Housing Value and Consumption in Europe: Micro-Findings from Post-Financial Crisis Data

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Housing Value and Consumption in Europe: Micro-Findings from Post-Financial Crisis Data

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ABSTRACT

Additional housing equity collateral can loosen borrowing constraints and increase spending for households that value their home highly. However, rising home values also raise the cost of living via higher imputed rental costs, offsetting their impact on consumption. Usage of Household Finance and Consumption Survey microdata and third-party evaluation of housing value enable identification of the causal effect of house price changes on consumer spending. This paper is one of the first that explores this relationship European-wide with an application of an instrumental variable technique. The paper identifies heterogeneities among different households based on their housing status. A $1 increase in home values leads to a $0.127 increase in spending for homeowners overall, and $0.185 for homeowners with mortgages specifically. Results reflect large responses among credit-constrained households, suggesting borrowing constraints as one of the key drivers of the MPC out of housing wealth.

JEL Classification: E21, G51, O18.

Keywords: Housing Wealth, House Prices, Household Consumption.

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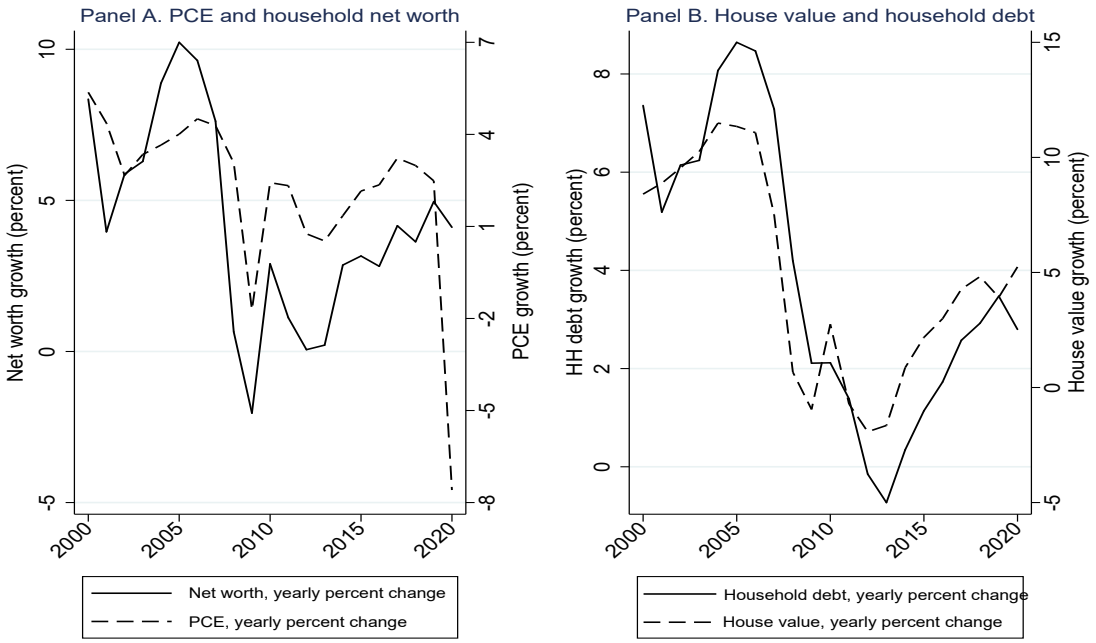
1. INTRODUCTION

The recent global financial crisis re-emphasizes the important effects coming from the demand side, household balance and particularly housing, as essential determinants of the consumption and business cycles. Moreover, it has drawn attention to the question of the effect of house prices on household spending, and what drives this relationship. From the theoretical point of view, the relationship between house prices and household expenditure remains unclear. In a permanent income model with infinitely-lived households, house prices do not play a role and do not affect consumption, as the positive endowment effect of higher current wealth is offset by the negative effect from a higher cost of living in the future (Buiter, 2008). In contrast, in a life-cycle model, homeowners who are likely to sell housing in the future have positive wealth effects as rising home values increase their current wealth by more than their expected cost of living (Sinai and Souleles, 2005). Furthermore, in a model with collateralized lending, an increase in house prices can have substantial effects on consumption. Higher home values directly loosen borrowing constraints by raising borrowing capacity. Moreover, households near the borrowing constraint are more impatient and have higher effective discount rates, causing them to react more sharply to the positive endowment effect of higher current home values relative to the negative income effect of a higher cost of living in the future (Berger et al., 2018). This shows that no clear relationship can be found from the theoretical point of view and even more, from the empirical one. Therefore, by using a detailed post-financial crisis micro-level dataset linking household spending, wealth, income and house prices, this paper attempts to empirically identify the marginal propensity to consume (MPC) out of housing wealth and discusses some possible mechanisms through which home values affect household expenditure.

Figure 1: House Values, Spending and Household Balance Sheets in Euro Area



Notes: : Panel A shows co-movements between personal consumption expenditures and household net worth. Panel B shows similar co-movement between housing net wealth and loans to the household sector. *Sources:* National accounts, Main aggregates (Statistic Data Warehouse, ECB).

This paper is related to a broader theoretical literature studying the effects of housing wealth on aggregate spending, especially in the presence of collateralized lending. Barro (1976),Stiglitz and Weiss (1981), and Hart and Moore (1994) show that when borrowers are unable to commit to repayment, they can post collateral as insurance against default. Recent work by Berger et al. (2018) shows the channels through

which the presence of collateralized lending amplifies the impact of housing wealth on consumption. In part, the larger consumption response in a model with collateralized lending reflects the direct effect of collateral constraints: higher house prices allow households at the constraint to borrow more. In addition, households near the constraint have higher effective discount factors, causing them to respond more sharply to the additional endowment of wealth today than the increase in the cost of living in the future. As I show in this paper, a combination of the direct collateral effect and the larger endowment effect causes MPCs among households that are more likely to face borrowing constraints to be much higher, suggesting that aggregate effects are more in line with those in a model including collateralized lending.

LITERATURE

Housing markets are often taken as a natural laboratory for studying how wealth and collateral affect consumption. To support this following Aladangady (2017), two main stylized facts are presented graphically. First, housing wealth is the largest part of household net worth, which moves closely with spending, as shown in panel A of Figure 1. As of 2019, the results from the Household Finance and Consumption Survey in Europe reported that household real estate wealth accounted for more than 50 percent of a household's net worth. More importantly, this statistic is more pivotal for younger households and those with less total wealth, as they often hold smaller amounts of financial wealth (Flavin and Yamashita, 2002; Network, 2020). Second, housing is one of the most commonly used sources of collateral available to households. Rising home values can loosen borrowing constraints for households near the collateral limit, allowing credit-constrained households to borrow against their homes in order to increase consumption (Aladangady, 2017). As seen in the right panel of Figure 1, rising home values in Europe are associated with increases in household debt. This relationship was crucial during the recent financial crisis, when substantial aggregate consumption losses during that time were related to the credit liberalization and expansion as well as overestimated expectations about house prices (Piazzesi and Schneider, 2016; Guerrieri and Uhlig, 2016).

Yet, disentangling causality from co-movements in the aggregate time series presented in Figure 1 is complicated and restricted by different endogeneity concerns. For example, household expectation about economic prospects is the common factor which played a pivotal role during the recent financial crisis and may jointly drive consumption and house prices at the same time. On the other hand, demographic trends or shifts in relative preferences for housing services may result in negative co-movement by capturing an increase in overall consumption, but also a drop in housing prices. Such unobserved common factors make aggregate time-series correlations or even OLS regressions in microdata difficult to estimate and interpret.

This paper joins a vast literature attempting to identify the causal relationship between housing wealth and value, consumption, and savings behavior. A number of researchers (Ludwig and Sløk, 2004; Case, Quigley and Shiller, 2005; Carroll, Otsuka and Slacalek, 2011), to mention a few, have found strong relationships between consumption and housing wealth in aggregate data, while the true nature of these relationships may be complicated by a variety of factors. For example, Attanasio and Weber (1994) argue that common factors such as income expectations may drive both housing and consumption demand. Similarly, in more recent work using microdata from the United Kingdom, Attanasio et al. (2009) finds a strong relationship between rising home values and spending of renters, evidence that common factors drive housing demand along with consumption of both owners and renters. In a related paper, Campbell and Cocco (2007) use a synthetic panel approach to show that older homeowners have larger responses to changes in housing wealth relative to younger cohorts. They also show that predictable changes in national house prices drive predictable changes in consumption, evidence that rising collateral values may loosen borrowing constraints. However, they find this result for both renters and owners, suggesting that a common factor such as financial liberalization may be driving both spending and house prices. Using third-party evaluation on housing as an instrument to estimate the robust and causal house price effect, this paper extends the existing literature

by controlling better for common factors in order to identify the causal effect of house value on household spending.

