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Indebtedness and spending: what happens when the music stops?

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Household Finance and Consumption Network (HFCN)

This paper contains research conducted within the Household Finance and Consumption Network (HFCN). The HFCN consists of survey specialists, statisticians and economists from the ECB, the national central banks of the Eurosystem and a number of national statistical institutes.

The HFCN is chaired by Ioannis Ganoulis (ECB) and Oreste Tristani (ECB). Michael Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II) and Arthur Kennickell act as external consultants, and Juha Honkkila (ECB) and Jiri Slacalek (ECB) as Secretaries.

The HFCN collects household-level data on households' finances and consumption in the euro area through a harmonised survey. The HFCN aims at studying in depth the micro-level structural information on euro area households' assets and liabilities. The objectives of the network are:

1) understanding economic behaviour of individual households, developments in aggregate variables and the interactions between the two;
2) evaluating the impact of shocks, policies and institutional changes on household portfolios and other variables;
3) understanding the implications of heterogeneity for aggregate variables;
4) estimating choices of different households and their reaction to economic shocks;
5) building and calibrating realistic economic models incorporating heterogeneous agents;
6) gaining insights into issues such as monetary policy transmission and financial stability.

The refereeing process of this paper has been co-ordinated by a team composed of Pirmin Fessler (Oesterreichische Nationalbank), Michael Haliassos (Goethe University Frankfurt), Tullio Jappelli (University of Naples Federico II), Juha Honkkila (ECB), Jiri Slacalek (ECB), Federica Teppa (De Nederlandsche Bank) and Philip Vermeulen (ECB).

Abstract

We analyse the effect of shocks to housing wealth and income before and after the Great Recession. We combine datasets containing information on expenditure, income, wealth and debt in a synthetic panel to understand how household indebtedness affects the response to income and wealth shocks. We find evidence for both a housing wealth effect and income shocks depressing household consumption during the crisis in Ireland. The long recovery of consumption is also related to high levels of indebtedness at the onset of the crisis. Households who entered the crisis with more debt are significantly more sensitive to changes in their income. In this way, household balance sheets can be an important amplification mechanism for aggregate shocks.

JEL classification: D14, D31, E21, H31.

Keywords: Housing, income, wealth, expenditure.

Non-technical summary

Like many other countries, the Great Recession in Ireland was preceded by a credit-fuelled housing bubble which played an important role in driving consumer expenditure before the crash. This paper investigates how spending adjusts to negative changes in income and wealth when households hold a large amount of debt. It adds to a growing empirical literature which asks whether the depth and length of recessions is significantly affected by the household debt-burden at the onset of a downturn.

Using micro data for the period 1995-2015, we construct a synthetic pane to understand the multitude of factors that had an impact on the spending behaviour of Irish households during this era. We find evidence for both a housing wealth effect and income shocks depressing household consumption during the crisis in Ireland. The baseline estimated MPCs for income and wealth are similar to those found elsewhere in the literature.

The large fall in consumer spending and subsequent long recovery is also related to high levels of indebtedness at the onset of the crisis. In particular, we find that households who entered the crisis with more debt are significantly more sensitive to changes in their income and wealth. The differences are largest for durable goods spending, where the income and wealth MPCs for highly indebted households are approximately double those of less indebted households. This key result highlights how balance sheets can be an important amplification mechanism for aggregate shocks.

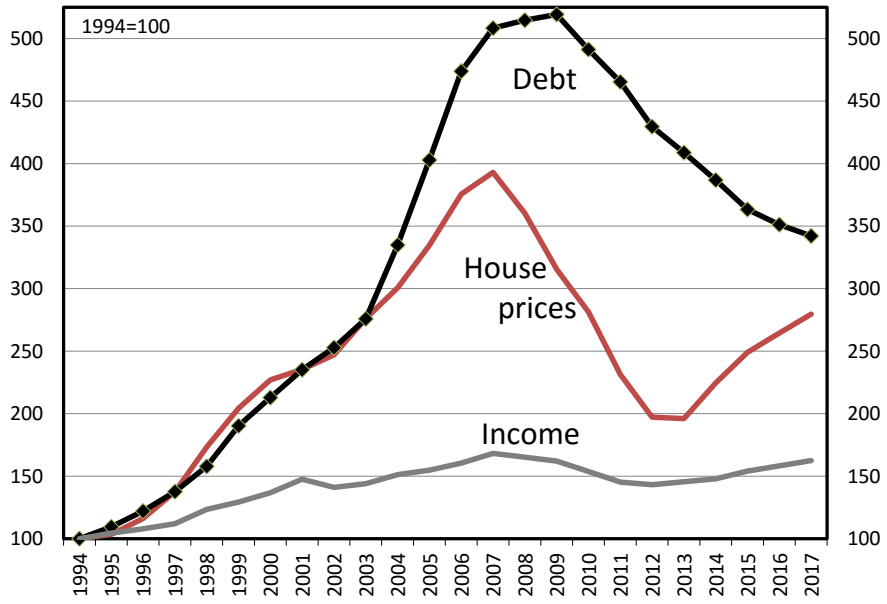
The final part of the paper discusses three aspects of our key result. First, we argue that these indebtedness effects are large enough to have significant aggregate effects. We show this by illustrating the scale of the increase in indebtedness during the credit boom and bust in Ireland. Next we decompose the Fisher effects to understand which factors contributed to unsustainable debt dynamics for so many households. We show how, despite sharp falls in the policy rate, the nominal interest rate on mortgage debt for borrowers who bought at the peak was between 440 and 720 basis points *higher* than the growth rate for nominal income during the six years of the recession. This is one of the key reasons why debt for certain cohorts stagnated at very high levels relative to income, dragging on consumer spend during the recovery. Finally, we show that, after controlling for income shocks and levels, highly indebted households are more likely to be credit constrained. This is consistent with the literature on the collateral constraints channel for wealth and debt.

1 Introduction

This paper investigates how spending adjusts to changes in income and wealth when households hold a large amount of debt. It adds to a growing empirical literature which asks whether the depth and length of recessions is significantly affected by the household debt-burden at the onset of a downturn.

