal link. Severely limiting health shocks appear unexpected. These results are consistent with the Chamberlain test of strict exogeneity.

The second identification concern relates to the preference structure underlying tests of consumption smoothing. As noted above, the move from models focusing on smoothing utility to empirical tests examining consumption and its underlying insurance channels relies on a preference structure that is separable between consumption, leisure, and health. The validity of severe limitation shocks to identify the appropriate effect is compromised if the limitations themselves lead to preference changes and reductions in the marginal utility of consumption. This could be the case if either the household marginal utility of consumption depended directly on the presence of severe limitations, or indirectly if health shocks change nonlabor time when consumption and leisure are not additively separable. Under such scenarios limitation shocks would be correlated with time-varying preferences in the error term that are not absorbed with stable preferences in the fixed effect.

We address these concerns in the empirical discussion with tests that examine subsamples of the data and predictions of the alternative explanations. We illustrate below that the identifying health transitions are transitory, and the results are consistent with financial risk and failures to insure. Conceptually, it is also important to note that the measurement of consumption is at the household level, and individuals experiencing limitation shocks are embedded in multi-person households. Mean household size of those with severe limitation transitions for married and unmarried respondents is 3.0 and 2.2 respectively, and it would appear reasonable to consider that the household's marginal utility does not steeply decline with the onset of severe limitations (Meyer and Mok, 2013).

While concerns of nonseparable preferences are plausibly important, it would appear any related bias is small and insufficient to explain the patterns in the data. The following section discusses the rich panel data used for the analysis.

3. Data

The data required to estimate Eq. (1) and analyze outcomes of non-coresident family members are not trivial to collect. We construct information on genetically linked families utilizing seven waves of biennial interviews from 1999 to 2011 of the Panel Study of Income Dynamics (PSID) that contain consistent health, expenditure, and wealth modules. As we define a number of controls in time *t* with data from the prior interview to avoid simul-

taneity issues, our estimation sample consists of approximately 33,000 household-year observations from the biennial 2001 to 2011 waves.

Beginning in 1968 with a nationally representative set of households, the PSID has used a unique following rule that tracks and interviews individuals from the original households and their offspring regardless of location. These individuals carry the PSID "gene" throughout their life course. By connecting gened PSID sample members to their families of origin, we are able to link a sample of 7578 individuals into approximately 2000 families.[5] We describe the sample construction process in detail in Appendix A.

3.1. Measuring health transitions

The focal measure of health is constructed through a module covering severe limitations in daily activities due to eleven acute, chronic, and psychosocial conditions.[6] This battery of questions was added in the 1999 wave to complement existing health information about general health status and days of work missed due to illness. For each of the eleven conditions, the respondent is asked if they have ever been diagnosed and whether the condition limits their daily physical activities "a lot," "somewhat," "a little," or not at all.

Our measure of poor health is the most extreme level of limitation an individual reports across all of their diagnoses. We focus on the impact of severe limitations with an indicator equal to one if an individual reports "a lot" for any of the eleven conditions, and include controls for reports of moderate and little limitations in all models. The choice to focus on the most extreme level of limitation across conditions was made after testing whether the impacts of severe limitations differed depending on which diagnosis the limitation was stemming from and whether there were additive effects of more than one severely limiting condition. In models similar to our baseline model (1) modified to allow for limitations from each specific condition to have a differential impact on the outcome, we fail to reject that the effect of severe limitations are equal across diagnoses for key financial outcomes including non-health expenditure (p-value on the test of equality = 0.810), health expenditure (0.177), labor supply (0.284) and the value of home equity (0.326).

Sixty percent of those with any severely limiting diagnoses report only one, and 80 percent have one or two. When we look at models that test whether there is an additive effect of additional severe limitations, we fail to reject that the impact of one severely limiting condition is the same as having two or more such conditions (p-value = 0.268). We maintain our indicator marker for at least one severely limiting condition as the effect of interest.

We benefit from the high quality of the PSID health data. The information on diagnoses and limitations accurately reflects patterns in the National Health Interview Survey (Andreski et al., 2009), and have been used in a wide variety of literatures. Recent contributions include Valerio et al. (2010), Johnson and Schoeni (2011), Moran et al. (2011), Zajacova et al. (2015), and Boudreaux et al. (2016). The diagnosis-linked limitations alleviate concerns about conflating health with labor supply implicit in days-of-work-missed questions, and allows for analysis that disaggregates the limitations by the underlying diagnosis to explore potential causal mechanisms.

Table 1
Severe limitations transition matrix.

Time Period and Report of Severe Limitations					
		$t+1$		$t+2$	
$t-1$	t	No	Severe	No	Severe
No	No	96.4	3.6	95.4	4.6
No	Severe	52.8	47.2	52.4	47.6
Severe	No	62.8	37.2	61.1	38.9
Severe	Severe	26.7	73.3	30.3	69.7

Notes: Values represent the fraction of the sample in each cell. "No" corresponds to all observations without severe limitations.

Essential for our within person analysis is that individuals transition into and/or out of severe limitations. Table 1 reports a second order transition matrix for severe limitations built from within our six period panel as in Meyer and Mok (2013). There are several key points to note. First, there is considerable persistence in good health. Conditional on being without severe limitations in the prior two periods, there is a 96 percent chance of being without limitations today, and 95 percent chance tomorrow. Second, those who experience severe limitations today but not last wave (second row) are more likely to not have severe limitations in the future than they are to continue in severe limitations. Third, individuals with histories of consecutive severe limitations recover at significant rates, with between 26 and 30 percent transitioning out of severe limitations in the following waves. These improvements are approximately twice as likely to occur to moderate levels of limitations rather than "little" or no limitations and reflect meaningful changes in economic outcomes.[7]

It is important to note that due to the within-person estimation design, those in the "corners" of the transition matrix provide no identifying information for the effect of severe limitations. This is clear for those always in good health, but also true for those who persist with severe limitations throughout the panel. We highlight this point by illustrating the autocovariance structure in severe limitations that is actually used in identifying the effect of severe limitations in columns 5 and 6 of Appendix Table A1. The results report estimates from models with individual fixed effects regressing the likelihood of severe limitations today on having reporting severe limitations in the previous period. Column 6 adds additional contemporaneous control variables from the baseline model. The estimates suggest that the severe limitation shocks identifying our models are transitory and mean reverting as in Liu (2016) – an individual is approximately 10 percentage points less likely to have severe limitations today if they had severe limitations in the prior wave, controlling for individual fixed effects.[8]

Table 1 and columns 5 and 6 of Table A1 establish that many individuals with severe limitations report improvements over time. As we note below, not only do these individuals subjectively report lower limitations, but their consumption, health expenditure, labor supply, and earnings outcomes show signs of full or partial recovery upon transitioning out of severe limitations. This lends credibility to the interpretation of severe limitation transitions measuring a meaningful health status rather than simply reporting errors.

The PSID also includes an Activities of Daily Living (ADL) battery and self-rated health that we use as complementary measures of health in robustness checks reported in Supplementary Appendix

[5] A number of papers examining family interaction in the PSID use this feature of split-offs, including the seminal work of Altonji et al. (1992) and Hayashi et al. (1996), as well as more recent papers including Waldkirch et al. (2004) and Fitzgerald (2011).

[6] The 11 conditions asked about in the survey are stroke, high blood pressure, diabetes, arthritis, asthma, lung disease, cancer/malignant tumor (excluding skin cancer), heart attack, heart disease, emotional distress, and memory loss. Once a respondent answers that they have ever been diagnosed they are asked about limitations due to the condition in the current interview as well as in each subsequent wave.

[7] The frequency of severe limitation transitions is not related to whether the data comes from an individual's self-report or is provided by a proxy respondent.

[8] It is unlikely that this effect is driven by selective mortality or attrition due to health shocks, as individuals with severe limitations are no more likely to be missing from the subsequent wave.

Table S3. The results from these alternative measures are consistent with those reported in the body of the paper.

3.2. Measuring consumption, insurance mechanisms, and financial risks

Along with the diagnosis-linked health module, the 1999 wave of the PSID also marked the beginning of an expanded consumption module. For thirty years after its inception in 1968, the PSID collected only food and housing expenditure. During this time it was standard practice to either use only food expenditure when testing consumption smoothing and risk sharing (e.g. Hall and Miskin, 1982; Cochrane, 1991; Altonji et al., 1992; Hayashi et al., 1996), or use a procedure to impute total household expenditure from food spending developed by Skinner (1987).

