# DECOMPOSING THE WEALTH EFFECT ON CONSUMPTION

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*Abstract*—We decompose the wealth effect on consumption into two components. First, we distinguish between exogenous and endogenous wealth changes. Second, we distinguish between anticipated and unanticipated exogenous changes. We estimate the impact of exogenous components using data from the 2008–2010 panel of the Italian Survey of Household Income and Wealth. The wealth effect is about 3 cents per (unexpected) euro increase in wealth and driven by house price changes. The consumption response to anticipated changes in wealth is of similar magnitude and also driven by housing. We show that these findings are consistent with binding borrowing constraints.

## I. Introduction

WHETHER and how much changes in wealth affect households' consumption are crucial for understanding how asset prices affect the economy and evaluating the role of monetary policy. The basic ideas and key theoretical links between wealth and consumption are typically described using the life cycle permanent income model. According to this model, consumers accumulate and deplete their wealth in order to keep the marginal utility of consumption smoothed over time. In one version of the theory, interest rates are nonstochastic, and income is the only source of uncertainty. It follows that changes in wealth reflect unexpected changes in earnings. In models with stochastic interest rates, however, households may experience an unexpected change in wealth even with constant income, due, for example, to asset price shocks, which will induce revisions in their optimal consumption plan. This is what is typically termed the wealth effect.

There have been several attempts to estimate the wealth effect on consumption, using aggregate data (e.g., Lettau & Ludvigson, 2001, 2004; Sousa, 2008) or household-level data (e.g., Dynan and Maki, 2001; Paiella, 2007; Juster et al., 2006). Cross-country comparative studies include Case, Quigley, and Shiller (2005, 2011), Bertaut (2002), Ludvig & Sløk (2004), and Slacalek (2009). This research has partially been stimulated by the wide variability in asset prices over past decades, in particular the stock market boom of the second half of the 1990s and its subsequent decline, as well as the house price boom and bust that culminated with the Great Recession of 2007–2009.

Despite their explicit reference to the life cyle permanent income model, most studies in the literature do not consider the distinction between anticipated and unanticipated changes in wealth (exceptions include Campbell & Cocco, 2007, and Browning, Gørtz, & Leth-Peterson, 2013). Another issue that is sometimes neglected in the empirical literature is the distinction between exogenous changes in wealth (due to changes in asset prices) and endogenous changes (due to portfolio choice). In this paper, we address both issues. To do so, we combine subjective asset price expectations from the 2008–2010 Italian Survey of Household Income and Wealth (SHIW) with ex post price realizations to identify asset price shocks, which we then merge with data on beginning-of-period wealth to separate unanticipated from anticipated wealth variation. Italy is a particularly useful case to study, as household wealth is quite high by international standards (the average wealth-to-income ratio is 8, compared to 6 in Germany and 5 in the United States), real assets represent about two-thirds of total wealth, and debt (including mortgage debt) is low (about 80% of disposable income).[1]

We argue that the pure wealth effect that is of interest in most of the literature is captured by the response of consumption to wealth changes that are exogenous and unanticipated (i.e., due only to asset price shocks). In contrast, the response to expected wealth changes (absent portfolio reallocation or frictions) should be 0, as rational consumers incorporate news about the evolution of their permanent income (including changes in the value of the assets they own) immediately onto consumption.

We report three main results. First, in our sample, the overall wealth effect is around 1 to 3 cents per (unexpected) euro increase in wealth. This effect is driven primarily by a consumption response to house prices. In contrast, the effect of a variation in stock prices is statistically insignificant. Second, we find that the consumption response to anticipated changes in wealth is also large and significant, of the same magnitude as the response to unanticipated changes, and similarly driven by changes in housing wealth. This result stands in contrast to theoretical predictions and appears to suggest that consumers are excessively sensitive to expected changes in house prices. Third, we provide evidence suggesting that binding borrowing constraints may be behind the excess sensitivity finding, as well as evidence of asymmetric consumption behavior in response to anticipated and unanticipated wealth changes.

Our study is not the first to distinguish between predictable and unpredictable wealth changes. Campbell and Cocco (2007) make the same distinction and also find that

Received for publication June 24, 2014. Revision accepted for publication March 16, 2016. Editor: Mark W. Watson.

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The first draft of this paper was written while L.P. was visiting EIEF, whose hospitality is gratefully acknowledged. Thanks to Tullio Jappelli and three anonymous referees for very useful comments. The usual disclaimers apply.

A supplemental appendix is available online at http://www.mitpressjournals.org/doi/suppl/10.1162/REST_a_00629.

[1] Despite the high wealth-to-income ratio, the response of consumption to a change in wealth is not necessarily higher in Italy than in other countries. In fact, the elasticity of consumption with respect to wealth depends on the product of the wealth-to-consumption ratio (which is higher in Italy) and the marginal propensity to consume (which tends to be smaller in Italy than in the United States). See Paiella (2007) for a comparison of Italy and the United States.

*The Review of Economics and Statistics,* October 2017, 99(4): 710–721

doi:10.1162/REST_a_00629

consumption responds to both.[2] They interpret the positive and significant effect of predictable wealth changes as an indication that house prices affect consumption by relaxing borrowing constraints, along the lines of the literature on the excess sensitivity of consumption to income changes. We reach a similar conclusion, but on the basis of tests of asymmetric behavior of consumption in response to wealth changes of different sign. These tests are, to our knowledge, novel to the wealth effect literature. Other papers that distinguish between expected and unexpected innovations are Browning et al. (2013) and Disney, Gathergood, and Henley (2010), who consider only housing wealth. None of these studies has access to subjective expectations data, and hence they estimate a process for house prices in order to separate expected changes from innovations. A paper also related to ours is Contreras and Nichols (2010), who distinguish between permanent and transitory shocks to housing returns and find that consumption responds to both, although the response to permanent shocks is larger. Finally, a stronger wealth effect for housing than stocks is also found by other studies, including Case et al. (2005, 2011), Bostic, Gabriel, and Painter (2009), Benjamin, Chinloy, and Jud (2004), and Campbell and Cocco (2007).

The rest of the paper is organized as follows. In section II, we derive an estimation framework that allows us to distinguish between responses to anticipated and unanticipated wealth changes. In section III, we describe the data and present our empirical strategy, while section IV reports and discusses the results. Section V concludes.

## II. Decomposing Wealth Effects

Wealth effects on consumption are typically estimated by regressing consumption growth (or changes in consumption) on changes in wealth:

$$\Delta C_{it+1} = \alpha + \beta \Delta W_{it+1} + Z'_{it+1}\gamma + \varepsilon_{it+1}. \tag{1}$$

Differencing takes care of issues arising from omission of unobservable variables such as risk aversion or discount factor, which might vary systematically across the wealth distribution and contaminate estimation of the true relationship between consumption and wealth. Several studies take an equation like equation (1) as a starting point for a wealth effect analysis with microdata, such as Poterba (2000); Juster et al. (2006) Case et al. (2005), and Christelis, Georgarakos, and Jappelli (2011).

[2] Campbell and Cocco (2007) differ from our paper because they do not have access to subjective expectations data on house prices. To estimate the effect of predictable wealth changes on consumption, they regress changes in consumption growth on house price growth and instrument this price growth with lagged values. To estimate the effect of unpredictable changes, they regress consumption growth on the residual of their first-stage IV regression. Correctly separating anticipated from unanticipated wealth changes depends on the (strong) assumption that the econometrician conditions on the same information set as the individual.

