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# Wealth shocks, unemployment shocks and consumption in the wake of the Great Recession <sup>☆</sup>



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## ABSTRACT

Data from the 2009 Internet Survey of the Health and Retirement Study show that many US households experienced large capital losses in housing and financial wealth, and that 5% of respondents lost their job during the Great Recession. For every loss of 10% in housing and financial wealth, the estimated drop in household expenditure was about 0.56% and 0.9%, respectively. Those who became unemployed reduced spending by 10%. In line with predictions of standard inter-temporal choice models, households who perceived the stock market shock to be permanent adjusted spending much more than those who perceived the shock to be temporary.

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## 1. Introduction

In 2008, American households experienced a loss of 13.6 trillion in wealth, compared to a disposable income of 11 trillion. Between October 2007 and October 2008 the stock market declined by almost 40%, and house prices by almost 20%. The unemployment rate, which throughout 2007 averaged 4.8%, doubled in less than two years, from 5% in January 2008 to 10.1% in 2009. Many analysts link this large, unexpected and unprecedented fall in the market value of household wealth and the dramatic increase in unemployment to the drop in consumption that took place in the second half of 2008 and 2009. Indeed, real consumption expenditures dropped from 10.078 trillion dollars (in constant 2009 prices, seasonally adjusted at an annual rate) in the second quarter of 2008 to 9.806 trillion dollars in the second quarter of 2009, i.e., a decline

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of about 2.7%. All these figures suggest that a special feature of the Great Recession is that households were hit by three different shocks: a large drop in house prices, a strong decline in the stock market, and a dramatic worsening of the labor market conditions.

This paper attempts to estimate the separate impact of these three shocks on households' expenditures, using recently available microdata. In particular, the paper makes three contributions. First, it takes advantage of the first (to the best of our knowledge) household dataset that provides at the same time information on consumption, capital gains on financial assets and housing, and labor force status, and use it in order to assess the impact of wealth losses and unemployment on consumption. The use of directly elicited information on stock capital gains/losses in particular is an important breakthrough in the literature on wealth effects. This is the case because typically in microdata surveys one has information on the level of stock holdings in two or more waves, and thus a change in the value of such holdings can be due not only to changes in stock prices but also to purchases or sales of stocks, mutual funds, etc. As a result, measures of stock capital gains/losses typically found in the literature are contaminated by the effect of transactions, while the measure used in the paper is not. Having in the dataset information on housing capital gains/losses is also fundamental, given that the house is the main component of most households' wealth.

Second, the paper takes into account household heterogeneity in exposure to each of the three shocks in order to show the fundamental role that capital losses on stocks and housing, as well as unemployment shocks played for the reduced consumption of older Americans during the Great Recession, which is the most serious economic crisis affecting the US economy since the 1930s.

Third, the paper uses available information on household expectations on the persistence of stock losses in order to show how these expectations affect households' consumption response to such losses. After documenting the considerable heterogeneity in these expectations, the paper shows that households that perceive wealth losses to be more long-lasting reduce their consumption by a greater percentage than their counterparts that expect a rebound in the stock market. This finding is in line with predictions from standard economic theory, and points to the importance of household expectations for consumption adjustments during the Great Recession.

The microdata used in this paper come from the 2009 Internet Survey of the Health and Retirement Study (HRS), and refer to the population aged 50 or older. Hence, they are particularly well suited to analyze the impact of wealth shocks on consumption. Indeed, older households have accumulated significant amounts of wealth over the lifecycle and therefore control a large fraction of society's resources;<sup>1</sup> thus their decisions have pronounced aggregate implications. Those aged fifty and above typically have higher stock market participation rates than the rest of the population, and a higher fraction of their wealth is invested in risky financial assets. Furthermore, over 90% of households in the sample own their home. Hence, the analyses are less likely to suffer from the endogeneity bias that arises when one examines consumption responses to housing wealth losses over homeowners, and the heterogeneity of responses with respect to wealth losses experienced by owners and renters. Finally, recent studies (e.g., [Attanasio et al., 2009](#)) emphasize that co-movements in consumption and house prices may be driven by a common factor such as income expectations. Given that the elderly typically face a relatively flat future income profile, this problem may be less severe in the sample.<sup>2</sup> On the other hand, the unemployment rate and the probability of job loss tend to be lower among older households.

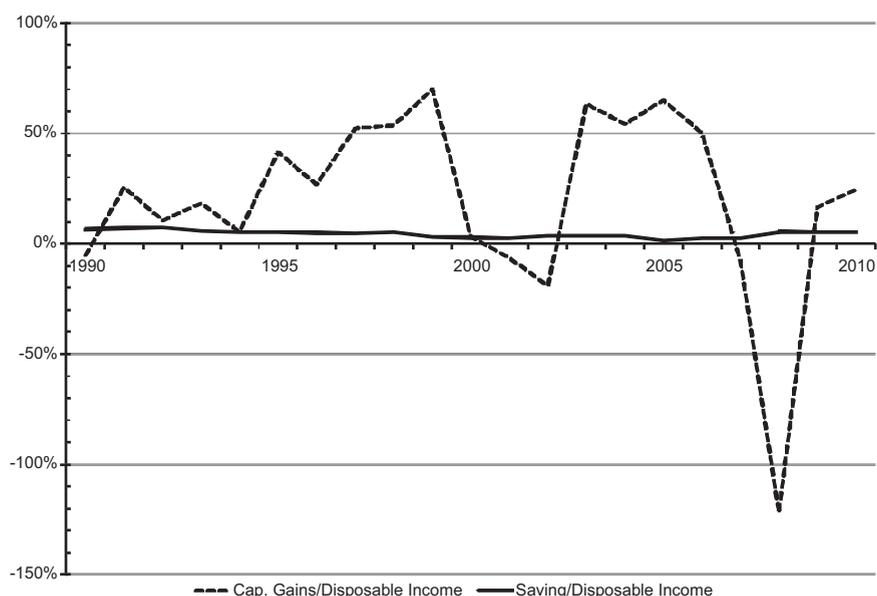
We find that capital losses on housing and financial assets, as well as the income loss from becoming unemployed, do indeed lead households to reduce their spending, and these effects are net of the influence of a number of important socio-economic characteristics including family size, health deterioration, and change in working and retirement status. Furthermore, an analysis using disaggregated financial assets shows that the effects of financial losses come primarily through losses experienced from directly held stocks and individual retirement accounts (IRAs).

More specifically, the elasticity of consumption to financial wealth losses experienced in 2008–2009 is about 0.09, implying a marginal propensity to consume with respect to financial wealth equal to 3.3 percentage points. In addition, households in which at least one of the two partners in the main couple (or the single head) became unemployed in 2008 and early 2009 reduced consumption by 10% in 2009. Finally, the fall in house prices between the summer of 2006 and the first half of 2009 also has an important impact on consumption (the estimated elasticity is about 0.06 and the associated marginal propensity to consume reaches 1 percentage point). Furthermore, we generate artificial data from both a buffer stock and a permanent income model, and use them to calculate the implied elasticities of consumption to wealth. The empirical estimates of the elasticities are in line with those generated by these two standard intertemporal consumption models.

It should be noted that, while the paper studies the consumption response to capital losses using data from 2008 to 2009, the economic relevance of this issue is more general, given that large asset price movements have by now become the norm in the US economy. [Fig. 1](#) plots capital gains and active saving accruing to the US household sector (both are measured as a share of personal disposable income) from 1990 to 2010. As the graph makes it clear, during this period capital gains and losses form a much larger part of households' year-to-year asset accumulation than active saving; in fact, the median yearly absolute ratio of capital gains to active saving is equal to 5.43. Furthermore, the accumulated real (in 2009 prices) capital gains, after subtracting real losses, are equal to about 35.99 trillion dollars during this period, while the accumulated

<sup>1</sup> Information from the 2007 and 2010 waves of the US Survey of Consumer Finances indicates that households in which the head is aged 50 and above have about 62% of total gross housing wealth, 78% of all equity wealth, and 75% of total net worth.

<sup>2</sup> Indeed, [Attanasio et al. \(2009\)](#) find that younger households (most of which are renters) have higher wealth-consumption correlations than older households, and take this as evidence that the co-movement between consumption and house prices is driven by income expectations, rather than a genuine wealth effect.



**Fig. 1.** Capital gains and saving, 1990–2010.

Notes: The graph is derived using data from the [Board of Governors of the Federal Reserve System \(2011\)](#) and [BEA \(2014\)](#). Details are provided in Appendix E in [Supporting information](#).

real household saving is equal to about 8.14 trillion dollars. As shown in [Section 3](#) below, very large capital losses will show up also in the microdata that we will use for our analyses.

According to several models of intertemporal choice, the impact of wealth shocks on consumption depends on the nature of the shocks (permanent or transitory) and the opportunities to smooth them through credit and insurance markets. To distinguish between permanent and transitory shocks to financial wealth one can rely on subjective expectations elicited in the fall of 2008 about stock market gains or losses expected one year ahead. In particular, it could be informative to split the sample between households that expected the stock market to recover in a year's time, and those who did not. The consumption response to wealth shocks should be larger for the latter group, who are likely to perceive the negative shock to their financial wealth as permanent. Indeed, the response of consumption to this shock is very strong for this group of households, while it is insignificant for the other group. In addition, increased income uncertainty may lead to a drop in consumption. However, measures of income risk calculated using subjective expectations do not have a statistically significant effect on consumption.

The remaining of the paper is organized as follows. [Section 2](#) reviews previous literature on the effect of wealth and unemployment shocks on consumption. [Section 3](#) presents the data. [Section 4](#) presents estimates of the effect of wealth shocks and unemployment on consumption. [Section 5](#) compares the results to those obtained from two standard models of intertemporal choice (the permanent income model and the buffer stock model) in which shocks to the return on capital are added. [Section 6](#) takes into account heterogeneity in stock market expectations and presents estimates of the response of consumption to transitory and permanent wealth shocks. [Section 7](#) presents various robustness checks to corroborate the empirical findings. [Section 8](#) presents results from an additional source, namely the Panel Survey of Income Dynamics. [Section 9](#) concludes.

## 2. Wealth and unemployment shocks

Standard models of intertemporal choice suggest that unexpected and permanent drops in wealth reduce consumption, and that this reduction equals the annuity value of the drop in wealth. There is, however, much disagreement about the magnitude of the impact of wealth shocks on consumption. Most of the literature attempting to estimate this impact is based on two implicit assumptions: (i) wealth shocks (whether due to house price changes or movements in stock prices) are not predictable, and therefore not anticipated by consumers; (ii) current prices are the best predictors of future asset prices, and therefore changes in asset prices constitute a permanent wealth shock. According to the permanent income hypothesis, it follows from (i) and (ii) that wealth shocks should have a relatively large impact on consumption, equivalent to the annuity value of the wealth shock (in the order of 2–5%, depending on the assumed real interest rate).