The Irish experience in the early-2000s, serves as our case-study of how debt exacerbates consumption dynamics over the business cycle. The acceleration in house prices in the decade up to 2007, combined with a sharp loosening of credit standards, meant that house price and credit growth far outstripped income growth during this period. In real terms, house prices doubled between 2000 and 2007, while disposable incomes only increased by 30% (see Figure 1). Household debt increased by 250% during the same period. The run-up in debt prior to the recession left a large number of households highly exposed to the negative house price and income shocks that followed. When the crisis hit, house prices dropped by 55% from their peak in 2007. In the course of the recession, average disposable income dropped by 16% due to a combination of higher taxes, wage reductions and job losses. Household debt stagnated at high levels, increasing debt-service ratios and debt-to income ratios due to the fall in income.

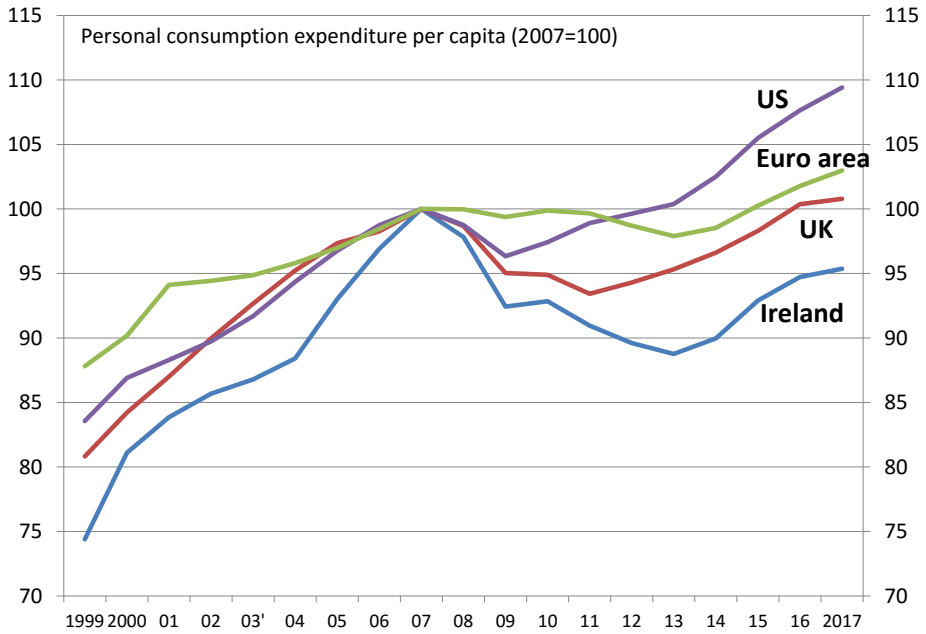
FIGURE 1. Debt, house prices and income trends



Source: Debt data is from Central Bank Money and Banking Statistics (to 2001) and Quarterly Financial Accounts (from 2002). Real house price data from 1994 onwards is taken from the Dallas Federal Reserve House Price Database (Mack and Martinez-Garcia (2011)). Household disposable income data is from Living in Ireland Survey (LIS, 1994-2001) and the Survey of Income and Living Standards (SILC, 2003-2017).

Compared to other countries, the reduction in spending during the recession was sharper and longer, with consumption per capita declining steadily throughout 2007-13 (see Figure 2). These aggregate trends hide considerable differences in the consumption experience of certain groups of households. Our main aim in this paper is to quantify exactly how much of this decline is attributable to high-levels of indebtedness, controlling for income and wealth changes.

FIGURE 2. Consumption trends



Source: National statistics offices. Real, per capita consumer spending, 2017 runs to Q3. The consumption measure in the chart is *total* spending on durable and non-durable goods and services. The recovery in consumer spending after 2013 in Ireland is primarily durables spending increases, and in particular the purchase of vehicles, which grew from 121,000 new and secondhand private vehicles in 2013 to 220,000 in 2017. The previous high was 240,000 in 2007. Transport durables spending – most of which is new vehicles – accounts for 7% on average of total household spending in the 2015/16 HBS. Therefore, an increase of this magnitude would have a significant impact on overall consumer spending trends.

Our contributions are threefold: **(1)** We document the manifold shocks that made Ireland one of the worst hit countries of the Great Recession. Not only was consumption greatly reduced throughout the recession, but almost one-third of mortgaged households (or 11% of all households) were plunged into deep negative equity. **(2)** Using repeated cross-sectional household surveys, we build a synthetic panel of Irish households before and after the crisis. We examine the impact of income, wealth and indebtedness on consumption growth, and we describe the responses of households to a change in these variables. We also discuss the Fisher dynamics that suppressed spending. **(3)** Finally, we discuss how the results fit into

our understanding of household spending and borrowing behaviour from two commonly-used frameworks: the permanent income hypothesis, and collateral credit constraints.

The remainder of this paper proceeds as follows. Section 2 discusses the literature and provides further context for the analysis. Section 3 provides an overview of the data and documents the evolution of income, consumption and wealth from 1995 through 2015 for three household types, mortgage owners, outright owners and renters. Section 4 presents our key result, namely that more indebted households are far more sensitive to income and wealth shocks. Section 5 teases out the reasons for out results, focusing on the PIH framework and collateral constraints. Finally, Section 6 concludes.

2 Overindebtedness and consumption dynamics during a downturn

The notion that household indebtedness affects the severity of recessions goes back to King (1994) who found that the deepest and longest recessions in the 1990s occurred in those countries which had seen the largest increases in private debt in the years prior to the crash, a phenomenon Irving Fisher had coined "debt deflation" in the 1930s. He argued that the marginal propensity to consume (MPC) out of wealth might be higher for credit constrained households. If MPCs are indeed heterogeneous, the distribution of wealth losses, and not just the average drop, may affect aggregate consumption which in turn has consequences for financial stability and the business cycle.[1]

With the increasing availability of household-level data comprising both detailed information on expenditures and the levels of net worth and indebtedness by household, recent papers have picked up on the impact of wealth shocks in the presence of indebtedness to analyse the consumption response of households following the Great Recession. Mian et al. (2013) find that retail sales declined more in US counties with a greater proportion of highly leveraged households at the onset of the crisis. They find evidence of both a pure wealth effect and tighter credit constraints, suggesting that the distribution of wealth losses matters, not just the level. Household spending falls in response to a reduction in household net worth, and this response is much stronger for poorer households and households with higher leverage. Also for the US, Dynan (2012) analyses how the wealth and credit constraint channel impacted

[1]More recent studies on international business cycles confirm the early findings that higher household debt leads to deeper recessions. Jorda et al. (2015) find that credit-financed housing price bubbles tend to be followed by deeper recessions and slower recoveries. This more recent empirical literature is also closely related to earlier work by Mishkin et al. (1977), which explains US consumption behavior during the 1970s in terms of shifts in household balance sheets.

consumer spending following the financial crisis. Highly leveraged households had larger declines in spending than less indebted households although the absolute changes in their net worth were smaller which suggests that leverage reduced consumption by more than what a pure wealth effect would have predicted. Baker (2018) also shows that consumption expenditures of highly indebted US households are more sensitive to income shocks.

