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The impact of diminished housing wealth on health in the United States: Evidence from the Great Recession

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ABSTRACT

The sharp decline in home values in many industrialized and developing countries was one of the most evident facets of the global economic recession of 2008. Using data from the Panel Study of Income Dynamics (PSID) for 2007–2011, this study examines how the decline in housing wealth affected the psychological and physical health and health-related behaviors of 4007 U.S. households who were homeowners in 2007. We focus on two mechanisms that could account for how the drop in housing wealth affects health: increase in stress and negative changes in health-related behaviors. Controlling for the changes in non-housing wealth and employment status during the recession, the decline in housing wealth is associated with a small but statistically significant increase in psychological distress. Psychological health deteriorates more as the housing wealth relative to total wealth decreases. Finally, homeowners who have difficulties with mortgage payments report substantial increases in psychological distress and have higher rates of depression. These findings, combined with limited evidence of the change in health-related behaviors, suggest that the increase in stress is the main cause of the adverse health outcomes.

1. Introduction

Following the collapse of the housing bubble in 2007 in the United States, the international financial system experienced an unprecedented volatility leading to the global economic recession in many industrialized and developing countries (Bernanke, 2010; Mian et al., 2010, 2011). As house prices declined, many borrowers found it increasingly difficult to meet their mortgage payments and/or refinance their loans. Consequently, the global economic recession of 2008 reinforced the trend of sharp declines in home values, and resulted in a record high number of foreclosures and devaluation of housing-related securities (Mian and Sufi, 2010). From the first quarter of 2007 through the last quarter of 2010, house price indexes fell by 36 percent in the U.S., 16 percent in Spain, and 5–7 percent in Italy, Japan and Britain (The Economist, 2014). Also, 2.2 percent of all U.S. housing units (one in 45) received a foreclosure notice in 2009, more than 4 times the rate of foreclosure fillings in 2006 (RealtyTrac, 2009).

The goal of this study is to examine how the rapid decline in housing wealth during the global recession affected the psychological and physical health, and health-related behaviors of homeowners. We focus on housing wealth, which we define as the difference between the value of primary residence and outstanding mortgage, because it is an important component of household economic well-being. Moreover, households in a number of countries have experienced large decreases in housing wealth since the beginning of the recession. The value of owner-occupied homes accounts for 33 percent of household assets in the U.S. and an even higher percentage of household assets in European countries (Bricker et al., 2012a; Guiso et al., 2001; Christelis et al., 2013). The pre-recession data from the euro area indicates that the share of home value in households' net wealth increased from 59 percent in 1999 to 68 percent in 2007 (Eiglsperger and Haine, 2009). Housing wealth is particularly important for middle-class families since approximately two-thirds of median household wealth is invested in the primary residence (Bricker et al., 2012b; Christelis et al., 2013).

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Our study aims to contribute to the literature on the relationship between socioeconomic status (SES) and health by examining the impact of unexpected large wealth losses on health. It also contributes to the growing literature that uses international data (U.S., U.K., Iceland, Greece, Australia, Spain, Portugal) to assess the effects of macroeconomic conditions and the recent financial crisis on physical and mental health (Ruhm, 2000, 2003; Ásgeirsdóttir et al., 2014; Karanikolos et al., 2013; Kentikelenis et al., 2011; Sargent-Cox et al., 2011; Katikireddi et al., 2012; Economou et al., 2013; Gili et al., 2013). Recessions could affect health in several different ways. First, the direct effect is generated by the loss of employment, income or wealth. Health could worsen due to the psychological stress of financial difficulties and tighter income constraints. At the same time, the reduced opportunity cost of time and the decrease in work-related stress could generate health benefits (e.g., more time for exercising or cooking). Second, macroeconomic effects could compromise health indirectly by reducing the generosity of private and public safety nets (e.g., public spending on health care). However, a slower economy could also improve health and reduce mortality due to reductions in environmental pollution or auto accidents.

Most recent studies focus on the direct effect of the recession by investigating the impact of unemployment or income loss on health (Bell and Blanchflower, 2011; Miller et al., 2009; Xu, 2013; Phillips and Nugent, 2014; Gili et al., 2013). Riumallo-Herl et al. (2014) show that job loss is associated with increased depressive symptoms in both the U.S. and Europe. In terms of the loss of wealth, McInerney et al. (2013) detect a limited impact of the stock market crash in October 2008 on health. Also relevant to our research, some previous studies examine the impact of the decline in housing prices or foreclosures on health. Currie and Tekin (2011) provide evidence of significant increases in unscheduled hospital and emergency room visits in areas most heavily affected by the foreclosure crisis in the U.S. They determine that the increase in hospital and emergency room visits is mostly caused by psychological stress, rather than the increase in unemployment or migration, decline in housing prices, or the switch from out-patient providers to hospitals. Lin et al. (2013) indicate that the declines in the county-level Housing Price Index in the U.S. are associated with higher rates of antidepressant utilization. Gili et al. (2013) show that the frequency of mental disorders in patients at the primary care centers in Spain increased significantly during the 2008 economic crisis, especially among those with mortgage payment difficulties.