With a growing interest in consumption, and seminal papers noted above which came out of the food expenditure data, the PSID expanded the set of expenditure categories in 1999 to include health expenditure, child care, education, transportation, and utilities. This is the set of categories that we draw from along with food and housing expenditure to examine non-health consumption. With the inclusion of the 1999 categories the PSID expenditure estimates cover between 70 and 90 percent of full household expenditure in the Consumer Expenditure Survey (Li et al., 2010; Attanasio and Pistaferri, 2016). This is also the measure of consumption used in recent work on consumption inequality and labor supply (Low and Pistaferri, 2015; Blundell et al., 2016). Blundell et al. (2008) highlights the importance of examining nonfood expenditures when assessing models of full insurance, and we indeed illustrate differential impacts of poor health on food expenditures compared to the more complete measure of consumption.[9]

Rich information on health insurance coverage, labor-market earnings, time use, public and family transfers, and asset holdings provides data to assess the financial risks from severely limiting health and to examine the potential underlying mechanisms families might use to insure consumption and spread risk. The data Appendix provides further detail on the components of the consumption and wealth variables.

The means and standard deviations for key demographic variables and outcomes are included in Table 2. Columns 1 and 2 includes the full sample, while columns 3 through 6 divide the sample into those with and without reports of severe limitations. Column 7 reports the p-value for tests of equality across these two groups. The sample is approximately 54 percent female. Respondents are nested in households with a mean of 2.9 members, and PSID family networks that contain 1.7 additional members. Of the 7578 individuals in the sample, 1321 report severe physical limitations at some point during the sample, with 79.6 percent of these individuals transitioning to and/or from having severe physical limitations. For those that transition, we observe 50.1 percent both fall into severe limitations and later recover to a more moderate level, 14.4 percent only recover from an earlier, unobserved episode, and observe onset only for the remainder. The most common conditions leading to severe limitations are arthritis, high blood pressure, heart disease, and emotional stress.

Table 2 reports statistically significant differences between observations with and without severe limitations for nearly all observed characteristics. Respondents who report severe limitations are older and more likely to be female. The observed differences across the groups emphasizes the importance of our empirical strategy that accounts for observed and unobserved heterogeneity through individual fixed effects, flexibly controls for time-varying demographic characteristics, and identifies the effect of health transitions through a longitudinal, within-person analysis.

4. Empirical results

We begin by illustrating the financial risks of severe health limitations to individuals and their families in terms of earnings losses and additional health expenses. These considerable losses motivate a close look at the extent consumption is impacted and the underlying, mitigating insurance mechanisms. Throughout the discussion health is specified as a gradient of the most severe limitation level an individual reports across the possible conditions, and we focus on, and report, the impact of severe limitations for clarity. The gened PSID member having no limitations is the omitted reference category. All standard errors in the analysis are calculated allowing for clustering at the extended-family level.

4.1. The financial impact of severe limitations

Table 3 reports estimates of the impact of severe limitation transitions on formal labor supply, labor income, and health expenditure from models of the form of equation (1) with individual fixed effects.[10] We examine labor-market outcomes separately for male and female individuals. Columns 1 and 2 illustrate a significant decline in annual hours worked outside of the home for both men and women linked to the onset of severe limitations with men experiencing a 364 hour reduction and women a 273 hour loss. Given the underlying means, these estimates both reflect approximately 20-percent reductions in labor supply.[11]

Columns 3 and 4 then illustrate corresponding reductions in labor earnings. Men experiencing a severely limiting condition lose approximately $5000 of labor earnings and women $2800. These are sizeable losses. Households are also strained by an additional $479 of health expenditures. Severe limitations lead to considerable financial shocks.

Taking earnings and health expenditures together, the financial losses from severe limitations are approximately $5500 for men and $3300 for women. Compared with household income levels without severe limitations, these represent statistically significant reductions of 14 and 11 percent (standard errors of 3.6 and 1.7). We next consider the extent that this financial burden is passed through to consumption.

4.2. Testing consumption smoothing

Given significant strains to earnings and health expenditure brought on by severely limiting health conditions, we next test whether households are able to smooth away the shock and experience no changes in consumption. This preliminary analysis motivates a closer examination of the mechanisms used to partially

[9] The PSID expanded the expenditure module in 2005 to include clothing, furnishings, vacation, and recreation expenditure and now covers nearly the full level of expenditure from the consumer expenditure survey (Andreski et al., 2014). Using only the 2005 and later waves with this larger expenditure measure leads to estimates extremely close in magnitude and statistically indistinguishable from those obtained with our baseline measure. We maintain the consumption measure available from 1999 onward so as not to exclude identifying health information from the earlier waves.

[10] Given the emphasis on marital status later in the paper, we tested and failed to reject the equality of impacts for married and unmarried individuals in all columns of Table 3 (p-values range from 0.42 for health expenditure to 0.91 for male labor earnings). We report estimates pooled by marital status as a result.

[11] This is consistent with García-Gómez (2011), which shows individuals reduce their labor supply in response to declining health in the majority of countries in the European Community Household Panel and with the 371 hour reductions in labor supply for men due to the onset of disability estimated with the PSID in Mok et al. (2008).

Table 2
Descriptive statistics.

Sample	Full Sample		Severe Limitations		Without Severe Limitations		Tests of Equality
	Mean (1)	SD (2)	Mean (3)	SD (4)	Mean (5)	SD (6)	(p-value) (7)
Age	47.76	16.27	61.48	17.16	46.52	15.60	0.00
Male (%)	45.78	49.82	39.13	48.81	46.38	49.87	0.00
Married (%)	58.81	49.22	36.78	48.23	60.80	48.82	0.00
Years of Education	13.18	2.47	11.72	2.81	13.32	2.40	0.00
Household Size	2.85	1.54	2.39	1.56	2.89	1.53	0.00
PSID Family Size	4.63	3.60	5.78	5.01	4.53	3.43	0.00
Formal Health Insurance (%)	86.76	33.90	90.25	29.66	86.44	34.23	0.00
Severe Limitations (%)	8.31	27.61					
Expenditures							
Health Expenditure	2331.2	4032.7	2918.6	7215.3	2278.4	3606.9	0.00
Food Expenditure	5845.2	20700.4	3890.1	3065.0	6020.9	21582.1	0.00
Non-Health Expenditure	26853.4	39078.0	15584.0	12759.5	27867.4	40464.8	0.00
Labor Market Outcomes							
Labor Income	27146.6	46319.6	4490.3	16599.6	29185.2	47575.5	0.00
Formal Labor Supply	1447.9	1055.4	335.1	732.3	1548.0	1022.0	0.00
Home Production	592.0	562.2	556.6	642.3	595.2	554.4	0.00
Spouse's Formal Labor	1513.8	1038.0	942.9	1090.4	1544.9	1026.1	0.00
Spouse's Home Production	674.7	629.6	849.2	782.5	665.2	618.9	0.00
Wealth – Value of [. . .]							
Home Equity	68052.7	126239.5	46297.4	96301.7	70010.2	128412.6	0.00
Savings	17057.8	52899.2	15283.1	56764.5	17217.5	52535.6	0.07
Stocks	24680.0	111314.9	13439.4	73690.9	25691.4	114040.0	0.00
Debts	7480.2	18419.0	4613.3	14760.5	7738.1	18691.8	0.00
Outside Assistance							
Received Social Security (%)	23.74	42.55	66.02	47.37	19.94	39.95	0.00
Social Security Amount	2740.2	6172.4	7050.0	7521.1	2352.4	5883.6	0.00
Received Family Transfer (%)	8.20	27.44	12.43	33.00	7.82	26.85	0.00
Transfer Amount	149.6	915.2	203.2	1034.7	144.7	903.5	0.00
N. Individuals	7578		1321		7307		
N. Observations	32857		2731		30126		

Notes: Expenditure, annual income, assets, and transfers measured in 2001 dollars. Labor supply and home production measured in hours. Column 7 reports p-values from tests of equality across severe and non-severe limitation groups.

Table 3
Financial consequences of severe limitations.

	Dependent Variable [. . .]				
	Annual Labor Supply		Annual Labor Income		Health Expenditures
	Male (1)	Female (2)	Male (3)	Female (4)	(5)
Severe Limitations	−364***	−273***	−5,073***	−2,808***	479***
	(39.6)	(34.1)	(1,477)	(478)	(163)
Dependent Variable Means	1658	1264	36273	19281	2372
Individual FE	Y	Y	Y	Y	Y
N. Observations	15,005	17,852	15,005	17,852	32,857

Notes: Table reports impact of severe limitations due to at least one diagnosis. The primary sample consists of 7578 individuals. Labor supply is reported as annual hours, and income and expenditure in year 2001 dollars. All regressions include controls for moderate and minor limitations, individual fixed effects, and additional control variables described in the text. All standard errors allow for clustering at the family level. ***p < 0.01

insure against financial risk due to poor health, and the role of both intrahousehold and noncoresident family support.