Outside of the US, Aron et al. (2012) (Japan and UK), Bunn and Rostom (2014), Disney et al. (2010) (both UK), Lydon and O'Hanlon (2012) (Ireland), Fagereng and Halvorsen (2016) (Norway) and Andersen et al. (2016) (Denmark) all find a negative correlation between household leverage and household consumption. Campbell and Cocco (2007) and Cooper (2013) use a life-cycle framework to show that marginal propensities to consume (MPCs) of constrained households are larger than for unconstrained households, pointing to the borrowing collateral effect rather than a pure wealth effect out of housing equity. Hence, the aggregate impact of falling house prices as experienced during the crisis, depends on how many households were borrowing against their houses and were no longer able to do so after credit standards tightened.[2] Our paper is closely related to Demyanyk et al. (2019) who use multiple micro and macro data sets at the county level to study the correlation of consumption growth with income, debt, unemployment, housing wealth and access to credit. They find a significant impact of income growth and unemployment on consumption growth between 2001 and 2012 but varying responses to wealth, debt and access to credit over different subperiods between 2001 and 2012, i.e. the dot-com recession (2001-2003), the subprime boom (2004-2006), the Great Recession (2007-2009) and the tepid recovery (2010-2012).

Using a heterogeneous agent model, Guerrieri and Lorenzoni (2017) complement the empirical literature and show that a tightening of credit can produce a deep and long recession through two effects: following a tightening of credit, borrowing-constrained households first reduce their spending in order to deleverage and then, secondly, they continue to spend less and build up precautionary savings before restoring consumption to its previous level. Unconstrained households react to a tightening in consumers' borrowing capacity by saving more for precautionary reasons.

3 Micro data on income, wealth, debt and spending

[2]Other examples include Disney et al. (2010), Browning et al. (2013), Attanasio et al. (2014) and Krueger et al. (2016).

Data construction

The household data on incomes, debt and spending comes from two surveys: *The Household Finance and Consumption Survey* (HFCS, 2013) and the *Household Budget Surveys* (HBS, collected at five-yearly intervals 1994/95-2015/16, see Table 1).

The survey years cover the period of exceptionally strong consumer spending growth (1995 to 2005), the collapse in spending in 2009/10, followed by the stagnation/slow decline in spending through to 2013, and finally the beginning of the recovery after 2013 (see Figure 2).

Household spending

We look at spending on durables and non-durables separately. Our non-durables consumption measure is defined as total weekly expenditure minus mortgage repayments, rent, spending on durable transport equipment (cars, bicycles, motorbikes, etc), household white goods and housing-related durables (home improvement and other investment in the home).[3] We include clothing and footwear in nondurable spending to ensure comparability with Mian et al. (2013) and Dynan (2012).

TABLE 1. Household survey data, 1994-2013

Survey	# households	Field work
1995 HBS	7,037	1994q2-1995q2
2000 HBS	6,958	1999q2-2000q3
2005 HBS	6,196	2004q3-2005q4
2010 HBS	4,972	2009q3-2010q3
2013 HFCS	5,419	2013q2-2013q3
2015 HBS	6,839	2015q1-2016q1

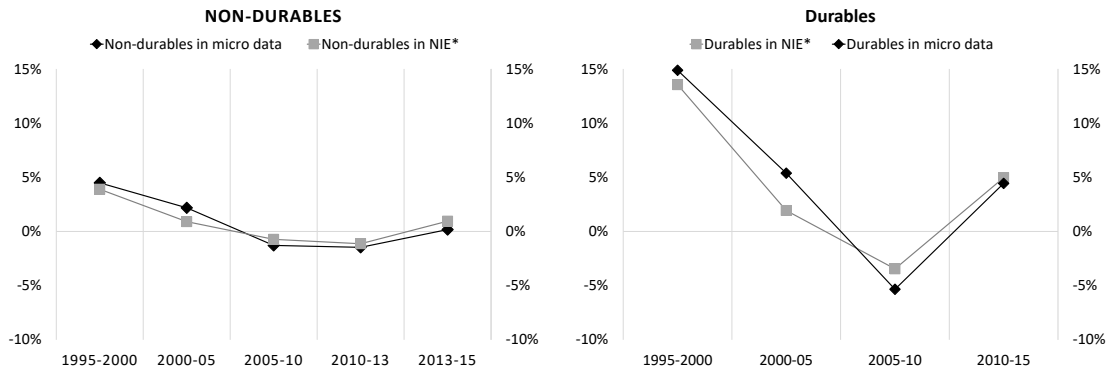
Spending on durable goods is defined as total weekly household expenditure minus both spending on non-durables (as defined above) and spending on rent or mortgage repayments. The share of durable goods in total consumption expenditure (excluding mortgage and rent) is between 10 and 17% between 1995 and 2015/16 (see Table 2).

Figure 3 shows that non-durables and durables spending trends in the micro data closely track National Accounts figures. Spending on durables is, as is well known, much more pro-cyclical

[3] See CSO (2012) for further background on the Household Budget Survey, including a full list of the individual expenditure items.

than non-durables. In fact, in the period spanning the end of the credit boom and beginning of the Great Recession/Financial Crisis in Ireland (2005-10), durables spending declines by a 4% *per year* on average. We discuss these trends in more detail in the section below on *The Irish Experience*.

FIGURE 3. Real household expenditure (average annual growth rate)



Notes: (*) *NIE* refers to the CSO *National Income and Expenditure Annual Results 2017*. To obtain average household expenditure, we divide by the number of Irish households in EU-SILC.

Housing wealth and income

The measure of wealth we use in this paper is *housing wealth*: specifically, the value of owner-occupied housing. We focus on housing wealth as it accounts for the bulk of Irish households' wealth (see Lawless et al. (2015)). Other empirical micro studies of wealth effects, such as Arrondel et al. (2015) and Case et al. (2005), show that the housing wealth effect tends to dominate other wealth effects, e.g. from financial assets.