Several studies, relying on macroeconomic or regional data, regress the logarithm of consumption, consumption growth or saving on shocks to housing or financial wealth, but no consensus has yet emerged on the link between house prices and consumption. For instance, [Davis and Palumbo \(2001\)](#) estimate that the MPC out of total wealth is in the range of 0.04–0.06. [Case et al. \(2004\)](#) provide estimates from a panel of developed countries and a panel of US states. In both datasets, they find an MPC out of housing wealth of around 0.03–0.04 and a small and insignificant MPC out of stock market wealth. [Ludwig and Sløk \(2004\)](#) found a larger effect of stock wealth than housing wealth in a panel of OECD countries. In a recent study,

however, [Carroll et al. \(2011\)](#) estimate the longer run effects on consumption from housing wealth changes, as opposed to the immediate ones (e.g., those of the next quarter), to be larger than the effects of financial wealth shocks.

Studies using microeconomic data allow researchers to dig deeper into this link. While changes in stock prices imply unambiguous wealth effects on consumption, as discussed in [Sinai and Souleles \(2005\)](#), [Campbell and Cocco \(2007\)](#) and [Attanasio et al. \(2009\)](#), the consumption response to a house price decline is quite heterogeneous across the population. Most empirical analyses using micro-data refer to the US and the UK. [Engelhardt \(1996\)](#) estimated an MPC of 0.03 or higher for the US in the 1980s, and [Juster et al. \(2006\)](#) found an even higher MPC out of stock price changes. On the other hand, [Hoyne and McFadden \(1997\)](#) found that households who had experienced housing capital gains increased their saving rather than their spending, and [Hryshko et al. \(2010\)](#) find that after a job loss homeowners can smooth consumption easier than renters in times of higher house prices. In the UK [Disney et al. \(2010\)](#) find a relatively low MPC out of housing wealth (of the order of 0.01), while [Campbell and Cocco \(2007\)](#) a relatively strong response for older households that own their home. [Attanasio et al. \(2009\)](#) conclude that the co-movements in consumption and house prices are not generated by a causal link running from the latter to the former, but by common factors, contradicting the findings in [Campbell and Cocco \(2007\)](#).

On balance, results based on micro-data are also mixed, with some papers finding large responses of expenditure to house and stock prices shocks, while others find smaller effects. This literature generally suffers from some limitations. First and foremost, house and stock price changes are likely correlated with other economic events, and therefore have an impact on expectations of future income. A second limitation is that most studies rely on aggregate measures of house price changes (either at the national, regional or county level), while house price risk has also an idiosyncratic component specific to each dwelling. A third limitation of current studies is that they usually do not distinguish between transitory and permanent wealth shocks, which should have different impact on consumption. In contrast, the data used in this paper do provide information that allows one to shed light on this issue.

Furthermore, most of the existing evidence refers to house price booms (as in the UK in the 1990s), while the present paper focuses on wealth losses during the Great Recession, which allows to estimate the impact of very large losses in both housing and financial wealth on consumption. As noted in [Browning and Collado \(2001\)](#), consumers may tend to smooth consumption when income or wealth changes are large, but are less likely to do so when the changes are small and the cost of adjusting consumption is not trivial. Indeed, it is quite possible that the literature has not been able to obtain more precise estimates of the MPC out of wealth shocks because some of the shocks are small, and consumers might react mostly to large shocks.<sup>3</sup>

During the Great Recession households also experienced negative income shocks, particularly those who became unemployed. The consumption response to unemployment shocks depends on the extent to which the shock is anticipated, on the persistence of the shock, and on the degree of imperfections of credit and insurance markets ([Jappelli and Pistaferri, 2010](#)). According to the permanent income hypothesis, the impact should be strongest when the shock is not anticipated (as is most likely the case for those who became unemployed in 2007–2008), when the shock is perceived to be permanent, and when consumers are liquidity constrained. One should also bear in mind that unemployment shocks may be partially insured through unemployment insurance. Therefore, a complete analysis of the impact of unemployment requires explicit modeling of the type of insurance available to individuals as well as of the possible interactions between public and private insurance.<sup>4</sup>

One of the earlier attempts to look at the effect of unemployment shocks on consumption is [Gruber \(1997\)](#). Using the PSID, he constructs a sample of workers who lose their job between period  $t-1$  and period  $t$ , and regresses the change in food spending over the same time span against the unemployment insurance (UI) replacement rate an individual is eligible for. Gruber finds a large smoothing effect of UI, in particular that a rise in the replacement rate by 10 percentage points reduces the fall in consumption upon unemployment by about 3%. He also finds that the fall in consumption at a zero replacement rate is about 20%, suggesting that consumers face liquidity constraints. [Browning and Crossley \(2001\)](#) estimate a small elasticity of expenditures with respect to UI benefit (equal to 0.05) in Canada. But this small effect masks substantial heterogeneity, with low wealth households at the time of job loss exhibiting elasticities as high as 0.2. This finding is also consistent with the presence of liquidity constraints.

Some recent papers study the implications of unemployment shocks and changes in wealth on consumption during the Great Recession. [Shapiro \(2010\)](#) uses data from the Cognitive Economics Study (CogEcon), conducted via Internet, in order to assess the effect of the financial crisis on the well-being of older Americans. The initial wave of CogEcon was fielded shortly before the financial crisis that began in the fall of 2008, and provides baseline wealth measurements and information about the structure of households' portfolios for a representative sample of almost 1000 US individuals aged 50 years and older. The second wave was completed in summer 2009. Shapiro finds that financial wealth fell by about 15% for the median household, and that financial losses were concentrated among households with high levels of wealth, who tend to have higher exposure to the stock market. Nonetheless,

<sup>3</sup> In quite different contexts, this "magnitude hypothesis" has been tested by [Coulibaly and Li \(2006\)](#) and [Scholnick \(2013\)](#), who argue that the final mortgage payment represents a large expected disposable income shock (that is, income net of pre-committed debt service payments). The test of the magnitude hypothesis looks at whether the response of consumption to expected income increases depends on the relative amount of mortgage payments. [Stephens \(2008\)](#) studies consumption adjustments due to an expected rise in income following the last repayment of a vehicle loan. [Shapiro and Slemrod \(2003\)](#) and [Agarwal et al. \(2007\)](#) examine consumption responses to the receipt of a tax rebate.

<sup>4</sup> Some of these interactions stem from the fact that most welfare programs are means- and asset-tested. For example, in the US individuals with more than \$2000 in liquid assets are not eligible to receive Food Stamps, Medicaid and other popular welfare programs even if they have no income. The disincentives to save (self-insure) induced by the presence of public insurance (which in most cases are not subject to time limits) have been studied by [Hubbard et al. \(1995\)](#).

households with little financial wealth suffered declines in consumption as large as households with substantial exposure to the stock market. Tight credit market conditions and adverse labor market outcomes account for much of the effect of the financial crisis on the consumption of these low-wealth households.

Hurd and Rohwedder (2010b) use the American Life Panel, an ongoing Internet survey of about 2500 respondents, which was fielded at the beginning of November 2008, immediately following the large declines in the stock market associated with the collapse of Lehman Brothers. They find that between November 2008 and April 2010 almost 40% of American households have been affected either by unemployment, negative home equity, arrears on their mortgage payments, or foreclosure. A third study, also by Hurd and Rohwedder (2010a) combines longitudinal data from the Health and Retirement Study (HRS) with the 2009 h Internet Survey to provide an overview of the effects of the financial crisis on the population aged 50 or older. According to the descriptive statistics reported by Hurd and Rowhedder, the majority of older households have suffered substantial losses in stocks and/or housing wealth, while some of them have extracted home equity (and, as a result, increased their indebtedness). They also find that almost 30% of households reduced spending between 2007 and 2009, and that the average decline was larger than 8 percentage points.

Using the 2007–2009 Survey of Consumer Finance panel, Bricker et al. (2011), find substantial heterogeneity in changes in wealth among households. Furthermore, these changes appear to reflect changes in asset values (particularly the value of homes, stocks, and businesses) rather than changes in the level of ownership of assets and debts or in the amount of debt held. The study also finds that families appear more cautious in 2009 than in 2007, as most families reported greater desired buffer savings, and many of them expressed concern over future income and employment. Petev et al. (2012) point out that the consumption of the wealthy fell more than that of the less wealthy during the recession. Using the typical estimates of the wealth effect available in the literature, they show that this factor can explain a significant fraction of the fall in consumption experienced by the wealthy.

A related issue is that the recession increased insecurity about the future. Indeed, the Consumer Sentiment Index declined dramatically in the second half of 2007. Petev et al. (2012) suggest that increased uncertainty may have reduced spending through precautionary saving, and that the credit crunch that followed the financial crisis may have prevented some households from purchasing goods that are typically acquired through borrowing. Deaton (2011) analyzes self-reported well-being questions collected by the Gallup Organization. Between the fall of 2008 and the spring of 2009 (at which point the stock market hit bottom), Americans became much more negative when evaluating their lives, were much more worried and stressed, and exhibited declines in positive affect. As discussed below, these issues are addressed in robustness checks that further examine the consumption response to household liabilities and to measures of income risk.

### 3. The data

#### 3.1. The HRS Internet Survey

The empirical investigation in this paper uses information from two micro-data surveys. The first data source is the HRS, which is a longitudinal, nationally representative microsurvey interviewing those aged fifty and above in the US. The survey, conducted on a biannual basis since 1992, provides extensive information on households' socioeconomic characteristics, income, and assets holdings (for a detailed description of the survey see Hauser and Willis (2005)).

Wave 9 of the HRS, which was conducted between February 2008 and February 2009, interviewed 16,477 individuals belonging to 11,187 different households. In 2009, the HRS asked a subset of the Wave 9 respondents to participate in an Internet survey (our second data source), with the aim to collect information on households' experiences and circumstances during the ongoing recession. Most of the sampled individuals had participated in wave 9 of the HRS and had reported having Internet access, while the few who had not appeared in wave 9 had participated in previous waves of the Internet Survey (2003, 2006, or 2007). The 2009 Internet Survey was conducted from March 2009 to August 2009, and its sample consists of 4415 respondents belonging to 3438 households (the sample response rate was about 77%). In order to reduce the possibility that the estimates are affected by outliers, 26 observations for which the absolute value of the percentage change in consumption is larger than 0.8 are dropped from the sample. The survey provides information on the wealth losses that respondents have experienced, on the adjustments they have made in their consumption, on changes in their labor status, and on how they cope with financial difficulties. After merging the 2009 Internet Survey with the 2008 main survey, one ends up with a sample of 3328 households.

