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The wealth-consumption channel: evidence from a panel of Spanish households

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Abstract
In this paper, we use a panel of Spanish households spanning the period 2002–2011 to study the marginal propensity to consume (MPC) out of wealth. The wealth effect is identified by exploiting within-household variations in a period of relatively large volatility in asset prices. We estimate a MPC out of total wealth of around 1 cent with changes in housing wealth affecting consumption more than other assets. We also find supporting evidence on the concavity of the consumption function, showing that the MPC decreases with net wealth. Our results uncover the existence of sign and magnitude asymmetries in the MPC. This asymmetric behavior is not present in households with higher income expectations, suggesting that the transmission channel is related to precautionary saving motives.

Keywords Marginal propensity to consume out of wealth · Wealth distribution · Household survey · Panel data · Income expectations

JEL Codes D12 · E21 · G51

1 Introduction

The way changes in wealth affect households' consumption is a relevant topic to understand the transmission of fiscal and monetary policies to consumer behavior. This question has recently regained attention due to the large changes in asset prices during the last business cycle and the use of unconventional monetary policies from Central Banks targeting specific assets.

A growing body of literature (Bover, 2005; Dynan & Maki, 2001, Disney et al., 2010; Paiella, 2007; Paiella & Pistaferri, 2017) estimates the wealth effect out of

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different assets using household-level data.[1] Results vary depending on the sample and the type of asset under analysis. The MPC out of wealth is usually estimated between 1 and 10 cents, but the relevance of different assets (e.g., housing vs. financial) differs by country and period. Recent studies shed more light on the wealth-consumption relationship by studying heterogeneities across the distribution of wealth (Arrondel et al., 2019; Garbinti et al., 2020) and the presence of asymmetric responses depending on the type of shock (Andersen & Leth-Petersen, 2019; Christelis, et al., 2020; Guren et al., 2020, de Roiste et al., 2021). While the former group focuses on the decreasing MPC pattern across the wealth distribution, the latter tries to disentangle the different mechanisms behind the housing wealth effect.[2]

This paper builds on this literature using a panel of Spanish households for the period 2002–2011 to estimate the MPC out of wealth and explore the potential channels at play. For the aim of this paper, Spain represents an ideal case study, as several factors contributed to exacerbate asset price variations during this period: (i) in the early 2000s, a liberalization of the housing market in a context of very low real interest rates pushed the economy towards the construction and real estate sectors causing a housing bubble; (ii) immigration and demographics increased the demand for housing supported by a banking system capable of satisfying the huge increase in credit demand using external funding; (iii) an extraordinary low unemployment rate, boosted by the development of the construction sector, excessively increased growth expectations pushing up the price of other financial assets; and (v) the financial crisis that, together with an abnormally high-leveraged private sector, caused the collapse of asset prices and the economic activity (Jimeno & Santos, 2014).

Figure 1 provides an overview of the variation in asset prices during this period, displaying the evolution of the Spanish reference stock index (IBEX 35, Fig. 1a) and house prices in euros per squared meter (Fig. 1b).[3] Both indicators show parallel trajectories with large jumps during the expansion period and significant drops during the crisis. During the expansion period (2002–2007), the IBEX 35 and house prices grew, respectively, 112% and 85%. After the crisis, stock prices adjusted faster, decreasing 35% from 2007 to 2011 compared to a decrease of only 16% in house prices.[4]

We rely on the Spanish Survey of Households Finances (*Encuesta Financiera de las Familias*, henceforth EFF) to carry out our analysis. This database presents a number of nice features. First of all, the survey presents a panel dimension that allows us to control for time-invariant heterogeneity and follow the same household for a relatively long period of time (2002–2011). Second, the EFF includes not only

[1] Several papers have estimated the MPC out of wealth using aggregate data (Case et al., 2005; Lettau & Ludvigson, 2004; Slacalek, 2009). Although this approach allows us to disentangle short and long-run effects, it prevents us from controlling for heterogeneous effects across households due to wealth inequality or different asset composition.

[2] For a detailed survey of the wealth-consumption literature see Paiella (2009), Cooper and Dynan (2016), and the literature review section in de Roiste et al. (2021).

[3] House prices per squared meter are calculated by Ministerio de Fomento using the appraised value after taking into account the physical and geographical characteristics of the different dwellings.

[4] The IBEX 35 index continued falling until 2012 to start a fast recovery from there on. House prices have continued the adjustment until 2014.

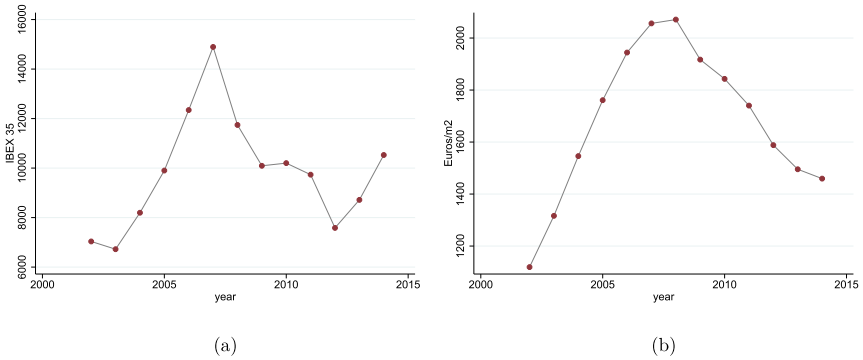

Fig. 1 Stock and house prices during the last business cycle in Spain. **a** IBEX 35. **b** House prices. *Source:* Instituto Nacional de Estadística

detailed questions on households' consumption, income, assets, and liabilities but also provides information on topics such as households' risk profile and income expectations. Finally, the survey covers the years around the 2008 financial crisis, characterized, as we mentioned, by uncommonly high fluctuations in asset prices and, consequently, in families' wealth.

By using this unique dataset, in this paper we: (i) estimate the MPC out of net wealth and its different components; (ii) present evidence on the concavity of the consumption function; (iii) explore the existence of asymmetric responses to passive changes on self-reported housing wealth; and (iv) explicitly study the role played by income expectations on the MPC out of net housing wealth.

Our findings are diverse. First, we observe that out of 1 additional euro of wealth, households increase their consumption by 1 cent, a relatively small response compared to the average findings of previous studies using household-level data. However, results are heterogeneous across assets. Households' consumption mostly responds to changes in the value of the primary residence, with a MPC of 3 cents, while we do not find evidence of any relevant effect of financial or other real assets. These results are very similar to the ones obtained by Bover (2005) using the EFF 2002, where she found a larger consumption reaction to changes in real assets prices (2 cents) than to changes in the value of financial wealth.

Second, we study the specific response to changes in households' wealth across the distribution of wealth. Similar to Arrondel et al. (2019) and Garbinti et al. (2020), we find a decreasing relationship between the MPC out of wealth and the level of net worth. Households in the bottom 20% of the distribution increase their consumption by 5.5 cents out of 1 additional euro of wealth as opposed to only 1.7 cents of the median quintile and 0.6 cents of the richest 20%. Again, these results are mostly driven by consumption responses to changes in the value of the primary residence, though we also find evidence of households in the bottom quintile reacting to changes in the value of financial assets. Unfortunately, for financial and other real assets, we are not able to disentangle exogenous from endogenous changes in value, and their results must be considered a lower bound estimate.

Third, using changes in self-reported housing wealth, we confirm the existence of an asymmetric response by sign and magnitude. More specifically, we find a larger

consumption response to negative than to positive shocks in housing wealth. The larger the negative shock, the larger the decrease in consumption, while the opposite happens with positive shocks. These results are compatible with precautionary savings or a different degree of persistence between positive and negative shocks. We do not find evidence supporting the collateral borrowing channel.

Finally, we use information on income expectations to analyze their role in the wealth-consumption channel. The inclusion of expectations in our analysis does not affect the estimates of the MPC out of wealth. However, allowing the MPC to depend on future income expectations, we find that more optimistic households consume more out of changes in housing wealth. We also observe that future expectations play an important role in the asymmetric response to positive and negative shocks, suggesting that the transmission channel is related to precautionary saving motives. We further show that our results do not depend on the sample, the methodology or the use of sample survey weights in the regression.

The rest of the paper is structured in the following way. Section 2 describes the data and presents some stylized facts. Section 3 describes our empirical strategy, while Section 4 shows the results. Section 5 concludes.

2 Data

2.1 Data source and sample selection

Our analysis relies on the EFF, an official survey conducted by the Bank of Spain every three years since 2002 that provides detailed information on households' financial situation.[5]

The EFF presents some nice features for the purpose of our analysis: (i) it has a panel data component that allows us to follow the same household during consecutive waves; (ii) it over-represents wealthy families to capture better the financial behavior of households at the top of the wealth distribution; (iii) it uses stochastic multiple imputation techniques to decrease the non-response rate; and (iv) it provides detailed information on households non-durable consumption, income, assets, and liabilities, along with socio-economic information regarding every member of the household.[6]

We use the panel component of the dataset to create a balanced panel with households present in each of the four waves from 2002 to 2011. A fifth wave (EFF 2014) was released in 2017; unfortunately, the Bank of Spain decided to limit to four the maximum number of editions of the survey in which a household may participate

[5] The EFF is also part of the Household Finance and Consumption Network (HFCN), an ECB project that coordinates similar surveys across European countries. There have been three survey waves on which the data were released in April 2013, December 2016, and March 2020.

[6] Due to the use of multiple imputation techniques, coefficients and standard errors throughout the paper are adjusted accordingly for a correct interpretation of the results (Rubin et al., 1996). Standard errors are further adjusted using 1000 replicate weights provided by the Bank of Spain to account for the stratification and clustering design of the survey. Results presented in the paper are obtained using Stata's mi command combined with svy.

Table 1 Consumption, income, and wealth distributions: baseline sample

	€2011	% Share				
	Median	Q1	Q2	Q3	Q4	Q5
Net wealth	269,950	2.42	5.49	8.95	16.45	66.69
Net financial wealth	14,018	0.33	1.26	5.97	12.00	80.44
Net housing wealth	169,098	5.51	12.29	16.22	23.54	42.44
Net other wealth	32,406	0.87	1.98	4.60	12.82	79.73
Consumption	15,033	14.60	15.43	18.74	20.56	30.67
Income	38,208	10.81	12.77	17.18	21.26	37.98

Notes: The baseline sample consists of every household present in 4 consecutive waves of the EFF for the period 2002–2011 after using the sample selection criteria explained in Section 2.1 (415 households)

and, as a consequence, the 2014 wave does not include any household taking part in the survey in 2002.[7]

Following Blundell et al. (2008), we restrict our sample to households formed by a stable couple where the reference person is aged between 25 and 65.[8] By stable couples, we mean that the reference person of the household and her partner must be present in every wave of the sample. By doing so, we help to mitigate the concern stemming from changes in the wealth-consumption relationship due to events such as divorce, widowhood, new couple formation, or couple break-ups. By restricting the age range of the reference person, we focus on households engaged in the working life and avoid potential issues related to retirement choices.

We further exclude households displaying negative values of either income or consumption, restricting the final sample to 415 households present in each of the four waves during the period 2002-2011. We are aware that sample selection might affect the interpretation of our results; throughout the paper, we present various robustness exercises to mitigate this concern.

2.2 Stylized facts

In this section, we present the descriptive statistics of our main variables of interest, emphasizing the behavior and composition of households' wealth. The first column of Table 1 shows the median values of household non-durable consumption, non-financial income, and a number of wealth variables.[9] In our sample, the median

[7] Selecting households present in every wave from 2005 to 2014 provides qualitatively similar results, but the size of the final sample decreases by almost 50%.

[8] The reference person is self-reported. If a household alternates the reference person across waves, we take as a benchmark the reference person self-reported in the third wave (EFF 2008). Selecting another year as a benchmark does not significantly alter our sample or results.

[9] Non-durable consumption includes household spending on consumer goods, considering all household expenses such as food, electricity, water, mobile phones, condominium services, leisure, school/university, etc. The survey explicitly asks to exclude spending on durable goods.

household owns a net worth of €269,950, consumes €15,033, and receives a non-financial income of €38,208 per year (in 2011 euros).[10]

The remaining columns in the table display the concentration of wealth, consumption, and income by wealth quintile.[11] In line with previous studies, we observe a larger level of inequality in wealth than in consumption or income.[12] Especially, households in the wealthiest 20% of the distribution own two-thirds of net total wealth in the whole sample, while the next 20% owns 16.45%. Consumption and income are more evenly distributed: households in the top quintile earn 37.98% and consume 30.67% of the total, respectively, 3.5 and 2 times the share of the bottom quintile.

The asymmetries detected in the distribution of wealth could hide significant differences across assets. In a comprehensive study of Spanish wealth inequality and asset composition, Martínez-Toledano (2020) shows that the primary residence is the main form of wealth for households in the middle part of the distribution. However, moving to the top of the distribution, "unincorporated business assets, secondary owner-occupied and tenant-occupied housing gain importance, and financial assets (mainly equities) gradually become the dominant form of wealth" (Martínez-Toledano, 2020, p.15). We examine the presence of these heterogeneities in the sample by dividing the net total wealth into the following three components:[13]

- Net financial wealth, which includes all household financial assets (deposits, shares, fixed-income securities, mutual funds, pension schemes, life insurances...).
- Net housing wealth, which only includes the net value of the primary residence.
- Net other real wealth, including other real estate properties, value of business related to self-employment, jewelry, works of art, and antiques.[14]

The median household owns €14,018 in financial assets, €32,406 in "other real wealth", and most of its wealth comes from the primary residence with a median net value of €169,098.[15] As we expected, housing wealth is more evenly distributed than

[10] The use of the median mitigates issues related to outliers and the asymmetry of the distribution, which would affect the mean. On average, households in our sample own a net worth of €642,845, consume €18,160, and have a gross non-financial income of €51,934 per year.

[11] Households are assigned to the same quintile for the whole period based on their average total net wealth.

[12] See Anghel et al. (2018) for an exhaustive analysis on income, consumption, and wealth inequality in Spain.

[13] Other studies follow a different classification (e.g., real vs. financial wealth; liquid vs. illiquid assets...). Our categorization is not arbitrary but necessary for identification purposes. Below we provide a detailed explanation.

[14] To compute the net value of each type of wealth, we subtract the debt associate with each asset from the gross component. Accordingly, outstanding debts from loans used to purchase the primary residence are deducted from the value of the primary residence. Liabilities associated with other real estate properties or businesses are discounted from other real wealth. Any other debt (secured loans, personal loans, credit card balances...) is subtracted from the gross financial wealth value.

[15] The average values show striking differences. If we look at the mean, "other real wealth" is the most important element in households' portfolios with a value of €300,072. It follows the primary residence, with a net value of €226,972. Finally, the average value of the net financial assets held by households is €115,800.