Housing wealth is directly recorded in the HFCS in 2013. For the earlier years we impute the value of owner-occupied housing from a hedonic house price regression estimated on an administrative house price database. The regression coefficients are allowed to vary across years. The data appendix describes the data construction in detail. Figure 4 shows that gross housing wealth in the micro data closely tracks published house price indices.

FIGURE 4. Comparison of trends in the micro data with other sources

Notes: (*) The property price database from 2005 onwards is the CSO's Residential Property Price Index. Prior to 2005, it is taken from the Dallas Federal Reserve International House Price Database; see Mack and Martinez-Garcia (2011).

Income is defined as total after-tax household income including social transfers ("net disposable income"). We use a broad measure of income to allow for insurance against shocks within households.

Debt

As we focus on housing wealth, our measure of debt is total mortgage debt with respect to the main residence ('owner-occupier mortgage'). We add up all mortgages on the main residence. While other studies additionally include consumer debt, Lawless et al. (2015) show that other forms of debt are largely irrelevant for Irish households. Fasianos et al. (2017) show that, compared with other countries such as the US and UK, large non-collateralised debt, such as student debt and credit cards, are much less important for Irish households. Figure 4 shows that our measure of (mean) mortgage debt at the household level closely tracks data published by the Central Bank.

A particular feature of the Irish experience is the rise of 'Buy-to-Let' (BTL) loans in the early 2000s. At the beginning of the decade around one-in-twenty loans were BTL. By the middle of the decade, it was around one-in-five; see Lydon and McCarthy (2013) for a detailed description of this phenomenon. Unfortunately, the Household Budget Survey contains no information on BTL mortgage liabilities. We do not, therefore, consider it explicitly in the analysis, which means we are understating the level of household indebtedness. However, the HFCS cross-section does list all households liabilities, including BTL. Only 7% of homeowners have BTL debt (6% of outright owners and 8% of households with an owner-occupier mortgage). Conditional on having both types of debt, the correlation between owner-occupier and BTL debt is 0.41 (p-value=0.000). Whilst BTL loans grew rapidly during the boom, the data suggests a high degree of concentration amongst a small number of households. As such, we do not think it is likely to be significant source of bias in the regression analysis. Where it could be important, however, is in thinking about the economic importance of the results, a topic we return to in the discussion in Section 5 on credit constraints.

The Irish experience 1995-2015

Table 2 reports yearly summary statistics from the household surveys over the time horizon 1995-2015; all euro values are in 2013 prices. Net disposable income over the ten year time period preceding the crisis (1995-2005) increased by more than 40% and then fell from 2005 until 2013 by 12% on average. Positive income growth returned in 2013, driven in the most part by strong employment growth that has seen unemployment rates fall from recession-highs of just under 16% in January 2012 to just 6.2% in December 2017. Nondurable consumption for the most part tracks income changes, for example, increasing by more than 30% before the crisis and then falling on average by 10% during the recession. The main exception is the recovery from 2013 onwards: despite an almost 10% increase in average household income, spending on nondurables and services changes little. Instead, spending on durables increases dramatically, driven mainly by vehicle purchases. Gross and net housing wealth rose considerably between 1995 and 2005 (180% and 65% respectively) and then plummeted between 2005 and 2013 by more than 50%.[4]

[4]The increase in house prices continued until 2007. We do not capture this peak exactly due to the timing of HBS survey waves. Therefore, the decrease of housing wealth computed here is a lower bound of the actual decline.

TABLE 2. Descriptive statistics: levels

Household Survey	HBS	HBS	HBS	HBS	HFCS	HBS
Mean values for all households	1994/95	1999/00	2004/05	2009/10	2013	2015/16
Net disposable income (€/year)	27,774	37,630	49,193	48,291	43,330	47,448
Spending on nondurables + services ((€) /year)	24,450	30,450	33,927	31,799	30,422	30,529
as a share of total spending	*81%*	*78%*	*75%*	*73%*	*[*]*	*70%*
Spending on durables ((€) /year)	2,939	5,879	7,641	5,809		7,217
as a share of total spending	*10%*	*15%*	*17%*	*13%*	*N.A.*	*17%*
Spending on mortgage or rent ((€) /year)	2,847	2,851	3,656	5,826	6,691	5,847
as a share of total spending	*9%*	*7%*	*8%*	*13%*	*18%**	*13%*
Net housing wealth (€, all households)	88,606	206,780	245,919	197,913	115,070	148,416
Housing tenure (%)						
Outright homeowners	44	47	49	34	37	36
Mortgage homeowners	37	35	33	35	34	33
Renters	19	18	18	32	30	31
For outright homeowners (mean)						
Average value household main residence (€)	110,370	233,598	304,485	275,302	178,976	253,967
For homeowners with a mortgage (mean)						
Average value household main residence (€)	110,119	239,065	311,276	266,417	205,854	254,452
Average mortgage debt on household main residence (€)	55,882	86,539	173,243	147,054	149,853	144,789
Observations	7,876	7,644	6,883	5,891	5,419	6,839

Source: HBS 1995-2010, HFCS 2013. All euro-values indexed to 2013 price levels using the CPI. The HFCS survey (2013) does not collect comprehensive data on non-durables spending. (*) Durables spending not in the 2013 HFCS.

Table 2 (cont). Descriptive statistics: changes

	1995-2000	2000-05	2005-10	2010-13	2010-15
Total spending	5.8	2.7	-2.0		0.1
Non-durables & services	4.5	2.2	-1.3	-1.5	-0.8
Durables	14.9	5.4	-5.3		4.4
Income	6.3	5.5	-0.4	-3.5	-0.4
Average value of household main residence	16.2	5.4	-2.0	-13.4	-1.6
Average outstanding mortgage on household main residence	9.1	14.9	-3.2	0.6	-0.5
Δ unemployment rate	-7.8	0.1	9.4	-0.7	-4.4

Notes: Annualised real growth rates for the average household : e.g. for spending, $(\bar{C}_t/\bar{C}_{t-n})^{(1/n)} - 1$, where $\bar{C}$ is average spending at the household level. Durables spending not in the 2013 HFCS.