An important, for the purposes of this paper, feature of the Internet Survey is that respondents are asked about changes in their total spending compared to the previous year (i.e., 2008). They are first asked to indicate whether their current spending is lower, higher, or has stayed the same. Subsequently, they are asked to report the percentage change in their total spending. As discussed below, both the continuous (percentage) and the qualitative (categorical) change in expenditure are examined as outcomes of interest.<sup>5</sup>

<sup>5</sup> The Internet Survey also asks about current spending on some basic consumption items. Furthermore, one can recover information on spending in 2008 by using information from the Consumption and Activities Mail Survey (CAMS), which is a supplemental mail survey conducted in 2009, and in which a sub-sample of 2008 h respondents were asked about their expenditures over the past 12 months. In principle, one could examine changes in consumption by also using this additional information. In practice, however, it is very difficult to use either of these additional sources of data on expenditure. First, there are very few observations (less than 400 households) for which the information needed from all three surveys (i.e., 2008 h, 2009 CAMS and the Internet Survey) exists. This is the case because the vast majority of households participating in 2009 CAMS do not participate in the Internet

Furthermore, the Internet Survey asks a series of questions aiming to measure the wealth losses that households have suffered. Specifically, households are asked whether their own home is worth more, less or about the same compared to its value in the summer of 2006, which is the year in which house prices peaked in the US. Then, they are also asked to report the change in the value of their house, both as an amount and as a percentage. The empirical specifications use as a forcing variable the answer to the percentage change question, given that the questions on changes in spending and on the value of financial assets are also asked in percentage terms.<sup>6</sup>

Finally, the Internet Survey also asks a series of questions regarding the percentage losses in the value of the following financial assets: employer retirement saving plans (incl. 401k's); individual retirement accounts (IRAs) or Keogh plans; investment trusts; mutual funds; directly held stocks; and stocks held through other assets. For each of these assets owners are asked to report the percentage decline of the asset value since September 2008, which was the month in which Lehman Brothers collapsed, resulting in a major upheaval in financial markets worldwide. Unlike the questions on the change in the value of the house, the questions on changes in the value of financial assets ask only about losses, and hence the values of the corresponding variables are censored at zero. However, given the fact that financial markets went in a tailspin in the fall of 2008, and that the US stock market in particular hit bottom in March 2009 (i.e., one month before the Internet Survey began), very few, if any, households in the survey are likely to have experienced any financial gains. In any case, in order to test the sensitivity of the results to this feature of the data, one can use as an alternative to the continuous percentage change variable a four-level categorical variable, the top level of which denotes no losses (or gains), while the other three levels the terciles of financial losses. Using this alternative categorical variable did not change the results in any significant way.

One may wonder to what extent the reported capital losses accurately reflect the actual losses households suffered on their assets. However, the empirical results in this paper are unlikely to be due to such a measurement error. First, households report the gain/loss that they perceive to have incurred on their house and on their equity holdings. These perceived price changes might be different from the ones that would be recorded if, say, there were an actual auction of the households' main home or if they sold their equity holdings. However, what should matter for households' consumption response is precisely this perceived loss and not the hypothetical accurately recorded one. After all, it is reasonable to assume that households act on what they think has occurred. On the other hand, measurement error would be an issue if a respondent knowingly misreports to the interviewer the value of the gain/loss, as in this case the household would act based on a value of the relevant variable that is different from the one observed by the econometrician. However, there is no evidence that such deliberate misreporting is common in the HRS.

Second, measurement error in the regressors has an attenuating effect on estimates. From linear models, such as those used in this paper. As a result, the bias that this error potentially induces goes against the finding of a positive wealth elasticity. On the other hand, measurement error in the dependent variable does not affect the consistency of the estimates; rather, it increases their standard errors. Third, as already mentioned, we also estimate empirical models featuring functional forms and variable formats that are much more robust to possible measurement error (e.g. models with a categorical dependent variable and/or dummies denoting quartiles of housing and financial wealth gains/losses). As discussed in Sections 4 and 7 below, the results from these models are entirely consistent with those from the baseline specification.

As an additional check of the quality of the HRS data, one can compare the measures of housing and capital losses recorded therein to those recorded in other sources, namely the 2007–2009 panel of the Survey of Consumer Finances and the Flow of Funds. As reported in detail in Appendix A in Supporting information, results from these two external sources are reasonably close to those obtained from the HRS data.

### 3.2. Descriptive statistics

The primary objective of the paper is to examine the relationship between, on the one hand, changes in consumption and, on the other hand, capital losses in housing and financial assets, as well as unemployment. Losses in financial assets will be expressed either as a weighted average of the percentage change in the aforementioned six financial assets, or as six separate percentage change variables. The weighted average of the percentage change in the value of financial assets can be calculated by weighing the percentage change in each of the six asset categories with the financial portfolio share of the respective asset, as recorded in the Internet Survey. As discussed below, one can also define an unweighted average of the changes in the value of the individual financial assets, and this change left results unaffected.<sup>7</sup> In order to avoid problems

(footnote continued)

Survey. Second, the Internet Survey does not provide any information on a number of major expenditure items (e.g., housing expenses, recreation, personal care).

<sup>6</sup> For cases in which the percentage change in the value of the home is missing, it can be calculated by using information from the amount change in the home value, and the current value, which are related to the percentage change by the equation  $p = DV/(V - DV)$ , where  $p$  denotes the percentage change,  $DV$  is the change in value, and  $V$  is the current value.

<sup>7</sup> The Internet Survey asks households to give an estimate of the current value of the six financial assets in question. It is not possible, however, to combine this information with asset values reported in the 2008 h in order to calculate percentage losses for each financial asset. This is the case because changes in asset values do not distinguish between active saving and changes in market prices. Furthermore, there is not an exact correspondence between

**Table 1**

Changes in consumption and capital gains.

Source: 2009 HRS Internet survey, 2008 HRS main survey.

Gains in assets	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Percentage change in consumption (unconditional)				Qualitative change in consumption		
	25th quantile	50th quantile	75th quantile	Mean	Lower	Same	Higher
<b>Panel A. Housing</b>							
1st quartile	−0.150	0.000	0.000	−0.052	0.298	0.482	0.220
2nd quartile	−0.150	0.000	0.000	−0.060	0.314	0.523	0.163
3rd quartile	−0.100	0.000	0.000	−0.043	0.239	0.579	0.182
4th quartile	−0.050	0.000	0.000	−0.028	0.209	0.575	0.217
<b>Panel B. Total financial assets</b>							
1st level	−0.150	0.000	0.000	−0.072	0.288	0.554	0.157
2nd level	−0.100	0.000	0.000	−0.053	0.256	0.557	0.188
3rd level	−0.100	0.000	0.000	−0.045	0.234	0.557	0.208
4th level	−0.050	0.000	0.000	−0.033	0.215	0.544	0.240

Notes: The 4th level of gains in financial assets denotes zero or positive appreciation. The remaining three levels denote the terciles of financial losses (e.g., the 1st level denotes the largest losses). All figures are calculated using sampling weights from the 2008 HRS main survey (the 2009 Internet Survey does not contain any sampling weights).

with sample selection, the estimation sample includes also households that do not own a house and/or financial assets. As expected, the value of the capital gains variables is equal to zero for those households.

Table 1 summarizes changes in consumption, both in percentages and in categorical form (lower, same, or higher compared to the previous year), by quartiles of percentage changes in asset values. Descriptive statistics suggest a negative association between asset capital losses and spending. While the median household has not reduced its consumption, households that have suffered the largest losses in housing have reduced their spending by 5.2% on average, while the corresponding drop for those with the largest losses in financial assets is 7.2%. On the other hand, households with the smallest losses (i.e., those in the 4th quartile), reduce on average their spending by 2.8% and 3.3% due housing and financial losses, respectively. The results on qualitative consumption changes suggest a similar picture, as the fraction of those reporting a decline (increase) in consumption increases (decreases) when losses are higher (i.e., at the lower quartiles).

Table 2 reports statistics on losses on housing and total (weighted) financial assets, as well as for each financial asset separately. It is immediately clear that a significant fraction of households have suffered losses in housing (54%) and in their financial assets (94%), conditional on ownership. The prevalence of losses is also very severe (between 73% and 92%) in all six financial assets.

About half of the households that have experienced a drop in their housing wealth have lost at least 18% of the value of their main home between the summer of 2006 and the spring of 2009. This implies a considerable hit to household net worth, given that the house is typically the dominant asset in household portfolios. The drop in households' financial wealth has also been very striking. Among those who have suffered losses the median percentage loss with respect to the four major asset categories (i.e., employer-based pension plans, IRAs, mutual funds, and direct stocks) is about 28% since September 2008. Furthermore, one out of four households with losses has witnessed a decline of at least 36% in the value of its investments in the aforementioned four assets.

In order to convert the percentage losses shown in Table 2 in dollar terms, one can apply the reported losses in percentages to the values of the assets as reported in the HRS Internet Survey. The resulting median amount of the sum of losses from housing and financial assets was about 50,300 dollars (in 2009 prices) for the whole sample. These large capital losses recorded in the HRS data are congruent with the aggregate capital losses during the Great Recession that are shown in Fig. 1, and likely have a negative impact on household spending.

Apart from changes in housing and financial wealth, some of the specifications use variables denoting a variety of socio-economic characteristics, information on which is taken from the 2008 h. These include age, household size, marital status, being in fair/poor health, working status, education, and race. Moreover, the number of correct answers to a numeracy test (five successive subtractions of the same number) is used as an indicator of cognitive ability, and total household income and net worth are used as indicators of households' resources in 2008.<sup>8</sup> Finally, some of the specifications include also

(footnote continued)

financial assets about which questions are asked in HRS 2008, and those in the Internet Survey (e.g., there is no information on employer provided plans and trusts in the 2008 h). As a result, we have to use the Internet Survey question on percentage changes in asset values in order to measure asset losses.

<sup>8</sup> Net income and net wealth have highly skewed distributions. The inverse hyperbolic sine transformation (hereafter IHS):  $\log(x+(x^2+1)^{1/2})$ , allows for nonlinear effects and is defined for zero and negative values. The IHS function is asymptotic to the logarithmic one (with a difference equal to the logarithm of two) starting from values of  $x$  that are very close to zero (Burbidge et al., 1988). Hence an estimated coefficient of an IHS-transformed variable can be interpreted essentially in the same way as a coefficient of a variable in logarithms.

**Table 2**

Capital losses in housing and financial assets.

Source: 2009 HRS Internet survey, 2008 HRS main survey.