Table 4 presents estimates from Eq. (1) with the log of food expenditures per capita and the log of all nonhealth expenditures per capita for a given household as the dependent variables in panels A and B.[12] We focus on the impact of severe limitations. Supplementary Appendix Table S1 reports the coefficients for each of the limitation levels and models without individual fixed effects for comparison.

The baseline results in column 1 are precisely estimated and suggest the financial losses illustrated in Table 3 are partially passed through to consumption, and result in a clear failure of complete insurance. Using either measure of per capita consumption, a respondent being severely limited relates to an approximate 10-percent decline in consumption.[13] The effects are smaller than the relative losses to earning in Table 2 and suggest partial insurance

[12] Defining our outcomes as total rather than per-capita consumption does not change the results. This is expected as we control for a rich set of household demographic characteristics (Wagstaff, 2007).

[13] As a comparison, Ball and Low (2014) find a 4-percent decline in food consumption from a severe work-limiting disability in the United Kingdom. The difference

Table 4
Consumption smoothing tests.

Panel A	*Dependent Variable: Log of per capita Food Expenditures*							
		Labor Market Hours			Formal Health Insurance		Married	
	Full Sample (1)	Reduced (2)	Stable or Increase (3)	Relative Labor Income (4)	Covered (5)	None (6)	Yes (7)	No (8)
Severe Limitations	−0.107*** (0.023)	−0.174*** (0.033)	−0.075** (0.030)	−0.067** (0.029)	−0.089*** (0.022)	−0.221*** (0.061)	−0.047* (0.028)	−0.158*** (0.033)
Interacted with ratio of own labor income to total household income in prior wave				−0.163*** (0.058)				
Individual FE	Y	Y		Y	Y		Y	
N. Observations	32,857	32,857		32,857	32,857		32,857	

Panel B	*Dependent Variable: Log of per capita Nonhealth Expenditures*							
		Labor Market Hours			Formal Health Insurance		Married	
	Full Sample (1)	Reduced (2)	Stable or Increase (3)	Relative Labor Income (4)	Covered (5)	None (6)	Yes (7)	No (8)
Severe Limitations	−0.101*** (0.018)	−0.140*** (0.029)	−0.077*** (0.023)	−0.078*** (0.023)	−0.089*** (0.018)	−0.176*** (0.047)	−0.017 (0.021)	−0.163*** (0.027)
Interacted with ratio of own labor income to total household income in prior wave				−0.104** (0.047)				
Individual FE	Y	Y		Y	Y		Y	
N. Observations	32,857	32,857		32,857	32,857		32,857	

Notes: Sample consists of 7578 individuals. Column 1 reports the coefficient on severe limitations in a baseline specification. Coefficients in columns 2 through 8 are from models interacting severe limitations with mutually exclusive indicators for change in hours worked (columns 2 and 3), whether the individual is covered by formal health insurance (column 5 and 6), and marital status (column 7 and 8). Column 4 examines the interaction of severe limitations with the ratio of own labor income relative to total household income in the prior wave. All regressions include controls for moderate and minor limitations, the variable being interacted with health, individual fixed effects, and additional control variables described in the text. All standard errors allow for clustering at the family level.
***p < 0.01, **p < 0.05, *p < 0.1

is smoothing roughly half of the financial loss. When one examines the non-food components of the consumption measure in Panel B, there are statistically significant reductions in transportation, 10.0 percent, and housing expenditure, notably a 5.8 percent reduction in spending on electricity, heating, and water utilities.

Column 1 suggests partial insurance of consumption against declining health. However, as noted in Section 2, the results are also potentially consistent with competing hypotheses focusing on nonseparable or state-dependent preferences.[14] Columns 2 and through 8 of Table 4 address concerns stemming from the alternative explanations, with columns 2 and 3 focusing on potential nonseparability of leisure and consumption. As shown above, a common outcome of worsening health is to work less. In this case, marginal utility might be maintained after a health decline if the utility value of increased nonlabor time substitutes for any loss in consumption. The reduced values of consumption in Column 1 might then suggest a rebalancing of utility from consumption toward leisure rather than incomplete insurance.

We rule out this hypothesis as the main effect driving our results by examining the impact of declining health on two mutually exclusive groups through interactions of severe limitations with prior labor supply—those who maintain or increase the number of hours worked in formal employment since the previous interview, and those who reduce the amount worked.[15] If nonseparability of leisure and consumption is driving our results and a drop in expenditures is explained by an increase in substituted leisure, one would see no reduction in consumption for households where the individual continues working the same number of hours (or more), as they have no additional leisure. The results in columns 2 and 3 reject the hypothesis for both food expenditures in Panel A and all nonhealth expenditures in Panel B: households where the labor supply of the ill individual does not decline see an approximate 7.5 percent reduction in expenditures. Note that for households where the hours of work do decline, expenditure falls by 17 percent (Panel A) or 14 percent (Panel B), a result consistent with incomplete insurance due to declining labor supply and income.

A related concern with nonseparability is the possibility of state dependence in the utility function. In this case, a change in consumption linked to declining health might be due to a change in one's preferences rather than insufficient insurance. The worsening consumption losses from "little" to "severe" limitations in Supplementary Table S1 rule out the threat that a "state" could be defined as having a diagnosed condition. If this were the case, one would see consumption fall by a similar amount regardless of the severity of the limitation rather than the observed gradient. The more realistic concern is when a "state" is defined by the severity of one's limitations. This seems unlikely given the household-level measure of consumption, transitory nature of the shocks, and the fact that it would require the marginal utility of services such as water and heat to decline to fully explain the results. However, making use of heterogeneity in the PSID sample members, we test the role of state dependence by examining households that may be at more or less financial risk if the respondent experiences severe limitation.

The results in Column 4 focus on potential financial risk to the household based on the fraction of income the now-limited individual contributed to total household income in their previous interview. State-dependent preferences linked to "a lot" of limitations would predict that consumption would decline by a set amount regardless of the importance of the individual's contribution to household resources. Incomplete insurance of financial risks

may reflect more generous disability benefits in the UK or attenuated effects from noise in Ball and Low's banded measure of food expenditure.

[14] An additional concern is if individuals anticipate the health declines and preemptively mitigate any negative effects on consumption. This would bias the results toward the nulls we reject.

[15] The coefficients reported in columns 2 and 3, 5 and 6, and 7 and 8 come from single models where the main impact of the interaction term is included as an additional control in all cases.

suggests health declines will have a larger impact on households where the individual earns the majority of labor income. Column 4 includes the standard severe limitations marker, as well as an interaction between severe limitations and the individual's share of prior household-labor. Food expenditures decline by 6.7 percent and nonhealth expenditures by 7.8 percent for households in which the limited individual earned none of the previous labor income. There is then a strong financial gradient captured by the interaction in both panels. At the extreme, nonhealth expenditures fall by approximately 18 percent for those households where the limited individual was the sole labor income earner. This is not consistent with state dependence.

A related test to examine if the results are driven by financial losses and estimate the approximate magnitude of partial insurance is to directly assess how the lost income and increased health expenditure shown in Table 3 pass to changes in consumption. In supplemental analysis we define a measure of the financial resources available to a household for consumption and savings decisions as their labor income less health expenditure. If the underlying mechanism is health causing financial shocks, then severe limitations serve as an appropriate instrument for the lost income in these models.

As we establish in Table 3, severe limitations are tightly linked to labor income and health expenditure, and the first stage is strong. In the second stage we estimate that a $1000 decrease in disposable income leads to a 1.74 percent decrease in nonhealth expenditures (standard error of 0.41, p-value less than 0.01). This is approximately a $460 decrease at the mean. The gradient of consumption losses with financial risk is suggestive of partial insurance rather than state dependence.[16]

Formal health insurance coverage is likely to be a key determinant of insulation from the financial risk of poor health. Columns 5 and 6 isolate the difference between households based on whether the individual reported being covered by formal health insurance in the previous interview.[17] Those households that did not have formal insurance in the past see approximately twice the reduction in consumption, 18 versus 9 percent in Panel B, but all households experience a statistically significant decline in consumption regardless of insurance status. This result emphasizes the holes that might exist with formal insurance and suggests the need for a better understanding of informal mechanisms used to fill such gaps.