Some other recent studies have used similar identification strategies to study the link between home equity, debt, and spending. Mian and Sufi (2011) use regional household credit data to show that households extracted and spent as much as $0.25 per dollar of home equity growth during the mid-2000s. While these results are suggestive of large consumption responses, households may use extracted equity to save or pay down other more expensive forms of debt, muting consumption responses. Other studies have attempted to address this issue by using regional data on automotive loans, car registrations, and credit card transactions as proxies for local spending in the United States (Kermani, 2012; Mian, Rao and Sufi, 2013). These studies find MPCs that range from 0.05 to 0.07, which is lower than the range estimated in this paper.

There are also some studies that analyze MPC in Europe using the same dataset of the Household Finance and Consumption Survey. Most of the findings remain valid across different papers, while the real effects of MPC out of housing in Europe and empirical strategies differ significantly. In their paper, Arrondel, Lamarche and Savignac (2015) found a lower MPC out of housing than the one in this paper. They focus their study on France and limit their analysis only to the first wave of HFCS results. However, their conclusions remain the same, showing a higher MPC out of financial wealth in comparison to housing wealth, whereas MPC out of housing wealth identifies clear heterogeneities across income and wealth distributions. Another analysis of MPC in Europe comes from Jørgensen and Kuchler (2017), where they use nonparametric methods to estimate MPC out of income in Denmark. By using a slightly different time period, from 2005 to 2013, the authors found significantly higher MPC out of income results than most other analyses. The results of Jørgensen and Kuchler (2017) also remained heterogeneous across households as in other similar analyses of MPC. Therefore, I take this conclusion and incorporate income-based household heterogeneities into my estimations as well. A recent study by Garbinti et al. (2020) analyzes MPC out of wealth across different European countries by using a similar estimation technique, the instrumental variable approach, as I do in my paper. Their MPC effect tends to be about twice lower than in my case, but significant differences between the papers come from the fact that Garbinti et al. (2020) concentrate their analysis on a separate country basis and on a smaller time period, between 2010 and 2014. However, heterogeneities of MPC effects between different household groups remain the clear pattern across most of the papers in this literature.

While the administrative regional datasets used in those studies contain significantly larger samples, the household-level data used in this study offers some advantages that supplement the existing results in the literature. First, as discussed above, household-level data allows me to compare households that vary in ownership status and exposure to borrowing constraints in order to better understand the mechanisms driving the relationship between housing wealth and spending. While regional administrative datasets offer a rich source of data, the ability to compare across household types is limited. Secondly, while administrative data sources have lower reporting errors than surveys, they are not always designed to capture a complete picture of household spending. For example, auto registrations must be mapped to spending using assumptions about unit values and nominal shares of auto spending across regions. Similarly, credit card utilization is more cyclical than actual spending and may differ in areas with tighter borrowing constraints. Additionally, most administrative datasets offer a limited time series, leading much of the literature to identify wealth effects using only a cross-sectional variation in house price growth generated by the housing boom and bust periods during the 2000s. To complement the existing literature, Aladangady (2017) used a longer time-series, starting in 1986, to show a stable relationship between consumption and housing wealth over time. Therefore, with this paper I contribute to the literature by analyzing only the post-financial crisis period and household level changes that occurred between 2010 and 2017. In this case, housing boom and bust periods are excluded to keep the focus on the questions of what households learned during this

crisis, and whether or not housing wealth importance continued to describe household behavior. Finally, differences in the specific instruments and sample used in this study may also help explain why resulting MPC estimates are slightly higher than those found by Mian, Rao and Sufi (2013) or Aladangady (2017), using data from the United States.

The rest of this paper is structured in the following manner. Section II discusses the various datasets used in this study, including the HFCS, and an additional third-party housing valuation to create the instrumental variable. Section II also discusses empirical strategy and identifying assumptions that provide estimates of the MPC out of housing wealth. Section III discusses the main results and explores alternate mechanisms that may be driving the relationship between housing and consumption. Section IV concludes.

2. DATA AND EMPIRICAL FRAMEWORK

DATA

The *Household Finance and Consumption Survey* (HFCS). HFCS consists of a rotating panel of households, interviewed every three to four years. HFCS uses the household as the unit of observation, defined as a financially interdependent group of people living in the same home and making joint expenditure decisions. In reality, a home may contain different members of the household who make independent spending decisions on housing, food, and living expenses, though such occurrences are relatively rare and not included in the data. Currently, data from three HFCS waves is available to analyze and contains fragmented information from 2010, 2014 and 2017. In the first wave of HFCS, 15 countries participated, combining total responses from 68 627 households. In the next two waves, the number of countries and households increased slightly. The HFCS wave in 2014 included 20 countries and 84 611 households, while the latest HFCS wave from 2017 provides information about 21 country and 84 829 households. However, the core of this analysis is the panel component, thus limiting the pool of countries to those who provide the panel component. Therefore, the final sample shrinks to 13 countries and approximately 50 000 - 55 000 households in every HFCS wave. Finally, all the information on the household balance sheet, spending, income and wealth is in yearly measures (i.e. yearly expenditures, yearly income) and deflated by CPI. Table 1 provides summary statistics on the sample used.

HFCS data provides information about house values that are self-reported by the households. Additionally, yearly income values are adjusted to approximate taxation in different countries in order to get after-tax values. Finally, consumption measure is constructed using respondents' information about their monthly spending on food. To complete the picture, total expenditures are estimated by using additional information from the Household Budget Survey on the shares of food at home and outside expenditure by income quintiles. Detailed household-specific information (i.e. age, education, marital status, number of persons in household) is also available from HFCS data to analyze and control for side effects. The cross-section part of the data remains important to understand, as two different country pools are used in the the analysis. Generally, the analysis is focused on the 13 countries which provide the panel household component between different survey waves. The country pool includes Belgium, Cyprus, Germany, Estonia, Spain, Finland, France, Italy, Latvia, Malta, Netherlands, Poland and Slovakia. However, the instrumental variable part is limited to 6 countries (Belgium, Cyprus, Estonia, Italy, Latvia and Malta) due to the special information that is necessary for the estimation but is held confidential by most of the countries.[2] The variability and representation that comes with this subgroup of 6 countries is summarized in Appendix 8, as it shows the percentage of homeowners in these countries and other household characteristics. Lastly, all the estimations

[2]These 6 countries are analyzed due to availability of information that is publicly unavailable but was kindly provided by the national institutions of particular countries. Other European countries are excluded from analysis because of issues with panel dimension or too strict restrictions on providing publicly unavailable data.

clearly highlight which pool of countries is particularly used and robustness checks are run to show results being independent from the country selection.

Table 1: Household Finance and Consumption Survey Summary Statistics

	Panel countries	Panel countries (with IV variables)
After-tax income (annual)	37454.03	27628
Total expenditures (annual)	34250.42	29231.7
Home value (if owner)		
Self-reported	238066.1	218025.1
Percentage owners	52.48	58.27
Percentage owners w/mortgage	74.82	74.28
Age	56.15	57.43
Family size	2.48	2.53
Number of countries	13	6
Observations	79,363	28,157

All values are reported in 2015:I euros.