Asset	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership prevalence	Prevalence of losses, conditional on ownership	Quantiles of losses, conditional on having any losses			
			25th quantile	50th quantile	75th quantile	Mean
<b>Panel A. Main residence and all financial assets</b>						
Main residence	0.893	0.537	-0.250	-0.180	-0.111	-0.197
Financial assets	0.692	0.944	-0.357	-0.275	-0.176	-0.275
<b>Panel B. Financial assets in detail</b>						
Employer-provided pension plans	0.402	0.878	-0.400	-0.300	-0.200	-0.304
Individual retirement accounts	0.406	0.921	-0.400	-0.300	-0.200	-0.310
Mutual funds	0.443	0.917	-0.400	-0.300	-0.200	-0.297
Directly held stocks	0.321	0.839	-0.400	-0.250	-0.175	-0.308
Trusts	0.104	0.807	-0.330	-0.250	-0.150	-0.256
Other assets invested in stocks	0.245	0.730	-0.330	-0.205	-0.125	-0.254

Note: Lower quantiles of losses denote larger losses (more negative gains). All figures are calculated using sampling weights from the 2008 HRS main survey (the 2009 Internet survey does not contain any sampling weights).

dummy variables denoting transition into unemployment, exit into retirement, and deterioration in health status between HRS 2008 and the Internet Survey.<sup>9</sup>

Table 3 provides summary statistics on the aforementioned socioeconomic characteristics. The mean age is about 63 years, while households in which there are two partners form 75% of the sample. In about half of the households at least one member was employed full time, hence facing a potential risk of unemployment. On the other hand, in 34% of cases both partners were retired. In a non-trivial fraction of older households (5%) at least one of the two partners (or the single head) became newly unemployed between the 2008 h and the Internet Survey (as opposed to almost 6% for the population at large in the same period). In the same period, the rate of exit into retirement was 11%. Roughly 7% of households have at least one member declaring deterioration in health status in comparison to 2008, while one out of four households declares health problems in 2008. The median household income was about 70,000 dollars, while the corresponding numbers for financial and net real assets are 81,800 and 193,100 dollars, respectively (the latter figure is mainly due to the high home ownership rate and relatively low amounts of outstanding mortgages observed in the HRS sample).

Fig. 2 highlights graphically the main results. It plots the change in the value of financial assets and the home against consumption growth, with the data aggregated in bins. Both relations are positive, suggesting sizeable wealth effects. The response of consumption to financial losses appears, however, to be much stronger. In particular, the left panel of Fig. 2 shows that a drop in the value of housing wealth of 25% is associated with a decrease in expenditure of about 2%. On the other hand, the right panel of Fig. 2 shows that financial wealth losses of 25% are associated with a reduction in consumption of about 4%.

## 4. Empirical results

### 4.1. Model specification

The consumption effect of capital gains on housing and financial assets can be studied using a linear specification, in which the percentage change in consumption  $C$  will be associated to the percentage changes in the values of housing and financial wealth (denoted by  $HW$  and  $FW$ , respectively),<sup>10</sup> to becoming unemployed (denoted by  $\Delta U$ ) as well as to various

<sup>9</sup> In the case of couples, characteristics represent a combination of the information from the two partners. In particular, the empirical specifications include average age, worse reported health status, and the maximum of educational level and of the numeracy score. Furthermore, the couple is determined to be in the labor force if any of the two partners is working and retired if both are retired. With reference to changes in occupation, a couple with at least one newly unemployed or newly retired member between HRS 2008 and the Internet Survey is classified as becoming unemployed or retired, respectively.

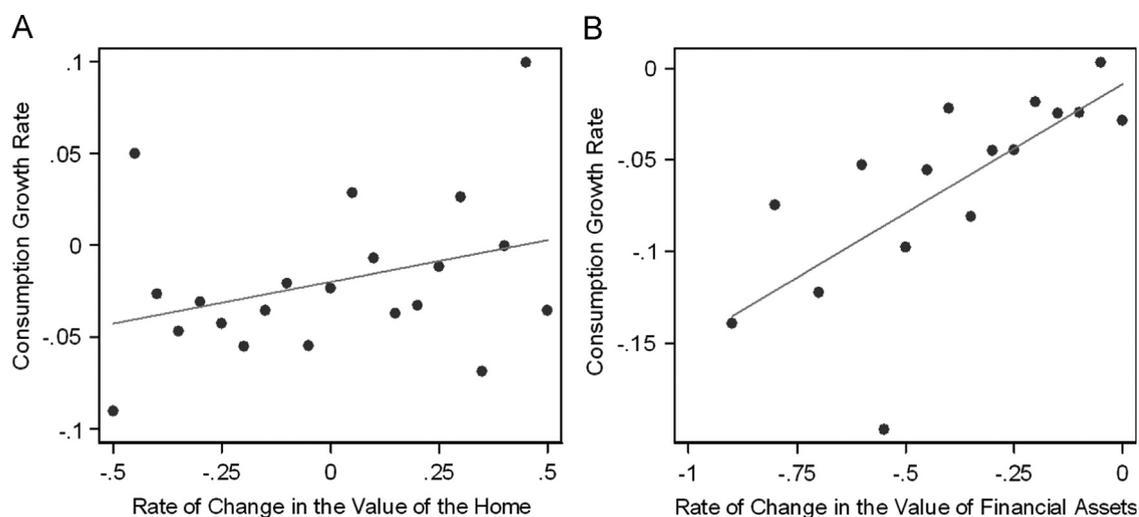
<sup>10</sup> In the variables denoting percentage changes, negative values will denote capital losses; in other words, these variables will effectively denote capital gains.

**Table 3**

Demographic and economic characteristics in the sample.  
Source: 2009 HRS Internet Survey, 2008 HRS main survey.

Variable	Statistic
Age	62.60
Household size	2.20
Becomes unemployed between 2008 and 2009	0.05
Becomes retired between 2008 and 2009	0.11
Health deterioration between 2008 and 2009	0.07
Couple	0.75
High school education	0.50
More than high school	0.49
Self-reported health fair or bad	0.25
Numeracy score (max. 5)	4.56
Working	0.61
Retired	0.34
White	0.90
Household net real assets (median)	193,108
Household net financial assets (median)	81,799
Household income (median)	70,034

Notes: Figures reflect average age, household size, numeracy score, and median net real and financial assets and household income. The remaining figures denote prevalence. All figures are calculated using sampling weights from the 2008 HRS main survey (the 2009 Internet Survey does not contain any sampling weights). All magnitudes are measured at the household level as discussed in the text.



**Fig. 2.** Growth rates of consumption and of the value of assets.

Note: The bins are constructed by first dividing the range of values of the capital gains into intervals with a width of 5 percentage points, except for values denoting very heavy stock capital losses (worse than  $-50\%$ ), for which the interval width was 10 percentage points due to the low number of observations exhibiting such values. Subsequently, the mean capital gain and consumption growth are calculated over all observations in each interval.

changes over time in a vector of demographic and economic variables  $X$ . This leads to the following equation:

$$\frac{\Delta C_{it}}{C_{it-1}} = \alpha + \beta \frac{\Delta HW_{it}}{HW_{it-1}} + \gamma \frac{\Delta FW_{it}}{FW_{it-1}} + \delta \Delta U_{it} + \zeta \Delta X_{it} + \varepsilon_{it}, \quad (1)$$

where  $i$  denotes the household and  $\varepsilon_{it}$  an error term. This specification has been often used in the literature in order to capture the effect of various impulses on the growth rate of consumption. As Souleles (1999) notes, Eq. (1) nests the linearized Euler equation of Zeldes (1989) and Lusardi (1996) when  $\beta$  and  $\gamma$  are equal to zero.<sup>11</sup> Due to differencing, estimation is not affected by any household fixed effects that could influence the expenditure in levels (Parker, 1999).

In this framework, the coefficients of the variables denoting percentage changes in the values of the two assets (i.e.,  $\beta$  and  $\gamma$ ) have a straightforward economic interpretation: they represent the elasticity of consumption with respect to those assets. Similarly,  $\delta$  represents the semi-elasticity of consumption to becoming unemployed. As discussed in Section 6 below, one

<sup>11</sup> Other papers that use the same framework include Parker (1999), Johnson et al. (2006), Agarwal et al. (2007), and Disney et al. (2010).

**Table 4**  
Elasticities and marginal propensities to consume.

Variable	Model 1		Model 2		Model 3		Model 4	
	Marg. eff.	Std. error						
<i>Panel A. Regression estimates</i>								
Age/100	0.3515	0.0540***	0.3302	0.0550***	0.3160	0.0569***	0.2416	0.0713***
Household size	0.0084	0.0049*	0.0094	0.0050*	0.0091	0.0050*	0.0065	0.0053
Becomes unemployed			-0.1014	0.0277***	-0.1018	0.0277***	-0.0990	0.0277***
Becomes retired			-0.0267	0.0123**	-0.0278	0.0124**	-0.0241	0.0128*
Health deterioration			-0.0123	0.0174	-0.0113	0.0175	-0.0143	0.0176
Household net worth (IHS)					0.0019	0.0013	0.0020	0.0014
Household income (IHS)					0.0025	0.0048	0.0057	0.0050
Couple							0.0189	0.0137
High school education							-0.0215	0.0443
More than high school							-0.0359	0.0446
Bad health							-0.0008	0.0112
Numeracy score							-0.0105	0.0063*
Working							-0.0077	0.0253
Retired							0.0148	0.0245
White							-0.0127	0.0180
Percentage change in value of the main residence	0.0578	0.0305*	0.0537	0.0307*	0.0572	0.0309*	0.0541	0.0308*
Percentage change in value of financial assets	0.0887	0.0277***	0.0862	0.0279***	0.0997	0.0290***	0.0838	0.0294***
Constant	-0.2564	0.0410***	-0.2363	0.0412***	-0.2761	0.0727***	-0.1939	0.0895**
Number of observations	1915		1883		1883		1881	
<i>Panel B. Marginal propensities to consume</i>								
Implied marginal propensity to consume with respect to the value of the main residence	0.0094	0.0050*	0.0090	0.0051*	0.0094	0.0052*	0.0091	0.0050*
Implied marginal propensity to consume with respect to the value of financial assets	0.0323	0.0102***	0.0319	0.0107***	0.0370	0.0110***	0.0321	0.0112***

Notes: The implied marginal propensity to consume out of the value of the main residence and out of financial assets is computed as the corresponding elasticity (which is equal to the regression coefficient) divided by the ratio of the associated asset to total expenditure. This ratio is computed using information recorded in the main HRS surveys of 2006 and 2008, and in the CAMS surveys of 2007 and 2009. The table reports robust standard errors.

\* Statistical significance at 10%.

\*\* Statistical significance at 5%.

\*\*\* Statistical significance at 1%.

can check the robustness of the results to the assumption of linearity by re-estimating all specifications using the fractional variable framework of Papke and Wooldridge (1996, henceforth PW).

As shown in (1), all empirical specifications used include a constant  $\alpha$  that captures the effects of aggregate shocks to consumption growth. Hence, the estimates of  $\beta$ ,  $\gamma$  and  $\delta$  reflect the response of household consumption to idiosyncratic shocks to their wealth and employment status.

We estimate four different variants of each model that include four different sets of covariates, in addition to those denoting capital gains. The first set includes age and household size, i.e., there is a basic specification as in Zeldes (1989). The second set includes in addition variables that capture changes in the households' circumstances between the main HRS survey of 2008 and the 2009 Internet Survey: whether at least one of the two partners (or the single head) becomes unemployed, retires, or reports a deterioration in their health. The third set controls additionally for economic resources by adding net real and financial assets, as recorded in the main HRS survey in 2008.