2. Link between housing wealth and health

A rapid decrease in the value of primary residence and home equity (used interchangeably with housing wealth) has substantial effects on housing tenure decisions and financial well-being. The decline in home equity diminishes the likelihood of a refinance or sale. Homeowners with outstanding housing debt may become “upside-down” in their mortgages, i.e., their mortgage becomes larger than the value of their home. In response to a decrease in home value, some homeowners, especially those with negligible down payments and negative home equity, may decide to default and “walk away” from their home loans. Foreclosures and forced sales have numerous adverse consequences, ranging from the need to find a new residence to credit downgrades, tax obligations, and the emotional toll of leaving behind a home and neighborhood, all of which create psychological stress. The unexpected financial shock of losing a home to foreclosure implies tighter budget constraints, which are likely to generate adverse changes in health-related behaviors. For example, households experiencing a decline in wealth may reduce expenditures by not filling prescriptions, postponing doctor visits, and substituting healthy food with less healthy but more affordable alternatives (Feinstein, 1993; Jensen and Richter, 2004; Lusardi et al., 2010).

Default on mortgage liability might not be an issue for homeowners with positive equity who are not affected by short-term liquidity constraints. However, their consumption can still be affected in two ways. First, life-cycle models suggest that households adjust their consumption and labor supply whenever they receive new information regarding lifetime wealth. Several empirical studies show that unrealized home equity gains/losses have consumption effects (Campbell and Cocco, 2007; Lovenheim and Reynolds, 2013). Second, a change in housing wealth can affect consumption by relaxing or tightening borrowing constraints. A decline in home equity reduces the possibility of utilizing a home as a collateral and causes consumption to decline (Hurst and Stafford, 2004; Cooper, 2013). Similar to the impact of foreclosures, a decline in housing wealth can also have an adverse effect on psychological and physical health through emotional distress. Around three quarters of Americans cite money issues as a cause of stress, and household indebtedness is among the most frequent determinants of stress (American Psychological Association, 2012; Bridges and Disney, 2010; Brown et al., 2005). Also, health-related behaviors can be negatively affected by the contractions in budget constraints.

Emotional distress affects both mental and physical health in a variety of ways. Stress is associated with anxiety, depression, sleeping and eating disorders, weight loss or gain, and also leads to health-undermining behaviors, such as smoking, and abuse of alcohol and/or drugs (Goldberger and Breznitz, 1993; Cooper, 2004). In addition, stress is considered to be one of the causes of hypertension and therefore is a risk factor for a heart attack or stroke (Cohen et al., 2007; Strike and Steptoe, 2004). Stress may also depress the immune system, increasing susceptibility to various diseases including cancer (Chida et al., 2008; Cohen et al., 2012).

3. Methods

3.1. Data

We draw upon the 2007, 2009 and 2011 waves of the Panel Study of Income Dynamics (PSID), which is a publicly available secondary dataset that provides a nationally representative sample of U.S. households. The economic recession in the U.S. officially began in December 2007 and ended in June 2009, with most significant declines of home values experienced in 2008 and 2009. A number of recent studies used the 2007–2009 PSID to investigate the impact of the recession on wealth, retirement decisions, and economic well-being (Bosworth, 2012; Dynan, 2012; Lerman and Zhang, 2013). Our analysis includes the 2011 wave to additionally account for the changes in housing and non-housing wealth beyond the official end of the recession.

The value of a home is reported by homeowners in each wave of the PSID. The literature provides evidence that some homeowners misestimate their house value, although the magnitude of error is not large, typically ranging between 3 and 5 percent (Agarwal, 2007). This measurement error should not affect our results because consumption and spending decisions, as well as decisions regarding repaying or defaulting on mortgage loans, depend on the homeowner's subjective estimate of the home value (Agarwal, 2007).

Housing wealth (home equity) is the difference between the value of the primary residence and outstanding mortgage liability. Non-housing wealth is constructed as the sum of assets (excluding primary residence) minus all debts (excluding mortgage liability).

Net wealth is the sum of housing wealth and non-housing wealth. In 2009 and 2011, homeowners with mortgage liabilities were asked whether they were delinquent on their mortgage payments (Difficulty with mortgage) and whether the foreclosure process had started (Foreclosure).