Table 1 shows that the average after-tax income was 37 454.03 EUR among the panel set of 13 European countries. At the same time, average total expenditures reached the average value of 34 250.42 EUR. However, values remain lower if we are looking only at the pool of 6 countries that are used for IV estimation. The average after-tax income was 27 628 EUR among these countries, while the total expenditures reached as high as 29 231.7 EUR on average and exceeded the average income. It is possible that this signifies an increase in values of household consumption loans, to compensate for exceeding consumption. On the other hand, it is hard to draw such a conclusion due to a higher standard deviation for income than expenditures that is also captured in the data. Taking standard deviations into consideration, household annual income and expenditures stand on a similar level, but leave very little space for savings on average. Calculations of the after-tax income can also slightly affect the precision of the income measure and create this unbalance with the value of average expenditures. Additionally, Table 1 indicates that the average house value between 2010 and 2017 was slightly higher than 238 000 EUR among the 13 panel countries and around 218 000 EUR if we consider only the pool of 6 countries that are used for IV estimation. Moreover, 52 to 58 percent of households tend to be owners without any mortgage, depending on the pool of countries, but the proportion of home owners reaches close to 75 percent in both situations if owners with mortgages are included. On top of these numbers, the following paragraphs provide a more detailed view of each segment - household *income*, *spending* and *housing wealth*.

Household Income. The household income measure is built from self-reported household information delivered in HFCS. It covers information about income from employment, self-employment, renting or financial investment, as well as from pensions, regular social and private transfers. Moreover, the sum of all household income is deflated by CPI and adjusted for the taxing system used in each country. Income tax is adjusted by using experimental statistics from Eurostat on distribution of direct and indirect taxes paid by households as a percentage of their gross income by income quintile. Using this measure allows me to use different income tax rates not only between countries but also within them, by using income quintiles. Finally, income changes for the same household between different survey waves is used for the final estimation to capture income effect on consumption. Results in Appendix 9 provide an additional picture of household income dynamics over the analyzing period between 2010 and 2017. They show that in both pools of countries (either 13 panel or 6 IV estimation countries), after-tax income increased more than household expenditures or housing values. However, some heterogeneities are also identified from Appendix 10, where results show some countries with significant increases in income during the period, while

others even faced some decrease in household after tax income.

Household Spending. The household spending measure is estimated from the self-reported household members' information given in HFCS. Every new wave of HFCS includes additional consumption questions, giving a better overall understanding of spending. However, to remain consistent throughout all three survey waves, I stick with the information that is provided since the first wave of HFCS. Therefore, total household consumption is estimated by using information about values of spending on food and drinks at home and adjusting it for the share of the consumption basket that is related to food and beverages by income quintiles[3]. With this exercise, I account for income-based differences, as a poorer household usually spends a higher share of its income on food than a richer one, and estimate total household spending based on information about food and beverage consumption at home. Like household income, spending is also deflated by CPI. Therefore, changes in total household consumption are captured for the panel households between different waves and only these households are used for the final estimation. From Appendix 9, we can see that household expenditures were increasing in the period between 2010 and 2017, but at a lower pace than the average income. Finally, Appendix 10 also shows heterogeneous household spending among different countries. There were countries like Cyprus that were strongly affected by the recent financial crisis and their household spending was slow to recover. However, a majority of the other countries faced an increase and at least partially recovered their pre-financial crisis numbers in consumption.

Housing Wealth. Housing wealth is measured as the household's self-reporting of the housing as the main residence (HMR) value. HMR values are taken from the HFCS. On the one hand, these values represent how owners evaluate their residences but do not necessary reflect the similar values detected in the market at the time. On the other hand, these values are captured at the household level, their changes can be tracked via panel households, and they represent information necessary to understand individuals' consumption behavior. Like the previous measures, housing wealth is also deflated by CPI and changes in its values among panel households are used for the final estimations. Appendix 9 shows that self-reported house values were increasing after the recent financial crisis, but also at a slower pace than household income. On top of this, Appendix 10 also suggests heterogeneity in home value dynamics across different European countries, similarly to what was found for income or household consumption.

Instrumental Variable on Housing Value. However, housing values are likely to result in a biased estimate of the causal effect of housing wealth on consumption due to the endogeneity problem. In order to solve this, instrumental variable (IV) is used, as explained in more detail in the following chapters. Therefore, the key to the IV method is to find a variable that will be correlated with housing values but does not directly affect consumption growth. The HFCS dataset provides the possibility of generating a variable that fulfills all the above-mentioned requirements. In this paper, interviewers' external evaluation of housing is used as an IV variable. To explain in detail, after each survey, interviewers are asked to answer some questions about respondents' housing. This means that interviewers make their first-impression evaluations about the housing belonging to the respondents. Such an evaluation is exogenous from any household (respondent) expectations about its future consumption changes. The questions that are used to create the IV variable are listed in Appendix 11. As we can see from Appendix 11, interviewers' answers can be ranked and used as a categorical variable. In every question, a lower rank is associated with a higher value of the housing. Therefore, the sum of these answers is used as the IV variable for later calculations. In other words, all the answers are added up and their sum is taken as the synthetic variable representing the interviewers' evaluation of housing. Distribution of this synthetic instrumental variable is shown in Appendix 2 and is close to the normal distribution. Moreover, from Appendix 3 we can also see how values of IV are connected to the average housing wealth among households. It shows that the lowest sum of the synthetic IV is associated

[3]Shares of the consumption basket are taken from the results of the Household Budget Survey (HBS).

with the highest value of the housing and vice versa. What is more, such a synthetic variable does not allow me to estimate the exact values of housing, but it captures the variation of it, which is the main purpose of a good IV (Stock, 2001). Finally, IV estimation is limited to 6 countries (Belgium, Cyprus, Estonia, Italy, Latvia, and Malta) as only they were able to share non-publicly available information about interviewers' post-survey evaluations of housing. Moreover, only panel households are used in the estimation in order to capture changes between time periods for the same households. This limits the number of observations but also raises some questions about whether the used sample remains representative or not. To answer this, I looked at the household level sub-sample (used for IV estimation) and checked the distribution by income and wealth quintiles. Appendix 4 shows that the distributions of households either by wealth or income quintiles in the country are close to normal quintile distributions. There is only a minor shift in favor of the wealthier quintiles. This means that the sub-sample used for the IV variable is a good representation of results country-wise. To summarize, I also show distributions of households by wealth and income quintiles in the euro area. Appendix 5 shows the distribution by income quintiles in Europe and suggests that the IV sub-sample is representative from the euro area perspective. However, household distribution by wealth quintiles in the euro area is much more concentrated on the wealthier side and makes the final conclusions more tentative from the euro area perspective.

IDENTIFYING THE EFFECTS OF HOUSING WEALTH ON CONSUMPTION

Theoretical Background

Researchers have long been interested in the questions of the size of the housing wealth effect and how it affects household spending behavior, but a definitive answer has remained elusive. To study these questions, I follow the approach of Aladangady (2017) and consider a simple linearized relationship between growth in a household's real consumption, $\Delta c_{i,t+1} = \ln(C_{i,t+1}) - \ln(C_{i,t})$, and the growth rate of real housing wealth, $\Delta w_{i,t+1} = \ln(W_{i,t+1}) - \ln(W_{i,t})$, controlling for changes in household characteristics and after-tax income, captured by a vector $\Delta x_{i,t+1}$:

$$\Delta c_{i,t+1} = \alpha_1 \Delta w_{i,t+1} + \alpha_2 \Delta x_{i,t+1} + \epsilon_{i,t+1}, \tag{1}$$

where households represent the cross-section dimension, HFCS waves capture the time-series dimension, α_1 and α_2 stand for the estimated parameters, and $\epsilon_{i,t+1}$ is built from the normal distribution.

Traditional models of consumer behavior suggest that rising permanent wealth causes an increase in household spending (Friedman, 1957; Hallb, 1978b), but the relationship between housing service costs and home values complicates this result in the case of housing wealth, stemming from the differences between homeowners and renters. By living in his or her own apartment, a homeowner forgoes rental income on the property but at the same time saves on housing service payments, implicitly acting as both the landlord and tenant. If we consider house price to be determined by the present value of rental income, then increases in the home value that accrue to the landlord are met with a corresponding increase in the present value of rental costs to the tenant. The infinitely-lived owner-occupier is therefore perfectly hedged against fluctuations in home values over time (Buiter, 2008), and such a model would predict that the coefficient α_1 in (1) is zero.

This naturally raises the question of whether housing has a causal effect on spending. Planned changes in home size, due to life-cycle effects or other changes in preference for homeownership, may drive a wedge between the positive endowment effect of higher home values and the negative effect of higher future cost of living (Sinai and Souleles, 2005). For example, an older household planning to sell their home and downsize will have a net positive wealth effect since the value of their current home has risen by more than the cost

of living in their future smaller home. This would result in $\alpha_1 > 0$ for these households. The opposite is true for younger renters who are likely net buyers of housing in the future and would be expected to have negative wealth effects resulting in $\alpha_1 < 0$ (Campbell and Cocco, 2007). However, unless there is a wedge between the MPCs of natural buyers and natural sellers, the wealth effect from rising home values is simply a transfer from buyers to sellers with little impact on aggregate spending.