Finally, the fourth set adds further controls from the 2008 survey in order to check the sensitivity of results and capture potential heterogeneous consumption responses of different population groups. These controls include: being in a couple, educational attainment, the score in a numeracy test, being in fair or bad health, race, and working status.<sup>12</sup>

#### 4.2. Baseline results

Panel A of Table 4 reports the elasticities derived from associating the percentage change in consumption to the percentage changes in the values of the house and in the weighted percentage change in financial assets. The elasticity of consumption with respect to the value of the house is roughly equal to 0.056 across all four specifications and significant at the 10% level. Gains on financial assets appear to have a strong positive association with the change in consumption, as the estimated elasticity equals 0.089 and is also significant at the 1% level. Obviously, a constant elasticity does not imply that

<sup>12</sup> We use two dummies denoting unemployment in the 2008 h and becoming unemployed between that time and the 2009 Internet Survey interview. If one is already unemployed in 2008, the transition to unemployment dummy is equal to zero. Therefore, using both variables gives more information on the effects of unemployment on spending. Analogous arguments apply for the transitions into bad health and into retirement.

rich and poor households change their expenditure by the same amount in response to a given percentage drop in their wealth. In fact, as rich households generally spend more than poor ones, a constant elasticity implies that they will reduce their consumption by a greater amount.<sup>13</sup> Note, however, that the estimated elasticities of consumption to housing and financial wealth are not strictly comparable, given that the associated capital gains variables reflect asset price changes taking place over different time periods (i.e., since the summer of 2006 for housing and since September 2008 for financial assets); we will return to this issue below.

As regards the remaining variables in the empirical model, the percentage change in consumption is very strongly associated with the transitions into unemployment and into retirement (the semi-elasticities are equal to 0.1 and 0.026, respectively). The strong effect of unemployment suggests that it represents a shock that is at least partly unanticipated and against which the household can only partially insure. The negative association of consumption with retirement points to the lack of perfect consumption smoothing, as well as to the possible existence of consumption items that are complementary to working (Banks et al., 1998).<sup>14</sup>

#### 4.3. From elasticities to MPC

Having thus calculated the elasticity of consumption with respect to the values of the house and of financial assets, one can subsequently calculate the marginal propensity to consume out of those two assets (shown in Table 4, Panel B), which is equal to the elasticity divided by the ratio of the value of the associated asset to consumption expenditure. For housing, one can use the value of the house as recorded in the 2006 h, as the question is about changes in the price of the house since the summer of 2006. For financial assets, one can use the value of risky financial assets as recorded in the 2008 h, as respondents in the Internet Survey are asked about their losses since September 2008. For the associated consumption expenditure, one can use the values of total expenditure recorded in the 2007 and 2009 CAMS surveys, which also partly cover the previous calendar year. As already discussed, however, merging the CAMS surveys with the Internet Survey gives information on total expenditure only for relatively few households (367 for CAMS 2007, and 386 for CAMS 2009). The values of the marginal propensities to consume (shown in Panel B of Table 4) that are obtained by using the asset to consumption ratios recorded for households in the Internet Survey are equal to 0.009 for housing and to 0.033 for financial assets.<sup>15</sup> As is the case for the underlying elasticities, the two MPC estimates are not strictly comparable due to the different time frames in reported gains, yet they both fall within the range of estimates found in previous literature (reviewed in Section 2).

The relatively small magnitude of the estimated MPC out of housing could be due to the fact that not all homeowners may reduce their consumption in response to a house-price decrease. For example, homeowners who expect to remain in their current dwelling for a very long time are hedged against fluctuations in rents and house prices. Furthermore, in the absence of any substitution effects or credit constraints, a change in house prices is less likely to affect their consumption. On the other hand, a decline in house prices might induce a decline in consumption for homeowners planning to trade down, or stay in the same home and access their housing wealth through an equity release scheme. For homeowners wishing to trade up in the future, however, the effect is ambiguous, as the value of both their current property and of any future dwelling will have unexpectedly declined. One should also keep in mind the possibility that the long-term effect of housing losses on consumption could be larger than the short-term one (Carroll et al., 2011).

In order to check whether the MPCs are affected by the relatively small number of observations used in their calculation, the estimated elasticities (i.e., the regression coefficients) are applied not only to the households in the Internet Survey that also appear in the main HRS surveys in 2006 and 2008, but rather to all households in the 2008 (2006) HRS for which expenditure information exists from the 2009 (2007) CAMS. One can do this because the elasticities are fixed numbers, i.e., they do not depend on any of the independent variables on which information can be found in the Internet Survey but not in the 2006 and 2008 h. The advantage of using these alternative samples is that one ends up with much larger numbers of households on which one can calculate the MPCs (1846 households for the MPC out of housing, and 1294 households for the MPC out of financial assets). The calculated MPC out of housing remains the same at 0.009, while the MPC out of financial assets is slightly lower at 0.03. Therefore, MPC estimates from the Internet Survey are not significantly affected by the relatively small number of observations used for their calculation.

As already discussed, the estimated MPCs out of financial assets and housing are not directly comparable to each other, given that the underlying reported gains used in their calculation refer to time periods that overlap only in part. One way to address this issue is to change the period of reference of housing capital gains so that it starts from September 2008, as is the case with financial asset gains. In order to do this one would need to calculate the part of the total reported housing capital gain (i.e., from the summer of 2006 to the time of the interview) that occurred from September 2008 to the time of the

<sup>13</sup> This is consistent with the evidence presented by Petev et al. (2012), who, using CEX data, find that during the recession the consumption of the rich fell more than that of the poor.

<sup>14</sup> There is also a positive association between the growth rate of consumption and age. One cannot distinguish, however, between age and cohort effects in this framework.

<sup>15</sup> The calculation of the MPC out of financial assets includes bond holdings recorded in the 2008 h because: (i) the single question on them therein also includes bond holdings in mutual funds; (ii) the Internet Survey provides information on the capital losses on mutual funds only for all types of funds combined. Excluding bond holdings, the calculated MPC out of financial assets is only slightly higher at 0.034.

**Table 5**  
Categorical change in consumption.

Variable	Model 1		Model 2		Model 3		Model 4	
	Marg. eff.	Std. error						
<i>Probability that consumption is lower</i>								
Becomes unemployed	–	–	0.2107	0.0531***	0.2128	0.0534***	0.2063	0.0525***
Percentage change in value of the main residence	–0.0153	0.0068**	–0.0149	0.0069**	–0.0151	0.0070*	–0.0146	0.0067*
Percentage change in value of financial assets	–0.0240	0.0063***	–0.0227	0.0064***	–0.0246	0.0066***	–0.0204	0.0066***
<i>Probability that consumption is the same</i>								
Becomes unemployed	–	–	–0.0720	0.0303**	–0.0732	0.0309**	–0.0691	0.0295**
Percentage change in value of the main residence	–0.0006	0.0008	–0.0008	0.0008	–0.0008	0.0009	–0.0008	0.0008
Percentage change in value of financial assets	–0.0015	0.0013	–0.0017	0.0013	–0.0020	0.0014	–0.0014	0.0012
<i>Probability that consumption is higher</i>								
Becomes unemployed	–	–	–0.1387	0.0241***	–0.1396	0.0238***	–0.1373	0.0243***
Percentage change in value of the main residence	0.0159	0.0073**	0.0156	0.0075**	0.0159	0.0075**	0.0153	0.0072**
Percentage change in value of financial assets	0.0255	0.0072***	0.0244	0.0073***	0.0266	0.0075***	0.0218	0.0073***
Number of observations	1940		1907		1907		1905	

Notes: Marginal effects of the percentage changes in the values of the main residence and of financial assets are computed after assuming a change of 15 pp in the two underlying variables. The table reports robust standard errors.

\* Statistical significance at 10%.

\*\* Statistical significance at 5%.

\*\*\* Statistical significance at 1%.

interview. In order to do this apportioning one has to make an assumption about the rate of change in housing prices from the summer 2006 on. It turns out that the different housing price indices give conflicting results for this rate. The Case–Shiller US house price index implies that the drop in housing prices slowed down from September 2008 on compared to the interval between the summer of 2006 and September 2008. On the other hand, the US house price index produced by the Federal Housing Finance Administration (FHFA) leads to the opposite conclusion.<sup>16</sup> Hence, a reasonable solution would be to assume that the rate of change of housing prices was roughly constant from the summer of 2006 to the time of the interview. It is important to note that this apportioned housing capital gain/loss varies across households because the latter are interviewed at different points (chosen randomly) in the first half of 2009.

We use this calendar time-based apportioning scheme both for households reporting housing gains and for those reporting losses. It turns out that the so-apportioned (i.e., since September 2008) housing price change is, on average, about one fourth of the actual reported one, although, as already mentioned, this proportion varies across households. As a result, when this apportioned housing price change is substituted for the actual one, the associated regression coefficient is about four times larger, i.e. the elasticity changes from about 0.055 to about 0.23. This is to be expected, given that the dependent variable and all other regressors retain their original values; hence, dividing one regressor by a factor of four on average results in an inverse adjustment of its estimated impact.

Given that the MPC out of housing is equal to the estimated elasticity multiplied by the ratio of consumption to the housing value, it also becomes roughly four times larger. Hence, it is approximately equal to 0.04, i.e. a bit larger than the MPC out of stock capital gains, but still within the range of estimates usually found in the literature. The same reasoning obviously implies that if the apportioned housing capital loss since September 2008 is smaller on average than one fourth of the actually reported total loss since the summer of 2006, then the upward adjustment of its associated coefficient will be larger. Notably, the estimated elasticity of consumption to stock wealth remained essentially unchanged when the modified measure of housing capital gains was used.

#### 4.4. Alternative specifications

In order to check whether results are sensitive to any outliers in the variable denoting consumption growth, the model is re-estimated using as a dependent variable the categorical change in consumption relative to the previous year instead of the continuous percentage change. As there are three possible values (lower, the same, higher) to this categorical variable, Table 5 reports the marginal effects on the three associated probabilities, derived from an ordered probit (more details about the calculation of marginal effects are given in Appendix B in Supporting information). Note that a capital gain of 15% (the assumed perturbation of the capital gains variables) lowers the probability of reducing consumption by about 1.5 percentage points and 2.2 percentage points in the case of housing and financial assets, respectively. Analogously, this capital gain

<sup>16</sup> The FHFA index declined, on a seasonally adjusted basis, by 9.6% in 9 quarters (i.e., from 221.98 in the second quarter of 2006 to 202.88 in the third quarter of 2008). The same index fell by 4.5% between the third quarter of 2008 and the second quarter of 2009 (= 193.67), which represents an accelerated pace compared to the previous period. On the other hand, the Case–Shiller index for the US declined from 189.93 to 139.41, i.e., by about 27%, during the first period, while it declined by 4.5% in the second period (its value was equal to 133.18 in the second quarter of 2009).