As a final differentiation, columns 7 and 8 illustrate the distinction between married and unmarried households.[18] This division highlights key differences between food and nonhealth expenditure and how financial shocks are passed through to consumption. With food expenditures, married and unmarried households both face a statistically significant reduction in consumption when experiencing a health decline, although the size of the decline for unmarried households is approximately three times as large at 16 relative to 5 percent.[19] For the total nonhealth expenditure measure, however, the point estimate suggest only a 1.7 percent reduction in consumption for married households. With a standard error of 2.1, we fail to reject the full-insurance model for this group. Unmarried households experience consumption declines on the order of 16 percent, suggesting that marriage is a key smoothing mechanism. This is an important result in illustrating how households may be differentially insured.

Analyzing the relative financial shock to married and unmarried households does not appear to fully explain the differential consumption insurance patterns. We fail to reject any difference in the dollar value of income losses and health expenditure changes reported in Table 3 for married and unmarried respondents. However, due to the possible presence of additional earners in the household, financial shocks to married individuals' may reflect a smaller relative change in total household resources. It is important then to establish how the relative shocks are passed through to consumption. Supplementary Table S2 reports results similar to those obtained from Table 3 that estimate the relative financial shock due to severe limitations on household disposable income, approximately measured as income less health expenditures, and consumption. We consider four groups by marital status and gender of the respondent.

In all cases, households experience statistically significant and meaningful reductions in resources, and the consumption declines are smaller than the income losses suggesting a partial pass-through of the financial shock to consumption. To take the case of married households where there is a possible second earner, these households experience between 5 and 11 percent income losses from severely limiting health at the mean. The 11 percent reduction in income, a substantial shock consistent or greater than the magnitude of other health shocks used in the literature to test consumption smoothing (e.g. Gertler and Gruber, 2002; Liu, 2016), leads to effectively no change in consumption as in Table 4. The relative size of the shock across married and unmarried households also does not appear to fully explain the differential insurance patterns of the two groups. When we isolate married households who experience earnings losses on the order of 25 percent or more, similar to the relative shock to unmarried households shown in Table S2, there is still no evidence that this group fails to smooth consumption compared to other married households with severe limitation shocks.[20]

The differential insurance patterns of unmarried and married households also highlight a broader methodological point on the important contrast between measures based on food expenditure in Panel A and the broader measure of consumption in Panel B. First, we have tested whether the null coefficient in Panel B is simply an artifact of attenuation bias due to classical measurement error in the nonhealth expenditures of married households by estimating a model in which marriage is fully interacted with each of the control variables and examining the predictive power of the interaction terms. If the difference between food and nonhealth expenditures is one of precision, then the interaction terms should be less precisely estimated when nonhealth expenditure is the outcome. This is not the case. Joint tests for all interacted regressors return F-statistics of 4.96 for nonhealth consumption and 3.24 for food consumption. The stronger predictive power of covariates for married households in nonhealth expenditure suggests that classi-

[16] A back of the envelope calculation with results from Tables 2–4 would suggest losses of approximately $5500 (Table 3) and expenditure decline of $2700 (Tables 2 and 4), implying approximately 49 percent of the losses are passed through to consumption. This is very similar to the 46 percent determined from the IV regression.

[17] Thirty percent of the individuals in the sample report not having formal coverage at some point during the sample time frame. Coverage includes employer-provided insurance, directly purchased plans, and government programs such as Medicare and Medicaid.

[18] Marriage is defined contemporaneously, unlike prior employment or health insurance, as health limitations are not predictive of changes in marital status. This is consistent with Charles and Stephens (2004), who find that a spouse's disability does not increase the couple's likelihood of divorce.

[19] As has been required by data limitations in previous research, focusing on food expenditure leads to a larger-point estimate of the percentage of decline in consumption in response to a health decline. This is in line with findings from Blundell et al. (2008), who suggest food expenditure is an insufficient metric to test for consumption smoothing.

[20] The additional reduction in consumption for this large earnings-shock group relative to other married households experiencing severe limitations is a 0.6 percentage point difference with a standard error of 3.3 (p-value = 0.848).

cal measurement error in the dependent variable is not driving the null finding.[21]

A more plausible scenario is that the role of home production for married households operates as a smoothing mechanism. In this case, a decline in food expenditures for married households would be consistent with complete insurance of all nonhealth consumption if spousal home production reduces food expenditure but maintains marginal utility across health states. Given that the nonfood categories, which comprise approximately 80 percent of nonhealth expenditures in the sample, are less likely to be affected by home production, we have removed food from the nonhealth consumption measure and estimated a model of nonhealth, nonfood expenditures per capita. In results available upon request, we find a slightly positive, but imprecisely estimated effect for married households, while the statistically significant and negative effect on unmarried households remains. This interpretation is consistent with a story of full insurance for married households, but not for unmarried households, and again highlights the importance of a detailed consumption inventory. Analyses based on food expenditure alone might potentially miss the smoothing that married households conduct in order to effectively insure. This result, in concert with the discussion above concerning relative financial shocks, calls for further exploration of how married and unmarried households insure. Our examination of the underlying insurance channels in the following analyses is presented by marital status to address specific concerns about relative shocks and differential smoothing mechanisms.

In sum, the results in Table 4 suggest the pooled sample of households appear to be only partially insured against the financial burden of severe limitation shocks. This effect is isolated among unmarried households. While there are important considerations about the structure of preferences underlying these interpretations, the body of evidence supports an interpretation based on incomplete insurance of financial risks.

4.3. How do households and families respond?

Table 5 presents results from estimating Eq. (1) with alternative dependent variables at the individual, household, and family level to examine how one might rely on coresident and noncoresident family members when experiencing a health shock. We continue examining interactions between severe limitations and marital status to better understand why married households appear to be fully insured in Table 4.[22]

Panel A assesses time-use changes of the respondent and their spouse, if married. Table 3 established marked reductions in labor supply linked to severely limiting health conditions. Columns 1 and 2 of Panel A illustrate the formal labor supply responses of spouses, if married. As discussed by Siegel (2006) and García-Gómez et al. (2013), a spouse might look to the formal labor market to make up for lost wages, or they might focus on home production as a caregiver. We see marked reductions in both male and female spouses working outside of the household, although the reduction is statistically significant only for wives.

Despite the large literature on formal labor-market responses to health status, less is known about how health impacts home production. We take advantage of questions in the PSID that elicit information about the amount an individual works inside the home while performing activities such as cooking, cleaning, and other work around the house.[23] Severe health conditions lead to an imprecisely estimated reduction of 55 hours of home production for unmarried men and large, but again imprecisely estimated, reductions in home production for women regardless of marital status. With spousal home production, columns 5 and 6, husbands show a marked increase in hours, while wives report no change. This may very well be due to the larger margin men operate under, as wives work approximately three times more in home production in terms of mean values. This provides marginal evidence of married households increasing home production in response to a health decline that is consistent with the decline in food expenditures but statistically insignificant effect on total nonhealth expenditures in Table 4.

Panel B in Table 5 illustrates that the costs of the negative health conditions are felt severely in the household's own assets, consistent with the drawing down of liquid resources in response to shocks seen in other settings (e.g., Frankenberg et al., 2003).[24] The largest estimated reduction comes in the value of home equity for both married and unmarried households. Married households see a reduction of $12,101 in home equity compared to $4,815 for the unmarried. Given differences in the underlying means, these effects represent reductions of approximately 13 percent of the mean value for each group. This is in line with Hurd and Kapteyn (2003), who find a 16-percent decline in total wealth in response to poor self-assessed health in the Health and Retirement Survey.

While prior research has highlighted evidence of households using home wealth to pay for college expenses (Lovenheim, 2011), refinancing to smooth consumption in response to unemployment (Hurst and Stafford, 2004), or as a replacement for long-term-care insurance (Davidoff, 2010), to our knowledge this is the first evidence of families using home equity to cover the costs of deteriorating health across the life cycle. The reliance on home equity assets is consistent with our sample covering a period with low interest rates and a high frequency of refinancing.[25] In a regression available upon request, we focus on the sample of homeowners and find that unmarried households are 4.7 percentage points, or 22 percent, more likely to have refinanced their mortgage loans when health declines.

The magnitudes of the equity declines for married respondents are large relative to the monetary cost seen in health expenditures and lost income in Table 3. This partly reflects that refinancing is not costless or available on an as-needed basis—a new separate loan is unlikely to be obtained with the receipt of each medical bill. Households might take out larger-than-necessary loans to cover imminent expenses with the expectation that they will also need to cover additional expenses in the near future.