The effects of a change in housing wealth on health outcomes are captured with five different variables: psychological distress, feeling depressed, self-reported health status, and clinically-diagnosed onsets of high blood pressure and depression. While wealth and income are measured at the household level, health variables are the responses of the household head (husband for couples). Psychological distress is measured using the K-6 Non-Specific Psychological Distress Scale (Kessler et al., 2003). The items in the K-6 scale are very similar to those in the Center for Epidemiological Studies Depression (CES-D) scale, a measure commonly used to detect depression. The K-6 scale was designed as a shortened tool for general surveys (Kessler et al., 2002), and includes six questions that ask the respondents if they felt (1) "*so sad that nothing could cheer you up*"; (2) "*nervous*"; (3) "*restless or fidgety*"; (4) "*hopeless*"; (5) "*that everything is an effort*"; and (6) "*worthless*". The possible responses are "*none of the time*" = 0, "*a little of the time*" = 1, "*some of the time*" = 2, "*most of the time*" = 3 and "*all of the time*" = 4. Our measure of psychological distress is the sum of the answers to these six questions. Following Kessler et al. (2002), a respondent is considered to be feeling depressed (Depressed) if the sum of his responses to the six items in the K-6 scale is equal or greater than 13. The third measure of health is self-reported health status. The responses are collected on a 5-point scale from "*excellent*" = 1, "*very good*" = 2, "*good*" = 3, "*fair*" = 4 and "*poor*" = 5. Finally, the PSID reports the history of clinically-diagnosed health conditions. High blood pressure and depression are two health conditions that are caused and/or aggravated by high levels of stress. We identify new onsets of high blood pressure and depression problems and create indicator variables (High blood pressure and Depression) that we use as the fourth and fifth measures of health outcomes, respectively.

The PSID also includes a number of questions designed to identify the behavioral consequences of stress. Individuals who reported symptoms of stress (answered "*some of the time*" = 2, "*most of the time*" = 3, or "*all of the time*" = 4 to one of the six items in the K-6 scale) are asked "*How much do these feelings usually interfere with your life or activities?*" (Distress interference). The possible responses are "*not at all*" = 0, "*a little*" = 1, "*some*" = 2, and "*a lot*" = 3. They were also asked two additional questions: the number of days during the past 30 days that they were unable to work or carry out normal activities due to these feelings (Days unable to work due to distress) and the number of days during the past 30 days that they were able to work but had to reduce their activities (Days had to reduce work due to distress).

3.2. Statistical analysis

We investigate the health and behavior effects of three aspects of the housing crisis, namely the loss in housing wealth, difficulties with mortgage payments, and foreclosures. The decline in housing wealth can affect health in two ways: financial distress causes psychological distress, and budget constraints cause changes in health-related behaviors. We examine the link between the three aspects of housing crisis and various types of health-related behaviors, including expenditures on health care (total, prescription drugs and in-home medical care) and food. The multivariate regressions also control for non-housing wealth, income and unemployment status, all of which were adversely affected by the recession. The extent of a loss in home value might be correlated with both observed (e.g., demographic variables) and unobserved (e.g., investment preferences and health endowments) characteristics. We control for unobserved time-invariant characteristics by using a household-level fixed-effects estimation strategy.

Since psychological distress, self-reported health status, and distress inference are discrete ordinal variables, we model these outcomes with both linear fixed-effects (FE) and fixed-effects ordered logit estimators. There is no consensus in the literature on how to implement the fixed-effects ordered logit estimator (Baetschmann et al., 2013). In short panels, the parameters of ordered logit cannot be estimated due to the incidental parameter problem (Hole et al., 2011). Therefore, all versions of the fixed-effects ordered logit estimator rely on conditional logit estimation of a dichotomized response. We use the "blow-up and cluster" (BUC) estimator (as described in Baetschmann et al. (2013), Dickerson et al. (2014), and Hole et al. (2011)), which is a preferred approach when the number of responses in some response categories is low. It is not possible to calculate the marginal effects for BUC because the fixed-effects are conditioned out of the likelihood function (Hole et al., 2011). One advantage of FE is that coefficients can be interpreted as marginal effects. We also estimate fixed-effects logit models for binary indicator variables such as feeling depressed, being diagnosed with depression or high blood pressure. Our findings are robust to the different estimation methods.

4. Results

4.1. Descriptive overview

Our sample consists of 4007 households who were homeowners in 2007 (approximately 67% of the PSID sample) and who were interviewed in all of the three waves used in our study. Table 1 provides the summary statistics of the key variables for 2007, 2009 and 2011. The homeownership rate decreased by approximately 5% each wave following 2007. The median home value for homeowners decreased from $200,000 in 2007 to $190,000 in 2009 and to $180,000 in 2011. Consequently, the median housing wealth decreased by 18.8% from 2007 to 2009 and 6.9% from 2009 to 2011. Households in our sample also experienced a decline in non-housing wealth. Altogether, the decreases in housing and non-housing wealth generated a 17.1% decrease in median net wealth from 2007 to 2009, with an additional 6.1% decrease in 2011. In addition, 5% of homeowners with mortgage loans reported that they had difficulties making their mortgage payments, and almost 1% of this group reported that they were in the foreclosure process. We verified that the wealth measures and trends observed in our sample are similar to the corresponding statistics obtained from the 2007–2009 panel supplement to the Survey of Consumer Finances (SCF), a nationally representative survey conducted by the Federal Reserve Board.