Nevertheless, there are a number of problems with this regression. First, it is not clear that a regression of the change in consumption on the change in wealth measures the "wealth effect." In fact, changes in wealth arise from two different types of variation: changes in the price of assets, for given portfolio composition and changes in portfolio composition, for given asset prices. The former are exogenous (outside the agent's control), but the latter are endogenous (e.g., because consumers who expect higher returns in the future change their asset holdings—a pure intertemporal substitution effect).

To see this, note that in the presence of multiple assets, the consumer's budget constraint is defined by

$$W_{it} = \sum_j W_{it}^j = \sum_j p_t^j A_{it}^j,$$
$$\sum_j W_{it+1}^j = \sum_j R_{t+1}^j W_{it}^j + Y_{it+1} - C_{it+1},$$

where $W$ is end-of-period total wealth, $Y$ and $C$ are income and consumption, $A^j$ are end-of-period shares of asset $j$ with price $p^j$ and gross return $R_{t+1}^j = \frac{p_{t+1}^j}{p_t^j}$, and $W^j$ is wealth held in asset $j$. If there is a single asset, of course, we have the usual budget constraint: $W_{it+1} = R_{t+1}W_t + Y_{t+1} - C_{t+1}$.

We can decompose the change in wealth across two time periods as follows:

$$\begin{aligned}\Delta W_{it+1} &= \sum_j W_{it+1}^j - \sum_j W_{it}^j \\ &= \sum_j p_{t+1}^j \left(A_{it+1}^j - A_{it}^j\right) + \sum_j \left(p_{t+1}^j - p_t^j\right) A_{it}^j \\ &= \Delta W_{it+1}^E + \Delta W_{it+1}^X.\end{aligned} \tag{2}$$

The second equality comes from adding and subtracting $\sum_j p_{t+1}^j A_{it}^j$. $\Delta W_{it+1}^E$ is the change in wealth that results from portfolio shifts (and hence it is potentially endogenous), while

$$\begin{aligned}\Delta W_{it+1}^X &= \sum_j \left(p_{t+1}^j - p_t^j\right) A_{it}^j \\ &= \sum_j r_{t+1}^j W_{it}^j\end{aligned}$$

is the change in wealth that results from asset price changes (which is exogenous and not manipulable) and $r = R - 1$ is the net return.

What is commonly known as the wealth effect is the response of consumption to exogenous changes in wealth (i.e., capital gains in housing or stocks). Hence, for the purpose of identifying the wealth effect, the correct equation to consider is not equation (1) (which suffers from endogeneity bias) but[3]

$$\Delta C_{it+1} = \alpha + \beta \Delta W^X_{it+1} + Z'_{it+1}\gamma + \varepsilon_{it+1}$$
$$= \alpha + \beta \sum_j r^j_{t+1} W^j_{it} + Z'_{it+1}\gamma + \varepsilon_{it+1}. \quad (3)$$

The endogeneity bias has been noted by Carroll, Otsuka, and Slacalek (2011) and Dynan and Maki (2001), among others.

Another important distinction is between changes in asset prices that are expected and those that are unpredictable. A wealth effect should emerge only in response to the latter. Decompose the exogenous wealth increase to capture anticipated and unanticipated wealth changes as

$$\Delta W^X_{it+1} = \sum_j \left(p^j_{t+1} - p^j_t\right) A^j_{it}$$
$$= \sum_j \left(E_t p^j_{t+1} - p^j_t\right) A^j_{it} + \sum_j \left(p^j_{t+1} - E_t p^j_{t+1}\right) A^j_{it}$$
$$= \sum_j E_t r^j_{t+1} W^j_{it} + \sum_j \left(r^j_{t+1} - E_t r^j_{t+1}\right) W^j_{it}$$
$$= \Delta W^{XA}_{it+1} + \Delta W^{XU}_{it+1}, \quad (4)$$

where the second equality comes from adding and subtracting $E_t p^j_{t+1}$. Here $\Delta W^{XA}_{it+1}$ and $\Delta W^{XU}_{it+1}$ denote the anticipated and the unanticipated change in wealth, respectively. We can then rewrite equation (3) in more general form as

$$\Delta C_{it+1} = \alpha + \beta_A \Delta W^{XA}_{it+1} + \beta_U \Delta W^{XU}_{it+1} + Z'_{it+1}\gamma + \varepsilon_{it+1}, \quad (5)$$

which allows for potentially different responses to anticipated and unanticipated wealth changes. In this framework, $\beta_U$ captures the "pure" wealth effect on consumption. Regressions (1) and (3) may be unable to recover this parameter.

The typical mechanisms through which unanticipated (housing) wealth effects increase consumption are home equity loans and second mortgages. In Italy, the market for home equity loans (known as *mutui liquidità*) is relatively small due to their high costs, although it is rising in size. Nevertheless, even without these channels, it would still be possible to observe a wealth effect on consumption if households reduce their current saving out of current income or tap onto their existing (more liquid) wealth. For negative shocks to wealth, consumer behavior is independent of liquidity (because consumers want to optimally cut consumption). This asymmetric behavior in response to positive and negative exogenous wealth shocks is what we use to test for binding liquidity constraints.

As for the anticipated component, it should have no impact on consumption changes (e.g., if consumers face no frictions). The reason is that an expected wealth increase represents an increase in permanent income. A rational consumer adjusts her consumption at the time the news arrive; ex post, no change in consumption should be observed. In fact, the same argument is used in the literature to justify a 0 consumption response to expected income changes. In the presence of credit market imperfections or other frictions, however, it is possible that consumers may respond to changes in asset prices that were perfectly predicted—an "excess sensitivity" results. Also in this case, we might expect some asymmetric behavior: liquidity constraints distort behavior only when borrowing is optimal, as when wealth is expected to increase but not when it is expected to decline. This idea forms the basis of our tests for liquidity constraints of section IVE.

Equation (5) depends on the expectation of future returns by asset class $E_t r^j_{t+1}$, as well as the innovation to such returns, $\left(r^j_{t+1} - E_t r^j_{t+1}\right)$. In the next section, we discuss how we can use subjective expectations of future returns, together with observed return realizations, to estimate equation (5).

## III. Data

We use data from the Survey of Household Income and Wealth (SHIW), a representative survey of the Italian population. The SHIW is run biannually, and about a randomly selected half of the households are reinterviewed in the following survey. The survey collects detailed data on household consumption, income, wealth, and portfolio composition, as well as demographic characteristics. We use the 2008 and 2010 surveys, which include subjective expectation data on asset returns. Specifically, the survey collects individual expected returns for three broad asset classes: safe assets, stocks, and housing. The survey technique that is used to obtain these expectations is similar to that discussed in Manski (2004) and consists of eliciting information about two points of the subjective cumulative density function. For example, in the safe asset case, household heads are first asked to report the chances that in a year's time, the interest rate will be higher than today's, or $\Pr\left(r^f_{t+1} > r^f_t | I_{it}\right)$ (where $I_{it}$ is the respondent's information set at time $t$). Next, they are asked to report the chances that the rate will exceed today's rate by more than 1 percentage point—that is, $\Pr\left(r^f_{t+1} > r^f_t + 0.01 | I_{it}\right)$. In the stocks case, the two questions are $\Pr\left(r^s_{t+1} > 0 | I_{it}\right)$ and $\Pr\left(r^s_{t+1} > 0.1 | I_{it}\right)$. In the house price case, the question was asked only in 2010 and formulated slightly differently, as follows: $\Pr\left(r^H_{t+1} < 0 | I_{it}\right)$ and

[3] In some studies, researchers study the wealth effect associated with different types of assets, that is, estimate:

$$\Delta c_{it+1} = \alpha + \sum_j \beta_j r^j_{t+1} W^j_{it} + X'_{it+1}\gamma + \varepsilon_{it+1},$$

where $\beta_j$ measures the wealth effect associated with asset type $j$ (e.g., housing, stocks). Again, this regression may suffer from endogeneity bias.