Beyond home equity, there is no statistically significant change in asset holdings when facing declining health. The values of savings and stocks decline, but are imprecisely estimated. Consistent with home equity comprising 58 percent of wealth across these four categories, housing wealth appears to be the primary source of wealth from which assets are drawn.

Panel C turns outside of the household to formal public support through Supplemental Security Income (SSI) or Social Security Disability Income (SSDI) and monetary assistance from noncoresident family members. By applying for benefits due to a disability that affects one's ability to work, an individual can begin receiving SSDI payments based on their work history. Column 1 of Panel C shows

[21] A test for the presence of measurement error based on Griliches and Hausman (1986) further suggests that it is not a principle concern in explaining the results.

[22] Versions of Table 5 estimating effects for different subgroups of the sample as in Table 4 are omitted for space considerations and available upon request.

[23] The sample size has a marginal decrease of 0.6 percent due to a small number of respondents unable to give an estimate of the number of hours of home production.

[24] Qualitative results and magnitudes remain consistent when controlling for the level of other assets in these regressions.

[25] Nearly half of all homeowners have refinanced at some point since the early 1990's (Bennett et al., 2001; Doms and Krainer, 2007; Hurst and Stafford, 2004).

Table 5
Household and family responses.

Panel A Time Choices	*Dependent Variable [. . .]*					
	Spousal Formal Labor Supply		Home Production			
			Own		Spouse	
	Wives (1)	Husbands (2)	Male (3)	Female (4)	Wives (5)	Husbands (6)
Severe limitations for						
Married	−90.2*	−63.0	17.4	−48.4	−19.3	97.3***
	(46.8)	(57.9)	(30.6)	(50.0)	(40.2)	(34.0)
Unmarried			−55.2	−22.0		
			(40.8)	(27.9)		
Dependent Variable Means						
Married	1159	1950	425	866	927	365
Unmarried	–	–	427	606	–	–
N. Observations	10,635	8,675	14,947	17,728	10,549	8,641

Panel B Wealth	Home Equity (1)	Savings (2)	Stocks (3)	Debt (4)
Severe limitations for				
Married	−12,101***	−1199	−5745	582
	(2922)	(2172)	(4520)	(741)
Unmarried	−4815**	883	771	842
	(2431)	(1623)	(2328)	(567)
Dependent Variable Means				
Married	91,052	21,512	31,961	8,536
Unmarried	35,929	10,715	14,285	5,931
Observations	32,857	32,857	32,857	32,857

Panel C Transfers	Social Security		Noncoresident Familiy Transfers	
	I(Receive) (1)	Amount (2)	I(Receive) (3)	Amount (4)
Severe limitations for				
Married	0.065***	797***	−0.005	35.2
	(0.016)	(275)	(0.011)	(26.0)
Unmarried	0.069***	376**	0.076***	133***
	(0.013)	(163)	(0.014)	(34.2)
Dependent Variable Means				
Married	0.201	2832	0.042	97
Unmarried	0.295	2648	0.138	222
Observations	32,857	32,857	32,857	32,857

Notes: Table reports coefficients for interactions between severe limitations and marital status. The primary sample consists of 7578 individuals. Labor supply is reported as annual hours. Columns 1,2,5, and 6 of Panel A examine outcomes only for those who are married. The sample in columns 3 through 6 of Panel A is limited to those who answered questions concerning home production – approximately 99.4% of the full sample. All regressions include controls for moderate and minor limitations, individual fixed effects, and additional control variables described in the text. All standard errors allow for clustering at the family level.
***p < 0.01, **p < 0.05, *p < 0.1.

that respondents see a 6.5 to 6.9 percentage-point increase in the likelihood of receiving social-security payments when severely limited.

Social-security eligibility is dependent upon marital status and age; a qualifying individual's spouse is eligible to receive additional payments if the spouse is 62 or older or if there is a child 16 years or younger in the household. This suggests that married households might receive larger transfers from social security. Column 2 of Panel C shows this is the case, with married households receiving a payment more than two times as large as unmarried households. Social Security appears to provide a stronger safety net for married households than unmarried households when coping with a health decline. Where do unmarried respondents turn?

Transfer behavior of noncoresident family members motivates much of the literature on consumption smoothing, risk-sharing, and informal networks. Columns 3 and 4 of Panel C examine the receipt and amount of financial transfers received from noncoresident family. For married households, where we observed large equity draw downs and spousal labor-supply responses, there is no increase in the likelihood of receiving a family transfer. Unmarried households, however, significantly benefit from this channel and are 7.6 percentage points more likely to receive a transfer, a more than 50-percent increase relative to the mean. The value of the received transfers also increases by $133, a 60-percent increase over the mean, as shown in Column 4. Whereas married households have spousal support, larger asset stores, and more generous formal support, it may be that the extended family acts as a safety net for unmarried family members who might otherwise have difficulty smoothing consumption on their own.[26,27]

[26] Given that marriage is a choice, these results could also represent that individuals might be less likely to marry if they can rely on their extended family for financial assistance. Both interpretations are consistent with the extended family acting as a safety net for many households.

[27] Attias-Donfut et al. (2005) jointly look at ten European countries and find an 11-percent increase in the likelihood of receiving an intergenerational transfer when the

Taken together, the broad array of results in Table 5 illustrate that households are exposed to health risk but that individuals, their spouses, and noncoresident family members do respond to adverse events through labor supply, asset holdings, and formal and informal transfers. Unmarried households appear particularly at risk and draw assistance from a wider array of insurance channels.[28] It remains a question as to which of these is the most effective strategy for smoothing consumption.

4.4. How do families share?

A key contribution of the PSID's intergenerational design is that we are able to examine how health shocks to an individual affect the consumption, earnings, and assets of their noncoresident family members. Table 6 reports estimates from equation (1) modified to the following form:

$$Y_{-hft} = \beta\theta_{ihft} + X_{ihft}\gamma + \mu_i + \varepsilon_{ihft} \quad (2)$$

where the outcomes of other households, -*h*, in family *f* not containing individual *i* are the focus. This specification allows us to examine how noncoresident family members are impacted by severe limitation shocks to their relative *i*. Utilizing the family tree structure of the PSID, we are able to distinguish noncoresident family members by their genealogical relationship and consider outcomes of children, siblings, and parents.

In results available upon request we find little evidence of an upstream or parallel impact of an individual's severe limitation shock on their noncoresident parents or siblings. Panels A and B of Table 6 report estimates from Eq. (2) examining the downstream impact of health shocks on noncoresident children. We distinguish between households with male and female children of the respondent. In line with the literature on upstream transfers from adult children supporting their parents, we find that these children take specific actions consistent with assisting their parents in times of need.

Panel A considers only households that contain the male children of respondent *i*. These households see marked reductions in home equity and savings when the health of their parents deteriorates. Panel B focuses on female children and finds large reductions in consumption of 8.1 percent, as well as increased out-of-pocket health expenditures, presumably used to help cover parental medical expenses.[29] These results may partially be explained by liquidity differences between female and male children, differential time discounting, or preference heterogeneity. Female children in the sample have approximately 90 percent of the wealth of sampled male children, experience short-run consumption reductions, and take on additional health expenditures. Male children use available assets, at a possible longer-run cost, to assist their parents experiencing a health decline. Understanding such motives and patterns of intrafamily exchange is a fruitful area for future work.

5. Discussion

The results in Tables 3 through 6 provide clear evidence of the impact that deteriorating health can have on an individual, their household, and their noncoresident family. We extend existing evidence by focusing on the role of noncoresident family assistance and illustrate the presence and effectiveness of previously unexamined household-based insurance channels when faced with declining health.[30] These patterns are consistent with partial insurance against health risk and are not easily explained by nonseparable, state-dependent preferences. We address four remaining empirical concerns below: the impact of onset versus recovery from severe limitations, reverse causality between job loss and health, deteriorating health shortening one's mortality horizon, and the unmeasured health of family members.[31] We maintain that the most valid interpretation of our findings is that households are incompletely insured in the face of health shocks.

5.1. Onset versus recovery from severe limitations

As the analysis in Table A1 suggests, our models are identified primarily by transitory health shocks. It is informative to consider the impact of falling into severe limitations versus recovery. Of the individuals that experience severe limitation transitions, we observe 50.1 percent of the sample both falling-into and recovering to a lesser severity from the shock. The transition matrix in Table 1 illustrates that there is substantial recovery from severe limitations, and that individuals are more likely to transition back to improved health after their first report of severe limitations rather than remain in poor health. To provide further validity on the quality of measurement in the analysis, it is important to examine if these subjective answers to the level of limitations are in fact related to changes in behavior.