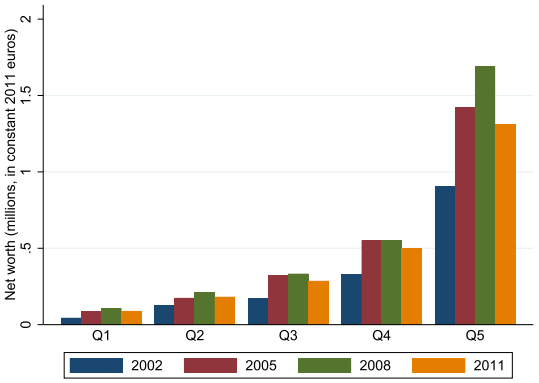

Fig. 2 Net wealth during the Business Cycle. *Notes:* Median net wealth by quintile and year. Millions in constant 2011 euros

the other components. In particular, households in the bottom 40% of the distribution account for 17.8% of the total housing wealth, by 42.44% of the top 20%. On the other hand, the share of financial and other real assets owned by households in the bottom 40% of the distribution is negligible (1.59% and 2.85% of the total, respectively), while the richest 20% households own around 80% of the total.[16]

Figure 2 shows the median net wealth by quintile and year during the period of analysis. In line with the descriptive statistics above, we find significant variation across quintiles. The median net wealth spans from an average value of €82,074 for the bottom quintile to €1,332,230 at the top of the distribution. These heterogeneities are also observable across quintiles at the middle part of the distribution, with the median household in the second quintile owning on average a net wealth of €173,597 over the whole period 2002–2011 and the median household in the second top quintile almost half a million (€482,938). The middle quintile net wealth amounts to €278,632.

On the other hand, all quintiles share a similar trend during the business cycle. Independently of the quintile, the growth rates are negative only in the period 2008–2011, the one that fully accounts for the Great Recession. The largest increase in households' wealth is between 2002 and 2005, where, on average, the growth rate for median households was 69.56%, with the bottom quintile doubling their wealth. Between 2005 and 2008, the growth rate slowed down to 13.05%, probably an early sign of the upcoming crisis. Finally, considering the whole period, there has been a general increase in households' wealth, with an average growth rate for the median household in every quintile of 61.65%. The median household at the bottom quintile experienced the most significant increase, doubling its wealth level between 2002 and 2011.

[16] Table A.1 in Appendix A shows that, if we consider every household that is present in each of the four EFF waves from 2002 to 2011, there are no significant differences in the distributions of our variables of interest. One may notice that the whole sample displays slightly lower median values of "other real wealth" and non-financial income, probably due to the lower presence of people above 65 (discarded in our baseline sample) in the labor market.

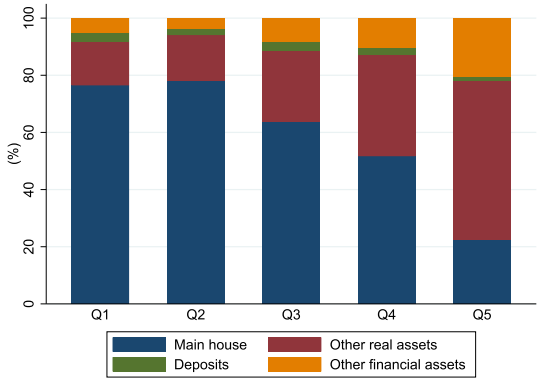

Fig. 3 Wealth composition by quintile. *Notes:* Average gross wealth composition by net wealth quintiles

Figure 3 shows the composition of wealth by quintile. To explore potential heterogeneities in household assets, we further divide financial wealth into deposits and other financial wealth. Not surprisingly, the primary residence is the principal source of wealth for most of the distribution, and its relevance decreases with the level of wealth. Around 80% of the total wealth for the bottom 40% comes from this asset, but it is still the most relevant asset for the third and fourth quintile with shares of 60% and 50%, respectively, of the total wealth. In contrast, it only accounts for 20% of the wealth for households in the top quintile.

Interestingly, financial assets (excluding deposits) are not highly relevant at any point of the distribution. The share increases across the wealth distribution, but it rises from 5% in the bottom quintile to only 20% for households in the top 20%. The main component of wealth at the top of the distribution is "other real wealth", such as other real estate properties and businesses. This is also the second most important component for the rest of the distribution.

3 Empirical strategy

3.1 Baseline estimates

Following Paiella (2007), Arrondel et al. (2019), and Garbinti et al. (2020), we estimate a consumption function based on the life cycle model where households use wealth accumulation to smooth consumption over their life cycle. In addition, their current consumption is proportional to their total wealth (see Deaton, 1992).

Empirically, we have:

$$\frac{C_{h,t}}{Y_{h,t}} = \beta_0 + \beta_1 \frac{W_{h,t}}{Y_{h,t}} + \beta_2 \boldsymbol{X_{h,t}} + Q^j * \phi_t + \mu_h + \epsilon_{h,t}, \tag{1}$$

where $C_{h,t}$, $W_{h,t}$ and $Y_{h,t}$ represent, respectively, household h's non-durable consumption, wealth, and non-financial income in period t. $\boldsymbol{X_{h,t}}$ is a row vector of control variables, μ_h are household fixed effects, $Q^j * \phi_t$ are quintile-specific time dummies

controlling for common shocks across households within the same quintile j and wave, and $\epsilon_{h,t}$ is a zero mean white-noise residual. β_1 is our parameter of interest and can be interpreted as the marginal propensity to consume out of wealth.[17]

The inclusion of household fixed effects alleviates the concerns arising from unobserved heterogeneity common in cross-sectional studies. However, time-varying unobserved heterogeneity might still bias the estimates. To mitigate this concern, we follow the literature and include a large set of variables to account for the life cycle position and changes in the preferences of the household. More specifically, we control for the age of the reference person, the size of the household, the number of employed adults, and the number of kids below 16 or dependent adults under 25. Heterogeneities in the consumption profile are taken into account by including categorical variables on the work status, health condition, education, and job skills for both members of the couple. We also control for whether the household has any outstanding debt, the type of house ownership, and a dummy indicating if households have carried out renovations in the main house the year before the survey takes place.

We further include in the analysis categorical variables that, although recognized as relevant by the literature, are usually not available due to data limitations. In particular, we include proxies of households': (i) preferences towards risk, (ii) credit constraints, (iii) liquidity constraints, (iv) unexpected deviations from the normal value of current income, (v) future uncertainty, and (vi) income expectations.[18]

Following the literature, we decrease the influence of extreme values on our results by controlling for the presence of outliers. An observation is considered an outlier if any of the following conditions hold: (i) the yearly non-financial income is less than €2000, (ii) the consumption to income ratio is larger than 5, (iii) the three years growth rate of consumption is larger than 200%, (iv) the three years growth rate of income is larger than 200%, or (v) the net total wealth three years growth is bigger than 300%. Conditions (i) and (ii) account for extreme values of income and consumption. As our strategy relies on within-household variation, points (iii) to (v) identify outliers using growth rates.[19]

In total, 9.06% of our observations are considered outliers. Dropping households that present at least an outlier observation would imply to lose 36% of our baseline sample (150 households). In order to avoid dropping more observations, our preferred specification includes an interaction term between our variables of interest and a dummy that identifies outliers.

In more technical terms, we estimate:

$$\frac{C_{h,t}}{Y_{h,t}} = \alpha_0 + \alpha_1 \frac{W_{h,t}}{Y_{h,t}} + \alpha_2 \frac{W_{h,t}}{Y_{h,t}} * D_{h,t} + \alpha_3 D_{h,t} + \alpha_4 \boldsymbol{X_{h,t}} + Q^j * \phi_t + \mu_h + \varepsilon_{h,t}, \quad (2)$$

[17] Paiella (2007) and Arrondel et al. (2019) identify β_1 using cross-sectional data. In contrast, Garbinti et al. (2020) estimate a first-differences version of Eq. (1) to control for time-invariant heterogeneity. In our case, having more than two periods, our preferred strategy is to include household fixed effects and estimate Eq. (1) in levels. Nonetheless, a regression in first-differences yields very similar results.

[18] Tables A.2 and A.3 in Appendix A present, respectively, the descriptive statistics of our variables of interest and the definition of some selected variables.

[19] The choice of the cut-points defining an outlier is based on the sample distribution of the variables of interest.

where $D_{h,t}$ represents a dummy variable that takes a value of 1 if household h behaved as an outlier in wave t. α_1 is the parameter of interest and represents the marginal propensity to consume out of wealth, after controlling for the presence of outliers.

3.2 Endogeneity issues

Our empirical strategy relies on the use of within-household variations in wealth to estimate the MPC. Changes in wealth between two periods can be decomposed as follows:

$$\begin{aligned}\Delta W_{h,t+1} &= W_{h,t+1} - W_{h,t} \\ &= \underbrace{p_{t+1}(A_{h,t+1} - A_{h,t})}_{\text{Endogenous}} + \underbrace{(p_{t+1} - p_t)A_{h,t}}_{\text{Exogenous}},\end{aligned} \tag{3}$$

where, for simplicity, A represents a generic asset of price p.

Equation (3) splits wealth variation into two components: the first one, $p_{t+1}(A_{h,t+1} - A_{h,t})$, explains variations in wealth following changes in the composition of households' portfolio, while the second component, $(p_{t+1} - p_t)A_{h,t}$, represents changes in wealth purely due to asset price variations.[20] The first component is clearly endogenous, as it is correlated with households' consumption decisions. More specifically, an increase in wealth due to the purchase of new assets is, by definition, associated with higher household's savings and, hence, lower consumption expenditures. The second component is likely to be exogenous, as long as one assumes that households cannot affect asset prices.

Ideally, we would aim at isolating the second term of the decomposition to rely on an exogenous source of variation in households wealth and rule out endogeneity issues. Unfortunately, for most assets, our dataset does not provide the required level of disaggregation to separate price variations from changes in the composition of the portfolio. More precisely, the EFF includes information on different wealth components (i.e., stocks, bonds, deposits...) but not on the specific underlying assets that comprise them. As a second best, we decided to pay special attention to an asset for which this information is available and still accounts for a fair part of Spanish households' total wealth; that is, households' primary residence. Our strategy to isolate housing price variations consists in restricting the sample to include only households that have been living in the same residence since (at least) 2002, corresponding to the first wave of the survey.[21] Given the negative correlation between the first component of Eq. (3) and consumption, our results for financial and "other real wealth" can be interpreted as a lower bound estimate.

[20] Paiella and Pistaferri (2017) further decompose wealth variation in anticipated and unanticipated changes. Following the literature, a wealth effect would only emerge from unanticipated changes. Unfortunately, we do not have enough information to identify this component.

[21] Note that the value of the primary residence could also change due to works of improvement made during the period under analysis. In order to control for this potential effect, we include a categorical variable accounting for households that have carried out renovations in the primary residence the year before the survey takes place.

It is worth mentioning that, as EFF housing wealth is self-reported, our empirical estimates will capture how households respond to their perceived changes in wealth and not exactly to exogenous changes in housing wealth.[22]

4 Results

4.1 MPC out of wealth

Table 2 shows the results obtained from Eq. (2). The table is divided into two blocks depending on the sample considered: Block A displays the MPC out of wealth from the baseline sample, as defined in Section 2.1, while Block B restricts to households owning the same residence for the whole period under analysis. Although the average ownership rate of the baseline sample is 91% (see Table A.2), by restricting to those who own and did not change their primary residence between 2002 and 2011, the sample decreases to 336 families (henceforth "homeowners sample"), corresponding to roughly 81% of the baseline sample.

The first remarkable result is that, regardless of the sample under study and whether we consider gross or net total wealth (first two columns of each block), we find that 1 additional euro of wealth is associated with 1 cent of additional consumption.[23] These results are in line with previous studies, though in the lower bound. Nonetheless, there might be significant heterogeneities across households depending on asset composition (Case et al., 2005). For instance, asset characteristics such as liquidity, risk, or type of investment could play a role in the way consumption responds to changes in asset values. Economic theory, however, did not reach a consensus on the size and direction of these effects, and the question remains mainly empirical. We try to shed some additional light in columns [3] and [6], where we show the MPC after total net wealth splits into three broad components, as defined in Section 2.2: financial wealth, housing (primary residence), and "other real wealth". Our results are, again, very similar across samples and unveil important heterogeneities across assets. In particular, we do not observe any significant effect on households' consumption arising from changes in the value of financial assets and only a marginal impact (0.3 cents) from changes in "other real wealth" in the case of

[22] The identification of the exogenous component could also be achieved by using instrumental variables. We have explored this option by following Schwandt (2018), where household changes in wealth are instrumented with the weighted average of different asset prices, with the average portfolio composition during the sample period being the weights. We checked different specifications depending on the level of aggregation (aggregate financial assets; stock, bonds, and other financial assets...), but results from the first stage indicated that our instrument was not correlated with changes in wealth. Although unfortunate, the result comes as no surprise for at least two reasons: (i) the composition of households' stock and bond portfolios are likely to be very heterogeneous and not always correlated with standard indexes like IBEX 35, S&P500, or the 10-year Government Bond and (ii) the EFF does not provide households' geographic information and, therefore, we are constrained to use the average housing price index at the national level, ignoring important regional heterogeneities.

[23] Table A.4 in Appendix A shows that our results are not sensitive to the use of a dummy to control for outliers or different outlier definitions.

Table 2 MPC out of wealth: baseline results

	Block A: baseline sample			Block B: homeowners sample		
	[1]	[2]	[3]	[4]	[5]	[6]
Gross wealth/ Income	0.010*** (0.002)			0.010*** (0.002)		
Net wealth/Income		0.009*** (0.002)			0.010*** (0.002)	
Net financial wealth/Income			0.007 (0.006)			0.006 (0.004)
Net housing wealth/ Income			0.032*** (0.004)			0.029*** (0.004)
Net other wealth/ Income			0.003* (0.002)			0.003 (0.002)
Households	415	415	415	336	336	336
Obs	1660	1660	1660	1344	1344	1344
R^2	0.421	0.410	0.615	0.539	0.526	0.721
RMSE	0.338	0.341	0.276	0.302	0.307	0.235
% Outliers	9.06	9.06	9.06	6.76	6.76	6.76
Household FE	✓	✓	✓	✓	✓	✓
Quintile * Wave FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

the baseline sample. On the other hand, the overall wealth effect uncovered in column [2] ([5]) is mostly explained by the response of consumption to changes in the net value of housing wealth.[24] The MPC is equal to 0.032 (0.029) or, in other words, households increase their consumption by 3.2 (2.9) cents out of every extra euro increase in the value of the house.[25]

[24] It is worthwhile to note that an increase in housing prices would have opposite effects depending on whether households own or rent the primary residence. If housing price rises, owners increase their net worth, whereas renters (future owners) see it as a larger future cost (Campbell & Cocco, 2007).