The measure of psychological distress averaged at 2.45 (out of 24) in 2007, increased to 2.71 in 2009 and leveled off at 2.66 in 2011. The distribution of psychological distress in each wave is skewed, with the 50th percentile around 1 and the 75th percentile around 4 (not shown). Among the household heads who reported depressive symptoms, 45% in 2007 and 50% in 2011 reported that psychological distress interfered with their life activities (not shown). The average values for distress inference, the number of days (of the previous 30 days) that these households were unable to work or carry normal activities, and the number of additional days they needed to reduce work due to distress exhibited small increases throughout 2011. The self-reported health status worsened from 2007 to 2011 as the household heads aged.

Table 1
Descriptive statistics.

	2007	2009	2011
Sample size	4007	4007	4007
Wealth and income			
Homeowner	1.000	0.944	0.905
Home value[a] | Homeowner = 1	$200,000	$190,000	$180,000
Holds mortgage (=1)	0.686	0.642	0.577
Mortgage[a] | Have mortgage = 1	$113,000	$117,000	$119,024
Housing wealth[a]	$106,000	$86,000	$80,000
Non-housing wealth[a]	$67,500	$65,000	$60,000
Net wealth[a]	$217,000	$180,000	$169,000
Total family income[a]	$69,090	$70,000	$67,000
Difficulty with mortgage (=1) | Have mortgage = 1		0.055	0.051
Foreclosure (=1) | Have mortgage = 1		0.011	0.013
"Underwater" mortgage (=1) | Have mortgage = 1	0.023	0.079	0.105
Unemployed	0.023	0.048	0.039
Health outcomes			
Psychological distress	2.459	2.713	2.663
Depressed (=1)	0.022	0.023	0.023
Feeling sad	0.32	0.34	0.32
Feeling nervous	0.64	0.69	0.65
Feeling restless	0.69	0.76	0.73
Feeling hopeless	0.16	0.20	0.21
Feeling effortless	0.52	0.56	0.56
Feeling worthless	0.14	0.17	0.19
Self-reported health status	2.39	2.48	2.57
High blood pressure (=1)	0.352	0.423	0.474
Diagnosed depression (=1)	0.047	0.047	0.043
Health behavior			
Substantial distress (=1)	0.363	0.391	0.400
Distress interference | Substantial distress = 1	0.73	0.77	0.78
Days unable to work | Substantial distress = 1	0.82	1.01	1.01
Days need to cut down work | Substantial distress = 1	1.11	1.32	1.47
Out-of-pocket medical expenses	$1445	$1829	$1836
Food consumption	$10,274	$9795	$10,051
Reasons to move			
Moved	0.166	0.113	0.120
Contraction	0.017	0.035	0.041
Expansion	0.109	0.054	0.047
Mixed reasons	0.022	0.020	0.025
Socioeconomic variables			
Age of head	53.46		
Head is male (=1)	0.784		
Head is married (=1)	0.674	0.666	0.653
Hispanic	0.075		
African-American	0.090		

Notes: Descriptive statistics are weighted using family weights.
[a] Median values are reported. Psychological distress is the sum of six questions about feelings of sadness, nervous, restless, hopeless, effortless, and worthless. The possible responses for these feelings are "none of the time" = 0, "a little of the time" = 1, "some of the time" = 2, "most of the time" = 3 and "all of the time" = 4. Psychological distress is measured on a 0–24 scale. Depressed equals 1 if Psychological distress equals 13 or larger, and 0 otherwise. Health status is measured on a 1–5 scale, where "excellent" = 1, "very good" = 2, "good" = 3, "fair" = 4 and "poor" = 5. Diagnosed depression equals 1 if the respondent is diagnosed with depression or anxiety, and 0 otherwise. Substantial distress equals 1 if the respondent answered "some of the time" = 2, "most of the time" = 3, or "all of the time" = 4 to one of the six questions about feelings. Distress interference measures whether substantial distress interferes with life or normal activities, on a 0–3 scale, where "not at all" = 0, "a little" = 1, "some" = 2, and "a lot" = 3. Days unable to work refers to the number of days out of the past 30 days when the respondent was unable to work or carry out normal activities due to depressive feelings. Days need to cut down work refers to the number of the remaining days out of the past 30 days the respondent was able to work but had to cut down work due to depressive feelings. Moving reasons are grouped into three types: contraction (less space, less rent), expansion (more space, better place), and mixed reasons.

4.2. Health outcomes and behavioral consequences of stress

The estimates of the fixed-effects regression models for health outcomes and behavioral consequences of stress are presented in Table 2. Since housing wealth, non-housing wealth and household income can be negative, we use the inverse hyperbolic sine (arsinh) transformation. The arsinh transformation is expressed as $\text{arsinh}(x) = \log(x + \sqrt{x^2 + 1})$. This type of transformation has been utilized in previous economic studies to transform wealth (Burbridge et al., 1988; Pence, 2006), and arsinh(x) has a similar interpretation to log(x).