The home ownership rate – both outright and mortgaged homeowners – was stable until 2005, at around 80% of households, and then declined by 10 percent until 2013. This change is mostly reflected among the outright home owners whose fraction first increased until 2005 and then declined by 15% before recovering slightly. Over the time span 2005-2010, the fraction of renters went up from 18% to more than 32%. The fraction of mortgage home owners

remained broadly stable during the crisis. These developments highlight that there were very few transactions[5] and that renters tended not buy homes to become mortgage home owners during the period of falling prices (from mid-2007 to mid-2013).[6]

The house price boom is also visible in the value of the main residence: the average property value almost trebled between 1995 and 2005. House price growth was strongest between 1995 and 2000, growing at an average annual rate of 16.2%. This increase exceeded the growth rate in *average* mortgage debt, consistent with the picture in Figure 1 that increasing leverage was not a big factor during this period. The opposite is true between 2000 and 2005 when house price growth slowed (to 5.4% per year), but average mortgage indebtedness per household took off, growing by almost *15%* per year. The collapse in house prices after 2007 is evident in the micro data with average annual price falls of -13.4% between 2010 and 2013. The deleveraging after 2005 is also in the data, but at a much slower pace than the house price collapse, highlighting just how long it can take for individual households to unwind excessive debt positions.

At a household level, spending on both durables and non-durables grew strongly between 1995 and 2005, with stronger growth in the five years to 2000. The large swings in durables spending in particular closely resemble the US experience during the sub-prime boom-bust, as outlined in Demyanyk et al. (2019). Whilst there is some recovery in durables spending in the final wave, it is notable that total spending by 2015 remained almost 10% below levels seen a decade earlier.

In order to understand how much debt was built up by different types of households in the years preceding the crisis and how households deleveraged afterwards, we present a more in-depth picture of our sample in Table 3. We divide households by their tenure status, and additionally we subdivide mortgaged households into high and low leverage households. We define high leverage households as those in the highest quintile of mortgage debt to house value (LTV) ratio within a given survey-wave.[7]

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[5] Lydon and O'Leary (2013) shows that housing transactions declined by over 90% during the housing crash.

[6] The almost complete absence of housing transactions in 2010, 2013 and 2015 waves is very clear in Figure 13 in the appendix, which shows the distribution of property purchase year by survey wave.

[7] For comparisons both within and between groups across time, it is important to remember that the underlying micro data are repeated cross sections and *not* panel data. Changes in the composition of groups can therefore affect group means.

The experience of leveraged home owners

Highly leveraged home owners tend to be younger and more educated than households with other tenure states. While the value of their homes over time evolves similarly to the value of the homes of households with less debt, their mortgage debt to income (DTI) ratio tends to be considerably larger. For example, in 2000, the DTI for high leverage households was 3.7, compared to a figure of 1.2 for low leverage households. This itself was already a signficicant increase on the 2.6 ratio observed in 1995. By 2005, the debt to income ratio of the highly leveraged households had increased to more than four years' worth of net income while it stayed the same for the lower leverage group. During the same time, incomes had also increased very robustly as had house prices. The increase in indebtedness for the highly leveraged is also reflected by the increased mortgage debt-to-home value ratio (that is, LTV) that on average amounted to just-under 1 in 2005, up from 0.80 a decade earlier. Due to a combination of increased incomes and ever increasing loan terms, the average debt-service even declined slightly in 2005, from 19 to 18% of net income.[8]

When the crisis hit between 2005 and 2010, home values decreased quickly in value, so that the average net housing value of highly leveraged households was negative, lifting *average* LTV ratios to 1.15. Low-leverage households also experienced a growth in indebtedness over time but their LTVs stayed well below 0.5 through 2010. The low-point of the recession is observed in the 2013 (HFCS) data: disposable incomes drop significantly for all households, although there are clearly compositional factors at play. LTVs also rise, reflecting the prolonged fall in house prices: by 2013 the top-fifth of indebted households (relative to property value) had debts 66% greater than the asset value, on average. By comparison, the turn-around in incomes and, for some groups, spending after 2013 was relatively unforeseen. Employment growth, feeding income growth triggered a turn-around in the housing market, with house prices rising by 27% in real terms between 2013 and 2016Q1. The inflow of new borrowers after 2013 means that the composition of highly leveraged households is likely to have changed over time. We can see this in a number of variables, such as the fall in average age from 40 to 38 and the 10% fall in average incomes.

[8]Using administrative data on loan draw-downs, Lydon and O'Hanlon (2012) show that the average loan-term at origination increases from around 250 months in 2000 to 310 months by 2005.

The experience of outright home owners

Outright owners tend to be older on average with a smaller proportion of college-educated heads and a lower net income. This reflects their position in the life cycle as most of them have paid off their debts around retirement. Consequently, their spending is substantially lower than that of indebted households. They tend to have slightly smaller and less valuable homes before the crisis and are not as much affected by the drop in house prices as the younger and higher leveraged households. Additionally, older outright owners have less volatile incomes, compared with younger and higher leveraged households who bore the brunt of job losses, wage cuts and tax increases during the recession.

The experience of renters

In the absence of housing wealth, renters have mainly been affected by changes in net income. Over most survey years, the level and growth of net income of renters is significantly below that of all other groups, suggesting that this tenure status generally comprises income and wealth poorer households. The main exception is 2015/16, with substantial income growth (21%) versus 2013. The compositional shift in this group – already evident in 2013 with the large increase in college-education household heads in this group – continues in 2015/16 with a substantial increase in average ages between waves, from 39 in 2013 to 42 in 2015/16. Tighter lending standards after the bust (lower LTVs and loan-to-income ratios) have contributed to a longer period of saving before buying a home.

TABLE 3. Leverage and debt-burdens 1995-2015

	1994/5					1999/2000				
	All households	High-leverage	Low-leverage	Outright owner	Renter	All households	High-leverage	Low-leverage	Outright owner	Renter
Age head of households	50.9	37.0	45.4	60.2	43.5	51.7	36.9	45.6	60.9	42.4
% with a college degree	12.5%	39.3%	15.1%	7.3%	9.9%	21%	48.1%	23.5%	14.5%	23.4%
Household net income (€)	€27,774	€45,368	€33,702	€24,378	€19,824	€37,630	€56,098	€45,681	€32,801	€30,364
Spending on non-durables and services (€)	€24,450	€37,283	€30,001	€21,836	€17,094	€30,450	€41,187	€38,127	€27,107	€22,909
Spending on durables (€)	€2,939	€6,434	€3,784	€2,578	€1,146	€5,878	€10,704	€7,384	€5,408	€2,834
House value	€113,065	€142,240	€139,253	€140,170		€193,904	€238,224	€239,262	€233,598	
Mortgage debt	€20,531	€116,535	€32,628			€30,863	€206,586	€55,440		
Net housing wealth	€92,534	€25,705	€106,625			€163,040	€31,638	€183,822		
Spending on non-durables & services/income	0.88	0.82	0.89	0.90	0.86	0.81	0.73	0.83	0.83	0.75
Net housing wealth / Income	3.33	0.57	3.16	5.75		4.33	0.56	4.02	7.12	
Mortgage debt / Income	0.74	2.57	0.97	0.00		0.82	3.68	1.21	0	
Mortgage / Home value	0.18	0.82	0.23	0.00		0.16	0.87	0.23	0	
Annual debt service / Income	0.04	0.15	0.09	0.00		0.04	0.19	0.11		
Rent / Income					0.12					0.18
# observations	7,876	601	2,242	3,403		7,642	560	2,110	3,713	1,259