Alternatively, collateralized lending may cause housing wealth to have much larger effects on aggregate spending. Incomplete markets that limit a borrower's commitment to repay debt can give rise to collateralized lending (Barro, 1976; Stiglitz and Weiss, 1981; Hart and Moore, 1994). In such models, borrowers insure their lenders against default by pledging their homes as collateral, which can be seized in the event that the borrower fails to repay. Borrowing capacity is determined by the value of the home minus the liquidation costs for the lender, so rising home values may increase borrowing capacity and loosen borrowing constraints for households near a borrowing limit. Moreover, households near the borrowing constraint have higher effective discount rates, causing the positive endowment effect of current housing wealth to outweigh the negative effect on spending due to a higher future cost of living (Berger et al., 2018). Thus, such households are likely to have high MPCs and borrow against their homes to finance spending. In the aggregate, this collateral effect can have large impacts on spending, driven primarily by constrained households.

It is crucial to note that in this simple model in which housing wealth shocks affect spending, heterogeneous agents are unable to fully share idiosyncratic risk. Constantinides and Duffie (1996) and Cochrane (1991) show that in a model with a sufficiently rich class of assets, agents would be able to self-insure against idiosyncratic shocks to wealth, implying $\alpha_1 = 0$. The results of this paper, discussed in the following section, point to a positive impact of housing wealth on homeowner spending. One possible explanation for this breakdown in full risk sharing is that households are often unable to hold housing outside of their immediate locality and are generally unable to take short positions in housing. Furthermore, down payment constraints and search frictions may further limit a household's ability to own housing. Such barriers to participation likely limit cross-sectional sharing of housing market risk (Aladangady, 2017).

Transforming the Basic Model to Estimate MPCs

Before discussing identification of consumption wealth effects, I first transform the model given by equation (1) to allow estimated coefficients to be interpreted as MPCs. Additionally, I also discuss the construction of hypothetical housing wealth variables for renters that could be used as an alternative to better understand how renters respond to changes in house prices.

Firstly, the coefficient α_1 in equation (1) provides an estimate of the elasticity of consumption with respect to housing wealth. To make results easier to interpret and more comparable to much of the literature, I instead estimate the MPC out of housing by multiplying the growth rate of housing by the ratio of housing wealth to consumption for each household individually. This puts both the change in consumption and change in wealth in common units, allowing the coefficient between them to be interpreted as an MPC. Specifically, I follow the approach suggested by Aladangady (2017) and define $\Delta w^{MPC}_{i,t+1} \equiv \Delta \ln(w_{i,t+1}) \frac{median\_price_{i,t}}{C_{i,t}}$ where $w_{i,t+1}$ is the individual household-level housing value, $median\_price_{i,t}$ is the median housing wealth in every country by income quintiles in the previous period, and $C_{i,t}$, is the household's real expenditure in the previous period. As suggested by Aladangady (2017), making this transformation ex ante for each observation prevents biases that may result from converting the estimated elasticity to an MPC ex post (Halla, 2009a; Owyang, Ramey and Zubairy, 2013; Ramey and Zubairy, 2014).

Defining $\Delta w_{i,t+1}$ in this manner also enables me to explore the effect of rising home values on renters who do not self-report the value of their homes. Specifically, renters are assigned the median housing wealth

increase in their country and by their quintile of income. As will be discussed in Section III, renters are unlikely to have positive spending effects due to an increase in home values, and a positive coefficient on housing wealth for this subgroup would imply that common factors may be driving up both housing wealth and spending. By linking renters to a "placebo" housing wealth increase, I can test the sign of the coefficient in both the OLS and IV cases to better understand if the presence of common factors is being addressed by the IV strategy.

Given these adjustments, the transformed model is given as

$$\Delta c_{i,t+1} = \beta_1 \Delta w_{i,t+1}^{MPC} + \beta_2 \Delta x_{i,t+1} + \upsilon_{i,t+1} \tag{2}$$

Empirical Strategy and Identification

Estimating equation (2) by simple OLS is likely to result in a biased estimate of the causal effect of housing wealth on consumption. For example, common factors, such as expectations about future productivity, may drive up aggregate demand, resulting in both increased consumption and higher house prices. Shifts in demographics or relative preferences for housing services and other consumption may lead to the opposite bias. Furthermore, causality may run in reverse: higher consumption of non-tradables may raise local employment and wages, leading to higher home values.

To address these sources of endogeneity, I follow Chaney, Sraer and Thesmar (2012), and aladangady2017housing and instrument the growth in self-reported housing wealth using the synthetic variable constructed out of interviewers' answers about the respondents' houses, their condition and geographical position. My proposed instrument is different from the one used by Chaney, Sraer and Thesmar (2012), and Aladangady (2017) as similar housing supply elasticity variables[4] are not available for European countries. Moreover, the housing supply elasticity variable proposed by Saiz (2010) and interacted with the real 10-year Treasury rate could potentially lose its predictive power after the recent financial crisis due to the low interest rate environment during the last decade. The relevance of my instrument can be easily understood by thinking about an interviewer as an independent evaluator of the real estate. As discussed in Section 2, this IV variable is constructed from the questions that cover information about the geographical position in the country, house comparison between as well as within districts, evaluation of housing conditions inside and outside the building, and level of urbanization. This IV variable does not represent supply elasticity as the measure proposed by Saiz (2010), but it captures similar dynamics through the geographical position and urbanization level variables. House prices are expected to be higher in the city center in comparison to residential districts or villages. Housing value is also expected to be higher in highly urbanized places driven by demand side factors. Additional information about housing conditions also helps differentiate prices even within the same district. Finally, the advantage of this IV variable comes from the fact that it is hard to argue that interviewers' evaluation of housing could be correlated with the dynamics of household expenditures. Therefore, following the instrumental variable approach, the magnitude of the house value response depends on the synthetic IV variable that I use.

[4] Chaney, Sraer and Thesmar (2012), and Aladangady (2017) use geographic determinant-based housing supply variable proposed by Saiz (2010).

The full model, including the first stage, can be described by the following equations and exclusion restrictions:

$$\Delta c_{i,t+1} = \beta_1 \Delta w^{MPC}_{i,t+1} + \beta_2 \Delta x_{i,t+1} + \upsilon_{i,t+1} \tag{3}$$

$$\Delta w^{MPC}_{i,t+1} = \gamma_1 IV_{i,t} + \gamma_2 \Delta x_{i,t+1} + \nu_{i,t+1} \tag{4}$$

$$cov(IV_{i,t}, \upsilon_{i,t+1}) = 0 \tag{5}$$

where $\Delta c_{i,t+1}$ is growth in household spending, $\Delta w^{MPC}_{i,t+1}$ is growth in house values adjusted as discussed previously, and $\Delta x_{i,t+1}$ includes a polynomial which takes into account the age of the household head, change in family size, growth in family income, real 10-year Government bond rate, and fixed country effects. Since the model is specified in growth rates, it allows for heterogeneity in consumption levels that may be driven by unobserved differences in household preferences or other factors (Aladangady, 2017).

The identifying assumption (5) is that $IV_{i,t}$, the synthetic instrumental variable, does not directly affect spending growth and hence has zero covariance with the error term, $\upsilon_{i,t+1}$, in equation (3). Intuitively, this implies that there is no systematic variation between household spending growth and interviewers' evaluation of respondent housing conditional on $\Delta x_{i,t+1}$.

Most of the literature criticises this approach, arguing that various determinants of consumption can be significantly correlated with the instrument. However, it is hard to argue that interviewers' opinions regarding housing conditions, its value and geographical location has an impact on household consumption behavior. It should remain as a good instrument by representing house value differences within households and staying absolutely independent from household consumption behavior. However, the strength of the instrumental variable will still be tested in the following section.