$\Pr\left(r_{t+1}^{H} < -0.1 | I_{it}\right)$.[4] The answers to these questions allow us to characterize the distribution of expectations of future asset returns at the individual level.

The subjective expectations questions were asked of the entire sample in 2008 and a randomly selected subsample (about half of the overall sample) in 2010. On average, around 45% of household heads answer the first of the two questions. The rest reported a "do not know" answer. While the nonresponse rate is high, it is comparable to the response rate obtained in other parts of the survey when asking questions involving a subjective judgment (such as lottery questions designed to measure risk aversion or intertemporal discounting). The high rate of nonresponse may be due to the complexity of the question. Nonresponses may also reflect the fact that the subjective expectation questions were asked without preparing the respondents with a set of warm-up questions. Finally, nonresponse may also reflect extreme uncertainty. We present two sets of results: we (a) exclude the subsample answering "do not know" and (b) impute expected returns using a model of expectation formation (as described in section IIIA).

Table 1 reports the distributions of subjective expectations of asset returns, excluding cases where individuals responses imply a declining CDF, that is, individuals who report $\Pr\left(r_{t+1}^{f} > r_{t}^{f} + 0.01 | I_{it}\right) > \Pr\left(r_{t+1}^{f} > r_{t}^{f} | I_{it}\right)$ (15% of respondents). For stocks and housing, we drop 6% and 10% of the sample, respectively. In table 1A, we report the distribution of $\Pr\left(r_{t+1}^{f} > r_{t}^{f} | I_{it}\right)$ (first column) and $\Pr\left(r_{t+1}^{f} > r_{t}^{f} + 0.01 | I_{it}\right)$ (second column). Note that in the first column, we report the unconditional distribution, while in the second column, we report the conditional distribution, as the follow-up question was asked only of those who answered the first question and did not report $\Pr\left(r_{t+1}^{f} > r_{t}^{f} | I_{it}\right) = 0$. When asked about the chances of an increase in interest rates, 25% of households assigned a positive chance. Of these, 12% gave a 0 chance to the event of an interest rate increase of 1 percentage point or more. Panels B and C repeat the same analysis for stock market returns and house prices. When asked about a stock market gain, 28% of households assigned a positive chance to that event. When asked about housing, 31% of households expected a drop in prices.

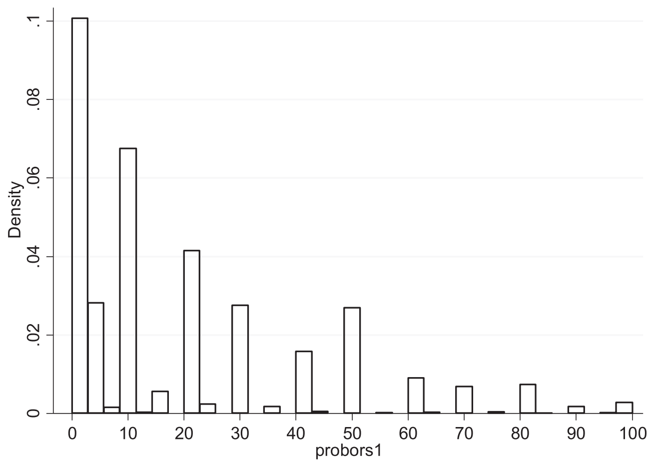
Studies of probabilistic expectations have pointed out that responses to such questions exhibit rounding to focal values, such as 5%, 10%, and 25%. In addition, there is commonly heaping in responses at values of 0%, 50%, and 100%. We observe a similar phenomenon in our data (see figure 1, where we plot the response distribution to the question on a positive stock market return), even though it seems less severe than in other surveys.[5]

TABLE 1.—SUBJECTIVE EXPECTATION RESPONSES: DESCRIPTIVE STATISTICS

| Response Interval | $r_{t+1} > r_t$ $N$ | $r_{t+1} > r_t$ Sample Proportion | $r_{t+1} > r_t + 0.01$ $N$ | $r_{t+1} > r_t + 0.01$ Sample Proportion |
|---|---|---|---|---|
| *A. Interest Rate on Safe Assets(2008 SHIW)* | | | | |
| 0% | 633 | 9% | 199 | 12% |
| 1–25% | 751 | 11% | 711 | 42% |
| 25–50% | 549 | 8% | 253 | 15% |
| 50–75% | 184 | 3% | 50 | 3% |
| 75–100% | 200 | 3% | 12 | 1% |
| Do not know | 4,480 | 66% | 459 | 27% |
| All | 6,797 | 100% | 1,684 | 100% |
| *B. Stock Prices (2008 SHIW)* | | | | |
| 0% | 797 | 11% | 587 | 29% |
| 1–25% | 1,237 | 17% | 977 | 48% |
| 25–50% | 571 | 8% | 143 | 7% |
| 50–75% | 138 | 2% | 22 | 1% |
| 75–100% | 81 | 1% | 5 | 0% |
| Do not know | 4,642 | 62% | 293 | 14% |
| All | 7,466 | 100% | 2,027 | 100% |
| *C. House Prices (2010 SHIW)* | | | | |
| 0% | 847 | 23% | 345 | 31% |
| 1–25% | 674 | 18% | 510 | 44% |
| 25–50% | 324 | 9% | 97 | 8% |
| 50–75% | 91 | 2% | 12 | 1% |
| 75–100% | 71 | 2% | 7 | 1% |
| Do not know | 1,653 | 45% | 189 | 16% |
| All | 3,660 | 100% | 1,160 | 100% |

From the initial sample we drop those observations where individual responses imply a declining CDF. In the 2010 SHIW, subjective expectations questions are asked only to a randomly selected half of the sample.

FIGURE 1.—DISTRIBUTION OF RESPONSES TO THE SURVEY QUESTION ELICITING THE PROBABILITY OF A STOCK PRICE INCREASE (2008 SHIW)




We drop observations where individual responses imply a declining CDF.

[4] The exact wording of the three questions is in the appendix. Note that it is only in the safe asset case that people are asked to report expectations about future interest rates. In the two other cases, people are asked to report expectations about prices (of stocks and housing, respectively). We convert expectations about prices into expectations about returns using $R_{t+1}^{j} = \frac{p_{t+1}^{j}}{p_{t}^{j}}$.

[5] Response distributions for the other two asset classes look qualitatively similar.

## A. Empirical Strategy

While the survey we use includes subjective expectations of asset returns, which are rarely collected in survey data, the data also have some limitations. First, since we observe only two points of the CDF, we need to impose distributional assumptions in order to recover the expected value of asset returns from the data; second, data are biannual; third, there is a timing discrepancy between the reported value of the stock of assets (which refers to the end of calendar years $t$ and $t+2$) and expected returns (which are collected at the time of the interview, typically in the middle of calendar years $t+1$ and $t+3$); finally, there is nonnegligible nonresponse on the subjective expectation questions.