We examine first-differenced models to clearly illustrate the effect of falling into severe limitations versus recovering from severe limitations. The outcomes of interest are the one-period changes in consumption, health expenditure, labor income, and labor supply, and the full vector of differenced baseline controls are included in each model. We estimate that severe limitations are related to a 6.1 percent decline in per-capita, non-health expenditure in the subsequent wave (s.e. of 2.3). Reductions in labor income, health expenditure, and hours worked are similar to those shown in Table 3 establishing the financial cost of severe limitations.

Theoretically it is not clear that when health improves one should expect immediate and full recovery to the previous level for each of the outcomes given that there may be frictions to labor market adjustments or follow-up health care. However, we are unable to reject that there is a complete, immediate recovery in consumption upon transitioning out of severe limitations; recovery is related to a statistically significant 5.2 percent increase in expenditure and we fail to reject that the −6.6 and 5.2 percent estimates are symmetric (p-value = 0.765). The effects of recovery on labor outcomes and health expenditure all carry the expected sign that would match with recovery. There is a statistically significant and meaningful

respondent reports bad or very bad health, suggesting a similar pattern of familial assistance in Europe.

[28] It is possible to map how changes in the underlying insurance channels impact consumption when experiencing severely limiting health. In regressions of consumption on health status interacted with each of spousal labor supply, home equity, social security receipt, and formal insurance status, imprecisely estimated results suggest holding formal insurance is the key smoother of consumption for married households, while home equity plays a particularly important role in partially insuring consumption for non-married households. These models are further explored in Dalton and LaFave (2017).

[29] The coefficients observed in Table 6 compared to the monetary transfer coefficient in Column 4 of Panel C, Table 5 suggest that a large portion of the assistance provided by family members may be coming in the form of in-kind transfers that are not recorded in the PSID. This is consistent with the result that female children increase their own health expenditures in response to the parent's declining health in Column 2, Panel B of Table 7.

[30] The patterns of incomplete insurance, asset depletion, and assistance from coresident family are similar to those found in settings in which formal insurance mechanisms are often absent. This includes evidence from Ethiopia (Dercon and Krishnan, 2000; Asfaw and von Braun, 2004), Indonesia (Gertler and Gruber, 2002; Gertler et al., 2009; Genoni, 2012; Sparrow et al., 2014), Tanzania (de Weerdt and Dercon, 2006), Vietnam (Wagstaff, 2007), and Bangladesh (Islam and Maitra, 2012) among others.

[31] In Supplementary Appendix Table S3 we show that our results are consistent with health measured through activities of daily living and self-assessed general health status. We prefer the condition-linked questions used throughout as they are anchored in specific ailments.

Table 6
The family's response to deteriorating health.

Panel A: Male Children	*Dependent Variable [. . .]*						
				Value of [. . .]			
	Log Nonhealth Expenditure (1)	Health Per Capita Expenditure (2)	Hours Worked (3)	Home Equity (4)	Savings (5)	Stocks (6)	Debt (7)
Parent household reports severe limitations	0.013 (0.028)	53.8 (79.2)	−28.0 (45.5)	−9,140** (4,215)	−10,360*** (3,373)	−3,779 (4,248)	1,654 (1,191)
Individual Fixed Effects	Y	Y	Y	Y	Y	Y	Y
N. Observations	5594	5594	5594	5594	5594	5594	5594
Panel B: Female Children	*Dependent Variable [. . .]*						
				Value of [. . .]			
	Log Nonhealth Expenditure (1)	Health Per Capita Expenditure (2)	Hours Worked (3)	Home Equity (4)	Savings (5)	Stocks (6)	Debt (7)
Parent household reports severe limitations	−0.081*** (0.027)	177** (70.5)	−53.1 (40.7)	−6,454 (3,951)	806 (2,420)	−5,013 (4,306)	−363 (1,173)
Individual Fixed Effects	Y	Y	Y	Y	Y	Y	Y
N. Observations	6140	6140	6140	6140	6140	6140	6140

Notes: Sample in Panels A and B focus on the noncoresident child households. There are 1509 eldest members with male children in Panel A and 1,632 with female children in Panel B. All regressions include controls for moderate and minor limitations, individual fixed effects for the parent, and additional control variables described in the text. All standard errors allow for clustering at the family level.
***p < 0.01, **p < 0.05.

increase in formal labor hours, and estimated recoveries in health expenditure and labor income. It appears that individuals do indeed recover in meaningful ways, and that the measure of the subjective level of limitations used in the analysis contains meaningful, important content.

5.2. Reverse causality and job loss

A potential threat to our interpretation of poor health impacting consumption is if the estimated effects are due to an outside event, such as loss of a job, which first impacts health and then in turn affects consumption. While this is inconsistent with the intertemporal results in Table A1 and those in Table 4 that show reductions in consumption even for individuals who were not employed in the previous wave, we further examine this concern by estimating whether the impact of nonwork-related conditions are different from those that are potentially induced by job loss. Following Strully (2009), nonwork-induced conditions are defined to include cancer, lung disease, and memory loss. Panel A of Appendix Table A2 reports results from a modification of Eq. (1) that tests if severe limitations from these nonwork conditions lead to differential impacts than the other 8 conditions. We focus on financial risks and examine estimates for consumption, health expenditure, labor supply, and earnings. The results in the second row of coefficients show that there is no statistically significant differences between the measure used throughout the paper and the effects of limitations from nonwork conditions on consumption, hours worked, and labor income. There is a slightly larger impact of limitations from these conditions on health expenditure. These results reject the concern that reverse causality through job loss is driving the results.

5.3. Mortality risk, time horizons, and bequests

Similar to concerns related to state dependence, marginal utility might be preserved even as consumption declines due to a changing time horizon.[32] If changing mortality expectations are the underlying mechanism, conditions that are most likely to subsequently lead to death should have a larger impact on consumption.[33] Panel B of Appendix Table A2 shows this is not the case: we fail to reject that limitations due to heart attack, heart disease, and cancer have a significantly different impact on consumption, health expenditure, or labor market outcomes relative to other conditions.

In addition, we also do not see evidence that bequest motives drive the reductions in consumption. There are no noticeable increases in savings, stocks, or other financial vehicles one would potentially use under such circumstances. There is also no noticeable increase in the amount or likelihood of sending inter-vivos transfers made to other family members by an individual experiencing a health shock.[34]

5.4. Health status of other family members

We examined the possibility that health status correlates with the health of other family members that we observe in the PSID and find that severe limitation shocks within an extended family are not highly correlated. When regressing an indicator for having severe limitations on individual fixed effects and whether observed family members also have severe limitations, there is no significant relationship between the family health measures. While we are limited to observing only a subset of the entire extended family, this suggests that results in the body of the paper, and particularly those in Table 6 examining family outcomes, are not biased due to an unmeasured correlation with relatives' health.

6. Conclusion

This paper contributes new results to a variety of literatures relating health outcomes to labor market experiences, formal and informal insurance, and family economics. The findings are useful for understanding patterns of resource allocation within families and how informal networks operate during adverse events. Using uniquely rich genealogical data, we present evidence on how severe

[32] Bíró (2013) finds empirical evidence that consumption increases when faced with a decrease in the time horizon. If this is the case, reduced mortality expectations would attenuate our results toward zero.

[33] High mortality conditions are defined based on leading causes of death from CDC (2012).

[34] *p*-values of 0.504 and 0.235 for sending and the amount of transfers respectively.

health limitations pose significant financial risk to individuals and their families and shed light on the interplay between formal health insurance and family risk-sharing.

We find that deteriorating health leads to significant declines in earnings and increases in health expenditure. These losses are partially passed on to nonhealth consumption in a way that is inconsistent with full insurance for unmarried households. We are unable to reject that married households smooth consumption across severe health limitations. Families mitigate losses in a variety of ways, with married households relying on a reallocation of spousal home production, drawing down home equity, formal health insurance, and social security. In addition to drawing down home equity, unmarried households rely on receiving transfers from noncoresident relatives.

Exploring the role of the extended family, we find that male children draw down home equity and savings, but that daughters reduce their own consumption in response to a parent's health decline. The results suggest that intricate support systems within informal networks maintain an important, but limited, role in filling gaps left by formal coverage.

These results offer a number of possible avenues for further examination to complement the evidence on within- and between-household smoothing to mitigate health shocks. As they stand, the findings highlight that the economic costs of poor health transmit throughout a family network and interact with connections across generations and space that offer support in times of need.