[25] The comparison between blocks A and B supports the robustness of the estimates to changes in the selected sample. Nonetheless, the interpretation of the results is not straightforward, and we have to be careful before claiming that sample selection does not affect our results. Following our previous discussion, we would expect a larger MPC out of housing wealth in Block B for two reasons: (i) the homeowners sample should not be affected by the downward bias stemming from households' saving decisions and (ii) by excluding renters from the analysis we do not consider households who do not benefit from higher housing prices. However, the MPC is even smaller than the one computed in Block A (2.9 vs. 3.2 cents). This outcome could be explained in part through a composition effect: most of the households discarded from the baseline sample (35 out of 79) belonged to the bottom quintile of the distribution, which is usually associated with a larger MPC (the full distribution of the 79 households excluded from the analysis in the homeowners sample is: $Q1 = 35$, $Q2 = 13$, $Q3 = 12$, $Q4 = 8$ and $Q5 = 11$). Table A.5 in Appendix A shows that, if we keep households in the original wealth quintiles, there are no differences in the quintile-specific MPCs regardless of the sample considered (i.e., baseline, excluding non-homeowners in at least one survey wave, and the homeowners sample). This supports the idea that changes in the composition of the sample play, to some extent, a role in our findings.

These estimates are in line with the ones presented by Bover (2005): using a cross-sectional sample of Spanish households in 2002, she estimates a MPC out of housing wealth of 2 cents, but no significant effect emerges concerning the financial wealth-consumption relationship. At first, this result could seem a little counter-intuitive. That is, we might expect more liquid assets (i.e., financial assets) more likely to be associated with changes in consumption as they are more easily translated into cash. Although part of this heterogeneity could be explained by the potential downward bias discussed above, it is worthwhile to note that this mechanism would only be relevant if households had to dis-save in order to increase their consumption. If they are able to decrease their current savings without having to cash assets, there is no reason why financial assets should imply a larger MPC than non-liquid assets. Households' consumption could respond to changes in the value of housing assets for different reasons: (i) higher housing prices could incentivize families to increase their consumption today if they plan to sell their primary residence in the future, or (ii) households could make use of the increased real estate wealth as collateral for borrowing. However, once we look at the data, neither of these channels seem to be very relevant for Spanish households. Interestingly, Skinner (1996) points out that the mere possibility of doing it in the future may be sufficient for homeowners to increase their consumption if the rise of housing prices reduces precautionary saving motives. This could be particularly relevant in the case of Spain, where real estate assets have been traditionally used to channel households' savings. Section 4.2 explores the topic in more detail.

Table A.6 in Appendix A displays the coefficients for the full set of control variables. If we focus on the homeowners sample (column [6]), we observe a significant impact of age on the consumption to income ratio, suggesting an increasing consumption pattern over the life cycle. The recent presence of liquidity constraints is also associated with larger consumption. In contrast, exceptional higher levels of current income, credit constraints, the presence of debt, and good health are negatively correlated with the share of households' income dedicated to finance non-durable consumption. Table A.7 further shows that the inclusion of household fixed effects increases the MPC out of housing wealth and that the results are not altered if we substitute a quintile-specific trend with a more standard common time trend. This suggests that time shocks affected Spanish households in a similar way across the distribution of wealth during the last business cycle.

In Appendix B, we study the presence of heterogeneities across the distribution of wealth. Table B.1 focuses on the homeowners sample and shows a decreasing relationship between the MPC out of wealth and the level of net worth: specifically, households in the bottom 20% of the distribution increase their consumption by 5.5 cents out of 1 additional euro of wealth as opposed to only 1.7 cents of the median quintile and 0.6 cents of the richest 20%. Again, these findings are mostly driven by consumption responses to changes in the value of the primary residence, though we also find evidence of households in the bottom quintile reacting to changes in the value of financial assets. As before, given the endogeneity problem discussed in Section 3.2, financial and "other real assets" coefficients must be interpreted as a lower bound and little can be said about the pattern across the distribution of wealth.

4.2 Asymmetries

So far, we assumed a symmetric response of households' consumption to changes in wealth regardless of whether wealth variations were positive or negative, or the magnitude of the change. However, recent studies (Andersen & Leth-Petersen, 2019; Christelis et al., 2020; Garbinti et al., 2020; de Roiste et al., 2021) find evidence of heterogeneous household reactions depending on the type of shock.

In this section, we empirically study the existence of asymmetric consumption behavior following changes in housing wealth.[26] There are different reasons why a household may react differently to negative or positive shocks. Regarding changes in housing wealth, one of the potential explanations for an asymmetric response is the collateral channel mechanism. According to this theory, increases in home values generate additional collateral which households can borrow against and use to finance spending. As the collateral constraint is only binding at the time of loan origination, this channel does not affect consumption in the case of decreases in home values.[27]

Beyond the collateral channel, other factors, like precautionary saving motives or households perception about the nature of the shock could affect the way families adjust their consumption. For example, in the presence of strong precautionary saving motives, households could adjust their spending more to negative than to positive changes in wealth in order to rebuild their savings as a hedge against future disruptions in income. The nature of the shock also matters. Households' consumption reaction should be larger to shocks considered more permanent. If households perceive positive and negative shocks to have a different degree of persistence, it would justify an asymmetric reaction.[28]

4.2.1 Sign asymmetries

We start by analyzing households' consumption responses to positive and negative changes in housing wealth. Changes in wealth are computed as the difference in the net value of the primary residence between two time periods, and therefore the regression will be run on the waves 2005–2011. We allow heterogeneous consumption response by splitting housing wealth into two components depending on whether the preceding change in wealth is positive or not. Empirically, we estimate an adapted version of Eq. (2) of the form:

$$\frac{C_{h,t}}{Y_{h,t}} = \delta_0 + \delta_1 \frac{Wh_{h,t}}{Y_{h,t}} * \mathbf{1}\{\Delta Wh_{h,t} > 0\} + \delta_2 \frac{Wh_{h,t}}{Y_{h,t}} * \mathbf{1}\{\Delta Wh_{h,t} \leq 0\} + \delta_3 \boldsymbol{X_{h,t}} + Q^j * \phi_t + \mu_h + \varepsilon_{h,t}, \tag{4}$$

[26] It is not clear how the bias from households' savings behavior could affect our estimates. For the sake of caution, in this section, we focus again on housing wealth using the homeowners restricted sample.

[27] Empirical evidence supporting this channel has been found by, among others, Andersen and Leth-Petersen (2019), Aladangady (2017), Acolin (2020), Christelis et al. (2020), Cooper (2013), and Petersen (2010).

[28] Regarding housing wealth, Buiter (2010) further highlights that households could react differently depending on whether the change in value comes from a change in the fundamentals or a housing bubble.

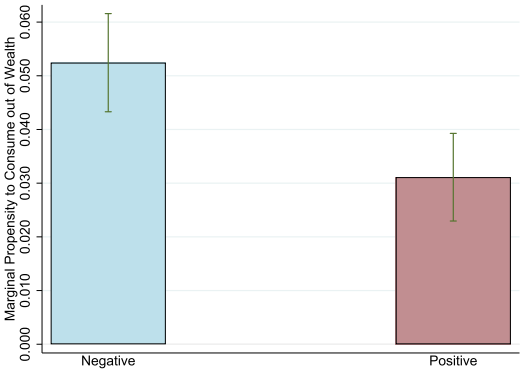

Fig. 4 MPC out of net housing wealth: sign asymmetries. *Notes:* MPC out of positive and negative changes in net housing wealth (along with the 90% confidence intervals). Results are obtained from Eq. (4). Table A.8 (Column [1]) in Appendix A shows more information on the regression. A Wald test rejects the equality of the coefficients with a $p - value = 0.000$

where *Wh* represents net housing wealth, $\mathbf{1}\{.\}$ is an indicator function, and δ_1 and δ_2 are, respectively, the MPC out of positive and negative changes in net housing wealth.[29]

Figure 4 shows the MPC out of negative and positive shocks from housing wealth. We find a larger consumption reaction to negative rather than to positive changes in wealth. More specifically, our results show that households' consumption decreases by 5.2 cents when there is a 1 euro decline in the net value of their house, but it only increases by 3.1 cents when there is a 1 euro increment in that value.

These findings seem to indicate that precautionary saving motives are more relevant than the use of additional wealth as collateral for new debt or that negative shocks are perceived as more permanent than positive ones. Conveniently, the EFF explicitly asks households whether increases in the value of the property were used as collateral for a further loan allowing us to investigate the topic.[30] We define a dummy variable equal to 1 for households that have used increases in the value of the property to take out a further loan and 0 otherwise. When we interact this variable with positive changes in housing wealth, we do not find any significant effect. This result suggests that the collateral channel is not a key driver of households' consumption during the last business cycle in Spain.

Another possible explanation for our results is that negative and positive shocks are not randomly allocated across the wealth distribution. Previously, we have seen that households in the lower part of the distribution are associated with larger MPCs. If negative changes in wealth are mostly concentrated on that part of the distribution, a larger MPC out of negative wealth changes could represent a mere compositional

[29] Financial and "other real wealth" are included as controls in the regression. For the sake of simplicity, we do not explicitly include the dummy interaction term in the specification, but all the wealth variables are multiplied by the dummy.

[30] The exact wording of the EFF question is: "*Has this increase in the value led you to take out a further loan, using the property as collateral or as a guarantee?*"

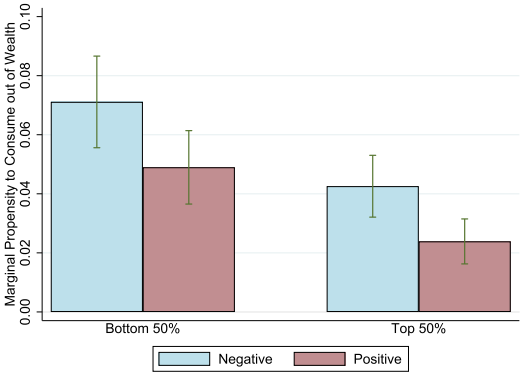

Fig. 5 MPC out of net housing wealth: sign asymmetries across the distribution. *Notes:* MPC out of positive and negative changes in net housing wealth across the distribution of wealth (along with the 90% confidence intervals). Results are obtained from an adapted version of Eq. (4) where positive and negative changes in net housing wealth are allowed to have different impacts across the distribution of wealth (above and below the median). Table A.9 (Column [1]) in the Appendix shows more information on the regression. A Wald test rejects the equality of the coefficients in both the bottom ($p - value = 0.012$) and top parts of the distribution ($p - value = 0.005$)

effect and not an asymmetric household behavior. We investigate to what extent this could affect our results by studying consumption responses across the wealth distribution.[31]

Figure 5 displays the MPC out of negative and positive changes in wealth at different points of the distribution. More specifically, we allow positive and negative changes in housing wealth to have a different impact for households above or below the median total net wealth in our sample. We find that households' consumption responds more to negative changes in housing wealth regardless of the part of the distribution under analysis. Households at the bottom part of the wealth distribution display a MPC of 7.1 cents out of negative changes in wealth as opposed to only 4.9 out of positive ones. Findings are similar for households above the median: families decrease their consumption by 4.3 cents when their wealth decreases by 1 euro, but they only increase it by 2.4 cents when there is a positive shock. We reject the equality of positive and negative MPCs for both parts of the distribution. Beyond the asymmetric response of the MPC, consistent with previous findings, less wealthy households show a larger MPC compared to wealthy ones. In this case, we also observe that it is not due to the kind of shocks they face.

Nevertheless, one could be concerned that, by using levels to estimate the MPC out of positive and negative changes in wealth, our results could capture whether consumption is more sensitive following a period in which wealth decreased rather than pure MPC asymmetries. As a robustness check, Tables A.8 and A.9 in Appendix A show the results obtained from an adapted version of Eq. (4), where consumption and wealth variables are included in growth rates rather than in levels.

[31] Figure A.1 in Appendix A shows that changes in wealth are evenly distributed across the distribution of wealth. Regardless of the quintile, changes in wealth are mostly positive, with households in the upper part of the distribution experiencing a slightly larger share of negative shocks. Though far from being conclusive, this suggest that the concern about compositional effects should be of second order.

The results (column [2] in both tables) show that negative changes in wealth are associated with a larger consumption elasticity than positive changes. When we convert the elasticities into MPCs, we obtain a MPC of 7.4 cents for negative changes in wealth and a MPC of 2.3 cents associated with positive changes. Interestingly, using growth rates, we do not find significant differences across the distribution of wealth when households face a positive shock (2.1 cents in the lower part vs. 2.2 in the upper part), while the bottom part of the distribution presents a much larger MPC out of negative shocks (11.5 cents) than households above the median net wealth (5.3 cents).

4.2.2 Magnitude asymmetries

Intertemporal models with income risk suggest that households' consumption response depends not only on the sign but also on the magnitude of the shock. For example, the theory predicts that, due to precautionary saving motives, households facing large negative shocks should adjust more their consumption than households facing small decreases in wealth.

In this section, we decompose changes in wealth into five groups depending on the relative size of the change. As households in the sample experience more positive than negative shocks, we divide positive variations into three equal groups while negative changes are evenly split in two. The cut-points separating our groups are: −22.5%, 22.8%, and 66.5%. On average (across the five imputed datasets), every negative (positive) group has 228 (184) observations. Empirically, we estimate an adapted version of Eq. (4) that further disaggregates changes in wealth depending on the magnitude of the variation.

Figure 6 shows the estimated MPC. For relatively small variations in wealth (between −22.5% and 22.8%), there are no significant differences between positive and negative shocks with households adjusting their consumption by 4.6 and 4.7

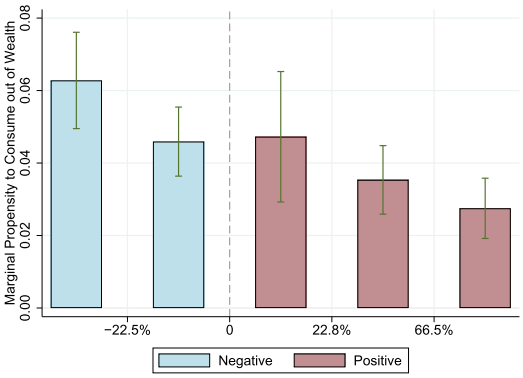

Fig. 6 MPC out of net housing wealth: magnitude asymmetries. *Notes:* MPC out of net housing wealth by the magnitude of the change (along with the 90% confidence intervals). Results are obtained from an adapted version of Eq. (4) where changes in wealth are disaggregated into 5 categories depending on the magnitude of the variation. Table A.10 (Column [1]) in Appendix A shows more information on the regression

cents, respectively. However, the response changes when we consider larger variations in wealth. For positive changes in the range of 22.8%–66.5% households display a MPC of 3.5 cents, while the MPC is only 2.8 cents when we consider changes in wealth larger than 66.5%. The opposite occurs for negative variations, with households decreasing their consumption by 6.3 cents when negative shocks are larger, in absolute value, than 22.5%.[32]

Interestingly, this result suggests that the sign asymmetries found in the previous section are mostly due to relatively large positive or negative changes in wealth, while households facing small changes in wealth respond in a similar way independently of the sign of the shock. In the next section, we complete the analysis by checking the role played by income expectations.