We now discuss how we tackle these four issues. Whenever possible, we test for our assumptions or conduct robustness checks.

*Distributional assumptions*. The responses to the probabilistic expectations questions can be used to fit individual specific subjective distributions. To compute the first two moments of these distributions, we need to make assumptions about the underlying density. We assume that household $i$ expectations for the return on asset $j$ are normally distributed with mean $E_t r^j_{t+1}$ and variance $\text{var}_t r^j_{t+1}$ (where $E_t x = E(x|I_{it})$ and $\text{var}_t x = \text{var}(x|I_{it})$). In practice, each household head in the sample is asked to report:

$$\Pr\left(r^j_{t+1} > \alpha^j | I_{it}\right) = \Phi\left(\frac{E_t r^j_{t+1} - \alpha^j}{\sqrt{\text{var}_t r^j_{t+1}}}\right),$$

$$\Pr\left(r^j_{t+1} > \beta^j | I_{it}\right) = \Phi\left(\frac{E_t r^j_{t+1} - \beta^j}{\sqrt{\text{var}_t r^j_{t+1}}}\right),$$

where $r^j$ denotes the return on financial asset $j$ ($j = f, s$), and $\Phi$ (.) denotes the CDF of the standard normal distribution. In the safe asset case, $\alpha^f = r^f_t$ and $\beta^f = r^f_t + 0.01$. In the stocks case, $\alpha^s = 0$ and $\beta^s = 0.1$. In the house price case, people are asked:

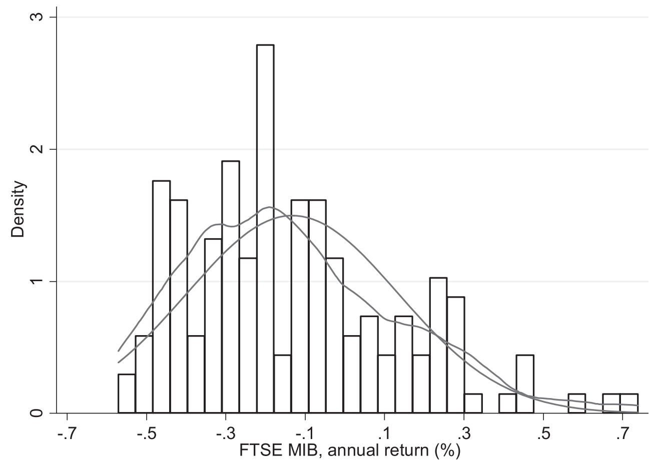
$$\Pr\left(r^H_{t+1} < \alpha^H | I_{it}\right) = 1 - \Phi\left(\frac{\alpha^H - E_t r^H_{t+1}}{\sqrt{\text{var}_t r^H_{t+1}}}\right),$$

$$\Pr\left(r^H_{t+1} < \beta^H | I_{it}\right) = 1 - \Phi\left(\frac{\beta^H - E_t r^H_{t+1}}{\sqrt{\text{var}_t r^H_{t+1}}}\right),$$

and $\alpha^H = 0$ and $\beta^H = -0.1$.

We observe the probabilities on the left-hand side from subjective reports, and $\alpha^j$ and $\beta^j$ are either constant or depend on $r^f_t$, which we set equal to the actual value observed in the year of the interview. This hence becomes a system of two equations in two unknowns that can be solved for $E_t r^j_{t+1}$ and $\text{var}_t r^j_{t+1}$. Note that in order to estimate $(E_t r^j_{t+1}, \text{var}_t r^j_{t+1})$, we can only use respondents who answer both questions on the expected return on asset $j$. If more than two questions were available, one could improve the precision of the estimates or fit more flexible distributions. Moreover, the system would be overidentified. One important question is whether the assumption of normally distributed returns is appropriate. This assumption is clearly strong, but as the actual distribution of the Italian FTSE MIB returns shown in figure 2 suggests, it is not unreasonable.

FIGURE 2.—DISTRIBUTION OF REALIZED ANNUAL RETURNS TO THE ITALIAN STOCK MARKET, 2008–2010 (END-OF-WEEK VALUES)




Weekly returns have been averaged over the previous 52 weeks and then annualized. The mean annual return is −13%, with a standard deviation of 27 percent. The curves represent a fitted normal distribution (with the same mean and standard deviation) and a kernel density estimate of the empirical density.

In the safe asset case, the identification of the reference return $r^f$ is somewhat complex, as the survey question makes reference to no specific safe asset (it just refers generically to the "interest rate"). We assume that the reference return is the one that investors would earn on a basket composed of bank deposits and government bills and bonds, whose returns have moved in parallel until the end of 2010. We use the average before-tax return on deposits at the end of 2008 (1.7%) and the end of 2008 return on a basket of government bonds of different maturity (4.4%). For stocks and housing, no knowledge of returns is required, as households are asked the probability of a gain (a loss for housing), and the probability that the gain (loss) is 10% or more.

*Biannual data*. The regression equation (5) assumes access to annual data. However, the SHIW data are collected every other year (2008 and 2010 in our specific case). Hence, we observe consumption and wealth data for 2008 and 2010 ($C_{i,08}, C_{i,10}, W_{i,08}$, and $W_{i,10}$), and one-year-ahead expected returns $E_{08} r_{09}$. We adapt our estimation framework to the timing of data collection. To see how we get the equivalent of equation (5) in the biannual data case, we start by rewriting equation (3) for a single asset in terms of the frequency of our data (omitting for brevity controls and the superscript $X$ on the change in wealth variable):

$$\Delta C_{i,10} = \alpha + \beta r_{10} W_{i,09} + \varepsilon_{i,10},$$
$$\Delta C_{i,09} = \alpha + \beta r_{09} W_{i,08} + \varepsilon_{i,09}.$$

Summing up the two equations (and assuming that asset holdings in 2009 are approximately equal to those in 2008, as we do not have any information about asset holdings in 2009),[6] we obtain:

$$\begin{aligned} C_{i,10} - C_{i,08} &= \tilde{\alpha} + \beta \left( r_{10} W_{i,09} + r_{09} W_{i,08} \right) + \varepsilon_{i,10} + \varepsilon_{i,09} \\ &= \tilde{\alpha} + \beta \left( p_{10} - p_{08} \right) A_{i,08} + \varepsilon_{i,10} + \varepsilon_{i,09} \\ &= \tilde{\alpha} + \beta \left( (1 + r_{09}) (1 + r_{10}) - 1 \right) W_{i,08} \\ &\quad + \varepsilon_{i,10} + \varepsilon_{i,09}, \end{aligned}$$

which is the biannual equivalent of equation (3).