Strength of the Instrumental Variable

In addition to exogeneity assumptions on instruments used, another important assumption is that the excluded instruments are sufficiently strong predictors of $\Delta w_{i,t+1}$. If the synthetic instrumental variable does not affect real house value, identification may be weak, resulting in non-normal asymptotic distributions of the 2SLS estimator and poor coverage probabilities of confidence intervals (Aladangady, 2017). Table 2 provides estimates from the first-stage regression of equation (4) using all homeowners in the baseline CES sample. The first line shows that the instrument – the synthetic variable – has a significant impact on changes in housing wealth if the sample is full or if only homeowners are analysed. In addition, the F-test for the excluded instruments, robust to clustering at the country level, exceeds the Pflueger and Wang (2015) thresholds for relative size and bias at the 5 percent level. To conclude, results in Table 2 suggest the instrument is both relevant and strong.

Table 2: Effect of Excluded Instruments on Country-level Variables

	Housing wealth change	Housing wealth change
Synthetic Instrumental Variable	.017***	.023***
	(.003)	(.004)
Change in After-tax Income	.042**	.057**
	(.015)	(.019)
10-year Government Bond Rate	-.015	-.016*
	(.008)	(.007)
First Stage F-test (Montiel-Pflueger, 5 percent bias)	43.841	37.916
Sample	All sample	Homeowners
Estimation	OLS	OLS
Observations	13,173	10,321

Excluded instruments are household controls from baseline model (age, change in household members and country fixed effects. Standard errors in parentheses are clustered at country level. The critical value for 5 percent Montiel-Pflueger test bias is 37.418.

3. RESULTS AND DISCUSSION

CONSUMPTION RESPONSE TO HOUSE PRICES

Under the assumption that the exclusion restriction given by equation (5) is not violated, IV estimates of coefficient β_1 from equation (3) can be interpreted as MPCs out of housing wealth. Furthermore, using external housing evaluation as an IV, I can estimate consumption responses across households with different exposures to credit constraints. These results provide insight into the various mechanisms that drive the co-movement between housing and consumption.

Baseline results shown in Table 3 describe the estimated consumption responses for owners (with mortgage and without) and renters using a simple OLS regression. Overall, the results suggest that while common factors may play a role in jointly driving housing wealth and consumption, there is a causal effect of rising housing wealth on the consumption of homeowners, especially those with mortgages.

Results from OLS estimates suggest an MPC of 0.039 for the full sample (column 1). From columns 2-5 we can see that results do not significantly differ between owners and renters; the quantitative difference is very small. At the same time, MPC from income changes remains significant for all but differs between groups and suggests a higher consumption effect for owners compared to renters or owners with mortgage. This result, echoed in the literature, suggests that common factors can jointly drive housing demand and consumption of both owners and renters (Campbell and Cocco, 2007; Attanasio et al., 2009). An additional robustness check comes from the fact that results could be driven by different changes in credit standards across periods or by different income or wealth quintiles. Appendix 13 shows that the baseline results remain similar and mostly driven by income and housing effects.

However, a possible endogeneity problem could bias the results. To deal with it, I used an IV variable which will be explained in more detail below. Therefore, the instrumental variable also placed restrictions on the sample, as it was not available by all countries. To be more precise, the subsample used for IV estimation includes Belgium, Cyprus, Estonia, Italy, Latvia and Malta. To make results comparable, the same estimation as in Table 3 was used based on the previously mentioned subsample. Results in Table 4 show a bit higher MPC out of housing which remains consistent between different homeownership groups.

By comparison, under the assumption that the exclusion restriction is not violated, the IV results address this

Table 3: Effects of Housing on Consumption: Baseline

	Baseline	Renters	Homeowners		
				Owners	Mortgage owners
	(1)	(2)	(3)	(4)	(5)
House value change	.039*	.041***	.038	.039	.041
	(.019)	(.011)	(.034)	(.037)	(.025)
Income change	.175***	.157***	.181***	.192***	.150***
	(.036)	(.050)	(.032)	(.036)	(.026)
Household controls	+	+	+	+	+
10 year government bonds	+	+	+	+	+
Sample	Pooled	Renters	All owners	Owners	Mortgage owners
Estimation	OLS	OLS	OLS	OLS	OLS
Observations	31,288	7,396	23,892	16,793	7,099
Clusters	13	13	13	13	13

Each row represents a separate regression of the variable on the real 10-year Government bond rate, country-level housing supply variable interacted with real 10-year Government bond rate, and country fixed effects. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in.

Table 4: Effects of Housing on Consumption: Subsample

	Baseline	Renters	Homeowners		
				Owners	Mortgage owners
	(1)	(2)	(3)	(4)	(5)
House value change	.069*	.089	.065**	.069**	.057**
	(.026)	(.063)	(.021)	(.023)	(.019)
Income change	.249***	.250**	.249***	.266***	.196***
	(.051)	(.066)	(.048)	(.044)	(.040)
Household controls	+	+	+	+	+
10 year government bonds	+	+	+	+	+
Sample	Pooled	Renters	All owners	Owners	Mortgage owners
Estimation	OLS	OLS	OLS	OLS	OLS
Observations	13,173	2,852	10,321	7,816	2,505
Clusters	6	6	6	6	6

Each row represents a separate regression of the variable on the real 10-year Government bond rate, country-level housing supply variable interacted with real 10-year Government bond rate, and country fixed effects. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in.

source of endogeneity and provide an accurate estimate of the causal effect of house prices on consumption. Results from the IV estimation, shown in Table 5, point to a significant positive causal effect of house prices on the spending behavior of both homeowners and renters. Specifically, homeowners without mortgages (column 4) have a positive and statistically significant MPC of 0.114, suggesting housing wealth has a causal effect on homeowner consumption. Similarly, renters also enjoy the benefits of rising home values that are brought by the common factors in the economy. However, results are significantly higher for homeowners with mortgages, suggesting an MPC out of housing wealth equal to 0.185 for them. These results show that the response of homeowners with mortgages is significantly higher than that of renters or owners without mortgages. While ownership decisions may be correlated with unobserved determinants of consumption, results in Table 5 suggest that this IV strategy appropriately addresses the endogeneity introduced by common factors that bias the OLS models. Heterogeneous effects remain the significant part of MPC analysis across households. Therefore, I run an additional robustness check to see if similar IV estimation results hold and how the differ across different subgroups. Appendix 14 shows the IV estimation results based on different income quintiles. Results identify a clear heterogeneity and suggest higher MPC out of housing across higher-income households.

Table 5: Effects of Housing on Consumption: Instrumental Variable Approach

	Baseline	Renters	Homeowners		
				Owners	Mortgage owners
	(1)	(2)	(3)	(4)	(5)
House value change	.121***	.116**	.127***	.114***	.185***
	(.047)	(.050)	(.043)	(.037)	(.038)
Income change	.239***	.244***	.237***	.260***	.159***
	(.056)	(.065)	(.053)	(.044)	(.050)
Household controls	+	+	+	+	+
10 year government bonds	+	+	+	+	+
Sample	Pooled	Renters	All owners	Owners	Mortgage owners
Estimation	IV	IV	IV	IV	IV
Observations	13,173	2,852	10,321	7,816	2,505
Clusters	6	6	6	6	6

Each row represents a separate regression of the variable on the real 10-year Government bond rate, country-level housing supply variable interacted with real 10-year Government bond rate, and country fixed effects. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in. A subsample of Belgium, Cyprus, Estonia, Italy, Latvia and Malta is used for regressions.

A statistically significant response for renters should not be puzzling. If renters plan to buy homes in the future, one may expect a negative wealth effect for this group (Flavin and Yamashita, 2002; Campbell and Cocco, 2007). This may also reflect the fact that renters are able to adjust their behavior on other margins – delaying home buying or purchasing a smaller home – in response to a house price shock. It could also depend on the interaction between housing and rental costs. If rental costs become relatively lower due to a house price shock, it could create an advantage for renters, allowing them to increase their spending. However, this is highly dependent on a household's future plans to buy their own house or continue renting. This idea is partially checked and supported by using available HFCS information. Appendix 15 shows summary statistics for cases when house prices increased more than rental expenditure and vice versa. Therefore, the results indicate that over the analyzed period, between 2010 and 2017, consumption expenditures were increasing much more among households for whom house prices were growing faster than rental costs. This suggests that renters were taking advantage of the current situation and increasing

their spending when house prices were growing faster than their rental expenditures.