4.3 Income expectations

4.3.1 The role of income expectations

In a recent study, Arrondel et al. (2019) stress the importance of including income expectations in the analysis to isolate the direct wealth effect from any indirect or confidence channel (Poterba, 2000). The intuition is that both wealth and consumption would respond to changes in expectations about the future state of the economy. For example, an increase in the expected productivity growth would raise both asset values (current asset values take into account the larger expected profits) and households' consumption today (households are more optimistic about the future state of the economy), leading to a spurious positive relation between wealth and consumption.[33]

Compared to the datasets used by previous studies, our survey includes an explicit question on whether households expect their future income to be higher, lower, or the same as at present. While income expectations have always been included as a control in our analysis, in this section, we further exploit this information to study to what extent they are relevant when estimating the MPC and whether they could account for the asymmetric response emerged in the previous section. For the sake of interpretation, we redefine income expectations as a dummy variable that takes value 1 if households expect their income to be higher in the future and 0 otherwise.

Columns [1] to [4] of Table 3 present the results using the homeowners sample and different specifications of Eq. (2). Column [1] shows the MPC out of wealth when we only include the wealth variables and the rest of baseline controls (excluding income expectations) in the regression. Similarly to our previous findings,

[32] Figure A.2 in Appendix A shows that changes in wealth are evenly distributed across the wealth distribution and, therefore, compositional effects should not play a relevant role in the analysis. Table A.10 in Appendix A shows that our results are robust to the use of consumption and wealth growth rates.

[33] For a more detailed explanation on the role of expectations and the wealth-consumption relationship see, among others, Attanasio and Weber (1994), Attanasio et al. (2009), Carroll et al. (2011), Disney et al. (2010).

Table 3 MPC out of net housing wealth: income expectations

	[1]	[2]	[3]	[4]	[5]	[6]
Net financial wealth/Income	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	0.006 (0.004)	0.006 (0.003)	0.007** (0.003)
Net housing wealth/Income	0.022*** (0.004)	0.022*** (0.004)	0.023*** (0.004)	0.029*** (0.004)	0.027*** (0.005)	
Net other wealth/Income	0.004*** (0.002)	0.004*** (0.002)	0.004*** (0.002)	0.003 (0.002)	0.003* (0.002)	0.005** (0.002)
$E(Income)^H$		−0.001 (0.018)	−0.001 (0.017)	0.006 (0.017)	−0.063* (0.030)	−0.081* (0.043)
$E(Income)^H$*Net housing wealth/Income					0.012*** (0.005)	
Net housing wealth/Income$_{Q<50}$						0.044*** (0.007)
$E(Income)^H$*Net housing wealth/Income$_{Q<50}$						0.018** (0.008)
Net housing wealth/Income$_{Q>50}$						0.015*** (0.005)
$E(Income)^H$*Net housing wealth/Income$_{Q>50}$						0.013* (0.006)
Households	336	336	336	336	336	336
Obs	1344	1344	1344	1344	1344	1344
R^2	0.646	0.646	0.649	0.721	0.727	0.727
RMSE	0.265	0.265	0.264	0.235	0.233	0.233
% Outliers	6.76	6.76	6.76	6.76	6.76	6.76
Quintile*Wave FE	✗	✗	✗	✓	✓	✓
Wave FE	✗	✗	✓	✗	✗	✗
Households FE	✗	✗	✗	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

housing is the main driver of the MPC out of wealth with a MPC of 2.2 cents (0.7 cents lower than the MPC estimated in Table 2). The inclusion of income expectations (column [2]) does not alter the results; moreover, the coefficient is not statistically different from zero.[34] Columns [3] and [4] show that our findings are not affected by the inclusion of wave fixed effects; however, the MPC increases from 2.3 to 2.9 cents when we control for household fixed effects.

In contrast with what theory predicts about the confidence channel, we do not find evidence of income expectations affecting the estimated MPC. Nonetheless, we can still use income expectations to shed more light on the mechanisms driving the response to changes in wealth. In column [5] we show the results of a regression including an interaction of net housing wealth and income expectations: estimates suggest that more "optimistic" households tend to respond more to changes in wealth. Specifically, while households that expect their future income to be the same or lower than the current one display a MPC of 2.7 cents, "optimistic" households increase their consumption by 3.9 cents. This result is in line with Bleichrodt and Eeckhoudt (2005), who, using a rank-dependent utility model, show that pessimism induces precautionary saving.[35] Finally, estimates in column [6] suggest that the larger response of more "optimistic" households does not depend on their position in the wealth distribution, with positive expectations boosting the MPC of households below and above the median net wealth by 1.8 and 1.3 cents, respectively.[36]

To conclude the analysis on the role of income expectations, we test whether, as suggested by Bleichrodt and Eeckhoudt (2005), pessimism increases precautionary saving motives. If this was the case, we would expect households with more optimistic outlooks to display a smaller (larger) MPC out of negative (positive) changes in wealth. Figure 7 shows the MPC out of housing wealth by sign of the shock and income expectations. We observe that the asymmetric behavior uncovered in the previous section is mostly driven by households who do not expect a higher income in the future. When we consider "optimistic" households, we find no differences between their response to positive and negative shocks (4.1 vs. 4.4 cents). Most importantly, as expected, "optimistic" households have a lower MPC out of negative changes in wealth (4.4 vs. 5.4 cents) and a larger one out of positive shocks (4.1 vs. 2.9 cents), although we can only reject the equality of the coefficients for the latter. All in all, our results seem to support the argument that precautionary saving motives might play a relevant role in explaining the marginal propensity to consume out of housing wealth in Spain.

4.3.2 Exploring alternative channels

In the previous section, we related our findings to the presence of precautionary saving motives, which pushes households not expecting an increase in future income

[34] Although surprising, this result is in line with Arrondel et al. (2019) findings using an imputed measure of income expectations.

[35] For a detailed survey of the precautionary saving literature see Baiardi et al. (2020).

[36] We also analyzed the impact of other variables such as liquidity constraints, credit constraints, financial risk profile, employment uncertainty, or age groups. We only find a weak positive impact of liquidity constraints on the MPC.

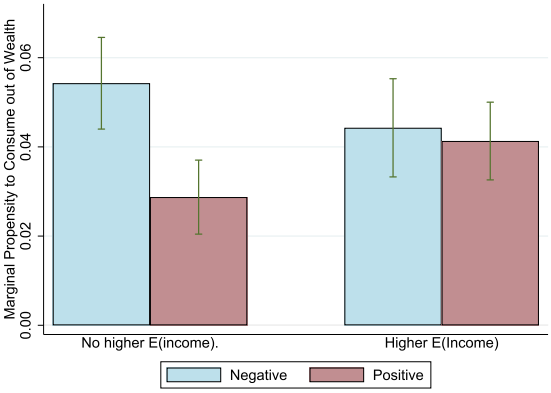

Fig. 7 MPC out of net housing wealth: income expectations and sign asymmetries. *Notes:* MPC out of positive and negative changes in net housing wealth by income expectations (along with the 90% confidence intervals). Results are obtained from an adapted version of Eq. (4) where positive and negative changes in wealth are further disaggregated based on income expectations. Table A.11 (Column [1]) in Appendix A shows more information on the regression. A Wald test reject the equality of the coefficients for positive changes in wealth ($p - value = 0.058$) but not for negative changes ($p - value = 0.222$)

to save more for a rainy day. However, this might sound puzzling to the reader, especially given the fact that Spanish households do not frequently use housing wealth as a source of borrowing, nor they are as likely to sell their primary residence as in other countries. Indeed, Buiter (2010) points out that households are not necessarily worse off when house prices decline since they can continue living in their home and consume the same housing service flow. Hence, why do "pessimistic" households react so strongly to decreases in house prices?

We already mentioned above that, though households may not employ their housing wealth as a source of credit, the mere possibility of being able to do it may be sufficient for a change in prices to reshape precautionary saving motives (Skinner, 1996). In other words, lower wealth makes individuals feel less safe concerning the future, even if in practice they are not likely to use it to finance consumption.

One might argue, however, that other mechanisms could equally be consistent with our findings. In particular, given that our sample covers the Spanish real estate crash and that we only include a general indicator of debt in our analysis, it is worthwhile to explore if households' debt characteristics could play a relevant role in driving the results. For instance, one possibility is that "pessimistic" households are the ones having difficulties meeting their mortgage payments. If this is the case, these families could cut back consumption so as not to fall further behind with the payments and/or to hedge against the cost of foreclosures or other debt collection.[37]

Table 4 studies to what extent this, and other related channels, could explain our findings. Specifically, we compare households' debt and wealth characteristics by income expectations. First of all, it is worth noticing that "pessimistic" households

[37] During the period under analysis, the foreclosure process in Spain implies that the debtor responds to the mortgage with all his present and future assets. In other words, the failure to repay the mortgage has consequences not only with the loss of the primary residence but also the seizure of other assets belonging to the owner.

Table 4 Heterogeneities across income expectations

	"Pessimistic" [1]	"Optimistic" [2]
Debt		
Any debt*	59.7	69.4
Mortgage debt*	25.4	32.3
Mortgage payments to income ratio (%)	4.5	5.2
Outstanding mortgage to house value ratio (%)	5.7	7.1
Years mortgage remaining	2.5	3.2
Liquidity constraints*	5.0	7.2
Credit constraints*	3.0	3.5
Variable interest rate*	18.5	25.0
Housing wealth		
$\%\Delta Wh$	20.4	37.8
Obs	783	225

Notes: Values obtained from the sample used to estimate Fig. 7. Variables with an asterisk (*) indicate the percentage share of observations in our sample. "Optimistic" ("Pessimistic") refers to households who (do not) expect their income to be higher in the future than at present. The mortgage payments to income ratio, outstanding mortgage to house value ratio, years mortgage remaining, and the growth rate of the house value ($\%\Delta Wh$) represent average values of each group. The mortgage payments to income ratio and the outstanding mortgage to house value ratio are shown as a percentage

are less likely to be indebted compared to more "optimistic" ones (59.7% vs. 69.4%) and less likely to have an outstanding mortgage (25.4% vs 32.3%). More "pessimistic" households also seem to face lower housing-related debt: they have a lower mortgage payment to income ratio, a lower outstanding debt with respect to the value of the house, and fewer years of mortgage remaining.[38] Rows 6 and 7 show, respectively, the percentage of households who struggled in repaying their debt and that suffered from credit constraints as defined in Table A.3: interestingly, 7.2% (3.5%) of "optimistic" households reported having liquidity (credit) constraints, as opposed to only 5% (3%) of more "pessimistic" ones. Overall, these figures do not seem to support the argument that more "pessimistic" households cut their consumption to face higher mortgage payments.[39]

Though "pessimistic" households do not hold more housing debt than others, it is still possible that the conditions of the housing-related debt differ among households that are more or less optimistic about their future. One might think, for instance, that

[38] Someone might find surprising the low values observed for these variables. The reason is the low share of households that have an outstanding mortgage in our sample (between 25.4% and 32.3%). Table A.12 in Appendix A shows the corresponding statistics when we consider only households with outstanding mortgages. In this case, mortgage-related characteristics are very similar regardless of households' income expectations.

[39] Given the limited number of observations, a more rigorous econometric analysis to test all these hypotheses is not feasible. However, when we interact a dummy variable that captures whether the household has an outstanding mortgage with changes in wealth, we do not find evidence supporting heterogeneous consumption responses.

households holding mortgages with a variable interest rate had to cut their consumption in order to pay the increasing housing cost during the European debt crisis. If those families were more likely to be pessimistic about their future, it could explain the results found in the previous section even in the absence of precautionary saving motives. Row 8 of Table 4 explores precisely this possibility, comparing the percentage of households holding mortgages with variable interest rates by income expectations. Once again, this does not seem to be a plausible channel, as more "pessimistic" households are sensibly less likely to face variable interest rates compared to "optimistic" ones (18.5% vs 25%).[40]

It is important to note that Table 4 may still hide some heterogeneities that could explain our previous results (Fig. 7). For instance, the larger consumption response to decreases in housing wealth observed for "pessimistic" households could indicate that this specific group is the one having debt-related problems. To explore this possibility, Table A.13 in Appendix A further disaggregates our variables of interest by changes in the value of the primary residence. If we focus on "pessimistic" households, we observe that the ones facing a decline in the value of the house are less likely to be indebted (57.4% vs. 61.8%), have an outstanding mortgage (21.8% vs. 28.8%), and have a mortgage with a variable interest rate (14.8% vs. 22%) than the ones experiencing an increase in the value of the primary residence. In contrast, they are more likely to have problems repaying their debts (6.1% vs. 4%), and they present a larger outstanding mortgage with respect to the value of the house (6.7% vs. 4.7%). These latter facts could help to explain the larger adjustment to negative shocks of "pessimistic" households, however, the same pattern is displayed by more "optimistic" families, suggesting that other factors are driving our results.[41]

Finally, as in the previous section we are accounting only for the sign of the shock but not for the magnitude, "pessimistic" households might respond more (less) to a decrease (increase) in housing prices just because they face larger shocks. That is, if the magnitude of shocks is correlated with income expectations, this would be sufficient to explain Fig. 7 results. The last row of Table 4 shows that, indeed, more "pessimistic" households seem to have experienced, on average, smaller increases in the value of the house during the period of analysis (20.4% vs. 37.8%). However, when we further disaggregate it by changes in the value of the primary residence (Table A.13), we observe that "pessimistic" households display both smaller losses and smaller gains in housing value compared to more "optimistic" ones. This rules out the possibility of our results being driven by the larger magnitude of shocks among "pessimistic" households.[42]

[40] Results from Fig. 7 are robust to the exclusion of the EFF 2011, the wave covering the early part of the European debt crisis.

[41] It is worthwhile to note that, after a decrease in the value of the primary residence, the outstanding mortgage to value ratio increases mechanically.

[42] Table A.12 further shows that households with different income expectations do not significantly differ in the use of increases in the value of the primary residence as collateral to borrow a further loan (10.6% vs. 12.1%). Regarding the distribution of expectations over the business cycle, we find that "pessimistic" households are concentrated in the years of the crisis; however, the distribution of wealth (average quintile) is very similar across both samples.

All in all, we do not find supporting evidence of alternative mechanisms and the presence of precautionary saving motives still seems the most plausible channel behind the results presented in the previous sections.

4.4 Robustness

As extensively discussed in the previous sections, our empirical strategy builds on the construction of a panel dataset restricting the sample to households included in the survey for all four consecutive waves. One potential concern might hence be that our results could suffer of selection bias. In an attempt to rule this out, we test the sensitivity of our estimates to alternative sample definitions and empirical approaches.

First, we only require households to be in the survey for at least two consecutive waves.[43] By doing so, we not only increase the number of households significantly for the period 2002–2011, but we can also include the EFF 2014 wave in the analysis. Following Garbinti et al. (2020), we estimate a first-differences version of Eq. (1) to control for time-invariant heterogeneity. Importantly, households with observations in more than two consecutive waves are considered different units in the analysis. In practice, this implies that we estimate a pooled first-differences regression where each household enters with one observation. We include dummies to account for the fact that households are observed in different pair of waves.[44]

To help the comparison with previous estimates, Table 5 displays the results for two different samples: Block A includes 2746 households spanning the period 2002–2011, the same as the one studied in our main analysis, and Block B adds the EFF 2014 wave including a total of 3590 households for the period 2002–2014. Regardless of the sample used, our results are qualitatively similar to those obtained in our main analysis. When we focus on the MPC out of total wealth, households increase their consumption by 0.6 cents out of 1 additional euro (0.4 cents lower than in the benchmark specification). Again, this MPC is mainly driven by net housing wealth, with a MPC of 3.3 cents. The effect of financial and "other real assets" is estimated with higher precision but is still small in magnitude and likely to suffer from the bias stemming from households' saving decisions.