Both BUC and FE estimates show that psychological distress increases with a decline in home equity. The estimated coefficients for psychological distress in Table 2 point to a relatively small marginal effect, implying that experiencing a 10% decrease in housing wealth would increase the baseline level of psychological distress (2.46) by 0.0012 units. Non-housing wealth also has a similar, small but statistically significant, effect on psychological distress. The self-reported health status deteriorates at a small but statistically significant rate when housing wealth and non-housing wealth decrease. Finally, the likelihood of being diagnosed with high blood pressure or depression does not increase with a decline in housing and non-housing wealth. On the other hand, unemployed household heads have 0.288 unit (11.4% of the baseline level) higher distress and are 1.58 percentage points more likely to feel depressed compared to their employed counterparts.

Table 2 also presents the fixed-effects estimates for the behavioral consequences of stress. While the effect of a decline in housing wealth is insignificant and the effect of a decline in non-housing wealth is small, unemployment has a large effect on behavioral consequences of stress. Distress interference with life activities increases by 0.119 unit with unemployment, which is an increase of 45% from the baseline level (0.26). Stress related to becoming unemployed increases the number of days that household heads are unable to carry out activities by a third of a day and the number of days that they need to cut down activities by an additional third of a day.

The magnitude of the effect of a change in housing wealth may vary across households characterized by different values of net wealth. We replaced housing and non-housing wealth with the ratio of housing wealth divided by net wealth in our regressions. For full results, see Appendix. Since net wealth also decreases with a decline in housing wealth, we use the net wealth measured before the recession in 2007 in the denominator of the ratio. The fixed-effects estimates show that as the ratio of housing wealth to net wealth decreases, psychological distress and the likelihood of feeling depressed increase.

We also investigate how experiencing difficulties with a mortgage and the start of a foreclosure process are related to health outcomes and behavioral consequences of stress. Since these questions were only asked in 2009 and 2011, we restrict the sample to these two waves and to respondents who have mortgages. A comparison of households who reported difficulties with a mortgage to those who did not report difficulties reveals that the unemployment rate was higher among those who reported difficulties (18.2% vs. 4.3%). In addition, those having difficulties with a mortgage experienced a 53.3% decline in median home equity (from $30,000 to $14,000), while those who did not have difficulties with a mortgage experienced only a 18.0% decline (from $95,000 to $77,800).

The estimates presented in Table 3 show that households facing difficulties with a mortgage have 0.546 unit higher psychological distress, which is a 20% increase from the baseline distress in 2007. The likelihood of feeling depressed increases by 3.86 percentage points and the likelihood of being diagnosed with depression

Table 2
Regressions for health outcomes and behavioral consequences of stress.

Dependent variables:	Psychological distress		Depressed	Self-reported health status		High blood pressure	Diagnosed depression	Distress interference		# of days unable to work due to distress	# of days cut down work due to distress
	BUC	FE	FE	BUC	FE	FE	FE	BUC	FE	FE	FE
arsinh (Housing wealth)	−0.0100*	−0.0122**	−0.0003	−0.0158***	−0.0051***	−0.0000	0.0001	0.0057	0.0013	0.0033	0.0075
	(0.0056)	(0.0060)	(0.0003)	(0.0056)	(0.0015)	(0.0005)	(0.0003)	(0.0076)	(0.0014)	(0.0062)	(0.0064)
arsinh (Non-housing wealth)	−0.0104**	−0.0134***	−0.0004	−0.0095**	−0.0029**	−0.0003	−0.0001	−0.0068	−0.0017	0.0040	−0.0152***
	(0.0044)	(0.0049)	(0.0003)	(0.0046)	(0.0013)	(0.0004)	(0.0003)	(0.0054)	(0.0011)	(0.0051)	(0.0052)
Unemployment	0.2450*	0.2880**	0.0158**	0.1346	0.0377	0.0088	0.0066	0.5311***	0.1186***	0.3835***	0.3553**
	(0.1258)	(0.1413)	(0.0072)	(0.1296)	(0.0358)	(0.0112)	(0.0079)	(0.1679)	(0.0319)	(0.1463)	(0.1491)
arsinh (Family income)	0.0155	0.0180	−0.0019	0.0098	0.0047	−0.0051*	−0.0052***	−0.0243	−0.0083	−0.0728**	−0.0682*
	(0.0349)	(0.0353)	(0.0018)	(0.0315)	(0.0090)	(0.0028)	(0.0020)	(0.0424)	(0.0079)	(0.0364)	(0.0370)
Moved	−0.1102	−0.1134	0.0002	−0.0518	−0.0055	0.0089	0.0024	−0.2125*	−0.0380*	−0.0532	−0.0798
	(0.0868)	(0.0872)	(0.0045)	(0.0820)	(0.0221)	(0.0069)	(0.0049)	(0.1177)	(0.0197)	(0.0901)	(0.0919)
Age	−0.2049***	−0.1637	−0.0007	0.0497	−0.0776***	0.0127	0.0060	−0.1066*	−0.0121	0.1213	−0.0078
	(0.0499)	(0.1191)	(0.0058)	(0.0492)	(0.0286)	(0.0090)	(0.0063)	(0.0647)	(0.0255)	(0.1165)	(0.1188)
Age2/100	0.2112***	0.2286***	0.0006	0.0864*	0.0314***	0.0067*	0.0018	0.1399**	0.0243**	0.0168	0.0336
	(0.0474)	(0.0477)	(0.0024)	(0.0462)	(0.0118)	(0.0037)	(0.0026)	(0.0603)	(0.0105)	(0.0482)	(0.0492)
Family size	0.0667	0.0735	0.0048*	0.0499	0.0138	−0.0109***	−0.0019	0.0744	0.0133	0.0012	0.0106
	(0.0516)	(0.0512)	(0.0026)	(0.0477)	(0.0129)	(0.0041)	(0.0028)	(0.0630)	(0.0115)	(0.0528)	(0.0538)
F-statistics/Wald Chi2 for BUC	62.20	4.02	2.16	168.76	11.36	44.91	2.26	43.97	2.83	3.14	1.93
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N of observations	11,751	11,820	11,820	11,932	12,002	12,001	11,997	11,942	12,014	12,004	11,985
N of households		3981	3981		4007	4007	4006		4007	4007	4007