POSSIBLE CHANNELS

Results from the previous subsection indicate higher consumption in response to higher home values. These results appear robust to potential endogeneity concerns, suggesting that the strategy appropriately adjusts for the impact of common factors that may be driving a correlation between housing and consumption in the raw data. Exploiting heterogeneity across households in the data, I explore the relative importance of the mechanisms driving the causal relationship between housing and consumption. Specifically, I evaluate whether rising home values simply drive up spending through wealth effects or primarily loosen borrowing constraints by providing additional collateral. The relative importance of these mechanisms has important implications for the aggregate impacts of house prices on spending and the types of households most affected by rising home values.

As discussed previously, in order for homeowners' consumption to respond to a change in house prices, there must be a wedge between the endowment effect from higher current wealth and the negative income effect from a higher cost of living. Such a wedge may arise due to life-cycle effects, as households tend to buy and sell housing at various points in their life cycle (Sinai and Souleles, 2005). This is consistent with the finding in Table 5 that homeowners (with a mortgage) have higher MPCs relative to renters, who are often younger and more likely to purchase homes in the future. However, this alone does not guarantee aggregate effects on consumption since fluctuations in house prices are simply transfers between buyers and sellers. In a model with limited commitment, however, rising home values may loosen borrowing constraints by providing homeowners with additional collateral (Barro, 1976; Stiglitz and Weiss, 1981; Hart and Moore, 1994). For homeowners at or near a borrowing limit who value their current endowment of housing more than the future increase in their cost of living, the increase in collateral values loosens borrowing constraints and can have a large effect on spending Berger et al. (2018). Homeowners with large borrowing capacity ex ante and renters who do not own any housing collateral are unaffected by this channel and behave much like their counterparts in a standard model. Appendix 16 supports this idea by showing that mortgage owners with a large borrowing capacity has a higher MPC out of housing than the baseline results. As a result, higher home values can mitigate agency costs for borrowers near a borrowing limit, and aggregate effects on spending can be larger.

Taking these insights to the ideal dataset simply involves comparing MPCs across households with differing exposure to borrowing constraints. In practice, this poses two general problems. First, in the presence of uncertainty, households near a borrowing limit may behave much like those at the limit out of fear that the constraint will bind them in the future. This precautionary savings motive blurs the line between constrained and unconstrained households, leading to a continuum of households that behave increasingly like constrained households as they approach the borrowing limit (Carroll and Kimball, 1996). Second, identifying constrained households can be difficult in practice since the borrowing limit may not be observable and household choice of net wealth holdings is determined by historical consumption decisions.

Since the shadow value of the borrowing constraint is not directly observable, this paper follows the approach in the literature of comparing spending responses across households who are more or less likely to be impacted by the change in borrowing limits based on observed balance sheet and debt payment variables (Zeldes, 1989; Cooper, 2009; Johnson and Li, 2010). Specifically, I discuss results comparing MPCs of households across ownership status, debt-service ratios (DSRs), and leverage. While this does not provide a quantitative breakdown of how pure wealth effects and collateral effects determine the MPC out of housing, it provides a qualitative assessment of which households drive the aggregate MPC and provides insight into the relative importance of the two mechanisms.

Is the MPC of homeowners driven primarily by households that are more exposed to the borrowing constraint? To answer this question I first compare homeowners with different debt-service ratios, a common ratio used by banks to assess credit quality, defined as the ratio between debt service payments and after-tax income. This ratio is the preferred measure of credit constraints in this study for a few reasons. First, DSRs have been shown to predict the likelihood of being denied credit and are commonly used by both academics and banks (Johnson and Li, 2010). Secondly, households are more likely to recall periodic payments made on a debt rather than the outstanding balance, meaning DSRs are more likely to be measured accurately than measures depending on loan balances (Aladangady, 2017).

Table 6: Effects of Housing on Consumption: Possible Channels

	Baseline	DSR>.40	DSR<.40
	(1)	(2)	(3)
House value change	.185***	.103**	.189***
	(.038)	(.048)	(.050)
Income change	.159***	.122***	.205***
	(.050)	(.021)	(.072)
Household controls	+	+	+
10 year government bonds	+	+	+
Sample	Mortgage owners	Mortgage owners	Mortgage owners
Estimation	IV	IV	IV
Observations	2,505	399	2,106
Clusters	6	6	6

Each row represents a separate regression of the variable on the real 10-year Government bond rate, country-level housing supply variable interacted with real 10-year Government bond rate, and country fixed effects. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in. A subsample of Belgium, Cyprus, Estonia, Italy, Latvia and Malta is used for the regressions.

I group households above and below the DSR threshold of 0.4 for each year in the sample to ensure that groupings reflect cross-sectional heterogeneity in DSRs rather than aggregate fluctuations in debt or income over time. Table 6 presents results allowing MPCs for homeowners to vary across DSR. The first column repeats the preferred specification with all controls, as shown in Table 5, column 1. The average response shown in the first column masks substantial heterogeneity between households above and below the DSR threshold. Column 2 and 3 solve this problem by splitting homeowners with mortgages into subgroups a having housing debt service to income ratio above and below 0.4. Such a threshold of 0.4 is the most common number used to identify financially vulnerable households across studies in Europe(Bankowska et al., 2015). Results in Table 6, column 2 and 3, show that MPC out of change in housing value is much higher between households that appeared below the threshold. They show that households with borrowing constraint cannot adjust their consumption due to limitations on increasing their loans. This fact appears consistent with a model in which rising home values loosen borrowing constraints, resulting in increased spending, especially for households who were previously constrained. These results may also partly reflect so-called wealthy hand-to-mouth consumers who have large amounts of illiquid wealth. Rising collateral values allow these households to extract liquidity from additional home equity (Kaplan, Violante and Weidner, 2014). This means that many households in Europe remain with a limited amount of liquid assets and adjust their consumption behavior mostly by extracting their increased housing value instead of using savings.

Table 7 shows results splitting households based on mortgage use and loan-to-value (LTV) ratios. For convenience, the first column once again repeats the preferred specification, pooling all homeowners. Turning to the second and third columns, I split households based on LTV of 0.75, the common measure in similar studies about household financial vulnerability in Europe (Bankowska et al., 2015). The high MPCs for these

households with high LTVs suggest that their discount rates are high due to credit constraints. Moreover, the results in column 2 and 3 suggest that these credit constrained households utilize collateral in their homes to finance spending as house prices rise. Specifically, the high MPC among high-LTV homeowners is largely driven by households who recently refinanced up to a higher outstanding balance (column 2) as opposed to those that did not extract equity in the last year (column 3).

Table 7: Effects of Housing on Consumption: Possible Channels

	Baseline (1)	Loan to value HMR>.75 (2)	Loan to value HMR<.75 (3)
House value change	.185***	.355***	.169***
	(.038)	(.097)	(.037)
Income change	.159***	.178***	.157***
	(.050)	(.047)	(.054)
Household controls	+	+	+
10 year government bonds	+	+	+
Sample	Mortgage owners	Mortgage owners	Mortgage owners
Estimation	OLS	OLS	OLS
Observations	2,505	390	2,115
Clusters	6	6	6

Each row represents a separate regression of the variable on the real 10-year Government bond rate, country-level housing supply variable interacted with real 10-year Government bond rate, and country fixed effects. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in. A subsample of Belgium, Cyprus, Estonia, Italy, Latvia and Malta is used for regressions.

Overall, these results suggest that rising home values have a direct impact on homeowners' spending via loosening borrowing constraint. As discussed previously, renters whose borrowing is not affected by changing home values have smaller MPCs consistent with relatively small negative income effects from higher costs of living. On the other hand, mortgage owners have higher MPCs. The overall response for homeowners with mortgages appears to be driven by households with higher exposure to borrowing constraints. Furthermore, this result is not driven simply by low or high income households, but instead more broadly by households who use debt more heavily and those who have recently extracted equity from their homes. While these subgroups may differ in unobserved ways, the overall results appear to be consistent with an incomplete markets model where rising home values loosen collateral constraints on indebted homeowners. More importantly, these results suggest that house price fluctuations are not simply transfers between home buyers and sellers, but can have large aggregate impacts on real household spending, especially when a large fraction of households face borrowing constraints (Guerrieri and Iacoviello, 2017).