We next distinguish between anticipated and unanticipated wealth effects and write

$$\begin{aligned} C_{i,10} - C_{i,08} &= \tilde{\alpha} + \beta_U [((1 + r_{09}) (1 + r_{10}) - 1) \\ &\quad - E_{08} ((1 + r_{09}) (1 + r_{10}) - 1)] W_{i,08} \\ &\quad + \beta_A E_{08} ((1 + r_{09}) (1 + r_{10}) - 1) W_{i,08} \\ &\quad + \varepsilon_{i,10} + \varepsilon_{i,09}. \end{aligned}$$

Note that we observe $E_{08} r_{09}$, not $E_{08} r_{10}$ (the two-year-ahead price or return expectation). Assume that individuals know that annual returns follow an AR(1) process:

$$r_t = \rho r_{t-1} + \xi_t.$$

We can estimate $\rho$ from the data and use the law of iterated expectations to write

$$E_{08} r_{10} = \rho E_{08} r_{09}$$

so that

$$E_{08} ((1 + r_{09}) (1 + r_{10}) - 1) \approx (1 + \rho) E_{08} r_{09}, \tag{6}$$

if the term $r_{09} r_{10}$ is negligible. Since $\rho$ is preestimated, we bootstrap the standard errors. Hence our estimating equation becomes

$$\begin{aligned} C_{i,10} - C_{i,08} &= \tilde{\alpha} + \beta_U [(r_{09} + r_{10}) - (1 + \rho) E_{08} r_{09}] W_{i,08} \\ &\quad + \beta_A (1 + \rho) E_{08} r_{09} W_{i,08} + \varepsilon_{i,10} + \varepsilon_{i,09}, \end{aligned} \tag{7}$$

which is the equivalent of equation (5) adapted to the biannual data case.

*Timing discrepancy*. Interviews for the SHIW are typically conducted between January and October, while consumption and wealth refer to the previous calendar year. At the time of the interview, households report their expectations about asset returns over a one-year horizon. This means that while the ideal expectation of the return would be $E_{08:12} r_{09:12}$ (the expected one-year return elicited at the end of 2008), we observe instead $E_{09:m} r_{10:m}$, where $m$ is the month of the interview. Expectations provided in the middle of 2009 may contain new information (e.g., monetary policy intervention) released between the end of the previous calendar year 2008 and the time of the interview. This timing discrepancy may therefore induce a spurious correlation with the error term of equation (7). To address this issue, we model expectation formation (as we illustrate below) and correct for the timing discrepancy. Our expectation formation model also allows us to impute expected returns to those who do not answer the survey questions.

Let $E_{09:m} r_{10:m}$ denote a household's expectation of one-year return $r$, with $m$ denoting the month of the interview. We assume that subjective expectations of returns are a function of a set of demographic controls that are constant or evolve deterministically over time and of past actual returns, as follows:

$$E_{09:m} r_{10:m} = \gamma_0 + \sum_{\tau=1}^{T} \gamma_\tau r_{09:m-\tau} + \gamma_z Z_i + \nu_i. \tag{8}$$

We set $T = 6$. Predicted subjective expectations of annual returns at the end of 2008 are obtained using

$$\widehat{E}_{08:12} r_{09:12} = \widehat{\gamma}_0 + \sum_{\tau=1}^{T} \widehat{\gamma}_\tau r_{08:12-\tau} + \widehat{\gamma}_z Z_i, \tag{9}$$

where $r_{08:12-\tau}$ denotes the return in month 2008:12$-\tau$. Clearly, the richer $Z_i$, the greater the variability of predicted values.

In practice, we estimate the expectation model in equation (8) using subjective expectations of returns on stocks, and subjective expectations of returns on deposits and on bonds, available from the 2008 survey. The survey does not ask expectations of house prices. Hence, we retrieve this information from the 2010 survey to fit the expectation model and then predict expectations as of the end of 2008. We assume that house price expectations depend on past prices in the province where the household lives, which we compute averaging self-reported house values from the SHIW. Predictions based on equation (9) are then used to compute the anticipated change in wealth. The difference between predictions as of the end of 2008 and realizations in 2009 is used to compute the unanticipated change.

[6] This is an assumption that may be acceptable for housing, business wealth, and for other financial assets in the presence of inertia or adjustment costs.

The estimating equation (7) now becomes

$$C_{i,10} - C_{i,08} = \tilde{\alpha} + \sum_j \beta_U^j \left[ \left( r_{09}^j + r_{10}^j \right) - \left(1 + \rho^j\right) \widehat{E}_{08} r_{09}^j \right] W_{i,08}^j + \sum_k \beta_A^j \left(1 + \rho^j\right) \widehat{E}_{08} r_{09}^j W_{i,08}^j + \varepsilon_{i,10} + \varepsilon_{i,09}, \quad (10)$$

where we have also allowed for the fact that we estimate the wealth effect for $j$ different asset, where $j$ = deposits and bonds, stocks, and real assets.[7]

*Nonresponse*. A non-negligible fraction of our sample does not answer the subjective expectation questions. We approach this problem in two ways. First, we analyze the behavior of a reduced sample of households that does respond to the subjective questions (the "Respondents" sample) and compare estimates obtained assuming missing-at-random data and nonrandom nonresponse (which we correct using standard sample selection methods). Second, we impute expected returns to nonrespondents using the estimates of the expectation formation model discussed above (the "Whole Sample"). Since nonresponse is unlikely to be nonrandom, also in this case we correct our estimates for sample selection.[8]

## IV. Empirical Results

### A. *Heterogeneity of Individual Expectations*

Table 2 reports the percentiles of the distributions of the estimated means and standard deviations of one-year-ahead expectations of the returns on bank deposits, government bonds, and stocks, from the 2008 survey, and housing, from the 2010 survey. When examining the findings, it is helpful to have a sense of actual returns in the year preceding and following the elicitation of the expected returns. Hence, in the last two rows of the table, we also report ex post return realizations in 2008 and 2009.

Estimates exhibit a high degree of heterogeneity. For bank deposits, the interquartile range of the expected return is about 200 basis points. Realized returns on deposits were 2.17% in 2008 and 1% in 2009 on average. Since the average expected return is 0.93%, most respondents expected returns to fall relative to 2008. Their forecasts were indeed correct and very close to the actual 1% return. Similar considerations apply to expectations of returns on government bonds. The average expected return was 3.6%, very close to the realized 3.54%. For stocks, the median expected return is −4.86%. In 2008, the Italian stock market experienced a dramatic loss, equal to almost 50% of its value. The decline continued until March 2009. The table suggests that most respondents also expected losses on stocks in the year ahead but expected such losses to be much smaller than those of the previous year. Expectations fell short of realizations. In fact, by the end of 2009, the stock market index was up 16.52% with respect to the beginning of the year. Finally, according to SHIW-based estimates, the average return on housing was 1.6% per year in the 2007–2008 period and 1.03% in the 2009–2010 period. In contrast, the median expected return on housing in 2011 was much higher, at 4.31%.

The comparison between expectations and realizations shows that individual expectations were significantly close to realized returns for assets whose returns were relatively easier to predict, such as deposits or government bonds. For stocks and housing, however, the expectations were not matched by realizations. What matters, of course, is not that people formed perfect expectations when choosing their consumption and portfolio composition, but that they acted on such expectations (however imperfect they were).

### B. *Expectations Model*

Table 3 reports summary statistics of predicted individual expectations based on the estimation of the expectations model in equation (8). Table A2 in the appendix reports two-step estimates of the model, where we correct for any sample selection due to nonrandom nonresponse to the subjective expectation questions. To control for selection, we use three variables based on information provided by the interviewers regarding the general level of understanding of the survey questions, the reliability of the answers on household income, and the general atmosphere in which the interview took place. Besides these three variables, we add a dummy for answering other subjective expectation questions in the survey. These four variables are jointly strongly significant in the probit for the probability of answering the expected returns questions ($p$-value $< 1\%$). The Mills ratio based on this probit regression has a positive and significant coefficient in the expectations model for stocks, bank deposits, and government bonds, which suggests that self-selection is likely to be an issue and lack of control may bias the estimates. Also, the positive coefficient implies that respondents tend to expect higher returns than the average household in the survey does. The Mills ratio is not significant in the regression for housing.[9]

[7] Real assets also include shares of (unlisted) private businesses. We proxy the return on the latter with the return on stocks. In fact, between 1995 and 2010, the return of unlisted firms, based on SHIW data, tracked closely the return on the FTSE MIB (the Italian stock market reference index).