(…*table continues on next page*)

Table 3 (cont.) Leverage and debt-burdens 1995-2015

	2004/05					2009/10				
	All households	High-leverage	Low-leverage	Outright owner	Renter	All households	High-leverage	Low-leverage	Outright owner	Renter
Age head of households	51.9	36.6	45.6	61.5	42.5	48.1	36.5	42.1	62	39.2
% with a college degree	27.4%	53.6%	34.0%	18.4%	25.6%	28.6%	57.9%	37.0%	22.4%	23.1%
Household net income (€)	€49,193	€68,602	€63,950	€41,097	€36,465	€48,291	€74,538	€61,177	€43,274	€35,312
Spending on non-durables and services (€)	€33,927	€41,611	€43,293	€30,384	€25,255	€31,799	€42,026	€40,466	€30,391	€22,340
Spending on durables (€)	€7,641	€12,977	€10,311	€6,229	€3,894	€5,809	€9,631	€7,995	€6,077	€2,715
House value	€251,406	€309,063	€311,313	€304,485		€184,0698	€246,849	€267,235	€275,302	
Mortgage debt	€59,686	€303,211	€77,679			€61,655	€284,056	€102,651		
Net housing wealth	€191,720	€5,852	€233,633			€122,493	-€37,207	€164,584		
Spending on non-durables/income	0.69	0.61	0.68	0.74	0.69	0.66	0.56	0.66	0.7	0.63
Net housing wealth / Income	3.9	0.09	3.65	7.41		2.54	-0.5	2.69	6.36	
Mortgage debt / Income	1.21	4.42	1.21	0		1.28	3.81	1.68	0	
Mortgage / Home value	0.24	0.98	0.25	0		0.33	1.15	0.38	0	
Annual debt service / Income	0.04	0.18	0.09			0.064	0.27	0.18		
Rent / Income					0.20					0.21
# observations	6,633	456	1,771	3,228	1,178	5,592	413	1,498	1,802	1,879

(*…table continues on next page*)

	2013					2015/16				
	All households	High-leverage	Low-leverage	Outright owner	Renter	All households	High-leverage	Low-leverage	Outright owner	Renter
Age head of households	50.0	40.2	45.8	63.7	39.2	50.6	38.3	45.3	63.3	42.1
% with a college degree	33.8%	54.8%	43.3%	20.6%	35.9%	35.0%	54.3%	49%	23%	34.3%
Household net income (€)	€43,330	€61,407	€54,801	€41,196	€31,016	€47,448	€55,006	€69,005	€43,163	€37,526
Spending on non-durables and services (€)	€30,422	€37,922	€36,338	€27,899	€26,243	€30,529	€40,068	€41,487	€28,223	€22,361
Spending on durables (€)	N.A.	N.A.	N.A.	N.A.	N.A.	€7,217	€10,522	€9,413	€8,452	€3,304
House value	€135,267	€157,680	€217,824	€178,976		€179,857	€196,229	€285,344	€254,221	
Mortgage debt	€50,759	€261,139	€122,201			€46,912	€205,652	€131,234		
Net housing wealth	€84,508	-€103,459	€95,623			€132,945	-€9,423	€154,110		
Spending on non-durables & services/income	0.7	0.62	0.66	0.68	0.85	0.65	0.62	0.62	0.66	0.60
Net housing wealth / Income	1.95	-1.68	1.74	4.34		2.80	-0.17	2.23		
Mortgage debt / Income	1.17	4.25	2.23	0		0.99	3.74	1.90		
Mortgage / Home value	0.38	1.66	0.56	0	0.26		1.04	0.46		
Annual debt service / Income	0.074	0.27	0.19			0.071	0.25	0.14		
Rent / Income					0.21					0.24
# observations	5,367	378	1,436	1,937	1,616	6,839	405	1,625	2,880	1,849

Source: Authors' calculations using HBS (2000, 2005, 2010 & 2016) and HFCS (2013). All euro-values indexed to 2013 price levels using the Consumer Price Index. High leverage households are those in the highest loan-to-value quintile for owner-occupied mortgages. N.A.: Durables spending figures not available for 2013 HFCS.

4 Data construction and regression results

Birth cohorts

Wealth and income effects on consumption are typically estimated by regressing the change in consumption on the changes in income and wealth for the same household. A differenced specification deals with potential omitted variables bias arising from the systematic variation of variables across the wealth distribution, such as risk aversion and discount rates. As our data comes from repeated cross-section surveys, we cannot track consumption, income and wealth at the household level over time. This is a common problem with household data. We follow the approach in Attanasio et al. (2009) and Campbell and Cocco (2007), creating a semi-aggregated pseudo-panel dataset using birth cohorts at the regional level. Cohort data tells us nothing about the dynamics of income, wealth and consumption within groups. However, it is useful for understanding how groups of households – for example, highly indebted homeowners – respond to shocks.

We use five-year birth cohorts from 1935 to 1990. To allow for regional house price differences, we also allocate cohorts to regions. The HBS regional coding is based on two regions (urban and rural) to 2000, and thereafter five regions (NUTS II regions with an urban/rural split: Dublin (all urban); Border, Midland and Western; SouthWest, South East, Mid-West, Mid-East excluding Dublin).