Appendix A. Data Description

Defining head of household

Our definition of head of household differs from the PSID definition for married households. In the PSID, the male member of a couple is determined to be the head of household, whether or not that male member is a true "PSID gened" member. For this paper, we define the head of household as the PSID-gened member regardless of sex for two primary reasons. First, there is a shorter panel for non-PSID-gened members since the first interview they are observed as a head will be upon marriage to a PSID-gened person. On the other hand, barring missed interviews, a PSID-gened household head is observed as a head as long as they are financially independent from their parents. For single households, our definition of head of household is the same as that used by the PSID.

One additional caveat: the PSID's following rule states that if a PSID-gened person moves out and then back in with a family member who is also being interviewed, the PSID will continue to interview both "family units" who reside in the same household. In order to maintain consistency and a single family unit within each household, we define the family unit with the eldest head as the actual "head." This reduces the sample by approximately 3 percent, or 200 observations, per wave.

Sample construction

Observations come from the six waves collected between 2001 and 2011 that all contain the improved wealth and consumption data. We do not include the 1999 wave for consistency since many regressions throughout the paper incorporate data from previous interviews in a head's panel into the analysis. For the same reason, we only include the second observed interview in the panel for each head of household. This is unlikely to bias any results given older household heads are more likely to be affected by a physical limitation and the observations dropped for being the first interview will be younger households.

We also eliminate household-year observations when the head reports being married but does not report a valid age or education for the spouse in that year. We also drop household-year observations with zero reported total expenditures or zero reported food expenditures for the year. These are both negligible amounts of the total observations.

Definition of Key Variables

Expenditures

Housing. The sum of reported, standardized monthly payments of property taxes, insurance premiums, first and second mortgages, rent, electricity, heating, water, and other utilities.

Care. Sum of adult care and child care in the previous year standardized to a monthly expense.

Education. The amount spent on schooling for the previous year, standardized to a monthly expense. The question includes tuition, room and board for any family member, and purchase of books and school supplies.

Health. Sum of health insurance payments, nursing home costs, doctor's visits, and prescriptions.

Transportation. Sum of car insurance, payments on car loans, car leases, down payments, car maintenance, gas, parking, bus or train fare, taxis, and other transportation.

Food. The sum of food at home, food delivery with and without food stamps, food outside of home with and without food stamps, and food stamps for anything else. The questions related

Table A1
Exogeneity of severe limitation transitions.

	Dependent Variable: Severe Limitations in Current Period					
	(1)	(2)	(3)	(4)	(5)	(6)
Previous Period's. . .						
log of Nonhealth Expenditures	−0.007			−0.0077		
	(0.005)			(0.0049)		
Labor Income ($1000)		−0.000056		−0.000051		
		(0.000039)		(0.000036)		
Wealth ($10,000)			−0.000014	−0.000014		
			(0.000009)	(0.000009)		
Severe Limitations					−0.095***	−0.114***
					(0.017)	(0.017)
Joint significance (p-value)				0.11		
Individual Fixed Effects	Y	Y	Y	Y	Y	Y
Additional Controls	Y	Y	Y	Y	N	Y
N. Observations	24,654	24,654	24,654	24,654	24,654	24,654

Notes: Sample consists of 7,578 individuals. All standard errors allow for clustering at the family level. ***p < 0.01.

Table A2
Financial impact of severe limitations across conditions.

	Dependent Variable					
			Male		Female	
	log(Non Health PCE) (1)	Health Expenditure (2)	Hours Worked (3)	Labor Income (4)	Hours Worked (5)	Labor Income (6)
Panel A: Nonwork Conditions						
Severe Limitations	−0.097***	269.8*	−373.2***	−276.4***	−4,908***	−2,899***
	(0.019)	(160.5)	(41.21)	(35.73)	(1,721)	(499.9)
Severe Limitations from cancer lung disease, memory loss	−0.018	871.3***	33.00	15.38	−603.4	419.5
	(0.032)	(336.9)	(54.22)	(37.11)	(1,462)	(546.5)
Individual FE and Controls	Y	Y	Y	Y	Y	Y
N. Observations	32,857	32,857	15,005	15,005	17,852	17,852
			Male		Female	
	log(Non Health PCE) (1)	Health Expenditure (2)	Hours Worked (3)	Labor Income (4)	Hours Worked (5)	Labor Income (6)
Panel B: High Mortality Conditions						
Severe Limitations	−0.101***	495.2***	−373.5***	−267.5***	−5,370***	−2,899***
	(0.019)	(187.0)	(42.27)	(34.58)	(1,726)	(495.1)
Severe Limitations from cancer heart disease, heart attack	0.002	−71.77	31.56	−31.74	1,012	519.0
	(0.031)	(263.4)	(52.07)	(47.78)	(1,662)	(563.8)
Individual FE and Controls	Y	Y	Y	Y	Y	Y
N. Observations	32,857	32,857	15,005	15,005	17,852	17,852

Notes: Sample includes 7578 individuals. Table reports coefficients from modifications of Eq. (1) including an indicator for severe limitations from any of the conditions as well as separate indicators for conditions unlikely to be induced by job loss in Panel A and conditions with the highest mortality risk in Panel B. Non-work conditions are defined following Strully (2009) to include cancer, lung disease, memory loss, and learning disabilities. High mortality conditions are based on leading causes of death from CDC (2012) and include heart attack, heart disease, and cancers. All regressions include controls for moderate and minor limitations, individual fixed effects, and additional control variables described in the text. All standard errors allow for clustering at the family level.
***p < 0.01, **p < 0.05, *p < 0.1.

to food expenditures are contemporaneous about spending habits in a "typical week."

All expenditure variables are meant to cover total expenses of the entire "family unit." In the few hundred observations where there is more than one family unit within the household discussed above, we sum the consumption for all family units to get total household expenditures. In the event that a family unit has a missing value for one of these categories, we predict that particular consumption category using fitted values from a regression model using observations with nonmissing values. In these regressions we control for separate dummies for the head being under age 25, between ages 25 and 34, between ages 35 and 44, between ages 45 and 54, between ages 55 and 64, and over age 65; dummies for the head having some high school education, high school education, some college, graduated from college, or post-collegiate schooling; dummy for whether the head is male, number of female children in home, number of male children, number of female adults and number of male adults. All values are inflation adjusted to year 2001 dollars.

Wealth

Savings. The value of checking- or savings-accounts balances, money-market funds, certificates of deposits, government savings bonds, and treasury bills.

Debts. Any nonmortgage, nonvehicle loans or debts. The question specifically references credit-card charges, student loans, medical or legal bills, and loans from relatives.

Stocks. The value of held shares, mutual funds, or investment trusts, excluding IRAs.

Home Equity. The value of the primary owned home minus any remaining first or second mortgage.

All values are inflation adjusted to year 2001 dollars .

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jhealeco.2017.02.001.

References

Altonji, Joseph, Hayashi, Fumio, Kotlikoff, Laurence, 1992. Is the extended family altruistically linked? Direct tests using micro data. Am. Econ. Rev. 82 (5), 1177–1198.

Andreski, P. K. McGonagle, and R. Schoeni. An analysis of the quality of the health data in the Panel Study of Income Dynamics. PSID Technical Series Paper #09-02, September 2009.

Andreski, P., Li, G., Samancioglu, M., Schoeni, R., 2014. Estimates of annual consumption expenditures and its major components in the PSID in comparison to the CE. Am. Econ. Rev. 104 (5), 132–135.

Asfaw, A., von Braun, J., 2004. Is consumption insured against illness? Evidence on vulnerability of households to health shocks in rural Ethiopia. Econ. Dev. Cultur. Change 53 (1), 115–129.

Attanasio, O., Pistaferri, L., 2016. Consumption inequality. J. Econ. Perspect. 30 (2), 3–28.

Attias-Donfut, Claudine, Ogg, Jim, Wolff, François-Charles, 2005. European patterns of intergenerational financial and time transfers. Eur. J. Ageing 2 (3), 161–173.

Bíró, Anikó, 2013. Subjective mortality hazard shocks and the adjustment of consumption expenditures. J. Popul. Econ. 26 (4), 1379–1408.

Ball, Steffan, Low, Hamish, 2014. Do self-insurance and disability insurance prevent consumption loss on disability? Economica 81 (323), 468–490.

Bennett, Paul, Peach, Richard, Peristiani, Stavros, 2001. Structural change in the mortgage market and the propensity to refinance. J. Money Credit Bank. 33 (4), 955–975.

Blundell, R., Pistaferri, L., Preston, I., 2008. Consumption inequality and partial insurance. Am. Econ. Rev. 98 (5), 1887–1921.