**Table 6**  
Elasticities of consumption obtained using disaggregated financial assets.

Variable	Model 1		Model 2		Model 3		Model 4	
	Marg. eff.	Std. error						
Age/100	0.3255	0.0514***	0.3049	0.0523***	0.2882	0.0535***	0.2378	0.0670***
Household size	0.0065	0.0047	0.0077	0.0048	0.0073	0.0048	0.0051	0.0051
Becomes unemployed			−0.1005	0.0263***	−0.1008	0.0263***	−0.0994	0.0263***
Becomes retired			−0.0161	0.0116	−0.0172	0.0116	−0.0145	0.0121
Health deterioration			−0.0041	0.0170	−0.0028	0.0170	−0.0037	0.0172
Household net worth (IHS)					0.0022	0.0013*	0.0024	0.0013*
Household income (IHS)					0.0028	0.0046	0.0060	0.0049
Couple							0.0142	0.0129
High school education							−0.0177	0.0435
More than high school							−0.0321	0.0439
Bad health							0.0052	0.0103
Numeracy score							−0.0107	0.0058*
Working							−0.0029	0.0242
Retired							0.0127	0.0235
White							−0.0163	0.0167
Percentage change in value of the main residence	0.0704	0.0285**	0.0665	0.0289**	0.0692	0.0290**	0.0668	0.0288**
Percentage change in value of employer-provided pension plans	0.0107	0.0274	0.0126	0.0277	0.0171	0.0282	0.0119	0.0283
Percentage change in value of IRAs	0.0372	0.0277	0.0329	0.0275	0.0417	0.0276	0.0316	0.0274
Percentage change in value of mutual funds	0.0208	0.0288	0.0136	0.0286	0.0218	0.0288	0.0179	0.0289
Percentage change in value of stocks directly held	0.0880	0.0252***	0.0776	0.0251***	0.0830	0.0252***	0.0785	0.0254***
Percentage change in value of trusts	−0.0181	0.0403	−0.0029	0.0413	−0.0008	0.0414	−0.0014	0.0421
Percentage Change in value of other assets invested in stocks	0.0052	0.0345	0.0100	0.0352	0.0103	0.0353	0.0044	0.0349
Constant	−0.2319	0.0387***	−0.2158	0.0391***	−0.2608	0.0680***	−0.1959	0.0837**
Number of observations	2235		2193		2193		2191	

Notes: The table reports robust standard errors.

\* Statistical significance at 10%.

\*\* Statistical significance at 5%.

\*\*\* Statistical significance at 1%.

makes the probability of increased spending higher by 1.6 percentage points and 2.4 percentage points. Importantly, the housing capital gain is statistically significant at the 5% level in most cases, while the  $p$ -value of the financial capital gain is always below 1%. Becoming unemployed has a large negative impact on consumption, as it increases that probability of smaller spending by roughly 21 percentage points, while it decreases the probability of higher spending by roughly 14 percentage points. Therefore, the results obtained by using the continuous consumption growth as the dependent variable are robust to the presence of outliers.

As the HRS Internet Survey contains detailed information on the composition of financial assets, the analysis is repeated using as separate controls the percentage changes in the asset values of the six financial assets found in the Internet Survey (as before, positive values of these six variables denote financial gains). Hence, it is possible to examine to which financial assets in particular one should attribute the strong effect of changes in total financial wealth on consumption displayed in Table 4. The results of this disaggregated analysis are shown in Table 6, and it is clear that the association of financial wealth shocks to consumption is to a large extent due to directly held stocks (the estimated elasticity is 0.088). It is also worth noting that in this specification the estimated elasticity of changes in housing wealth (0.068) is slightly larger than the one estimated from the specification that uses changes in the value of aggregated financial wealth. Importantly, this elasticity is now statistically significant at the 5% level, which indicates that the value of the home quite likely has a considerable effect on consumption expenditure. Losing one's job during the crisis has essentially the same large negative impact as before.

One notable feature of the results shown in Tables 4 and 6 is that the household's net worth as recorded in the main HRS survey in 2008 is not associated with the subsequent change in consumption, after controlling for capital gains. Households' indebtedness could, however, affect the response of consumption to capital losses; a household with large debts might have more difficulties in adjusting consumption smoothly to any changed circumstances due to the financial crisis. Therefore, instead of using total net worth in the third and fourth specifications shown in Tables 4–6 above, one can disaggregate net worth into its three components: gross real assets, gross financial assets, and total debt. The results are shown in Appendix Table A.1 for the specifications corresponding to Table 4 (columns (1)–(4)) and 6 (columns (5)–(8)), and in Table A.2 for the specifications corresponding to Table 5. Larger debts are indeed negatively associated with the change in consumption, with an elasticity of about  $-0.002$  in the specifications shown in Table A.1. In addition, the results in Table A.2 imply that an increase of 10,000 dollars in total debt increases the probability of lower consumption by about 1.1 percentage point. One possible interpretation of this effect is that households with more debt are more affected by tightening credit conditions,

**Table 7**

Elasticity of consumption to wealth, estimated using simulated data from the buffer-stock and permanent income models.

Specification	Capital gains in equity		Weighted average of capital gains in residential real estate and equity	
	Elasticity	Std. error	Elasticity	Std. error
<b>Buffer-stock model</b>				
Without interactions of capital gains with wealth and income	0.0986	0.0085***	0.0838	0.0123***
With interactions of capital gains with wealth and income	0.0963	0.0075***	0.0840	0.0108***
<b>Permanent income model</b>				
Without interactions of capital gains with wealth and income	0.0804	0.0016***	0.0787	0.0020***
With interactions of capital gains with wealth and income	0.0822	0.0009***	0.0786	0.0015***

Note: With no interactions of capital gains with income and wealth, the elasticity is equal to the regression coefficient of the capital gains variable. With interactions, the elasticity is equal to the average marginal effect of the capital gains variable, which is equal to the total derivative of the percentage growth in consumption with respect to capital gains, taking into account all interaction terms and averaging across all sample units.

\*\*\* Statistical significance at 1%.

and therefore cut back on their consumption more strongly (see also, Mian et al. (2013), who estimate a significantly higher MPC out of housing wealth in zip codes with poorer and more levered households). The results for changes in the values of the home and financial assets are affected very little by the disaggregation of net worth into its components.

## 5. Simulation results from two models of intertemporal choice

To gain insights about the potential size of wealth effects on consumption and to motivate the empirical specification, it is useful to simulate the consumption elasticity with respect to a wealth shock in two standard models of intertemporal choice, namely the Permanent Income Hypothesis (PIH) one and the Buffer Stock Model (BSM) one. In both models households maximize the expected value of an intertemporally additive constant relative risk aversion utility function over a finite time horizon. The labor income process is standard, with a permanent and a transitory component that are distributed log normally. The rate of return on wealth is the sum of a deterministic component and a stochastic component, which is meant to capture shocks to wealth. In our context, these shocks represent capital gains/losses. The crucial condition that differentiates the BSM from the PIH is the existence of a non-negativity constraint on wealth, which generates buffer stock saving (Deaton, 1991).

The stochastic process for capital gains is calibrated using data from the US Flow of Funds. All details about the models' specification, calibration and solution methods are reported in Appendix C in Supporting information. The BSM and PIH models are simulated for three periods for approximately 10,000 households, taking as an initial condition for wealth the cross-sectional distribution of wealth of the households in the HRS Internet Survey. The youngest age in the sample at the beginning of the simulation is 50 and the oldest one 90. One can generate in every period the values of consumption, capital gains, wealth and labor income corresponding to each household, and then estimate the same empirical model as in the HRS sample. In particular, one can estimate the following equation:

$$\frac{\Delta C_{it}}{C_{it-1}} = \alpha + \beta l_{it} + \varepsilon_{it}, \quad (2)$$

where  $l_{it}$  denotes capital gains/losses as a percentage of the value of the underlying asset. Hence the coefficient  $\beta$  in Eq. (2) can be interpreted as the elasticity of consumption to wealth.

Given that both the BSM and the PIH models imply a nonlinear relationship between percentage changes in consumption and wealth (or cash-on-hand) one can also estimate a version of Eq. (2) in which the capital gains variable is interacted with wealth and income, while including in the specification those two variables also as independent terms. Both variables are transformed using the inverse hyperbolic sine transformation, given that in levels they are both very skewed.

Given that now capital gains are interacted with income and wealth, one can calculate again the elasticity of consumption to wealth, which is now equal to the total derivative of percentage consumption growth with respect to percentage capital gains, taking into account both the uninteracted and the interacted terms in which these gains appear. This derivative varies across observations, as it now depends on the values of income and wealth; hence, we calculate its average across the sample, i.e., the average marginal effect of capital gains on percentage consumption growth.

The results of the estimation are shown in Table 7, for both the BFS and PIH model, with and without interactions with income and wealth, and for both definitions of the capital gains variable discussed above. When there are no interactions, the elasticity from the BSM is 0.098 when capital gains are calibrated to match data only from equities, and 0.084 when using a weighted average of capital gains on housing and equities. The corresponding magnitudes from the PIH model are 0.080 and 0.079, respectively. In all cases the elasticity is very precisely estimated.

It is possible to experiment also with a version of the PIH model in which both the permanent income shock and the transitory income shock are switched off, and thus labor income evolves deterministically. The resulting elasticity is found to be about 0.077 for both cases of capital gains. Therefore, it seems that the presence of income shocks in the PIH model does not affect the estimated elasticity of consumption to wealth.

When using interactions of capital gains with income and wealth, it turns out that the interaction terms are statistically significant in all cases. As can be seen from Table 7, however, the magnitude of the elasticity remains essentially identical to the one from the uninteracted models. Therefore, interaction terms in both simulated models, while individually statistically significant, do not affect the overall estimated impact of capital gains on consumption growth.

To summarize, the simulations reveal that the implied elasticities are somewhat higher in the BSM than in the PIH model, and that the estimated response of consumption to wealth derived from the data fall in between this range. This suggests that the empirical estimates of the sensitivity of consumption to wealth shocks are broadly consistent with standard intertemporal consumption models.

## 6. Permanent vs. transitory wealth shocks

One of the core predictions of the life-cycle theory of consumption is that, when hit by unexpected wealth or income shocks, households should adjust their consumption much more when they consider the shock to be permanent rather than transitory.<sup>17</sup> In order to determine whether shocks are transitory or permanent, one can estimate the process generating the shocks, or rely on subjective expectations. Contreras and Nichols (2010) follow the first approach. They exploit regional variability in house price dynamics and estimate that the consumption responses to permanent shocks to housing wealth is between 3.5 and 9.2 percentage points, while in the case of responses to transitory shocks the MPC is between 0.5 and 3.7 percentage points. The second strategy, forcefully endorsed by Manski (2004), is to use subjective expectations as recorded in survey data in order to elicit information on the distribution of future shocks.<sup>18</sup> In the case of stock market expectations this is actually the only feasible approach, because stock market prices do not vary among individuals or geographical districts.

This section presents results following the latter approach, and thus examines households' expectations about the course of the stock market in the near future in order to understand whether they consider the financial losses experienced during the crisis as permanent (there is no corresponding question on housing losses). These expectations, even if not fulfilled, can induce substantial consumption adjustments. Financial wealth losses should have stronger effect on consumption for households that perceive the stock market decline to be permanent, compared to those that anticipate stock prices to recover relatively fast.