[8] As reported in the online appendix (table A1), respondents differ from nonrespondents on observable characteristics. Respondents are four to five years younger than nonrespondents, are more likely to be in households headed by a male (10 percentage point difference), are more likely to be married (10 percentage point difference), self-employed (13% versus 8%), or public sector employees (13–14% versus 7–8%). They are also wealthier and better educated (almost three more years of schooling). These differences suggest that the willingness to respond is correlated with socioeconomic characteristics. Our sample selection strategy attempts to take this into account.

[9] We have checked the in-sample fit of our expectation formation model by randomly splitting the sample of households with expectations data in half and then using the parameters obtained from estimating the model on half of the sample to predict the expectations of the other half of the sample. We have then computed the differences between individual expectations and

TABLE 2.—SUBJECTIVE EXPECTATIONS OF RETURNS: DESCRIPTIVE STATISTICS

| | *Bank Deposits* | | *Long-Term Bonds* | | *Stocks (FTSE MIB)* | | *Housing* | |
|---|---|---|---|---|---|---|---|---|
| Percentile | Mean (%) | SD (%) | Mean (%) | SD (%) | Mean (%) | SD (%) | Mean (%) | SD (%) |
| 5th | −1.80 | 0.21 | 0.87 | 0.22 | −35.27 | 2.19 | −9.54 | 1.77 |
| 25th | −0.18 | 0.78 | 2.49 | 0.78 | −16.53 | 2.66 | 1.15 | 2.66 |
| Median | 1.30 | 1.70 | 3.97 | 1.70 | −4.86 | 9.73 | 4.31 | 9.73 |
| 75th | 1.73 | 2.75 | 4.40 | 2.75 | −1.82 | 22.73 | 16.60 | 22.73 |
| 95th | 2.78 | 4.08 | 5.40 | 4.08 | 6.16 | 36.68 | 40.23 | 36.89 |
| Mean | 0.93 | | 3.60 | | −9.59 | | 9.59 | |
| | (1.55) | | (1.56) | | (13.46) | | (15.47) | |
| *N* | 1,202 | | 1,204 | | 1,703 | | 965 | |
| Average realized return | | | | | | | | |
| In 2008 | 2.17% | | 4.46% | | −48.84% | | | |
| In 2009 | 1.00% | | 3.54% | | 16.52% | | | |
| In 2007–2008 | | | | | | | 1.59% | |
| In 2009–2010 | | | | | | | 1.03% | |

Realized returns on housing wealth are based on household self-reported house prices taken from the 2006, 2008, and 2010 SHIW surveys. Returns are based on changes in average annual prices by province.

TABLE 3.—EXPECTED AND REALIZED RETURNS ON ASSETS

| | (1) Bank Deposits | (2) Bonds | (3) Stocks | (4) Housing |
|---|---|---|---|---|
| *(A) Average expectations 2008–2009* | | | | |
| Estimation sample | 0.67% | 3.29% | −13.45% | 11.52% |
| | (0.48%) | (0.48%) | (4.87%) | (5.70%) |
| Whole sample | 0.74% | 3.37% | −15.44% | 10.38% |
| | (0.43%) | (0.42%) | (4.55%) | (6.44%) |
| *(B) Ex-post realizations 2008–2009* | 1.00% | 3.54% | 16.52% | 1.03% |
| *(C) Expectation error [(B) – (A)]* | | | | |
| Estimation sample | 0.33% | 0.25% | 29.97% | −10.49% |
| Whole sample | 0.26% | 0.17% | 31.96% | −9.35% |

Table 3A reports predictions for expected returns as of the end of 2008 based on equation (9). Panel B displays the ex post returns realizations for 2009. Finally, panel C reports expectation errors computed as the difference between return realizations in 2009 and predicted expectations for 2009. The error is largest for stocks, around 30 percentage points. It is large also for housing, around 10 percentage points. This confirms the descriptive results presented above.

### C. *Wealth Effect Estimates*

Our wealth effect estimates are based on a sample selected as follows. First, since we need to observe changes in consumption, we restrict the sample to the panel households, about 60% of the 2008 sample. Then we drop households headed by individuals under age 18 or over 80 (7% of the sample). To reduce the influence of outliers, we drop households whose consumption halved or doubled between 2008 and 2010 (1%), those whose annual saving amounted to more than ten times their total wealth (2%), and those with 0 assets (including housing) (2%).[10] Finally, we drop observations with anomalous reports on the subjective expected returns questions (1% of our sample). In our regressions, consumption consists of household expenditures on nondurable goods. Total assets are the sum of financial assets, which include end-of-year holdings of bank deposits, government and corporate bonds and stocks, and real assets, which include end-of-year holdings of real estate (land and buildings) and shares of private businesses.

Table 4 reports the results of the estimation of the wealth effect regression, equation (10), using the approximation in equation (6) for expectations of returns two years ahead. Estimates of the AR(1) process for the annual returns for such approximation are in table A3 of the appendix. The estimated AR(1) coefficient, $\rho$, ranges from 0.46 for stocks to 0.74 and 0.75 for bank deposits and bonds, respectively. For housing, information on past prices is limited, and fitting the AR(1) model is not feasible. Since house prices exhibit a higher degree of persistence, we set $\rho = 1$.[11] All regressions include a set of sociodemographic variables, listed in the note to the table, which allows us to control for differences in factors that may vary across the wealth distribution and contaminate the true relationship between changes in wealth and changes in spending.

Estimates in the first six columns of the table are based on the "Respondent" sample. Estimates in the last two columns are based on a larger sample that includes nonrespondents to the subjective expectations questions ("Whole Sample").

predictions and tested their statistical significance.The null hypothesis that such difference is equal to 0 can never be rejected.

[10] While in principle one would need to correct estimates for the self-selection arising from using only asset holders, in our sample this is unlikely to be an issue as only 2% of households have nonpositive total assets.

[11] We also experiment with lower persistence values ($\rho = 0.8$ and $\rho = 0.5$). The results are unchanged.