Note: Additional control variables include employment status (employed, unemployed, retired, not in the labor force), marital status (single, married, widowed, and divorced), insurance coverage (employer provided insurance, Medicare, private insurance, government program, and no insurance), and time dummies. The variations in sample sizes across regressions are due to the missing values. *** denotes coefficients significant at 1% level, ** denotes coefficients significant at 5% level, and * denotes coefficients significant at 10% level.

increases by 2.78 percentage points. Distress inferring with life activities also increases by 0.137 unit or 50% from the baseline if the household has difficulties with a mortgage. If the foreclosure process has already started, the distress increases by an additional 0.962 unit and the likelihood of feeling depressed increases by an additional 6.51 percentage points.

Table 3
Regressions for health outcomes and behavioral consequences of stress.

Dependent variables:	Psychological distress		Depressed	Self-reported health status		High blood pressure	Diagnosed depression	Distress interference		# of days unable to work due to distress	# of days cut down work due to distress
	BUC	FE	FE	BUC	FE	FE	FE	BUC	FE	FE	FE
Difficulty with mortgage (=1)	0.3916	0.5456**	0.0386***	0.2438	0.0787	0.0133	0.0278*	0.5984*	0.1369**	0.0246	0.0260
	(0.2393)	(0.2541)	(0.0131)	(0.2639)	(0.0652)	(0.0164)	(0.0145)	(0.3253)	(0.0614)	(0.2523)	(0.2751)
Foreclosure (=1)	0.9248*	0.9619**	0.0651***	0.6059	0.1866	−0.0361	0.0118	0.2440	−0.0412	0.8287*	0.3729
	(0.4775)	(0.4799)	(0.0247)	(0.5157)	(0.1236)	(0.0310)	(0.0274)	(0.6647)	(0.1164)	(0.4782)	(0.5198)
arsinh (Non-housing wealth)	−0.0023	0.0020	0.0002	−0.0282***	−0.0065***	0.0005	−0.0003	−0.0075	−0.0006	0.0051	0.0007
	(0.0081)	(0.0085)	(0.0004)	(0.0099)	(0.0022)	(0.0005)	(0.0005)	(0.0111)	(0.0020)	(0.0084)	(0.0092)
Unemployment	0.0466	0.0418	−0.0018	−0.2900	−0.0787	0.0066	0.0135	0.2504	0.0544	−0.0121	0.5206**
	(0.2454)	(0.2390)	(0.0123)	(0.2599)	(0.0614)	(0.0154)	(0.0136)	(0.3501)	(0.0578)	(0.2375)	(0.2581)
arsinh (Family income)	−0.1361	−0.0970	−0.0089**	0.1311**	0.0453**	−0.0002	0.0033	−0.3048*	−0.0404**	−0.0021	−0.6963***
	(0.1104)	(0.0846)	(0.0043)	(0.0609)	(0.0218)	(0.0055)	(0.0048)	(0.1589)	(0.0205)	(0.0843)	(0.0916)
Moved	0.2483	0.2439	0.0045	−0.0718	−0.0002	0.0113	0.0011	0.5578*	0.0594	0.0968	0.1385
	(0.1876)	(0.1828)	(0.0094)	(0.2098)	(0.0468)	(0.0117)	(0.0104)	(0.2850)	(0.0441)	(0.1813)	(0.1972)
Age	−0.1590	−0.2509	0.0028	−0.0465	−0.0591	0.0086	0.0131	−0.1614	−0.0662	−0.1235	−0.2489
	(0.1383)	(0.2296)	(0.0118)	(0.1535)	(0.0589)	(0.0148)	(0.0131)	(0.2138)	(0.0554)	(0.2275)	(0.2473)
Age2/100	0.0545	0.0251	−0.0105	0.2054	0.0429	0.0048	−0.0004	0.1025	0.0040	0.1243	0.1718
	(0.1386)	(0.1348)	(0.0069)	(0.1557)	(0.0344)	(0.0086)	(0.0076)	(0.2156)	(0.0324)	(0.1331)	(0.1448)
Family size	−0.0212	−0.0137	−0.0031	−0.0700	−0.0109	−0.0046	−0.0059	0.1214	0.0184	0.0458	0.0526
	(0.1105)	(0.1009)	(0.0052)	(0.1079)	(0.0259)	(0.0065)	(0.0057)	(0.1456)	(0.0244)	(0.1002)	(0.1089)
F-statistics/Wald Chi2 for BUC	31.10	1.84	2.83	40.33	2.47	6.25	2.39	29.48	1.59	2.13	3.94
P-value	0.028	0.000	0.000	0.002	0.000	0.000	0.000	0.043	0.000	0.000	0.000
N of observations	4982	5016	5016	5017	5051	5052	5047	5020	5054	5052	5048
N of households		2773	2773		2794	2795	2793		2795	2794	2793