4. CONCLUSIONS

This paper builds on the recent demand side and household balance sheets literature, which shows housing as the essential factor in explaining household spending fluctuations. It also utilizes interviewers' external evaluations of housing value and conditions to create an instrumental variable which enables establishment of a causal link between housing wealth and consumption behavior. Results suggest that common factors are partially responsible for the co-movement between house prices and consumption, but housing wealth also has an additional causal effect on the spending behavior of mortgage owners, especially those with larger exposure to borrowing constraints.

I estimate an MPC out of housing wealth of 0.121 with a significantly higher effect of 0.185 on mortgage

owners. These estimates appear robust to different subsamples and variety of household-specific conditions. Importantly, estimated responses appear to be similar over the post-financial crisis period and are not driven exclusively by the specific countries. Furthermore, the average MPC across analyzed countries is driven largely by households with higher DSRs and leverage, suggesting that collateral constraints play a crucial role in driving the relationship between house prices and spending. Specifically, rising home values provide additional collateral to households at or near the borrowing constraint. Since these households value the current endowment of collateral wealth more than the increased cost of living associated with higher house prices, their spending responses are disproportionately large and can drive large fluctuations in consumption, especially in times of tight credit or low wealth.

Taken together, the results provide an empirical link between housing values and real outcomes, and suggest that household balance sheets play an important role in determining aggregate demand. The importance of collateral constraints in driving these results indicates that models with incomplete contracts and collateralized lending may better explain dynamics in household spending. The results are also useful for understanding the impacts of housing market policies that may affect housing wealth as well as the mechanisms through which monetary policy and interest rates impact household spending.

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A. ONLINE APPENDIX

Table 8: Cross-country Household Characteristics and Housing Statistics

	Belgium	Cyprus	Estonia	Italy	Latvia	Malta
Percentage owners	46.58	36.70	57.33	63.89	62.94	65.78
Percentage owners w/mortgage	73.71	79.62	80.46	71.89	80.63	77.54
Age	56.50	50.48	51.42	60.02	52.83	56.25
Family size	2.37	3.34	2.59	2.43	2.34	2.74
Observations	4,515	2,507	2,196	15,871	1,198	1,870

Table 9: Household Finance and Consumption Survey Summary Statistics (changes)

	Panel countries	Panel countries (with IV variables)
After-tax income (annual)	.0419	.0543
Total expenditures (annual)	.0144	.0277
Home value (if owner)		
Self-reported	.0234	.0336
Number of countries	13	6

Changes are captured from log-linearized variables that are later used in the estimations. Also, all values are reported in 2015:I euros.

Table 10: Household Finance and Consumption Survey Summary Statistics (changes)

	Belgium	Cyprus	Estonia	Italy	Latvia	Malta
After-tax income (annual)	.066732	-.060983	.285671	.0329512	.0317023	.102833
Total expenditures (annual)	.037415	-.200814	.1421583	.034523	.0445904	.1072518
Home value (if owner)						
Self-reported	.056777	-.079214	.1653895	.0010569	.2217552	.1057106

Changes are captured from log-linearized variables that are later used in the estimations. Also, all values are reported in 2015:I euros.

Table 11: Questions for the Instrumental Variable

1) Type of dwelling:	1 - Individual house 2 - Semi-detached house 3 - Flat/apartment 4 - Other kind of dwelling 5 - Dwelling does not exist
2) Dwelling rating:	1 - Luxury 2 - Upscale 3 - Mid-range 4 - Modest 5 - Low-income
3) Dwelling location:	1 - Downtown 2 - Area between city centre and suburbs 3 - Town outskirts 4 - Isolated area, countryside
4) Dwelling - outward appearance:	1 - Generally clean and sound 2 - Some peeling paint or cracks in walls 3 - Needs substantial painting, refilling or repair 4 - Dilapidated
5) Dwelling - comparison to the neighbourhood:	1 - The dwelling is better than the neighbourhood 2 - The dwelling is as good as the neighbourhood 3 - The dwelling is worse than the neighbourhood 4 - There are no other buildings in view
6) Dwelling - rating of surrounding buildings:	1 - Luxury 2 - Upscale 3 - Mid-range 4 - Modest 5 - Low-income 6 - Very low income 7 - No surrounding buildings in view

Table 12: Statistics for Instrumental Variable

IV value	Number of observations	Mean housing value
2	267	662264.2
3	398	300234.4
4	513	312924.4
5	686	292725.1
6	900	280652.2
7	1,721	200472.9
8	4,094	165410.5
9	5,637	156988.6
10	3,403	139336.2
11	2,611	133894.5
12	2,190	114188.6
13	1,415	95952.96
14	921	75570.2
15	511	60613.21
16	380	53049.6
17	292	43923.38
18	105	40669.06
19	62	29593.45
20	27	64189.17
21	14	11559.65
22	6	15362.91

The second column shows the number of observations associated with a particular value of IV. The third column gives the mean value of housing for the particular value of IV.

Figure 2: Distribution of the Number of Observations Associated with Different IV Values

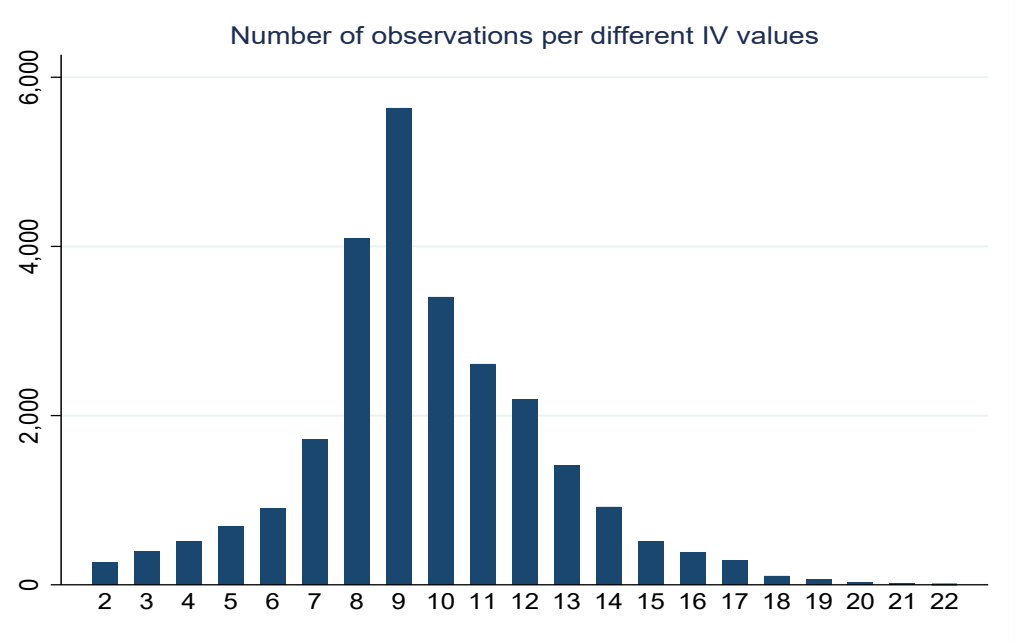

Figure 3: Distribution of the Mean Housing Values Associated with Particular IV Values

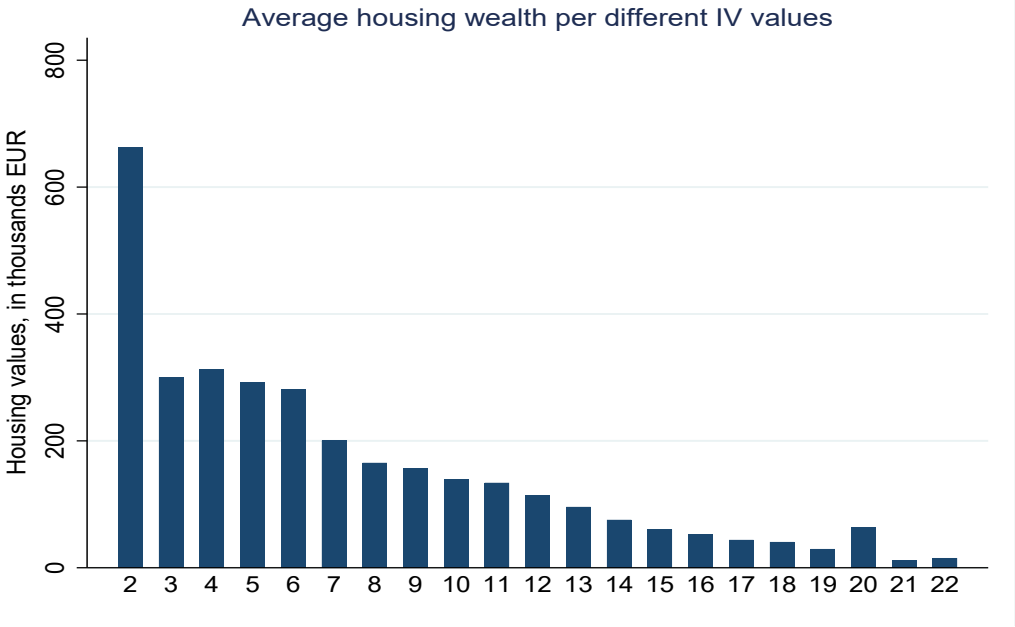

Figure 4: Distribution of IV sub-sample Households by Income and Wealth Quintiles in Country