Table A.14 in Appendix A studies MPC heterogeneities across the distribution of wealth and confirms the presence of a decreasing pattern.[45] The results are robust to the use of different sample periods. In the case of the regression for the period 2002–2011, households in the bottom quintile increase their consumption by 4.7 cents out of 1 additional euro of net housing wealth. Consistent with the baseline estimates, the MPC decreases across quintiles taking a value of 3.4 cents for the median quintile and 2.7 cents for the top 20% of the wealth distribution. Adding to the regression the EFF 2014 wave, which includes 844 more households, does not

[43] We consider households formed by a stable couple where the reference person is aged between 25 and 65. We further restrict our sample to include only homeowners that have been living in the same residence since at least the first year of the sample.

[44] Wealth and consumption first-differences variables are winsorized at the 1st and 99th percentiles per pair of waves and imputation to control for outliers.

[45] Households are assigned to wealth quintiles within their specific sample. The bottom quintile of the pooling sample consists of households in the bottom quintile of their respective pair of waves.

Table 5 MPC out of wealth: pooled first-differences

	Block A: 2002–2011			Block B: 2002–2014		
	[1]	[2]	[3]	[4]	[5]	[6]
Δ(Gross wealth/Income)	0.006*** (0.001)			0.006*** (0.000)		
Δ(Net wealth/Income)		0.006*** (0.001)			0.006*** (0.000)	
Δ(Net financial wealth/Income)			0.005*** (0.001)			0.004*** (0.001)
Δ(Net housing wealth/Income)			0.033*** (0.002)			0.032*** (0.002)
Δ(Net other wealth/Income)			0.001* (0.001)			0.002*** (0.000)
Households	2746	2746	2746	3590	3590	3590
R^2	0.174	0.167	0.329	0.191	0.181	0.337
RMSE	0.353	0.354	0.318	0.344	0.346	0.311
Sample FE	✓	✓	✓	✓	✓	✓
Quintile FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is Δ(Consumption/Income). Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. Wealth and consumption first-differences variables are winsorized at the 1st and 99th percentiles per pair of waves and imputation

change our results. All in all, the baseline results are robust to different empirical methodologies, changes in the sample size, and the period of analysis.

The use of a pooled first-differences regression allows us to increase considerably the sample size while still accounting for time-invariant unobserved heterogeneity. However, despite the advantages, this approach also has some drawbacks. Specifically, when we use this approach to estimate the MPC, we exploit cross-sectional variation of differences in consumption and wealth, as opposed to our benchmark analysis, where we identify the wealth effect through within-household variation across four consecutive waves. This becomes particularly relevant when we study if households adjust consumption in a different way to positive or negative changes in housing wealth. Using first-differences to identify this relation implies that we would identify the MPCs from two different samples (households facing positive vs. negative changes in wealth). Therefore, beyond a pure wealth effect, consumption responses to a realized shock could also reflect households' different characteristics in each sample (Christelis et al., 2019).[46] For this reason, we do not use first-differences as a robustness check in the rest of the paper.[47]

5 Conclusions

Households' consumption decisions play a crucial role in both economic growth and inequality. How households change their consumption when there is a change in the value of their assets is not only important to understand the effect of current economic events but to improve macroeconomic models that try to forecast the effect of fiscal and monetary policies.

We estimate the marginal propensity to consume out of wealth using a panel of Spanish households. We find that households' consumption increases by around 1 cent for each additional euro of net total wealth. This result hides important heterogeneities across both the distribution of wealth and the type of asset. In particular, the MPC out of wealth is a decreasing function of households' net worth, revealing the concavity of the consumption function in wealth. Regarding the type of asset, the most important component of wealth is the primary residence with a MPC of around 3 cents. We only find significant effects of financial assets in the bottom part of the distribution, while "other real wealth" have some impact in the central part. In any case, these last findings are less conclusive since they are potentially affected by a bias from households' saving decisions and must be considered as a lower bound estimate.

[46] Something similar would happen in our benchmark specification if different households were facing only a type of shock during the whole period under analysis. However, by covering the expansion and recession periods around the great recession, most households in our sample experience both positive and negative changes in wealth (in our homeowners sample, 10 households do not experience negative changes in housing wealth, while only 3 families do not have positive housing wealth variations), which allows us to identify the MPCs using within-household different responses to positive and negative changes in wealth. Note that we are talking about the difference between using first-differences in a sample where households only have observations during two consecutive waves and household fixed effects in a sample where we follow the same household for four consecutive waves. Using first-differences in the latter case to control for time-invariant unobserved heterogeneity does not alter our results.

[47] Appendix C discusses the use of sample survey weights in a regression analysis and shows the robustness of our results to its inclusion.

By focusing on housing wealth, we are able to identify self-reported variations of wealth and check the validity of various theoretical predictions. Beyond the concavity of the consumption function in wealth, we acknowledge the existence of sign and magnitude asymmetries in the MPC out of wealth as predicted by intertemporal consumption models with income uncertainty. Households do not only adjust more their consumption to negative changes in wealth than to positive ones, but the larger is the negative shock the bigger is the adjustment in consumption, while the opposite is true for positive shocks. This asymmetric behavior is not present in households expecting a higher income in the future, which indicates that the transmission channel is likely related to precautionary saving motives. Future research must aim to further disentangle the channel(s) behind these effects and the role played by financial and "other real assets".

All in all, this paper uncovers a complex relationship between wealth and consumption. There is not only evidence of heterogeneities across the distribution of wealth but also of asymmetric responses depending on the type of shock. This evidence should be taken into consideration in macroeconomic models aiming to address the impact of diverse economic policies.

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Compliance with ethical standards

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6 Appendix A: Supplementary tables and figures

Figures A1, A2, Tables A.1–A.14

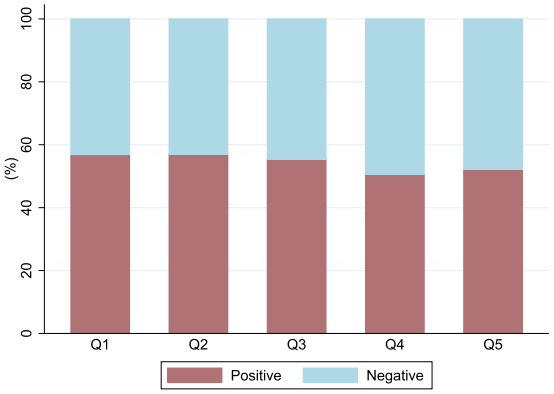

Fig. A1 Wealth variation by sign and quintile

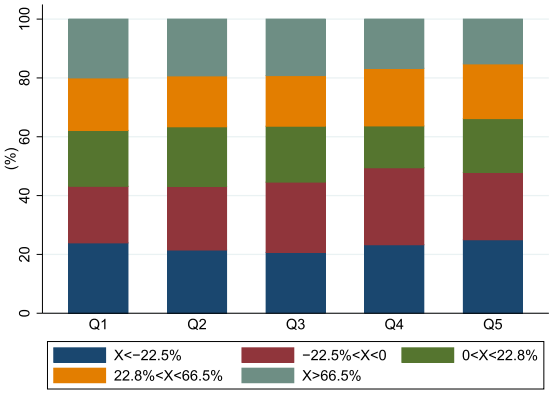

Fig. A2 Wealth variation by magnitude and quintile

Table A.1 Consumption, income, and wealth distributions: unrestricted sample

	€2011	% Share				
	Median	Q1	Q2	Q3	Q4	Q5
Net wealth	270,610	1.72	4.52	7.76	14.90	71.09
Net financial wealth	14,789	0.47	1.34	3.69	9.72	84.78
Net housing wealth	167,069	4.64	11.57	16.87	25.00	41.92
Net other wealth	22,914	0.49	1.62	3.99	11.05	82.85
Consumption	12,325	13.03	14.60	17.35	20.97	34.05
Income	26,243	10.59	12.63	16.35	21.46	38.96

Notes: The unrestricted sample consists of every household present in 4 consecutive waves of the EFF for the period 2002–2011 regardless of the sample selection criteria explained in Section 2.1 (1496 households)

Table A.2 Descriptive statistics: baseline sample

	2002–2011	2002	2005	2008	2011
Monetary variables (median)					
Gross wealth	306,336	205,972	338,094	352,797	320,609
Gross financial wealth	18,061	11,795	19,180	19,981	21,729
Gross housing wealth	189,971	151,977	216,152	211,739	180,304
Gross other real wealth	37,779	10,013	32,068	78,964	82,630
Net wealth	269,950	187,147	316,241	328,488	285,873
Net financial wealth	14,018	7841	14,523	16,057	19,513
Net housing wealth	169,098	126,713	201,921	193,665	162,319
Net other real wealth	32,406	7669	22,389	65,588	55,005
Consumption	15,033	14,960	15,051	15,317	14,254
Income	38,208	35,451	36,983	41,523	39,305
Age					
25–34	0.050	0.133	0.046	0.019	0.002
35–44	0.296	0.422	0.364	0.248	0.149
45–54	0.419	0.369	0.419	0.453	0.436
55–65	0.235	0.077	0.171	0.280	0.412
Employment status					
Reference person					
Employee	0.714	0.745	0.735	0.723	0.655
Unemployed	0.065	0.041	0.048	0.060	0.111
Retired	0.044	0.012	0.027	0.048	0.089
Inactive	0.177	0.202	0.190	0.169	0.145
Partner					
Employee	0.669	0.663	0.694	0.682	0.639
Unemployed	0.067	0.053	0.043	0.065	0.108
Retired	0.036	0.007	0.029	0.041	0.067
Inactive	0.227	0.277	0.234	0.212	0.186
Education					
Reference person					
Terciary	0.311	0.311	0.313	0.307	0.313
Secondary	0.283	0.311	0.287	0.267	0.267
Primary or lower	0.406	0.378	0.400	0.426	0.419
Education					
Partner					
Terciary	0.236	0.234	0.246	0.227	0.239
Secondary	0.323	0.364	0.311	0.324	0.292
Primary or lower	0.441	0.402	0.443	0.449	0.470
Health and Job skills					
Reference person					
Good Health	0.863	0.892	0.887	0.870	0.802
High skills	0.280	0.258	0.308	0.267	0.287
Partner					
Good Health	0.894	0.925	0.917	0.901	0.834
High skills	0.223	0.198	0.239	0.212	0.242
Household composition					
#Size	3.637	3.817	3.720	3.578	3.434

Table A.2 continued

	2002–2011	2002	2005	2008	2011
#Working adults	1.554	1.465	1.571	1.660	1.518
#Kids	0.848	1.104	0.952	0.771	0.564
House ownership					
Rented	0.036	0.036	0.034	0.043	0.029
Ownership	0.910	0.884	0.913	0.918	0.923
Free transfer (usufruct)	0.053	0.077	0.051	0.039	0.046
Other	0.002	0.002	0.002	0.000	0.002
Level of income					
Normal	0.612	0.648	0.635	0.622	0.545
Higher than usual	0.086	0.075	0.096	0.089	0.082
Lower than usual	0.302	0.277	0.269	0.289	0.373
Income expectations					
The same	0.596	0.618	0.566	0.632	0.568
Higher	0.250	0.302	0.334	0.206	0.160
Lower	0.154	0.080	0.100	0.162	0.272
Preferences toward risk	0.040	0.053	0.058	0.024	0.024
Credit constraints	0.032	0.010	0.038	0.020	0.058
Liquidity constraints	0.068	0.060	0.060	0.068	0.085
Future uncertainty	0.069	0.055	0.039	0.073	0.109
Reforms	0.173	0.188	0.191	0.145	0.166
Debt	0.638	0.636	0.668	0.642	0.606

Source: Spanish Survey of Households Finances (*Encuesta Financiera de las Familias*).

Notes: We display the median value of the monetary variables in euros of 2011. The rest of the variables are the full list of controls included in our regressions

Table A.3 Definition of selected variables

Variable	Definition
Preferences toward risk	Our categorical variable takes value 1 if households describe themselves as willing to run on a lot or a reasonable amount of risk in the expectation of obtaining a lot or above-normal profit. Zero otherwise.
Credit constraints	A household is considered credit constrained if in the last two years: (i) they did not ask a credit because they think it would be turned down, (ii) they have been denied a loan, or (iii) they have been granted a loan for an amount less than what they requested.
Liquidity constraints	Our categorical variable takes value 1 if the household has had financial difficulties in the last twelve months, which resulted in the delay of the payment of any debt.
Current level of income	The variable takes value: (i) 0 if households define their current income level as normal, (ii) 1 if households define their current income level as higher than usual, and (iii) 2 if they define their current income as lower than usual.
Future uncertainty	Our categorical variable takes value 1 if the reference person or her partner expect to lose their job in the next 12 months and zero otherwise. In 2011 the Bank of Spain asked explicitly for the probability of losing their jobs in the following 12 months; our variable takes value 1 if the reference person or her partner consider that this probability is larger than 50%.
Expected level of income	Our categorical variable takes value: (i) 0 if households expect their future income to be the same as at present, (ii) 1 if households expect their future level of income to be higher than at present, and (iii) 2 if they expect a future income lower than at present.