As we are interested in housing wealth effects, we drop renters (between 20 and 30% of households in any given year). The dependent variable is growth in mean consumer spending on either non-durables or durables between survey waves: $\Delta C_{g,t} = log(C_{g,t}) - log(C_{g,t-n})$. The estimated regression is:

$$\Delta C_{g,t} = \alpha + \beta_y \Delta Y_{g,t} + \beta_w \Delta W_{g,t} + \beta_{age} f(Age_{g,t}) + \beta_u U_{region,t-n} + \beta_{\Delta u} \Delta U_{region,t} + \epsilon_t \qquad (1)$$

The subscript g denotes the group (i.e. cohort-region). The lagged cohort n is equal to five for most years, reflecting the fact that the HBS is five-yearly. The exception is 2010-13 and 2013-15 in the non-durables regression, where n equals three and two respectively, because we use the HFCS 2013 wave. There are thirteen birth cohorts, two regions in 1995 and 2000, and five in 2005, 2010, 2013 and 2015. This gives us a maximum of 312 (247) observations in levels (changes). For cell size reasons, however, we restrict the sample to homeowners aged between 20 and 84 in the survey year. This means we lose three age-cohorts in the 1995 wave (1980-90), two in the 2000 wave (1985-90), one in the 2005 wave (1995) and one in the 2015 wave

(1930) – twenty observations in total. Note also that data on durables spending is not availabe in the HFCS (the 2013 wave), which means that we lose a further 65 observations in the durables regression. The number of observations in each birth cohort-region-year cell ranges from 208 (non-durables and services) to 214 (durables).[9] As well as income and wealth growth, we include the lag and change in the regional unemployment rate. In empirical consumption models, the unemployment rate is used to proxy income uncertainty. The lag is included to capture the idea that effects could depend on whether we start from a low or high level of unemployment. To be clear, the estimated coefficients are elasticities and can be interpreted as percentage change in spending for a percentage change in income or wealth. To obtain the MPC, we multiply the coefficient by ratio of the sample means of consumption to income (the Average Propensity to Consume).

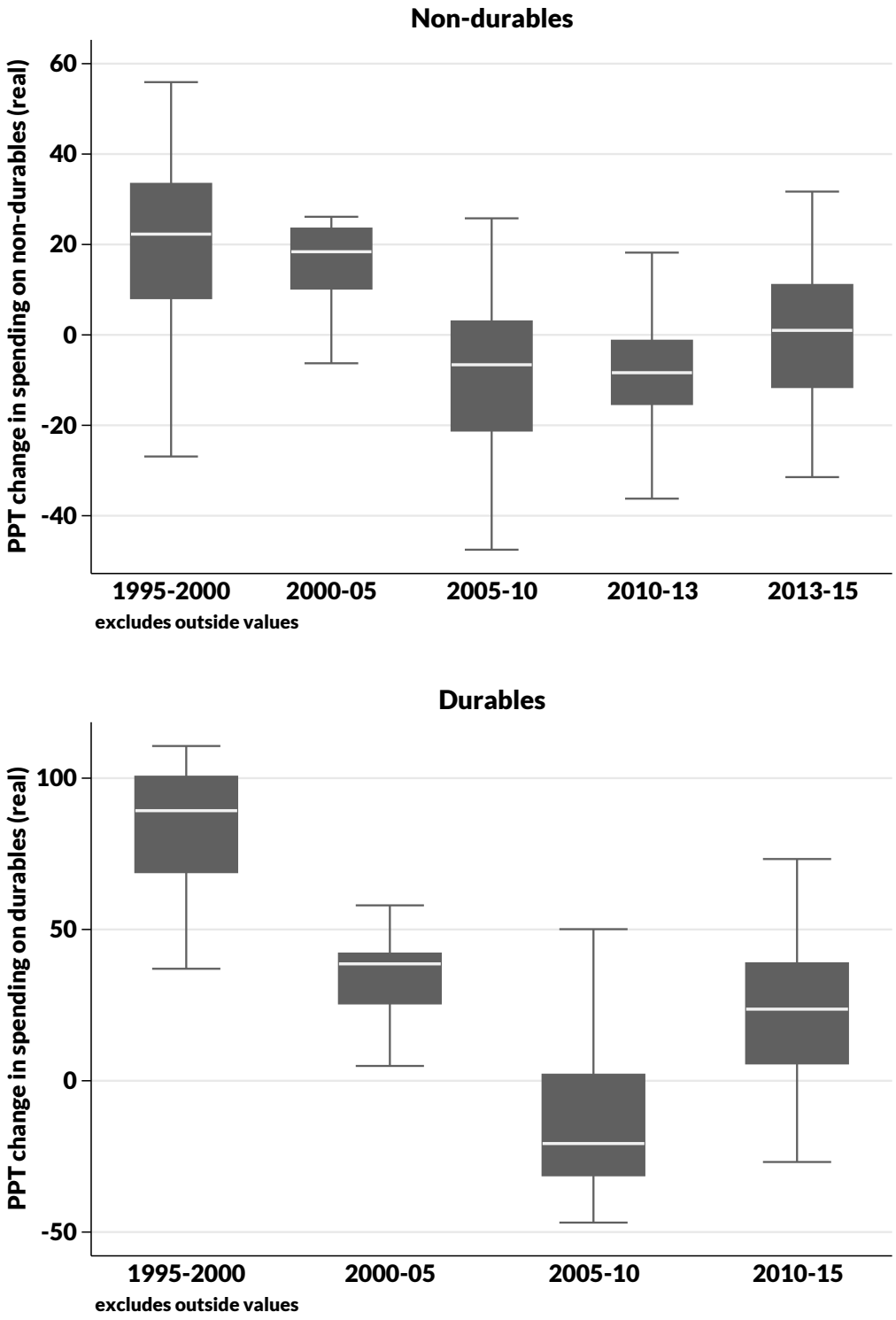
Figure 5 shows the variation in the dependent variable for each wave. This is cohort and not household data. The trends broadly track the stylised facts in Tables 2 and 3, but the point values are not comparable. Table 4 shows the baseline regression results. For nondurables, the estimated income elasticity (MPC) of 0.38 (0.25) is very similar to the cohort-based results for the UK in Campbell and Cocco (2007) and for the US in Cooper (2013) and Demyanyk et al. (2019). Proportionately, durables spending is significantly more sensitive to income changes, with an income elasticity (MPC) of 0.83 (0.132). This is consistent with the observation that durables spending is generally more pro-cyclical.

Spending increases with gross housing wealth, with an elasticity (MPC) of 0.07 (0.043) for nondurables and 0.22 (0.036) for durables. These estimates are very similar to estimates for the UK and US; see, for example, Bostic et al. (2009), Mian et al. (2013) and Attanasio et al. (2009). We use gross as opposed to net housing wealth in the regression, as in later specifications we condition on indebtedness.[10]

[9] With cell-sizes of around 200, there is the possiblity that means at the cohort-region level could be skewed by outliers. To prevent this, we winsorize the cohort-region cells at the 1 and 99% levels. We also tested the sensitivity of our results to using medians, which gives marginally lower MPCs. These results are available from the authors.