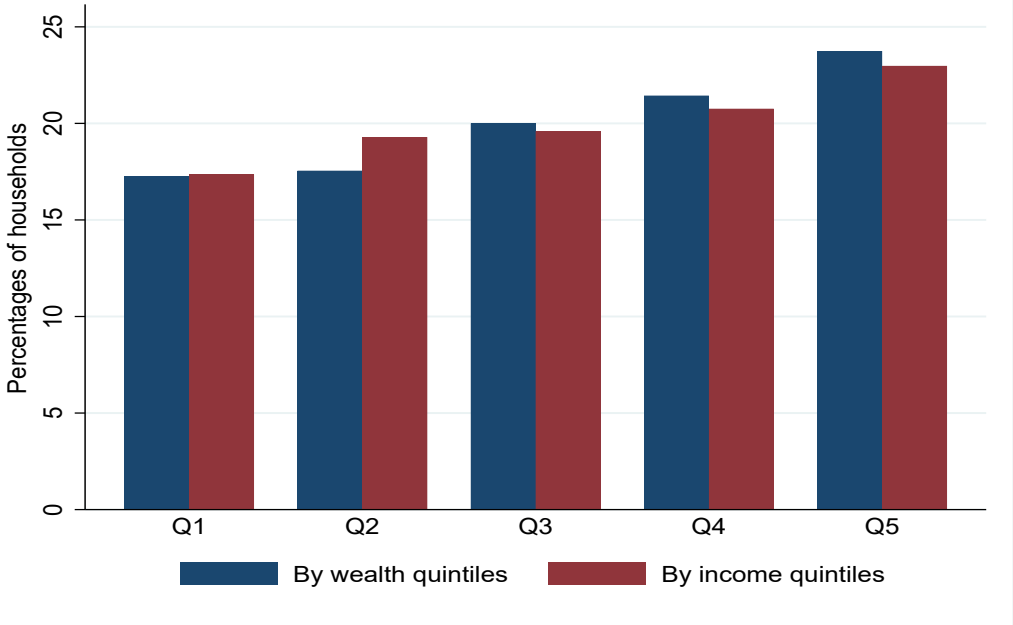

Figure 5: Distribution of IV sub-sample Households by Income and Wealth Quintiles in Euro area

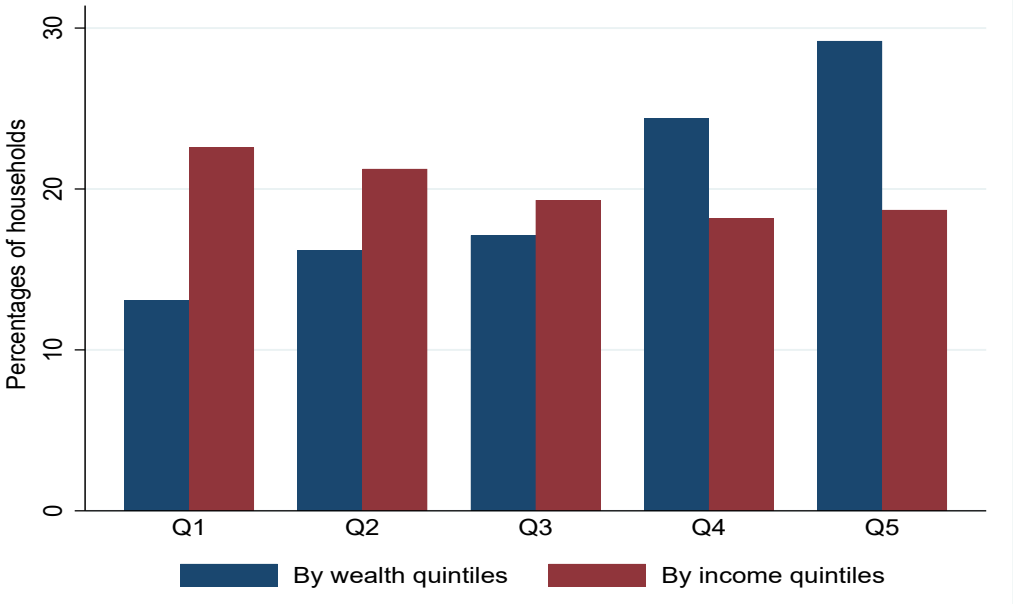

Table 13: Effects of Housing on Consumption: Robustness results including country-time fixed effects and income, and wealth quintiles as controls

	Baseline	Renters	Homeowners		
				Owners	Mortgage owners
	(1)	(2)	(3)	(4)	(5)
House value change	.038*	.041***	.036	.034	.038
	(.019)	(.011)	(.033)	(.037)	(.027)
Income change	.173***	.159***	.177***	.189***	.151***
	(.036)	(.051)	(.030)	(.036)	(.024)
Household controls	+	+	+	+	+
10 year government bonds	+	+	+	+	+
Country*time	+	+	+	+	+
Country income quintiles	+	+	+	+	+
Country wealth quintiles	+	+	+	+	+
Sample	Pooled	Renters	All owners	Owners	Mortgage owners
Estimation	OLS	OLS	OLS	OLS	OLS
Observations	31,298	7,398	23,900	16,801	7,099
Clusters	13	13	13	13	13

Each regression includes household controls on age and number of household members, on the real 10-year Government bond rate, on country*time and country fixed effects, on country income quintiles, and on country wealth quintiles. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in.

Table 14: Effects of Housing on Consumption: Income quintile-based results

	Baseline	Q1	Q2	Q3	Q4	Q5
	(1)	(2)	(3)	(4)	(5)	(6)
House value change	.121*	.038	.094**	.167*	.128	.175***
	(.052)	(.047)	(.035)	(.069)	(.082)	(.038)
Income change	.240***	.150***	.299**	.274**	.338**	.256***
	(.061)	(.036)	(.090)	(.073)	(.094)	(.054)
Household controls	+	+	+	+	+	+
10 year government bonds	+	+	+	+	+	+
Sample	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled
Estimation	IV	IV	IV	IV	IV	IV
Observations	13,174	2,012	2,330	2,577	2,883	3,372
Clusters	6	6	6	6	6	6

Each regression includes household controls on age and number of household members, and on the real 10-year Government bond rate. Median housing value is captured at the country level based on individual household answers about the values of housing that they live in. Regressions 2-6 are based on cross-country gross income quintiles.

Table 15: Summary of Household Consumption (changes in values)

	(1)	(2)
	mean	mean
Consumption change	.02935	.00502
Number of observations	11,439	7,302

Column 1 shows the results when house price increases more than rental expenditure, while Column 2 represents results when rental spending grows faster than house prices. The table summarizes statistics only for the households that are identified as renters..

Table 16: Summary of Household Consumption (changes in values)

	(1) Mortgage owners	(2) Mortgage owners
Consumption change	.141**	.256***
	(.051)	(.042)
Income change	.161	.164***
	(.086)	(.036)
Household controls	+	+
10 year government bonds	+	+
Sample	Pooled	Pooled
Estimation	IV	IV
Observations	1,232	1,273
Clusters	6	6

Column 1 shows the results when household loan to value ratio is lower than 0.3 (meaning households with a large borrowing capacity), while Column 2 represents results when the loan to value ratio is higher than 0.3.