This heterogeneity in expectation formation among households can be properly studied only by using microsurvey data. To that effect, one can exploit the fact that in both the 2008 main survey and the Internet Survey households are asked to report the probability that blue chips shares (like those in the Dow Jones Industrial Average) will be higher in a year's time. The distribution of answers to this question in the 2008 h is as follows: the first quartile is equal to 30%, the median is 50%, and the third quartile equal 70% (the mean is 49%). The corresponding quartiles computed from the 2009 Internet Survey are 10%, 30%, and 60% (the mean is 37%).

The shift of the distribution to the left suggests that many households became more pessimistic in the second interview about the future course of stock prices. On the other hand, a non-trivial fraction of households in the HRS sample (32%) become more positive about the stock market between the two surveys, in the sense that they reported a larger probability of a rise in the stock market in 2009 than in 2008. This upward revision in the reported probabilities likely indicates that these households consider the decline in stock prices to be temporary. Hence, their spending should be less affected by financial capital losses compared to that of households with a more pessimistic outlook on the stock market (i.e., those that report the same or a smaller probability in 2009 compared to 2008).

To check this intuition, one can re-estimate the baseline model after splitting the sample between these two types of households. The results are shown in Table 8, Panels A.1 and A.2. As expected, households that consider the stock market decline as non-transitory respond quite strongly to financial capital losses. Indeed, the estimated elasticity equals 0.12, substantially higher than the one found in the basic specification for the whole sample (shown in Table 4), which is about 0.09. On the other hand, the consumption adjustment made by households that in 2009 revise their expectations about stock prices upwards compared to 2008 is much weaker and statistically insignificant.

An alternative way to check the effect of permanent and transitory wealth shocks is to split the sample based only on the expectation about higher stock prices reported in the main HRS survey in 2008. Households that reported a probability

<sup>17</sup> Several studies have examined this prediction using aggregate or regional data (Lettau and Ludvigson, 2004; Luengo-Prado and Sorensen, 2008). There are also studies that use survey data in order to examine consumption responses to income shocks, and to distinguish between the effect of permanent and transitory shocks (Blundell et al., 2008). Recently, Campbell and Cocco (2007) have used survey data to investigate the impact of housing wealth fluctuations on consumption, distinguishing between anticipated and unanticipated changes in housing prices.

<sup>18</sup> Other papers that rely on subjective expectations to distinguish between transitory and permanent income shocks include Hayashi (1985), who used a four-quarter panel of Japanese households containing respondents' expectations about expenditure and income in the following quarter, and Pistaferri (2001), who combined income realizations and quantitative subjective income expectations contained in the Italian Survey of Household Income and Wealth (SHIW).

**Table 8**

Consumption and changes in expectations about the stock market between the 2008 and 2009 surveys.

Variable	Model 1		Model 2		Model 3		Model 4	
	Marg. eff.	Std. error						
<b>Panel A1. Negative or zero change in the reported probability of a rise in stock prices</b>								
Percentage change in value of financial assets	0.1192	0.0359***	0.1129	0.0357***	0.1291	0.0363***	0.1214	0.0367***
Number of observations	1015		1001		1001		1000	
<b>Panel A2. Positive change in the reported probability of a rise in stock prices</b>								
Percentage change in value of financial assets	0.0739	0.0537	0.0799	0.0546	0.0643	0.0576	0.0665	0.0555
Number of observations	483		473		473		472	
<b>Panel B1. Reported probability in 2008 of a rise in stock prices equal to 0.5 or lower</b>								
Percentage change in value of financial assets	0.1390	0.0394***	0.1403	0.0394***	0.1369	0.0414***	0.1195	0.0414***
Number of observations	916		904		904		903	
<b>Panel B2. Reported probability in 2008 of a rise in stock prices higher than 0.5</b>								
Percentage change in value of financial assets	0.0378	0.0398	0.0335	0.0399	0.0536	0.0406	0.0496	0.0414
Number of observations	765		748		748		747	

Notes: The table reports robust standard errors.

\*\*\* Statistical significance at 1%.

larger than 50% are considered as likely to believe that the drop in stock prices is temporary, whereas those that reported a probability less or equal to 50% are considered as more likely to think of the drop as a lasting one. Once more, the estimates (shown in Panels B.1 and B.2 of Table 8) strongly suggest that households that view the stock market slump as more likely to persist respond strongly to financial capital losses (the elasticity is equal to 0.134), whereas the response of those that expect a rebound in stock prices is again weak and not significant.

It is well documented (see, e.g., Fischhoff and Bruine de Bruin, 1999) that respondents in household surveys who cannot answer a question about the probability of a future event sometimes give an answer of 50% instead of admitting their inability to answer. In order to check the robustness of the results discussed in this Section to this pattern of answers, all analyses are repeated after excluding all households who gave an answer equal to 50%. None of the results were affected by this exclusion.

## 7. Robustness checks

One can perform various tests in order to check the robustness of the results presented in Section 4. Due to space constraints, only some of the test results discussed in this Section can be displayed. All results are available from the authors upon request.

First, given that the values of the percentage change in consumption lie between minus one and plus one, estimation is repeated using the PW fractional variable model (discussed in further detail in Appendix D in Supporting information), which features a conditional mean that is nonlinear in the regressors. This nonlinearity could be important because the closer this mean gets to the variable bounds, the less it should be influenced by changes in the regressors. In contrast, a linear model produces a constant effect of the regressors across all ranges of the conditional mean, hence potentially leading to an overestimation of the effect for sample units with predicted means close to the bounds. In addition, nothing prevents a linear model from predicting out of range. The results from the PW model, however, prove to be essentially identical both in sign and in magnitude to those obtained from the linear model. Therefore the linearity of the main statistical model is unlikely to lead to any bias in the results.

Second, in order to check the sensitivity of the baseline results to possible outliers one can perform robust regressions using Huber's (1973) M-estimator. The estimated impact of the variables denoting becoming unemployed and stock capital gains remains unchanged, while that of the variable denoting housing capital gains was slightly reduced from about 0.055 to 0.045. This latter effect, however, is much more precisely estimated; its *p*-value was below 0.02 in all specifications.

Third, instead of using as forcing variables the percentage changes in the values of the home and of financial assets, one can use: (i) the quartiles of the capital gains in housing; (ii) the four levels of capital gains in total financial assets, described in Section 3 above. Using a categorical variable is a natural way to check whether estimates are affected by the fact that in the HRS data the financial capital gains variables are censored at zero. The results reported in Table 9 show that the association of housing capital gains with the percentage change in consumption is strong and statistically significant at the top quartile: households that experience the largest capital gains (or smallest losses) increase their spending by roughly 2.4 percentage points compared to those with the lowest gains (or largest losses). The fact that a statistically significant association is present only for the top quartile of gains is indeed an indication of a non-linearity in the effect of housing capital gains. On the other hand, all levels of financial gains have a positive effect on the change in consumption (e.g., the

**Table 9**  
Changes in consumption using quartiles of changes in asset values.

Variable	Model 1		Model 2		Model 3		Model 4	
	Marg. eff.	Std. error						
Age/100	0.3525	0.0543***	0.3311	0.0554***	0.3136	0.0572***	0.2386	0.0716***
Household size	0.0082	0.0049*	0.0093	0.0050*	0.0089	0.0050	0.0065	0.0053
Becomes unemployed			−0.1008	0.0277***	−0.1017	0.0278***	−0.0982	0.0278***
Becomes retired			−0.0263	0.0124**	−0.0273	0.0124**	−0.0232	0.0129*
Health deterioration			−0.0134	0.0174	−0.0123	0.0174	−0.0151	0.0175
Household net worth (IHS)					0.0020	0.0014	0.0021	0.0014
Household income (IHS)					0.0026	0.0048	0.0058	0.0050
Couple							0.0177	0.0137
High school education							−0.0227	0.0442
More than High school							−0.0388	0.0446
Bad health							0.0011	0.0114
Numeracy score							−0.0105	0.0064
Working							−0.0076	0.0254
Retired							0.0159	0.0245
White							−0.0141	0.0181
2nd quartile of percentage change in value of the main residence	0.0023	0.0154	0.0032	0.0155	0.0023	0.0156	0.0039	0.0155
3rd quartile of percentage change in value of the main residence	0.0216	0.0152	0.0212	0.0155	0.0214	0.0155	0.0234	0.0155
4th quartile of percentage change in value of the main residence	0.0307	0.0138**	0.0305	0.0138**	0.0327	0.0138**	0.0329	0.0137**
2nd level of percentage change in value of financial assets	0.0260	0.0118**	0.0254	0.0118**	0.0247	0.0118**	0.0234	0.0119**
3rd level of percentage change in value of financial assets	0.0378	0.0117***	0.0373	0.0117***	0.0371	0.0117***	0.0358	0.0117***
4th level of percentage change in value of financial assets	0.0346	0.0126***	0.0331	0.0126***	0.0401	0.0134***	0.0305	0.0137**
Constant	−0.3216	0.0422***	−0.3000	0.0427***	−0.3460	0.0753***	−0.2537	0.0921***
Number of observations	1915		1883		1883		1881	

Notes: The table reports robust standard errors.

\* Statistical significance at 10%.

\*\* Statistical significance at 5%.

\*\*\* Statistical significance at 1%.

effect of the highest level of financial gains is roughly equal to 3.4 percentage points across the four specifications). The effects of all remaining variables (including the transition into unemployment) are essentially identical to those shown in Table 4.

In Appendix Table A.3 the analysis is repeated with the categorical change in consumption as the dependent variable, and the results are essentially the same as those shown in Table 5: housing gains again matter at the highest quartile, while financial gains matter at all levels. As a result, expressing the gains variables as categorical variables largely confirms the findings up to now; in particular, the censoring of the financial gains variable at zero has no apparent effect on the estimates.

To investigate further the relationship between consumption and wealth, one can estimate a specification with the categorical change in consumption as the dependent variable that conditions on disaggregated financial assets. The results (shown in Appendix Table A.4) confirm those shown in Table 6 for the continuous variable denoting change in consumption, i.e., gains on both housing and direct stocks are associated with increases in consumption, while the opposite is true for becoming unemployed. Importantly, in three out of four specifications there is an additional positive and economically significant association of changes in consumption with capital gains in IRAs: a 15% increase in the latter raises by more than 1.5 percentage points the probability that households spend more. Given that the prevalence of IRA ownership is larger than that of stocks, capital losses in IRAs are likely to be an important transmission channel of the effect of the financial crisis on household spending.

The 2009 Internet Survey does not collect information on income. This is the reason why variables denoting income from the 2008 and changes in employment status since 2008 are included in the baseline specifications, instead of the change in income between the 2009 Survey and the 2008 wave. The only other measure of income that is available is the income reported in the 2010 main wave, which refers to calendar year 2009 (this applies to almost 74% of households in the 2010 that were interviewed in 2010 and not in early 2011). One can find out, however, which households in the 2010 h that report their incomes from 2009 appear also in the Internet Survey. For these households, one can compute the percentage change in income between the 2009 and 2008 waves, and add it as a regressor to the baseline specifications. This measure of income change is not ideal, given that it covers the whole calendar year 2009, while the interviews in the Internet Survey take place in the first half of that year. It also represents a change over two years, i.e., from 2007 to 2009. In any case, when this variable is included in the baseline specifications, its coefficient is statistically significant and the associated elasticity is about 0.028. Importantly, the estimated elasticities with respect to both housing and stock wealth remain unaffected by the inclusion of the percentage change in income.