Table A.4 Marginal propensity to consume out of wealth: outliers

	Outliers: no outliers			Outliers: no action			Outliers: $\frac{W}{Y}$ levels			Outliers: growth rate 100		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Gross wealth/Income	0.008*** (0.001)			0.012*** (0.003)			0.011*** (0.002)			0.011*** (0.002)		
Net wealth/Income		0.008*** (0.001)			0.012*** (0.003)			0.011*** (0.002)			0.011*** (0.002)	
Net financial wealth/Income			0.007* (0.004)			0.003 (0.003)			0.003 (0.005)			0.007 (0.005)
Net housing wealth/Income			0.030*** (0.006)			0.052*** (0.006)			0.030*** (0.004)			0.039*** (0.006)
Net other wealth/Income			0.002* (0.001)			0.003* (0.001)			0.006*** (0.002)			0.003 (0.002)
Households	265	265	265	415	415	415	415	415	415	415	415	415
Obs	1060	1060	1060	1660	1660	1660	1660	1660	1660	1660	1660	1660
R^2	0.401	0.392	0.457	0.396	0.386	0.568	0.539	0.536	0.691	0.402	0.391	0.587
RMSE	0.200	0.201	0.190	0.345	0.348	0.292	0.302	0.303	0.247	0.344	0.347	0.285
% Outliers	–	–	–	–	–	–	0.52	0.52	0.52	24.25	24.25	24.25
Household FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Quintile * Wave FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Columns [1]–[3] estimate Eq. (1) excluding households with at least an outlier observation; Columns [4]–[6] estimate Eq. (1) without considering the presence of outliers; Columns [7]–[9] estimate Eq. (2) and an observation is considered an outlier if: (i) the yearly non-financial income is less than €2000, (ii) the consumption to income ratio is larger than 5, or (iii) the net wealth to income ratio is larger than 200; Columns [10]–[12] estimate Eq. (2) and an observation is considered an outlier if: (i) the yearly non-financial income is less than €2000, (ii) the consumption to income ratio is larger than 5, iii) the three years growth rate of consumption is larger than 100%, (iv) the three years growth rate of income is larger than 100%, or v) the net total wealth three years growth is bigger than 100%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table A.5 MPC out of wealth: composition effect

	Baseline sample	Excluding renters	Homeowners sample
Net housing wealth/Income^{Q1}	0.068*** (0.013)	0.066*** (0.014)	0.067*** (0.014)
Net housing wealth/Income^{Q2}	0.036*** (0.006)	0.037*** (0.006)	0.035*** (0.006)
Net housing wealth/Income^{Q3}	0.030*** (0.006)	0.030*** (0.007)	0.030*** (0.007)
Net housing wealth/Income^{Q4}	0.019*** (0.003)	0.021*** (0.003)	0.020*** (0.003)
Net housing wealth/Income^{Q5}	0.023*** (0.006)	0.023*** (0.007)	0.023*** (0.007)
Households	415	359	336
Obs	1660	1436	1344
R^2	0.671	0.764	0.773
RMSE	0.255	0.212	0.212
% Outliers	9.06	7.09	6.76
Household FE	✓	✓	✓
Quintile * Wave FE	✓	✓	✓
Controls	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Results are obtained from equation (B.1) once net total wealth is divided in three components: financial, housing and other real wealth. Households are assigned to wealth quintiles based on the baseline sample distribution. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table A.6 MPC out of wealth: baseline results

		Block A: Baseline sample			Block B: Homeowners sample		
		[1]	[2]	[3]	[4]	[5]	[6]
	Household						
	Gross wealth/Income	0.010*** (0.002)			0.010*** (0.002)		
	Net wealth/Income		0.009*** (0.002)			0.010*** (0.002)	
	Net financial wealth/Income			0.007 (0.006)			0.006 (0.004)
	Net housing wealth/Income			0.032*** (0.004)			0.029*** (0.004)
	Net other wealth/Income			0.003* (0.002)			0.003 (0.002)
	Size	0.037* (0.020)	0.036* (0.020)	0.044*** (0.016)	0.024 (0.018)	0.024 (0.018)	0.025 (0.015)
	Working adults	−0.061** (0.025)	−0.063** (0.025)	−0.045** (0.021)	−0.029 (0.020)	−0.030 (0.020)	−0.017 (0.017)
	Kids	−0.011 (0.018)	−0.010 (0.018)	−0.001 (0.014)	0.014 (0.015)	0.013 (0.015)	0.016 (0.013)
Kind of ownership	Ownership	−0.039 (0.105)	−0.035 (0.105)	−0.174* (0.105)			
	Usufruct	0.006 (0.126)	0.001 (0.125)	−0.086 (0.118)			
	Other	−0.160 (0.155)	−0.168 (0.157)	−0.175 (0.133)			
Level of income	Higher	−0.014 (0.030)	−0.014 (0.030)	−0.027 (0.021)	−0.029 (0.030)	−0.029 (0.030)	−0.044* (0.024)
	Lower	0.015 (0.022)	0.015 (0.022)	0.016 (0.018)	0.013 (0.022)	0.014 (0.022)	0.008 (0.018)
Income expectations	Higher	0.000 (0.021)	−0.002 (0.021)	−0.003 (0.016)	0.001 (0.025)	−0.002 (0.025)	0.006 (0.017)
	Lower	−0.012 (0.025)	−0.015 (0.025)	−0.016 (0.021)	0.000 (0.025)	−0.002 (0.025)	−0.000 (0.019)
	Risk	0.039 (0.062)	0.042 (0.062)	0.004 (0.032)	0.030 (0.088)	0.033 (0.088)	−0.001 (0.038)
	Credit constraints	−0.034 (0.054)	−0.037 (0.054)	−0.055 (0.051)	−0.073 (0.054)	−0.078 (0.055)	−0.101* (0.052)
	Liquidity constraints	0.043 (0.031)	0.049 (0.032)	0.049 (0.032)	0.061 (0.038)	0.069* (0.039)	0.087** (0.039)
	Uncertainty	0.029 (0.031)	0.028 (0.031)	0.014 (0.030)	0.031 (0.030)	0.030 (0.030)	0.022 (0.028)
	Renovations	−0.000 (0.024)	−0.001 (0.024)	−0.012 (0.020)	−0.002 (0.022)	−0.003 (0.022)	−0.013 (0.018)
	Debt	−0.020 (0.020)	−0.009 (0.020)	−0.008 (0.017)	−0.023 (0.022)	−0.013 (0.023)	−0.030* (0.016)
	Reference person						
Age	35-44	0.030 (0.040)	0.030 (0.040)	0.024 (0.033)	0.065 (0.041)	0.064 (0.041)	0.037 (0.037)
	45-54	0.086 (0.063)	0.088 (0.063)	0.067 (0.054)	0.169** (0.066)	0.168** (0.066)	0.123** (0.052)
	55-65	0.133* (0.079)	0.135* (0.079)	0.073 (0.068)	0.231*** (0.083)	0.230*** (0.083)	0.136** (0.067)
Employment status	Employee	−0.035 (0.056)	−0.034 (0.057)	0.018 (0.044)	−0.017 (0.050)	−0.016 (0.051)	0.037 (0.037)
	Unemployed	−0.124* (0.072)	−0.125* (0.073)	−0.072 (0.051)	−0.100 (0.066)	−0.101 (0.068)	−0.038 (0.038)
	Retired	0.029 (0.068)	0.027 (0.069)	0.019 (0.047)	0.014 (0.064)	0.013 (0.065)	0.001 (0.044)
Education	Terciary	−0.015 (0.055)	−0.015 (0.055)	0.025 (0.046)	−0.077 (0.064)	−0.080 (0.064)	−0.045 (0.039)
	Secondary	0.037 (0.043)	0.036 (0.043)	0.040 (0.042)	−0.021 (0.024)	−0.023 (0.024)	−0.020 (0.023)
Health and Job skills	Good health	−0.057 (0.035)	−0.056 (0.035)	−0.036 (0.027)	−0.111** (0.044)	−0.111** (0.044)	−0.075*** (0.024)
	High skills	−0.025 (0.021)	−0.025 (0.021)	−0.006 (0.017)	−0.036* (0.021)	−0.036 (0.022)	−0.026 (0.018)
	Partner						
Employment status	Employee	−0.046 (0.042)	−0.050 (0.043)	−0.028 (0.036)	−0.076* (0.044)	−0.081* (0.044)	−0.034 (0.033)
	Unemployed	−0.183*** (0.053)	−0.186*** (0.054)	−0.113*** (0.040)	−0.145*** (0.055)	−0.149*** (0.057)	−0.053 (0.038)
	Retired	−0.111 (0.142)	−0.109 (0.143)	−0.131 (0.127)	0.027 (0.074)	0.030 (0.076)	0.020 (0.050)
Education	Terciary	−0.034 (0.050)	−0.031 (0.050)	0.018 (0.045)	−0.008 (0.063)	−0.003 (0.063)	0.070 (0.046)
	Secondary	−0.032 (0.028)	−0.028 (0.029)	−0.027 (0.028)	−0.016 (0.025)	−0.012 (0.025)	−0.012 (0.024)
Health and Job skills	Good health	−0.031 (0.039)	−0.031 (0.039)	−0.007 (0.031)	−0.018 (0.038)	−0.019 (0.038)	−0.004 (0.034)
	High skills	0.035 (0.023)	0.037 (0.023)	0.014 (0.020)	0.034 (0.025)	0.036 (0.025)	0.015 (0.021)
	Households	415	415	415	336	336	336
	Obs	1660	1660	1660	1344	1344	1344
	R^2	0.421	0.410	0.615	0.539	0.526	0.721
	RMSE	0.338	0.341	0.276	0.302	0.307	0.235
	% Outliers	9.06	9.06	9.06	6.76	6.76	6.76
	Household FE	✓	✓	✓	✓	✓	✓
	Quintile * Wave FE	✓	✓	✓	✓	✓	✓
	Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table A.7 MPC out of wealth: the relevance of FE

	Block A: baseline sample				Block B: homeowners sample			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Net financial wealth/ Income	0.004 (0.004)	0.004 (0.004)	0.007 (0.006)	0.007 (0.006)	0.003 (0.003)	0.003 (0.003)	0.006 (0.004)	0.006 (0.004)
Net housing wealth/ Income	0.025*** (0.004)	0.026*** (0.004)	0.032*** (0.004)	0.032*** (0.004)	0.022*** (0.004)	0.023*** (0.004)	0.029*** (0.004)	0.029*** (0.004)
Net other wealth/ Income	0.003*** (0.001)	0.003*** (0.001)	0.003** (0.001)	0.003* (0.002)	0.004*** (0.002)	0.004*** (0.002)	0.003 (0.002)	0.003 (0.002)
Households	415	415	415	415	336	336	336	336
Obs	1660	1660	1660	1660	1344	1344	1344	1344
R^2	0.463	0.545	0.615	0.615	0.646	0.648	0.719	0.721
RMSE	0.325	0.300	0.276	0.276	0.265	0.264	0.236	0.235
% Outliers	9.06	9.06	9.06	9.06	6.76	6.76	6.76	6.76
Wave FE	✗	✓	✓	✗	✗	✓	✓	✗
Households FE	✗	✗	✓	✓	✗	✗	✓	✓
Quintile*Wave FE	✗	✗	✗	✓	✗	✗	✗	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table A.8 MPC out of net housing wealth: sign asymmetries I

	Benchmark [1]	Growth rates [2]
Net financial wealth/Income	0.006 (0.005)	−0.000 (0.000)
Net housing wealth/Income^{-}	0.052*** (0.006)	0.885*** (0.120)
Net housing wealth/Income^{+}	0.031*** (0.005)	0.351*** (0.088)
Net other wealth/Income	0.001 (0.001)	0.000 (0.000)
Households	336	336
Obs	1008	1008
R^2	0.777	0.224
RMSE	0.229	0.875
% Outliers	9.01	–
Quintile*Wave FE	✓	✓
Households FE	✓	✗
Controls	✓	✓
$\frac{C^-}{Y}$		0.454
$\frac{C^+}{Y}$		0.505
$\frac{W_h{}^-}{Y}$		5.42
$\frac{W_h{}^+}{Y}$		7.79
MPC^-		0.074
MPC^+		0.023

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression. Wealth and consumption variables in the growth rate regressions are winsorized at the 1st and 99th percentiles per year and imputation

Table A.9 MPC out of net housing wealth: sign asymmetries II

	Benchmark [1]	Growth rates [2]
Net financial wealth/Income	0.009* (0.005)	−0.000 (0.000)
Net housing wealth/Income$^{-}_{Q<50}$	0.071*** (0.009)	1.087*** (0.157)
Net housing wealth/Income$^{+}_{Q<50}$	0.049*** (0.008)	0.257*** (0.008)
Net housing wealth/Income$^{-}_{Q>50}$	0.043*** (0.006)	0.784*** (0.152)
Net housing wealth/Income$^{+}_{Q>50}$	0.024*** (0.005)	0.440*** (0.127)
Net other wealth/Income	0.002 (0.001)	0.000 (0.000)
Households	336	336
Obs	1008	1008
R^2	0.800	0.234
RMSE	0.217	0.869
% Outliers	9.01	–
Quintile*Wave FE	✓	✓
Households FE	✓	✗
Controls	✓	✓
$MPC^{-}_{Q<50}$		0.115
$MPC^{+}_{Q<50}$		0.021
$MPC^{-}_{Q>50}$		0.053
$MPC^{+}_{Q>50}$		0.022

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression. Wealth and consumption variables in the growth rate regressions are winsorized at the 1st and 99th percentiles per year and imputation

Table A.10 MPC out of net housing wealth: magnitude asymmetries

	Benchmark	Growth rates
	[1]	[2]
Net financial wealth/Income	0.001 (0.003)	0.000 (0.000)
Net housing wealth/Income$_1$	0.063*** (0.008)	0.835*** (0.159)
Net housing wealth/Income$_2$	0.046*** (0.006)	0.815*** (0.128)
Net housing wealth/Income$_3$	0.047*** (0.011)	0.764*** (0.197)
Net housing wealth/Income$_4$	0.035*** (0.006)	0.577*** (0.102)
Net housing wealth/Income$_5$	0.028*** (0.005)	0.156* (0.083)
Net other wealth/Income	0.000 (0.001)	−0.000 (0.000)
Households	336	336
Obs	1008	1008
R^2	0.824	0.273
RMSE	0.203	0.846
% Outliers	9.01	–
Quintile*Wave FE	✓	✓
Households FE	✓	✗
Controls	✓	✓
MPC_1		0.081
MPC_2		0.059
MPC_3		0.055
MPC_4		0.039
MPC_5		0.009

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression. Wealth and consumption variables in the growth rate regressions are winsorized at the 1st and 99th percentiles per year and imputation

Table A.11 MPC out of net housing wealth: income expectations and sign asymmetries

	[1]
Net financial wealth/Income	0.006 (0.004)
Net housing wealth/Incomee^-_{NHEI}	0.054*** (0.006)
Net housing wealth/Incomee^+_{NHEI}	0.029*** (0.005)
Net housing wealth/Income$^-_{HEI}$	0.044*** (0.007)
Net housing wealth/Income$^+_{HEI}$	0.041*** (0.005)
Net other wealth/Income	0.002 (0.001)
Households	336
Obs	1008
R^2	0.787
RMSE	0.223
% Outliers	9.01
Quintile*Wave FE	✓
Households FE	✓
Controls	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in the Appendix displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table A.12 Heterogeneities across income expectations (other variables)

	Homewners sample		"Pessimistic"		"Optimistic"	
	"Pessimistic" [1]	"Optimistic" [2]	$\Delta Wh \leq 0$ [3]	$\Delta Wh > 0$ [4]	$\Delta Wh \leq 0$ [5]	$\Delta Wh > 0$ [6]
Debt (only households with a mortgage)						
Mortgage payments to income ratio (%)	17.7	16.1	16.4	18.7	19.1	14.8
Outstanding mortgage to house value ratio (%)	22.4	22.0	30.8	16.4	35.7	16.1
Years mortgage remaining	10.0	10.0	10.4	9.7	12.4	8.9
Variable interest rate*	72.9	77.4	68.2	76.2	77.0	77.6
Other characteristics						
Collateral*	10.6	12.1	–	–	–	–
Quintile	3.0	2.9	3.1	3.0	2.9	2.9
% 2005*	28.8	49.1	9.0	47.4	18.0	66.5
% 2008*	34.4	29.5	33.7	35.1	39.3	24.0
% 2011*	36.8	21.4	57.3	17.5	42.7	9.4
Obs	783	225	379	404	81	144