TABLE 4.—WEALTH EFFECT REGRESSIONS

| | *Respondents* | | | | | | *Whole Sample* | |
|---|---|---|---|---|---|---|---|---|
| | *Actual* | | | | *Imputed* | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Unexpected gain on:* | | | | | | | | |
| Total assets | 0.031** | | 0.030** | | 0.031** | | 0.012*** | |
| | (0.012) | | (0.016) | | (0.012) | | (0.004) | |
| Financial assets | | −0.065 | | −0.074 | | −0.055 | | 0.093 |
| | | (0.543) | | (0.507) | | (0.601) | | (0.356) |
| Real assets | | 0.030** | | 0.030** | | 0.031** | | 0.013*** |
| | | (0.020) | | (0.022) | | (0.016) | | (0.004) |
| *Expected gain on:* | | | | | | | | |
| Total assets | 0.035*** | | 0.035*** | | 0.034*** | | 0.012** | |
| | (0.006) | | (0.006) | | (0.006) | | (0.014) | |
| Financial assets | | −0.026 | | −0.034 | | 0.003 | | 0.042 |
| | | (0.735) | | (0.701) | | (0.853) | | (0.378) |
| Real assets | | 0.034*** | | 0.034** | | 0.034*** | | 0.011** |
| | | (0.010) | | (0.012) | | (0.010) | | (0.016) |
| Sample selection term | | | 0.823 | 0.998 | | | | |
| | | | (0.796) | (0.755) | | | | |
| Observations | 410 | 410 | 4,217 | 4,217 | 410 | 410 | 3,180 | 3,180 |

In columns 1–6, the sample is restricted to the households that answer the subjective expectations questions in the 2008 SHIW, while in columns 7–9, we use the whole sample. In columns 3 and 4, we control for sample selection in answering the subjective expectations questions (nonrandom nonresponse). The variables included only in the selection equation are a dummy for whether the interviewer's impression is that the respondent has a good understanding of the questions, a dummy for whether the interviewer's impression is that the income information provided by the respondent is truthful, and an index ranging between 1 and 10 reflecting the interviewer's rating of the atmosphere in which the interview was conducted. In columns 5–9, expectations are imputed using a Heckman selection model, which allows for nonrandom nonresponse to the subjective expectations questions. All regressions include the following additional controls: a constant term; age; a second-order polynomial in years of education; dummies for gender, married, in employment, in public employments, and for self-employed; a second-order polynomial in the number of income recipients; a dummy for having some debt; dummies for living in a municipality with 20,000 inhabitants or fewer; and dummies for living in the northwest, center, south, or islands of the country. Bootstrap *p*-values in parentheses. Significant at *10%, **5%, ***1%.

In the first four columns, anticipated and unanticipated gains on financial assets are based on individual expectations computed directly from the answers to the expectations questions (i.e., disregarding any time discrepancy between date of interview and date to which wealth stocks refer to). Gains on housing are always predicted as of the end of 2008 using the expectation model estimated on data from the 2010 survey. We estimate that the overall wealth effect is significant and around 3 cents per unexpected euro increase in total assets. The response of consumption to anticipated changes in wealth is also significant and around 3.5 cents per euro variation. As shown in column 2, both effects are driven by real assets. Consumption does not appear to respond to expected or unexpected gains on stocks even if we restrict the sample to stockholders (regressions available on request).

Our real wealth effect estimate is in line with the findings of Engelhardt (1996) for the United States, regarding consumption response to gains on housing, and the estimates obtained by Disney et al. (2003) for the United Kingdom. However, unlike our framework, both papers look at realized gains without distinguishing between anticipated and unanticipated ones. Furthermore, our finding that consumption responses are smaller, if not negligible, for financial assets than for nonfinancial assets is in line with the evidence from other studies, including Case et al. (2005) and Guiso, Paiella, and Visco (2006). The lack of response to unanticipated changes in stock prices may have different intepretations, ranging from the expectation that the gains or losses can be very temporary or uncertain (as the estimates of the different AR processes suggest), to stock prices fluctuations being less salient than house price fluctuations, to some form of mental accounting that may lead consumers to earmark stock market wealth more for long-term consumption purposes. Unfortunately our data do not allow us to distinguish among these various explanations.

The surprising result, however, is that households appear excessively sensitive to expected wealth changes (for which no wealth effect should be present). Moreover, such excess sensitivity is significant only for housing. A similar result is found by Campbell and Cocco (2007). One possible intepretation is that borrowing constraints prevent households from acting on expectations of asset price changes. We examine this possibility below.

In columns 3 and 4, we consider a correction for selectivity induced by the fact that respondents may be systematically different from nonrespondents. We report the result of a simple Heckman selection model using as exclusion restrictions the same variables discussed above (the interviewer's assessment of the general level of understanding of the survey questions, the reliability of the answers on household income, and the general atmosphere in which the interview took place). The results are very similar. While the exclusion restrictions have power (*p*-value below 1%), the correction term is imprecisely measured in the consumption change equation.

In the rest of table 4, anticipated and unanticipated wealth gains are determined using predicted expectations as of the end of 2008 for all assets involved, using the strategy discussed in section IIIA. Estimates on the "Respondents" sample are very similar to those based on actual expectations. Our results are robust to changes in the specification of the expectation model for housing returns intended to increase the degree of heterogeneity in predicted expectations.

TABLE 5.—WEALTH EFFECT REGRESSIONS: TESTING FOR LIQUIDITY CONSTRAINTS

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Unexpected gain on:* | | | | | | |
| Financial assets | −0.063 | −0.119 | | −0.073 | −0.131 | |
| | (0.530) | (0.438) | | (0.443) | (0.389) | |
| Real assets | 0.030** | 0.030** | | 0.030** | 0.030** | |
| | (0.022) | (0.027) | | (0.022) | (0.027) | |
| Financial assets × **1**{Unexp. Gain FA > 0} | | | 0.573 | | | 0.561 |
| | | | (0.270) | | | (0.297) |
| Financial assets × **1**{Unexp. Gain FA ≤ 0} | | | −0.359 | | | −0.365 |
| | | | (0.292) | | | (0.276) |
| Real assets × **1**{Unexp. Gain RA > 0} | | | −0.018 | | | −0.018 |
| | | | (0.492) | | | (0.481) |
| Real assets × **1**{Unexp. Gain RA ≤ 0} | | | 0.040** | | | 0.040** |
| | | | (0.032) | | | (0.032) |
| *Expected gain on:* | | | | | | |
| Financial assets | −0.024 | | | −0.033 | | |
| | (0.724) | | | (0.670) | | |
| Real assets | 0.034** | | | 0.034** | | |
| | (0.016) | | | (0.016) | | |
| Financial assets × LC | 0.668 | | | 0.715 | | |
| | (0.476) | | | (0.416) | | |
| Real assets × LC | 0.006 | | | 0.006 | | |
| | (0.643) | | | (0.670) | | |
| Financial assets × **1**{Exp. Gain FA > 0} | | −0.027 | −0.202 | | −0.036 | −0.206 |
| | | (0.795) | (0.384) | | (0.741) | (0.378) |
| Financial assets × **1**{Exp. Gain FA ≤ 0} | | −0.091 | 0.599 | | −0.101 | 0.588 |
| | | (0.541) | (0.259) | | (0.470) | (0.281) |
| Real assets × **1**{Exp. Gain RA > 0} | | 0.035** | 0.044** | | 0.034** | 0.044** |
| | | (0.016) | (0.016) | | (0.016) | (0.016) |
| Real assets × **1**{Exp. Gain RA ≤ 0} | | 0.021 | −0.028 | | 0.021 | −0.027 |
| | | (0.697) | (0.595) | | (0.714) | (0.616) |
| LC | 0.307 | | | 0.063 | | |
| | (0.811) | | | (0.822) | | |
| Sample selection term | | | | 1.100 | 1.079 | 0.721 |
| | | | | (0.731) | (0.736) | (0.821) |
| Observations | 410 | 410 | 410 | 410 | 410 | 410 |

The sample is restricted to the households that answer the subjective expectations questions in the 2008 SHIW. LC is a dummy that denotes households turned down for a loan or failed to apply for a loan owing to fears that the application would be rejected. **1**{.} is an index function. In columns 4–6, we control for sample selection in answering the subjective expectations questions (nonrandom nonresponse). See note to table 4 for the variables included only in the selection equation and for the additional controls in the regressions. Bootstrap *p*-values in parentheses. Significant at *10%, **5%, ***1%.