Note: See Table 2 for the additional control variables. *** denotes coefficients significant at 1% level, ** denotes coefficients significant at 5% level, and * denotes coefficients significant at 10% level.

4.3. Health-related behaviors

We examine three types of expenditures: annual expenditures on prescriptions and in-home medical care (reported as a sum in PSID), total health expenditures, and food expenditures. Total health expenditures are calculated as the sum of annual out-of pocket expenses for prescriptions, in-home medical care, doctor, dental and out-patient surgery, nursing home and hospital stays. Food expenditures are the sum of annual expenditures on both food consumed at home as well as eaten elsewhere. We apply the logarithmic transformation to the expenditure variables and code zero expenditures as zero.

Our estimates in Table 4 show that a decline in housing wealth and difficulties with a mortgage do not decrease expenditures on prescription drugs and in-home medical care or total expenditures on health. Further empirical investigation revealed that insignificant estimates cannot be explained by the offsetting effects: higher stress increases health expenditures while budget contractions reduce them. Food expenditures significantly decrease with housing and non-housing wealth. However, the overall effect is very small. By contrast, food expenditures decrease by 11.3% after the household experiences an unemployment spell. Among those who have mortgages, there is no significant association between having difficulties with a mortgage and expenditures on food.

5. Conclusions

This paper examines how the housing crisis and the economic recession of 2007–2009 affected the psychological and physical health of U.S. households. Specifically, we quantify the health impacts of three aspects of the housing crisis: experiencing a decline in housing wealth, difficulties with payments of mortgage dues, and being subjected to a foreclosure. We find that a decline in housing wealth is associated with statistically significant, but quantitatively small, increase in psychological distress. However, psychological distress, the likelihood of feeling depressed and being diagnosed with depression increase substantially after experiencing difficulties with mortgage obligations or being subjected to a foreclosure. We also analyze the impact of these three aspects of the housing crisis on the behavioral consequences of stress. Our findings suggest that difficulties with payments of mortgage dues and foreclosures have more severe consequences on psychological distress and distress interfering with life than the decline in household wealth.

The unique feature of our study is the evaluation of two alternative mechanisms that could account for how changes in wealth lead to changes in health. Under the first scenario, loss of economic resources inhibits the use of health care or induces unhealthy behaviors. Under the second scenario, the stress associated with economic loss and financial difficulties directly impacts psychological and physical health. We did not detect any major effects of a decline in housing or non-housing wealth or difficulties with mortgage payments on health-related behaviors. We conclude that psychological distress, rather than a tighter budget, is the more likely channel through which the distress caused by a wealth shock interferes with life activities and health.

Our study also provides a unique insight into differences in the effects of unrealized and realized financial losses on health and stress interfering with normal life activities. The decline in housing wealth might not matter for households who do not use their house as collateral or do not plan to sell their house in the near future. Similarly, the loss of non-housing wealth during the recession, when caused by a decline of the value of assets invested in stocks, might be temporary and unrealized if stocks are not sold. Our findings suggest that unrealized losses are quite inconsequential to health and do not distort normal patterns of life activities. In contrast, the measures of actual financial hardship (difficulties with mortgage dues, foreclosures, unemployment spells, and income losses) appear to have sizable adverse effects on both psychological distress and life activities.