Notes: Values obtained from the sample used to estimate Fig. 7. Variables with an asterisk (*) indicate the percentage share of observations in our sample. "Optimistic" ("Pessimistic") refers to households who (do not) expect their income to be higher in the future than at present. The mortgage payments to income ratio, outstanding mortgage to house value ratio, years mortgage remaining, and quintile represent average values of each group. The mortgage payments to income ratio and the outstanding mortgage to house value ratio are shown as a percentage

Table A.13 Heterogeneities across income expectations and changes in the value of the primary residence

	"Pessimistic"		"Optimistic"	
	$\Delta Wh \leq 0$ [1]	$\Delta Wh > 0$ [2]	$\Delta Wh \leq 0$ [3]	$\Delta Wh > 0$ [4]
Debt				
Any debt*	57.4	61.8	67.9	70.3
Mortgage debt*	21.8	28.8	26.9	35.3
Mortgage payments to income ratio (%)	3.6	5.4	5.2	5.2
Outstanding mortgage to house value ratio (%)	6.7	4.7	9.6	5.7
Years mortgage remaining	2.3	2.8	3.3	3.2
Liquidity constraints*	6.1	4.0	10.1	5.6
Credit constraints*	3.4	2.7	5.4	2.4
Variable interest rate*	14.8	22.0	20.7	27.4
Housing wealth				
$\%\Delta Wh$	−26.6	64.4	−31.8	77.0
Obs	379	404	81	144

Notes: Values obtained from the sample used to estimate Fig. 7. Variables with an asterisk (*) indicate the percentage share of observations in our sample. "Optimistic" ("Pessimistic") refers to households who (do not) expect their income to be higher in the future than at present. The mortgage payments to income ratio, outstanding mortgage to house value ratio, years mortgage remaining, and the growth rate of the house value ($\%\Delta Wh$) represent average values of each group. The mortgage payments to income ratio and the outstanding mortgage to house value ratio are shown as a percentage

Table A.14 MPC across the wealth distribution: pooled first-differences

	2002–2011		2002–2014	
	[1]	[2]	[3]	[4]
Δ(Net wealth/Income)^{Q1}	0.030*** (0.006)		0.023*** (0.003)	
Δ(Net wealth/Income)^{Q2}	0.017*** (0.003)		0.017*** (0.003)	
Δ(Net wealth/Income)^{Q3}	0.015*** (0.002)		0.016*** (0.002)	
Δ(Net wealth/Income)^{Q4}	0.010*** (0.001)		0.009*** (0.001)	
Δ(Net wealth/Income)^{Q5}	0.003*** (0.001)		0.003*** (0.000)	
Δ(Net financial wealth/Income)^{Q1}		0.028 (0.019)		0.019 (0.015)
Δ(Net financial wealth/Income)^{Q2}		0.004 (0.010)		0.006 (0.005)
Δ(Net financial wealth/Income)^{Q3}		0.009 (0.006)		0.012** (0.006)
Δ(Net financial wealth/Income)^{Q4}		0.012*** (0.004)		0.007** (0.003)
Δ(Net financial wealth/Income)^{Q5}		0.004*** (0.001)		0.004*** (0.001)
Δ(Net housing wealth/Income)^{Q1}		0.047*** (0.007)		0.047*** (0.006)
Δ(Net housing wealth/Income)^{Q2}		0.037*** (0.004)		0.035*** (0.003)
Δ(Net housing wealth/Income)^{Q3}		0.034*** (0.003)		0.035*** (0.003)
Δ(Net housing wealth/Income)^{Q4}		0.029*** (0.006)		0.030*** (0.005)
Δ(Net housing wealth/Income)^{Q5}		0.027*** (0.003)		0.024*** (0.002)
Δ(Net other wealth/Income)^{Q1}		0.008 (0.005)		0.007 (0.005)
Δ(Net other wealth/Income)^{Q2}		0.008* (0.004)		0.008** (0.004)
Δ(Net other wealth/Income)^{Q3}		0.005* (0.003)		0.005** (0.003)
Δ(Net other wealth/Income)^{Q4}		0.003 (0.002)		0.003* (0.002)
Δ(Net other wealth/Income)^{Q5}		0.001* (0.000)		0.002*** (0.000)
Households	2746	2746	3590	3590
R^2	0.266	0.347	0.281	0.356
RMSE	0.333	0.314	0.324	0.307
Sample FE	✓	✓	✓	✓
Controls	✓	✓	✓	✓

Notes: The dependent variable is Δ(Consumption/Income). Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. Wealth and consumption first-differences variables are winsorized at the 1st and 99th percentiles per pair of waves and imputation

7 Appendix B: Heterogeneities across the distribution of wealth

Carroll and Kimball (1996) show that under the presence of income uncertainty or borrowing constraints, the consumption function is concave with respect to wealth. In other words, the marginal propensity to consume decreases with net wealth.

In order to study the MPC across the distribution of wealth, we first assign each household to a wealth quintile. Given the longitudinal nature of the data, however, households could potentially move across the distribution during the period of analysis, raising potential endogeneity issues. We alleviate this concern by considering a time-invariant measure of households' wealth, fixing households' position in the distribution for the whole period. One option would be to distribute households in quintiles using wealth at the beginning of the period, the main advantage being for the explanatory variable to be predetermined. However, given the large variation in asset prices witnessed during the last business cycle, the position assigned to

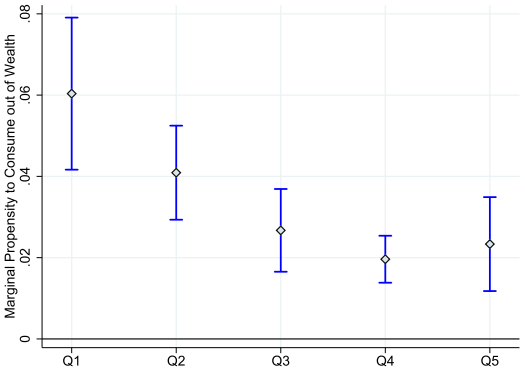

Fig. B1 MPC out of net housing wealth: homeowners sample. *Notes:* Marginal propensity to consume out of net housing wealth by quintile. Results are obtained from equation (B.1) once net total wealth is divided in three components: financial, housing and other real wealth. Table B.1 (Regression B) shows more information on the regression. Blue lines represent 90% confidence intervals

households would likely suffer of significant measurement error. As a halfway solution, we determine households' positions across the wealth distribution using their average net wealth during the whole period.[48]

Empirically, we estimate:[49]

$$\frac{C_{h,t}}{Y_{h,t}} = \theta_0 + \sum_{j=1}^{5} \theta_1^j \frac{W_{h,t}}{Y_{h,t}} * I_h^j + \theta_2 \boldsymbol{X_{h,t}} + Q^j * \phi_t + \mu_h + \varepsilon_{h,t}, \qquad (B.1)$$

where I_h^j is an index function indicating that household h belongs to the j wealth group and θ_1^j is the MPC for the j wealth group.

Table B.1 shows the results, using the homeowners sample, for two specifications, the first considering the total net wealth (Regression A) and the second estimating the MPC out of the three wealth components (Regression B).[50]

From Regression A, it emerges a clear descending pattern of the MPC out of total net wealth across the distribution of wealth. Households in the bottom quintile increase their consumption by 5.5 cents for each additional euro of net wealth, more than 9-folds the response observed for households in the top quintile, which only increase their consumption by 0.6 cents. Interestingly, all coefficients but the one for the top quintile are larger than the MPC obtained in the fifth column of Table 2. The median quintile displays a MPC out of wealth of 1.7 cents, 70% larger than the average MPC obtained in column [5] of Table 2, confirming the already commented skewness of the wealth distribution.[51]

[48] Although this solution is far from being ideal, it alleviates two main concerns: (i) endogeneity problems arising from households moving across the distribution during our sample period and (ii) a classification that is not representative of households' wealth during most of the period under analysis.

[49] For the sake of simplicity, we exclude the dummy interaction term from our terminology. In order to include all constitutive terms, we also include an interaction term between quintile categorical variables and the presence of outliers.

[50] Table B.2 shows that the results from our baseline sample are very similar.

[51] The net wealth weighted average MPC is 0.012, very close to the average MPC obtained in Table 2.

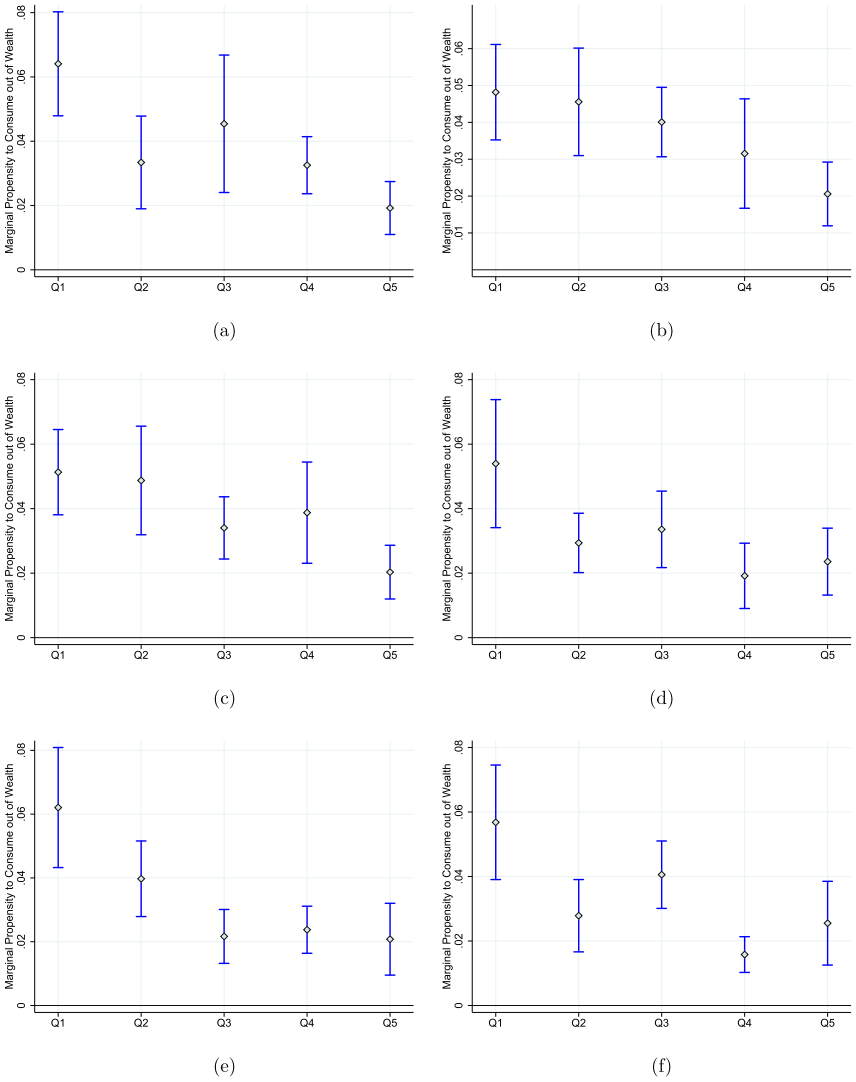

Fig. B2 MPC out of housing wealth: alternative wealth quintiles definitions. **a** Net wealth/Income. **b** Gross wealth/Income. **c** Net real wealth/Income. **d** Net financial wealth/Income. **e** Net real wealth. **f** Net financial wealth. *Source:* Marginal propensity to consume out of net housing wealth by quintile. Results are obtained from equation (B.1) using the homeowners sample once net total wealth is divided in three components: financial, housing and other real wealth. Households are distributed across wealth quintiles using: net wealth/income (**a**), gross wealth/income (**b**), net real wealth/income (**c**), net financial wealth/income (**d**), net real wealth (**e**), net financial wealth (**f**). Blue lines represent 90% confidence intervals

In Section 4.1, we have documented heterogeneous effects in the MPC depending on the characteristics of households' assets. While changes in the value of the primary residence were the key driver of households' consumption, we did not find any statistically significant effect of financial or "other real wealth" on consumption. It is worth mentioning that these two kind of assets are tipically owned by households in the upper part of the wealth distribution (Fig. 3). As such, the lack of a relationship might be due to

Table B.1 MPC across the wealth distribution: homeowners sample

	Q1	Q2	Q3	Q4	Q5		
Regression A: Total net wealth							
						Households	336
Net wealth/Income	0.055*** (0.010)	0.038*** (0.005)	0.017*** (0.003)	0.015*** (0.002)	0.006*** (0.001)	Obs	1344
						R^2	0.687
						RMSE	0.249
Regression B: Net wealth components							
Net financial wealth/Income	0.056** (0.022)	−0.017 (0.025)	0.005 (0.008)	0.012*** (0.005)	0.005 (0.005)		
						Households	336
Net housing wealth/Income	0.060*** (0.011)	0.041*** (0.007)	0.027*** (0.006)	0.020*** (0.004)	0.023*** (0.007)	Obs	1344
						R^2	0.771
Net other wealth/Income	0.016 (0.018)	0.040*** (0.009)	0.012*** (0.004)	0.015*** (0.003)	0.001 (0.002)	RMSE	0.213

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Both regressions include: household fixed effects, quintile-specific time fixed effects and the full set of control variables (Table A.2). RMSE presents the root mean squared error. The percentage share of outlier observations in the regressions is 6.76

Table B.2 MPC across the wealth distribution: baseline sample

	Q1	Q2	Q3	Q4	Q5		
Regression A: Total net wealth							
						Households	415
Net wealth/Income	0.062*** (0.011)	0.038*** (0.005)	0.017*** (0.003)	0.015*** (0.003)	0.005*** (0.001)	Obs	1660
						R^2	0.589
						RMSE	0.285
Regression B: Net wealth components							
Net financial wealth/Income	0.079*** (0.025)	0.016 (0.023)	0.014* (0.007)	0.010* (0.005)	0.005 (0.007)		
						Households	415
Net housing wealth/Income	0.068*** (0.013)	0.036*** (0.006)	0.030*** (0.006)	0.019*** (0.003)	0.023*** (0.006)	Obs	1660
						R^2	0.671
Net other wealth/Income	0.008 (0.017)	0.043*** (0.008)	0.011*** (0.004)	0.014*** (0.003)	0.002 (0.001)	RMSE	0.255

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Both regressions include: household fixed effects, quintile-specific time fixed effects and the full set of control variables (Table A.2). RMSE presents the root mean squared error. The percentage share of outlier observations in the regressions is 9.06

the fact that more affluent households respond less to changes in wealth, rather than to the nature of the asset considered. Regression B shows that an extra euro of financial wealth is associated with increases in consumption of 5.6 cents in the bottom quintile. For the rest of the distribution, the point estimate is only significantly different from zero in the fourth quintile, with a MPC of 1.2 cents. When focusing on "other real wealth", the pattern is slightly different: We find significant effect in the central part of the distribution (Q2, Q3, and Q4), but coefficients are non-significant at the extremes. Unfortunately, the MPC in the central part of the distribution does not follow any specific pattern, making it harder to interpret the results.[52]

[52] We need to keep in mind that these assets are potentially suffering from the bias arising from households' saving decisions. If wealthier households, as it is reasonable to assume, trade more often these assets, they would be more exposed to this bias, and hence we need to consider these estimates as a lower bound where very little can be said about the pattern across the distribution of wealth.