When we extend the analysis to the "whole sample," we obtain smaller effects, although the qualitative findings are similar: the consumption response to either anticipated or unanticipated wealth changes is about 1.3 cents per euro, but the effects are still entirely driven by real assets. The smaller response could reflect measurement error in the expectation variables. If respondents and nonrespondents differ in their expectation formation mechanism and our expectation model does not fully capture such heterogeneity, expectations imputed using respondents' data may not be a good description of nonrespondent beliefs, leading to some attenuation bias.

## D. *Robustness*

We have conducted various sensitivity analyses. The online appendix shows that the results are qualitatively unchanged if (a) we use the ECB reference rate or the Euribor rate instead of the average return on a basket of bonds and bills to compute innovations to returns on these two assets, (b) we assume that returns are distributed as logistic instead of normal, (c) we use total instead of nondurable consumption, and (d) we drop households where the head is retired.

## E. *Liquidity Constraints*

In theory, consumption should respond only to unanticipated changes in wealth and be independent of expected changes in wealth. We find the latter prediction to be violated in the data. The presence of binding liquidity constraints may explain this result ("excess sensitivity"). To test this, we follow a direct and an indirect route. The SHIW has a series of questions that try to identify households subject to binding borrowing constraints. In particular, households are asked if they have been turned down for a loan or failed to apply for a loan owing to fears that the application would be rejected. The households that report being constrained are only 5% of the sample. Interacting the anticipated return variables with the liquidity constraint dummy does not generate any significant finding (economically or statistically), as reported in columns 1 and 4 of table 5, perhaps because the question does not pin down constrained households accurately.

A more indirect test for the incidence of liquidity constraints uses the key idea that liquidity constraints induce asymmetric consumption behavior (Altonji & Siow, 1987). If households expect their wealth to go up, they would like to borrow. If they expect it to go down, they would like to save. Hence, excess sensitivity should emerge only in response to expected positive wealth changes. Shea (1995) presents a similar test. However, liquidity constraints can induce asymmetric behavior of consumption also in response to unanticipated wealth changes. In fact, access to credit may be one way in which a positive shock (i.e., an unanticipated change) to wealth may feed into consumption. If the consumer is liquidity constrained, however, his consumption may be unresponsive to an unanticipated positive change in wealth. In contrast, a negative shock to wealth requires cutting consumption, so liquidity constraints will not distort behavior. The regression we run is hence a variant of equation (5):

$$\Delta C_{it+1} = \alpha + \beta_A^+ \Delta W_{it+1}^{XA} \times \mathbf{1}\left\{\Delta W_{it+1}^{XA} \geq 0\right\} + \beta_A^- \Delta W_{it+1}^{XA} \times \mathbf{1}\left\{\Delta W_{it+1}^{XA} < 0\right\} + \beta_U^+ \Delta W_{it+1}^{XU} \times \mathbf{1}\left\{\Delta W_{it+1}^{XU} \geq 0\right\} + \beta_U^- \Delta W_{it+1}^{XU} \times \mathbf{1}\left\{\Delta W_{it+1}^{XU} < 0\right\} + Z_{it+1}'\gamma + \varepsilon_{it+1},$$

where $\mathbf{1}\{.\}$ is an indicator function. Binding liquidity constraints imply $\beta_A^+ > 0, \beta_U^- > 0, \beta_A^- = \beta_U^+ = 0$. Myopic behavior implies $\beta_A^+ = \beta_U^- > 0$. The key advantage of our expectations data is that we can easily construct individual expectations of positive and negative changes in wealth. While tests of asymmetric consumption response to expected changes in resources have appeared in the literature, to our knowledge this is the first test of asymmetric behavior of consumption in response to unanticipated wealth changes.

The results are presented in table 5 for the case where we distinguish between financial assets and real assets (although results are similar if we aggregate all assets). They are consistent with liquidity constraints. As before, changes to financial wealth (anticipated or unanticipated) have no (statistically significant) effect on consumption. And as before, consumption responds mainly to changes in housing wealth. However, while consumption is statistically significantly reduced in response to unexpected housing wealth destruction, it appears independent of positive shocks to housing wealth (at least statistically). Partly, this may depend on the fact that the home equity loan market is still relatively undeveloped in Italy. Expected wealth changes have the opposite effect. When the consumer has no liquidity needs (as when she expects her housing wealth to decline) consumption remains unchanged. In contrast, when the consumer would need to borrow (as when she expects a positive increase in housing wealth), liquidity constraints induce statistically significant excess sensitivity to expected wealth changes. In this respect, a liquidity constraint story appears remarkably consistent with the pattern of results.

## V. Conclusion

In this paper, we decompose the wealth effects on consumption into its various components using subjective expectations data. Individual expectations are important determinants of choice, and most economic models assign a central role to expectations regarding asset prices, future income, and individual mortality. Nevertheless, the collection of expectations data is rare. Given the lack of data, researchers have typically adopted ad hoc assumptions and measured individual expectations using past realizations.

In our work, we combine subjective expectations data of asset returns with ex post return realizations to distinguish between anticipated and unanticipated changes in wealth and investigate the separate consumption response to expected and unexpected changes in asset prices. Moreover, we stress that another important distinction (which is often neglected in the empirical literature on the wealth effect) is that changes in wealth are partly exogenous—that is, related to variations in asset prices—and partly endogenous—that is, related to portfolio shifts.

We find that the consumption response to unexpected exogenous changes in wealth (the "pure" wealth effect) is around 3 cents per euro. Also, consumption responds to expected changes in asset prices, which we argue reflects excess sensitivity. Both effects are driven by a consumption response to changes in house prices.

These results raise two questions. First, why is consumption unaffected by exogenous shocks to stock market returns? A possibility is that the extreme uncertainty surrounding the Italian stock market during our sample period may have induced households to wait and see before monetizing gains (or losses), a form of precautionary behavior response. The housing market was also volatile, but local factors induced much more heterogeneity. Second, why does consumption exhibit excess sensitivity with respect to expected wealth changes? To test if liquidity constraints can explain our findings, we decompose expected and unexpected changes into positive and negative. We find evidence of asymmetric behavior of consumption that is consistent with binding borrowing constraints. In particular, due to such constraints, the wealth effect emerges more convincingly when consumption needs to be cut rather than when positive wealth shocks would suggest raising it.

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## APPENDIX

### The Subjective Expectation Questions

The 2008 and 2010 Italian Surveys of Household Income and Wealth have a section designed to elicit individual expectations of future asset returns. Each participant in the survey is asked a set of probabilistic questions tightly worded along the lines set by Manski in several studies (e.g., Manski, 1990, 2004). Specifically, the 2008 survey includes the following questions:

1. On a scale from 0 to 100, what is the likelihood that in a year's time interest rates will be higher than today?
2. (If you gave a figure for question [1]) What is the likelihood that they will be more than 1 percentage point higher?
3. On a scale from 0 to 100, what is the likelihood that if you invest in the Italian stock market today you will obtain a profit in a year's time?
4. (If you gave a figure for question [3]) What is the likelihood that your investment will earn more than 10%?

Respondents can either give a probability or answer "do not know."

Besides these same questions, the 2010 survey also includes the following questions:

5. On a scale from 0 to 100, what is the likelihood that in a year's time house prices will be lower than today?
6. (If you gave a figure for Question [5]) What is the likelihood that they will fall more than 10%?