**Table 10**  
Elasticities and marginal propensities to consume, PSID data.

Variable	Model 1		Model 2		Model 3		Model 4	
	Marg. eff.	Std. error						
<b>Panel A. Regression estimates</b>								
Age/100	-0.0414	0.0225*	-0.0673	0.0237***	-0.1001	0.0247***	-0.1268	0.0294***
Household size	0.0194	0.0023***	0.0195	0.0023***	0.0159	0.0023***	0.0138	0.0027***
Becomes unemployed			-0.1117	0.0124***	-0.0975	0.0124***	-0.0713	0.0135***
Becomes retired			-0.0168	0.0141	-0.0147	0.0141	-0.0290	0.0150*
Health deterioration			-0.0072	0.0196	0.0031	0.0196	-0.0159	0.0270
Household net worth (IHS)					0.0012	0.0004***	0.0011	0.0004***
Household income (IHS)					0.0165	0.0028***	0.0125	0.0033***
Couple							0.0110	0.0087
High school education							-0.0121	0.0118
More than high school							-0.0137	0.0114
Bad health							0.0250	0.0199
Working							0.0555	0.0126***
Retired							0.0678	0.0163***
White							-0.0084	0.0073
Percentage change in value of the main residence	0.0482	0.0200**	0.0448	0.0199**	0.0554	0.0200***	0.0558	0.0201***
Percentage change in value of financial assets	0.0219	0.0074***	0.0233	0.0074***	0.0257	0.0074***	0.0256	0.0074***
Constant	-0.0680	0.0141***	-0.0452	0.0145***	-0.2163	0.0345***	-0.1922	0.0368***
Number of observations	10,686		10,580		10,580		10,488	
<b>Panel B. Marginal propensities to consume</b>								
Implied marginal propensity to consume with respect to the value of the main residence	0.0083	0.0034**	0.0077	0.0034**	0.0095	0.0034***	0.0095	0.0034***
Implied marginal propensity to consume with respect to the value of financial assets	0.0094	0.0032***	0.0100	0.0032***	0.0110	0.0032***	0.0109	0.0031***

Notes: The implied marginal propensity to consume out of the value of the main residence and out of financial assets is computed as the corresponding elasticity (which is equal to the regression coefficient) divided by the ratio of the associated asset to total expenditure. The table reports robust standard errors.

\* Statistical significance at 10%.

\*\* Statistical significance at 5%.

\*\*\* Statistical significance at 1%.

It would be useful to check whether the associations of capital gains with consumption differ by whether household members were retired or not. As already discussed, while households with members that still work might feel a stronger drop in their permanent income because of the recession, older households have less time to adjust their spending to any negative shocks; therefore, which of the two effects prevails is an empirical issue. When the retirement dummy is interacted with the variables denoting gains, however, the interaction term is insignificant, and the same is true for a dummy denoting that both partners (or the single household head) are less than 65 years old. In all cases, estimates are unaffected by the inclusion of these interacted terms.

One additional factor that could be considered is the perception (especially by the younger households in the sample) that permanent income has taken a negative hit during the Great Recession. This negative development could be reflected at the local level (e.g., due to the closing of a factory), and thus could affect the value of one's home. In order to control for perceived changes in permanent income, one can use a question that asks the persons who work to report the probability that they will become unemployed in the next year.<sup>19</sup> The results remain unaffected by the inclusion of this additional variable, which has a negative sign as expected but is not statistically significant.

The same probability  $p$ , when added in the specification in the form  $p(1-p)$ , could be used as a measure of uncertainty that households face about their future income prospects (Guiso et al., 2002). Such uncertainty has been proposed as one of the reasons for the drop in consumption in the US. The coefficient of the proxy for uncertainty is statistically insignificant and does not change the estimated effect of the financial capital gains on consumption. As for housing capital losses, their effect now becomes insignificant in the baseline specification, but it remains highly significant when expressed in quartiles and also when financial capital losses are disaggregated. This is true when consumption growth is expressed both as a continuous variable and as a categorical one. As a result, the weight of the evidence indicates that housing capital gains have an economically and statistically significant effect on consumption growth.

One can also try to account for negative permanent income developments and increased uncertainty by including information at the regional level. To that effect, one can use the change in the GDP per capita and in the unemployment rate

<sup>19</sup> This probability is assumed to be equal to zero for retirees. For the unemployed one can use two approaches: (i) given that they are asked about the probability that they will find a job next year, one can use one minus this probability; (ii) excluding the unemployed from the sample. In neither case did the results change.

from the 2nd quarter of 2008 to the corresponding quarter in 2009 for each Census Division, which is the most disaggregated regional level for which information is available in the data. The results indicate that a negative change in the regional GDP per capita has a strong negative effect on the growth in household consumption (a 1% decrease in regional GDP per capita implies a 0.4% decrease in consumption), while there is a negative but statistically insignificant effect of an increase in regional unemployment (possibly because unemployment at the household level is already controlled for). In any case, the inclusion of these two regional-level variables leaves the main results unchanged.

The elasticity of consumption with respect to assets may vary with the level of the assets that the household possesses (as already noted, the MPC does so because it is equal to the elasticity multiplied by the consumption to asset ratio). When variables denoting capital gains are interacted with the corresponding assets, however, the resulting interaction terms are not significant. The same is true of the interaction of the gains with the amount of household debt, although, as already mentioned, the coefficient of the uninteracted debt term is negative and statistically significant. The inclusion of these interaction terms does not change the coefficients of the uninteracted capital losses terms.

The results may also be affected by time effects. For example, there were considerable fluctuations in asset prices during the period in which the sampling for the Internet Survey took place (the S&P 500 Index increased by about 22% between March and June 2009). When dummies for the interview month are included, however, the results do not change.

Given that consumption could be affected not only by financial capital gains and losses, but also by any buying or selling of financial assets, one can perform a further robustness check by including in the specification both dummies that denote buying and dummies that denote selling of each of the financial assets recorded in the survey. Once more, the results are not affected by taking into account these financial transactions.

Finally, the results may be affected by the weighting procedure used to calculate the weighted percentage financial gain, as described in Section 3. To that effect, one can compute the unweighted percentage capital gain on financial assets for any given household by taking the simple arithmetic average of the percentage gains in all the financial assets owned by that household. The estimation results obtained from using this unweighted magnitude are essentially identical to those shown in Table 4. Hence, the particular weighting used to derive the overall financial capital gain variable does not affect the results.

## 8. Results from the Panel Study of Income Dynamics

Given that the HRS data include individuals aged 50 and above, it is instructive to compare the findings from this dataset to those from a representative sample of the whole US population. For this purpose one can use the Panel Study of Income Dynamics (hereafter PSID), which is a panel survey that has started in 1968, and since 1997 is conducted every two years. The recent PSID waves contain detailed information on consumption expenditures, as well as on the value of the house and risky financial assets. Consumption is defined as the sum of all expenditures that households report in the 2007–2011 waves, after excluding those expenditures that would not be considered as part of consumption (property taxes paid, and mortgage and car loan repayments). Risky financial assets refer to stocks in publicly held corporations, mutual funds, or investment trusts, and any money in private annuities or IRAs. For a detailed overview of the PSID, see McGonagle et al. (2012).

Unfortunately, the survey provides no information on capital gains or losses on financial assets. Hence, the change in the value of those assets from one wave to the next is the result of both asset price changes and active saving. On the other hand, one can deduce home capital gains or losses by calculating the cross-wave difference in the reported housing value for respondents who do not move between waves. The estimation sample used consists of the 2007, 2009, and 2011 waves in order to cover the period corresponding to the Great Recession. Moreover, only households who either own the home they live in and do not move between waves or households who rent in all waves are included. Hence, the final sample contains about 10,600 households.

We estimate Eq. (1) in the PSID using the same four specifications reported in Table 4 above for the HRS Internet Survey. The regressions of Table 10 indicate that the elasticity of consumption with respect to capital gains on housing wealth is about 0.051, which results in an MPC of about 0.009. Both these estimates are very close to the ones obtained from the HRS Internet Survey and shown in Table 4. The estimated elasticity with respect to risky financial assets is about 0.024, and the resulting MPC about 0.01. Hence, these estimates are smaller than those obtained from the HRS data; as already discussed, however, the variable denoting changes in financial assets is not comparable in the two surveys. Finally, the semi-elasticity of consumption with respect to a transition to unemployment is estimated to be about  $-0.0935$ , which is very close to the results obtained in the HRS.

All in all, the results from the PSID are comparable to those from the HRS for the variables whose definitions can be matched between the two surveys. As a result, it seems that the results obtained for the population aged 50 and above could be applicable to the whole US population.

## 9. Conclusions

This paper examines the effects of the recent crises in the US housing, stock and labor markets on household spending, using recently available HRS data for the population aged fifty and above. The dataset records capital losses, employment transitions, and consumption changes at the household level, as well as stock market expectations between 2008 and 2009. Housing and financial wealth losses have a substantial negative effect on household consumption, and the same is true if

someone in the household loses his/her job. In particular, the estimated elasticities of consumption with respect to housing and financial wealth are equal to about 5.6% and 9%, respectively, while the corresponding marginal propensities to consume are equal to about 1 and 3.3 percentage points, respectively. The effects of financial losses stem primarily from directly held stocks, while there is some evidence that losses on IRAs matter as well. The results are quite robust to numerous variations in specifications, outcome variables, and forcing variables. Importantly, the derived marginal propensities to consume out of both housing and financial assets are economically significant and fall within the range of estimates previously found in the literature on the effects of housing and financial wealth losses on consumption. Moreover, the estimated elasticities are in line with the corresponding elasticities implied by standard intertemporal consumption models. Results from the PSID are broadly comparable to those from the HRS for the variables whose definitions can be matched between the two surveys.

The results imply that higher housing and stock prices and an improved job market are needed for an increase in US household expenditure, especially at a time when households may desire to save more in order to rebuild their asset position. This process is unlikely to be brief because many households lost a large chunk of their wealth during the Great Recession, while still being saddled with considerable debt.

Given the finding that the effect of financial losses on expenditure depends on whether they are perceived as temporary or permanent, a general lesson of the paper is that a key factor for boosting final consumption is the confidence that households have in the economy's prospects in the near future. Optimistic expectations about the stock market are likely to increase spending, thus helping the economy and the stock market, to recover. In turn, this could make households even more optimistic, leading to further increases in spending. All these imply that if policy makers could steer households' expectations about asset prices into a positive direction, then this could generate a virtuous circle that could help the economy get back on track faster.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jmoneco.2015.01.003>.

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