Blundell, R., Pistaferri, L., Saporta-Eksten, I., 2016. Consumption inequality and family labor supply. Am. Econ. Rev. 106 (2), 387–435.

Boudreaux, M., Golberstein, E., McAlpine, D., 2016. The long-term impacts of Medicaid exposure in early childhood: evidence from the program's origin. J. Health Econ. 45 (January), 161–175.

Centers for Disease Control and Prevention, 2012. Ten Leading Causes of Death by Age Group, United States? http://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_ death_by_age_group_2012-a.pdf.

Chamberlain, G., 1982. Multivariate regression models for panel data. J. Econometrics 18 (1), 5–46.
Chamberlain, G., 1984. Panel data. In: Griliches, Z., Intriligator, M.D. (Eds.), Handbook of Econometrics. Elsevier Science, North-Holland.
Charles, Kerwin Kofi, 2003. The longitudinal structure of earnings losses among work-limited disabled workers. J. Hum. Resour. 38 (3), 618–646.
Charles, Kerwin Kofi, Stephens Jr., Melvin, 2004. Job displacement, disability, and divorce. J. Labor Econ. 22 (2), 489–522.
Cochrane John, John H., 1991. A simple test of consumption insurance. J. Polit. Eco. 99 (5), 957–976.
Cox, D., 2003. Private transfers within the family: mothers, fathers, sons and daughters. In: Munnell, A., Sunden, A. (Eds.), Death and Dollars: The Role of Gifts and Bequests in America. Brookings Institution Press, Washington, D.C, pp. 168–217.
Currie, Janet, Madrian, Brigitte C., 1999. Health, health insurance and the labor market. In: Ashenfelter, Orley, Card, David (Eds.), Handbook of Labor Economics, vol. 3. Elsevier, pp. 3309–3416.
Dalton, M., LaFave, D., 2017. Measuring the mechanisms of informal family insurance. In: Working Paper.
Davidoff, Thomas, 2010. Home equity commitment and long-term care insurance demand. J. Pub. Econ. 94 (1), 44–49.
Deaton, Angus, 1992. Understanding Consumption. Oxford University Press.
Dercon, Stefan, Krishnan, Pramila, 2000. In sickness and in health: risk sharing within households in rural Ethiopia. J. Polit. Econ. 108 (4), 688–727.
Doms, Mark S., Krainer, John, 2007. Innovations in mortgage markets and increased spending on housing. In: Federal Reserve Bank of San Francisco Working Paper 2007-05.
Fafchamps, Marcel, Lund, Susan, 2003. Risk-sharing networks in rural Philippines. J. Dev. Econ. 71 (2), 261–288.
Fitzgerald, John., 2011. Attrition in models of intergenerational links using the PSID with extensions to health and to sibling models. B.E. J. Econ. Anal. Policy 11 (3).
Frankenberg, Elizabeth, Smith, James P., Thomas, Duncan, 2003. Economic shocks, wealth, and welfare. J. Hum. Resour. 38 (2), 280–321.
García-Gómez, P., van Kippersluis, Hans, Owen, O'Donnell, van Doorslaer, E., 2013. Long-term and spillover effects of health shocks on employment and income. J. Hum. Resour. 48 (4), 873–909.
García-Gómez, Pilar, 2011. Institutions, health shocks and labour market outcomes across Europe. J. Health Econ. 30 (1), 200–213.
Genoni, Maria, 2012. Health shocks and consumption smoothing: evidence from Indonesia. Econ. Dev. Cultur. Change 60 (3), 475–506.
Gertler, Paul, Gruber, Jonathan, 2002. Insuring consumption against illness. Am. Econ. Rev. 92 (1), 51–70.
Gertler, Paul, Levine, David I., Moretti, Enrico, 2009. Do microfinance programs help families insure consumption against illness? Health Econ. 18 (3), 257–273.
Griliches, Z., Hausman, J., 1986. Errors in variables in panel data. J. Econometrics 31 (1), 93–118.
Hall, Robert E., Mishkin, Frederic, 1982. The sensitivity of consumption to transitory income: estimates from panel data on households. Econometrica 50 (2), 461–482.
Hayashi, Fumio, Altonji, Joseph, Kotlikoff, Laurence, 1996. Risk-Sharing between and within Families. Econometrica 64 (2), 261–294.
Hurd, Michael, Kapteyn, Arie, 2003. Health, wealth, and the role of institutions. J. Hum. Resour. 38 (2), 386–415.
Hurst, Erik, Stafford, Frank, 2004. Home is where the equity is: mortgage refinancing and household consumption. J. Money Credit Bank. 36 (6), 985–1014.
Islam, Asadul, Maitra, Pushkar, 2012. Health shocks and consumption smoothing in rural households: does microcredit have a role to play? J. Dev. Econ. 97 (2), 232–243.
Johnson, R., Schoeni, R., 2011. Early-life origins of adult disease: national longitudinal population-based study of the United States. Am. J. Pub. Health 101 (12), 2317–2324.
Li, G., Schoeni, R., Danziger, S., Charles, K., 2010. New expenditure data in the PSID: comparisons with the CE. Mon. Labor Rev. 133 (3), 29–39.
Liu, K., 2016. Insuring against health shocks: health insurance and household choices. J. Health Econ. 46 (March), 16–32.
Lovenheim, Michael F., 2011. The effect of liquid housing wealth on college enrollment. J. Labor Econ. 29 (4), 741–771.
Low, Hamish, Pistaferri, Luigi, 2015. Disability insurance and the dynamics of the incentive-insurance tradeoff. Am. Econ. Rev. 105 (10), 2986–3029.
Mace, Barbara., 1991. Full insurance in the presence of aggregate uncertainty. J. Polit. Econ. 99 (5), 928–956.
Meyer, Bruce, Mok, Wallace K.C., 2013. Disability, earnings, income and consumption. In: NBER Working Paper No. 18869 (March).
Mok, Wallace K.C., Meyer, Bruce D., Charles, Kerwin Kofi, Achen, Alexandra C., 2008. A note on the longitudinal structure of earnings losses among work-limited disabled workers. J. Hum. Resour. 43 (3), 721–728.
Moran, J., Farley Short, P., Hollenbeak, C., 2011. Long-term employment effects of surviving cancer. J. Health Econ. 30 (3), 505–514.
Siegel, Michele, 2006. Measuring the effect of husband's health on wife's labor supply. Health Econ. 15 (6), 579–601.
Skinner, J., 1987. A superior measure of consumption from the panel study of income dynamics. Econ. Lett. 23 (2), 213–216.
Smith, James P., 1999. Healthy bodies and thick wallets: the dual relation between health and economic status. J. Econ. Perspect. 13 (2), 145–166.
Sparrow, Robert, Van de Poel, Ellen, Hadiwidjaja, Gracia, Yumna, Athia, Warda, Nila, Suryahadi, Asep, 2014. Coping with the economic consequences of ill health in Indonesia. Health Econ. 23 (6), 719–728.
Stephens Jr., Melvin, 2002. Worker displacement and the added worker effect. J. Labor Econ. 20 (3), 504–537.
Strully, Kate W., 2009. Job loss and health in the U. S. labor market. Demography 46 (2), 221–246.
Townsend, Robert M., 1994. Risk and insurance in village India. Econometrica 62 (3), 539–591.
Valerio, A. Melissa, et al., 2010. Examining the association between childhood asthma and parent and grandparent asthma status: implications for practice. Clin. Pediatr. 49 (6), 535–541.
Wagstaff, Adam, 2007. The economic consequences of health shocks: evidence from Vietnam. J. Health Econ. 26 (1), 82–100.
Waldkirch, Andreas, Ng, Serena, Cox, Donald, 2004. Intergenerational linkages in consumption behavior. J. Hum. Resour. 39 (2), 355–381.
Wiemers, Emily, Slanchev, Vladislav, McGarry, Kathleen, Joseph Hotz, V., 2017. Living arrangements of mothers and their adult children over the life course. Res. Aging 39 (1), 111–134.
Wu, Stephen, 2003. The effects of health events on the economic status of married couples. J. Hum. Resour. 38 (1), 219–230.
de Weerdt, Joachim, Dercon, Stefan, 2006. Risk-sharing networks and insurance against illness. J. Dev. Econ. 81 (2), 337–356.
Zajacova, A., Dowd, J., Schoeni, R., Wallace, R., 2015. Employment and income losses among cancer survivors: estimates from a national longitudinal survey of American families. Cancer 121 (24), 4425–4432.