Our research contributes to the growing literature on the relationship and direction of causality between SES and health. Previous research showed that poor health is associated with lower wealth (Smith, 1999; Poterba et al., 2010; Babiarz et al., 2013; Babiarz and Yilmazer, 2013; Yilmazer and Scharff, 2014), while the causal relationship from wealth to health is relatively small (Smith, 1999; Adams et al., 2003; Meer et al., 2003; Lyons and Yilmazer, 2005; Michaud and van Soest, 2008; Apouey and Clark, 2014). Our findings support this narrative and match McInerney et al. (2013), who show that wealth losses attributable to the October 2008 stock market crash increased feelings of depression and the use of antidepressant drugs, but did not lead to clinically-validated depressive symptoms. We find two additional important adverse consequences of the recession, foreclosures and unemployment, both of which have significant negative effects on psychological distress and health. These findings support the previous results that job losses and foreclosures had significant causal impacts on health (Currie and Tekin, 2011; Phillips and Nugent, 2014; Riumallo-Herl et al., 2014). In addition, our findings are consistent with a larger number of studies that focus on the effects of exogenous job or income losses on health and provide evidence that mortality rates, suicides, and hospitalizations increase following a job displacement or establishment closing (Jensen and Richter, 2004; Sullivan and von Wachter, 2009; Eliason and Storrie, 2009a, 2009b).

A major strength of our study is that it provides a comprehensive analysis of the impact of recession on health using several measures of economic well-being, such as changes in wealth,

Table 4
Regressions for health-related behaviors.

Dependent variables:	Log (prescription and in-home medical care)	Log (health expenditure)	Log (food consumption)	
	FE	FE	FE	FE
arsinh (Housing wealth)	−0.0002	−0.0049	0.0028**	
	(0.0045)	(0.0046)	(0.0012)	
arsinh (Non-housing wealth)	−0.0073*	−0.0062	0.0027***	0.0013
	(0.0037)	(0.0038)	(0.0010)	(0.0017)
Difficulty with mortgage (=1)				−0.0811
				(0.0509)
Foreclosure (=1)				0.0289
				(0.0951)
Unemployment	−0.0288	0.0773	−0.1133***	−0.1508***
	(0.1056)	(0.1085)	(0.0292)	(0.0478)
arsinh (Family income)	0.0237	0.0645**	0.0259***	0.0275
	(0.0266)	(0.0276)	(0.0076)	(0.0168)
Moved	0.0974	0.0184	0.0159	0.0206
	(0.0647)	(0.0669)	(0.0178)	(0.0360)
Age	0.0270	0.0099	0.0673***	0.0817*
	(0.0848)	(0.0865)	(0.0229)	(0.0453)
Age2/100	−0.0886**	−0.0537	−0.0209**	−0.0306
	(0.0356)	(0.0359)	(0.0096)	(0.0265)
Family size	0.0602	0.1035***	0.1049***	0.1014***
	(0.0388)	(0.0394)	(0.0105)	(0.0200)
F-statistics	4.30	5.94	13.31	5.09
P-value	0.000	0.000	0.000	0.000
N of observations	11,379	11,892	11,854	5027
N of households	3992	4006	4000	2781

Note: See Table 2 for the additional control variables. *** denotes coefficients significant at 1% level, ** denotes coefficients significant at 5% level, and * denotes coefficients significant at 10% level.

income, employment, as well as difficulties with mortgage payments and experiencing foreclosure. We utilize longitudinal data that includes all of these changes in SES in addition to mental and physical health, behavioral consequences of stress, and food and health care expenditures. Previous studies of the effects of the recession on health relied on less comprehensive datasets and rarely were able to examine such a broad array of health effects and control for respondent-level heterogeneity.

There are some limitations of our study. The time span following the recession is short, which does not permit an examination of the long-term physical and mental health effects. Some of the mechanisms of the impact of diminished economic well-being on health may require a longer time horizon to develop. This might explain why some of the effects were statistically or quantitatively insignificant. In addition, measuring the impact of wealth, income and job loss on health typically presents an empirical challenge because the causal relation might also run from health to these factors. There is ample evidence that the shock to home values from 2007 to 2009 was not caused by U.S. households suddenly becoming ill (Demyanyk and van Hemert, 2011; Foster and Magdoff, 2009; Mian and Sufi, 2009). However, the extent of the loss in home value might be correlated with both observed and unobserved characteristics. Our empirical analysis was only able to control for the observed demographic and socio-economic characteristics, and the time-invariant unobserved factors. Some unobserved characteristics that are not accounted for could distort the validity of variable measurement and bias our results. For example, respondents could have heterogeneous expectations regarding the timing of an economic recovery or the future inflation in the housing market.

Following the housing market collapse of 2007–2009, governments in many countries considered and/or implemented programs that would alleviate adverse consequences of housing-related financial losses. For example, Making Home Affordable (MHA) is a social program set up by the federal government of the U.S. to provide loan modifications to individuals with high interest rates or mortgage payments, and to those who lost their jobs or experienced a significant drop in home values. Our results confirm the need for such social assistance and suggest that policy solutions designed to stabilize housing markets and help homeowners avoid foreclosures would also prevent the increase in psychological stress levels in society and thus produce positive externalities on mental and physical health. However, caution has to be advised with the generalization of our results to other countries. The heterogeneity in policy structures and financial market regulations across countries imply that any extrapolations of our findings have to be accompanied by a careful comparison of social policies and legal environments.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2015.02.028.

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