More interesting, however, is the MPC out of housing wealth. Figure B1 graphically shows the estimates where a clear decreasing MPC across the distribution of wealth is observed. Households in the bottom quintile display a MPC equal to 6 cents that progressively decreases across the wealth distribution ($MPC_{Q2} = 4.1$ and $MPC_{Q3} = 2.7$) to stabilize at the top two quintiles (Q4 and Q5) at around 2 cents, confirming our previous results about the concavity of the consumption function obtained from the net total wealth.[53]

All in all, our results show that: (i) the MPC out of total wealth decreases across Table B.1 the wealth distribution, (ii) housing wealth follows the same pattern as the MPC out of total wealth, and (iii) financial and "other real assets" have a significant effect on some parts of the distribution, but their patterns are much less clear Table B.2.

8 Appendix C: sample survey weights

Along with the EFF database, the Bank of Spain publishes sample survey weights in order to account for the unequal probability of a household being selected into the sample given to: (i) oversampling of the wealthy, (ii) geographical stratification, and (iii) different non-response rates. While the use of weights is needed if the target of the analysis is to obtain descriptive statistics that accurately represent the population, their inclusion in the case of a regression analysis is more controversial (Solon, Haider and Wooldridge, 2015). Cameron and Trivedi (2005) explain that, when the sample stratification is not based on the values of the dependent variable, "if one takes a structural or analytical approach and assumes that the model of $E[y|x]$ is correctly specified, there is no need to use sample weights." (Cameron and Trivedi, 2005, p.820). In other words, if our model is correctly specified, the coefficients of the regressions including sample weights should be similar to the ones presented in the main text.

Tables C.1–C.9 show the results. Reassuringly, estimates are robust and very close to the ones presented above. Specifically, households increase their consumption by 1 cent out of 1 additional euro of wealth, and this result is mainly driven by housing wealth. In the homeowners sample, the MPC out of housing wealth is 3.4 cents, 0.5 cents larger than the unweighted counterpart. Focusing on the MPC across the distribution of wealth, Table C.2 shows that the decreasing pattern uncovered previously is not affected by the inclusion of weights. The MPC out of housing wealth is 5.7 cents in the bottom quintile and steadily decreases to 2.3 cents in the top 20% of the wealth distribution. Tables C.3–C.9 confirm that all our results are robust to the inclusion of survey weights, suggesting that the concerns on sample selection bias are of second order.

[53] Figure B2 shows that our results are robust to the use of alternative wealth measures to distribute households across quintiles.

Table C.1 MPC out of wealth: baseline results (weighted)

	Block A: Baseline sample			Block B: Homeowners sample		
	[1]	[2]	[3]	[4]	[5]	[6]
Gross wealth/Income	0.010*** (0.002)			0.010*** (0.003)		
Net wealth/Income		0.010*** (0.003)			0.010*** (0.003)	
Net financial wealth/Income			0.011** (0.005)			0.009 (0.006)
Net housing wealth/Income			0.038*** (0.005)			0.034*** (0.005)
Net other wealth/Income			0.003 (0.002)			0.003 (0.003)
Households	415	415	415	336	336	336
Obs	1660	1660	1660	1344	1344	1344
R^2	0.535	0.526	0.616	0.682	0.671	0.736
RMSE	0.313	0.316	0.284	0.259	0.263	0.236
% Outliers	9.06	9.06	9.06	6.76	6.76	6.76
Household FE	✓	✓	✓	✓	✓	✓
Quintile * Wave FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table C.2 MPC across the wealth distribution: homeowners sample (weighted)

	Q1	Q2	Q3	Q4	Q5		
Regression A: Total net wealth							
						Households	336
Net wealth/Income	0.052*** (0.010)	0.038*** (0.005)	0.018*** (0.003)	0.017*** (0.002)	0.005*** (0.001)	Obs	1344
						R^2	0.763
						RMSE	0.223
Regression B: Net wealth components							
Net financial wealth/Income	0.054** (0.022)	−0.020 (0.028)	0.011 (0.008)	0.010 (0.008)	0.003 (0.006)		
						Households	336
Net housing wealth/Income	0.057*** (0.012)	0.043*** (0.007)	0.028*** (0.007)	0.022*** (0.004)	0.023*** (0.008)	Obs	1344
						R^2	0.793
Net other wealth/Income	0.021 (0.017)	0.040*** (0.009)	0.014*** (0.004)	0.017*** (0.003)	0.000 (0.002)	RMSE	0.209

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Both regressions include: household fixed effects, quintile-specific time fixed effects and the full set of control variables (Table A.2). RMSE presents the root mean squared error. The percentage share of outlier observations in the regressions is 6.76

Table C.3 MPC out of net housing wealth: sign asymmetries I (weighted)

	Benchmark [1]	Growth rates [2]
Net financial wealth/Income	0.012* (0.006)	−0.000 (0.000)
Net housing wealth/Income^{-}	0.060*** (0.008)	1.003*** (0.096)
Net housing wealth/Income^{+}	0.038*** (0.005)	0.309*** (0.097)
Net other wealth/Income	−0.000 (0.002)	0.000 (0.000)
Households	336	336
Obs	1008	1008
R^2	0.796	0.261
RMSE	0.226	0.845
% Outliers	9.01	–
Quintile*Wave FE	✓	✓
Households FE	✓	✗
Controls	✓	✓
$\frac{C^-}{Y}$		0.481
$\frac{C^+}{Y}$		0.527
$\frac{W_h{}^-}{Y}$		5.17
$\frac{W_h{}^+}{Y}$		7.39
MPC^-		0.093
MPC^+		0.022

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression. Wealth and consumption variables in the growth rate regression are winsorized at the 1st and 99th percentiles per year and imputation

Table C.4 MPC out of net housing wealth: sign asymmetries II (weighted)

	Benchmark [1]	Growth rates [2]
Net financial wealth/Income	0.010 (0.006)	−0.000 (0.000)
Net housing wealth/Income$^{-}_{Q<50}$	0.071*** (0.010)	1.027*** (0.156)
Net housing wealth/Income$^{+}_{Q<50}$	0.049*** (0.007)	0.232*** (0.076)
Net housing wealth/Income$^{-}_{Q>50}$	0.038*** (0.009)	0.971*** (0.091)
Net housing wealth/Income$^{+}_{Q>50}$	0.024*** (0.005)	0.416** (0.171)
Net other wealth/Income	0.002 (0.002)	−0.000 (0.000)
Households	336	336
Obs	1008	1008
R^2	0.810	0.271
RMSE	0.218	0.839
% Outliers	9.01	-
Quintile*Wave FE	✓	✓
Households FE	✓	✗
Controls	✓	✓
$MPC^{-}_{Q<50}$		0.110
$MPC^{+}_{Q<50}$		0.019
$MPC^{-}_{Q>50}$		0.068
$MPC^{+}_{Q>50}$		0.023

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression. Wealth and consumption variables in the growth rate regression are winsorized at the 1st and 99th percentiles per year and imputation

Table C.5 MPC out of net housing wealth: magnitude asymmetries (weighted)

	Benchmark	Growth rates
	[1]	[2]
Net financial wealth/Income	0.003 (0.004)	0.000 (0.000)
Net housing wealth/Income$_1$	0.070*** (0.010)	0.927*** (0.130)
Net housing wealth/Income$_2$	0.053*** (0.008)	0.919*** (0.136)
Net housing wealth/Income$_3$	0.060*** (0.010)	0.674*** (0.176)
Net housing wealth/Income$_4$	0.042*** (0.006)	0.494*** (0.109)
Net housing wealth/Income$_5$	0.032*** (0.006)	0.137* (0.076)
Net other wealth/Income	−0.001 (0.002)	−0.000 (0.000)
Households	336	336
Obs	1008	1008
R^2	0.829	0.297
RMSE	0.207	0.824
% Outliers	9.01	-
Quintile*Wave FE	✓	✓
Households FE	✓	✗
Controls	✓	✓
MPC_1		0.102
MPC_2		0.073
MPC_3		0.052
MPC_4		0.037
MPC_5		0.009

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression. Wealth and consumption variables in the growth rate regression are winsorized at the 1st and 99th percentiles per year and imputation

Table C.6 MPC out of net housing wealth: income expectations (weighted)

	[1]	[2]	[3]	[4]	[5]	[6]
Net financial wealth/Income	0.003 (0.004)	0.003 (0.004)	0.002 (0.005)	0.009 (0.006)	0.008 (0.006)	0.010* (0.005)
Net housing wealth/Income	0.024*** (0.004)	0.024*** (0.004)	0.026*** (0.005)	0.034*** (0.005)	0.032*** (0.005)	
Net other wealth/Income	0.005* (0.003)	0.005* (0.003)	0.005* (0.003)	0.003 (0.003)	0.003 (0.003)	0.006** (0.003)
$E(Income)^H$		−0.005 (0.018)	−0.004 (0.018)	0.004 (0.018)	−0.053 (0.033)	−0.070* (0.042)
$E(Income)^H$ *Net housing wealth/Income					0.010* (0.005)	
Net housing wealth/Income$_{Q<50}$						0.046*** (0.007)
$E(Income)^H$*Net housing wealth/Income$_{Q<50}$						0.016** (0.008)
Net housing wealth/Income$_{Q>50}$						0.013*** (0.004)
$E(Income)^H$*Net housing wealth/Income$_{Q>50}$						0.006 (0.006)
Households	336	336	336	336	336	336
Obs	1344	1344	1344	1344	1344	1344
R^2	0.662	0.662	0.665	0.736	0.737	0.737
RMSE	0.267	0.267	0.266	0.236	0.235	0.235
% Outliers	6.76	6.76	6.76	6.76	6.76	6.76
Quintile*Wave FE	✗	✗	✗	✓	✓	✓
Wave FE	✗	✗	✓	✗	✗	✗
Households FE	✗	✗	✗	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table C.7 MPC out of net housing wealth: income expectations and sign asymmetries (weighted)

	[1]
Net financial wealth/Income	0.010 (0.006)
Net housing wealth/Incomee^{-}_{NHEI}	0.063*** (0.008)
Net housing wealth/Incomee^{+}_{NHEI}	0.035*** (0.006)
Net housing wealth/Income$^{-}_{HEI}$	0.047*** (0.008)
Net housing wealth/Income$^{+}_{HEI}$	0.049*** (0.005)
Net other wealth/Income	0.001 (0.002)
Households	336
Obs	1008
R^2	0.798
RMSE	0.225
% Outliers	9.01
Quintile*Wave FE	✓
Households FE	✓
Controls	✓

Notes: The dependent variable is the ratio of non-durable consumption to non-asset income. Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. % Outliers shows the percentage share of outlier observations in the regression

Table C.8 MPC out of wealth: pooled first-differences (weighted)

	Block A: 2002-2011			Block B: 2002-2014		
	[1]	[2]	[3]	[4]	[5]	[6]
Δ(Gross wealth/Income)	0.012*** (0.001)			0.012*** (0.001)		
Δ(Net wealth/Income)		0.012*** (0.001)			0.012*** (0.001)	
Δ(Net financial wealth/Income)			0.005 (0.003)			0.006** (0.003)
Δ(Net housing wealth/Income)			0.036*** (0.003)			0.037*** (0.002)
Δ(Net other wealth/Income)			0.004*** (0.001)			0.003*** (0.001)
Households	2746	2746	2746	3590	3590	3590
R^2	0.258	0.240	0.338	0.263	0.242	0.331
RMSE	0.323	0.327	0.305	0.309	0.313	0.294
Sample FE	✓	✓	✓	✓	✓	✓
Quintile FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is Δ(Consumption/Income). Standard errors in parentheses account for multiple imputations and complex survey design. * significant at 10%; ** significant at 5%; *** significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. Wealth and consumption first-differences variables are winsorized at the 1st and 99th percentiles per pair of waves and imputation

Table C.9 MPC across the wealth distribution: pooled first-differences (weighted)

	2002–2011		2002–2014	
	[1]	[2]	[3]	[4]
Δ(Net wealth/Income)^{Q1}	0.037*** (0.005)		0.028*** (0.004)	
Δ(Net wealth/Income)^{Q2}	0.020*** (0.003)		0.020*** (0.002)	
Δ(Net wealth/Income)^{Q3}	0.016*** (0.003)		0.017*** (0.003)	
Δ(Net wealth/Income)^{Q4}	0.012*** (0.002)		0.012*** (0.002)	
Δ(Net wealth/Income)^{Q5}	0.005*** (0.001)		0.005*** (0.001)	
Δ(Net financial wealth/Income)^{Q1}		0.036** (0.015)		0.015 (0.011)
Δ(Net financial wealth/Income)^{Q2}		0.016 (0.011)		0.012** (0.005)
Δ(Net financial wealth/Income)^{Q3}		0.007 (0.007)		0.011* (0.006)
Δ(Net financial wealth/Income)^{Q4}		0.009 (0.006)		0.009* (0.005)
Δ(Net financial wealth/Income)^{Q5}		0.002 (0.005)		0.001 (0.004)
Δ(Net housing wealth/Income)^{Q1}		0.050*** (0.007)		0.046*** (0.006)
Δ(Net housing wealth/Income)^{Q2}		0.036*** (0.004)		0.035*** (0.004)
Δ(Net housing wealth/Income)^{Q3}		0.040*** (0.004)		0.041*** (0.004)
Δ(Net housing wealth/Income)^{Q4}		0.028*** (0.005)		0.030*** (0.005)
Δ(Net housing wealth/Income)^{Q5}		0.021*** (0.007)		0.020*** (0.006)
Δ(Net other wealth/Income)^{Q1}		0.010 (0.006)		0.008 (0.006)
Δ(Net other wealth/Income)^{Q2}		0.013* (0.007)		0.012* (0.006)
Δ(Net other wealth/Income)^{Q3}		0.004 (0.003)		0.003 (0.003)
Δ(Net other wealth/Income)^{Q4}		0.007** (0.003)		0.005* (0.003)
Δ(Net other wealth/Income)^{Q5}		0.003** (0.001)		0.003*** (0.001)
Households	2746	2746	3590	3590
R^2	0.307	0.356	0.301	0.355
RMSE	0.312	0.300	0.301	0.289
Sample FE	✓	✓	✓	✓
Controls	✓	✓	✓	✓

Notes: The dependent variable is Δ(Consumption/Income). Standard errors in parentheses account for multiple imputations and complex survey design. *significant at 10%; **significant at 5%; ***significant at 1%. Table A.2 in Appendix A displays the complete list of controls included in every regression. RMSE presents the root mean squared error. Wealth and consumption first-differences variables are winsorized at the 1st and 99th percentiles per pair of waves and imputation

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