[10] Using net wealth can also lead to endogeneity problems if households that experience income or wealth shocks prioritise consumption over debt repayment; see Paiella and Pistaferri (2017) (2014). We are particularly consicious of this in the Irish case as one-fifth of owner-occupier mortgage went into arrears on their mortgage repayments during the recession, up from less than 0.5% in 2007 (see Lydon and McCarthy (2013)).

FIGURE 5. Wave-to-wave real change in household spending (x100) on nondurables (top panel) and durables in the birth-cohort dataset



Notes: The box in the box plot shows the 25th percentile, median and 75th percentile. The lines outside of the box show the upper and lower adjacent values.

There are no clear age-effects for durables spending, where income appears to dominate. But for nondurables, spending follows the well known quadratic shape in age. Unemployment – both lagged and changes – has the expected negative sign, but is insigificant in the non-durables regression. It is, however, both statistically and economically significant in the durables regression, which is consistent with the idea that greater income uncertainty can lead consumers to defer large spending decisions.

TABLE 4. Cohort regression (birth cohorts)

Dep var. is Δ log spending (*100)	Non-durables	Durables
Δ Log income (*100)	0.38***	0.83***
	(0.046)	(0.11)
Δ Log gross housing wealth (*100)	0.07***	0.22***
	(0.028)	(0.07)
Age	10.49*	-2.51
	(6.57)	(8.30)
Age^2	-1.54***	0.51
	(0.54)	(0.78)
Lagged unemployment (ppt)	-0.15	-2.16***
	(0.50)	(0.82)
ΔUnemployment (ppt)	-0.41	-2.52***
	(0.47)	(0.86)
MPC income	0.25***	0.132***
	(0.045)	(0.018)
MPC wealth	0.043***	0.036***
	(0.021)	(0.013)
N	227	163
R^2	0.60	0.59

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The regression coefficients are elasticities. We convert these to MPCs by multiplying the coefficient by ratio of the sample means of consumption to income (the Average Propensity to Consume). Standard errors for MPCs are bootstrapped. The number of observations in the durables regression is lower as there is no durables spending information in the 2013 HFCS data.

Does indebtedness matter?

Indebted households might respond differently to wealth and income shocks for a variety of reasons. For example, according to the permanent income hypothesis (PIH), debt to fund consumption in the current period can be repaid by future income streams. If that income fails to materialise, or is significantly lower than expected – i.e., 'unfounded optimism' as described

in Demyanyk et al. (2019) and Mian et al. (2013) – indebted households may reduce spending by more in response to a given income shock. Even if income shocks are transitory, tighter credit availability that penalises high-debt households (i.e., a supply shock) might constrain consumption smoothing.

In a buffer-stock framework indebted households might reduce spending if debt-service burdens become higher than expected after an income shock, reducing a household's cash-on-hand. However, if the monetary policy maker also lowers interest rates in response to a downturn – as the ECB did in 2009 – this debt-service burden effect could be reduced. A related channel is the 'target' leverage ratio, as suggested by Dynan (2012). Households could target leverage ratios for several reasons, for example, if a threshold leverage ratio (such as being in negative equity) precludes access to credit.

To assess how debt interacts with wealth and income shocks, we re-estimate our baseline specification including interaction terms between income and wealth changes and lagged indebtedness measures. We use average lagged loan-to-value (LTV) and debt-service ratio (DSR) for each of our birth-region cohorts. We follow Campbell and Cocco (2007) and Attanasio et al. (2009) by further splitting the data into outright and mortgage homeowners.[11]

Table 5 reports the results, with two columns for each of nondurables and durables, for the lagged LTV and DSR coefficients respectively. Households with more debt are more sensitive to wealth changes – but the standard errors are large (statistically insignificant interaction effects), regardless of which measure of indebtedness we use. In contrast, income effects also vary substantially by debt, but are statistically and economically significant, in particular when we look at the lagged *debt-service burden*. Focusing on the MPCs for non-durables, the MPC out of income for low DSR households (defined as less than 5% of net income directed to repaying mortgage debt) is 0.24 – very similar to the base case. For high DSR houseoulds (defined as more than 40% of net income directed to repaying mortgage debt), the MPC is 0.34. For durables, the relative differences are much larger, and lagged LTV also appears to play a role. For high DSR households, the income MPC is 0.27, but only 0.13 for low debt households. Looking across low- and high-LTV households, we see a similar range of results, with the MPC almost doubling across the range. In the next section we move beyond statistical significance, discussing both the economic significance of this result and the potential factors driving it.

[11]Note that this does not automatically lead to a doubling of the sample size from the baseline regression as some cells have very few observations in each wave – for example, there are only a handful of young outright owner households in any given wave, and similarly for older mortgage households. We drop these households from the sample.

TABLE 5. Cohort regression (birth cohorts), including indebtedness

	Non-durables		Durables	
	(1)	(2)	(1)	(2)
	LTV	DSR	LTV	DSR
Δ Log income	0.36***	0.32***	0.60***	0.62***
	(0.04)	(0.035)	(0.13)	(0.12)
Δ Log income $\times$ LTV_{t-1} (PPT)	0.001		0.008***	
	(0.001)		(0.003)	
Δ Log income $\times$ DSR_{t-1} (PPT)		0.005***		0.025***
		(0.0019)		(0.009)
Δ Log wealth	0.06***		0.36***	0.36***
	(0.028)		(0.09)	(0.12)
Δ Log wealth $\times$ LTV_{t-1} (PPT)	0.0003		-0.001	
	(0.0005)		(0.001)	
Δ Log wealth $\times$ DSR_{t-1} (PPT)		0.0003		-0.006
		(0.0004)		(0.004)
	LTV	DSR	LTV	DSR
MPC Income (low LTV [10]/low DSR [5])	0.25***	0.24***	0.12***	0.13***
	(0.04)	(0.038)	(0.02)	(0.02)
MPC Income (mid LTV [60]/mid DSR [20])	0.27***	0.272***	0.17***	0.167***
	(0.07)	(0.046)	(0.03)	(0.03)
MPC Income (high LTV [120]/high DSR [40])	0.27**	0.34***	0.22***	0.27***
	(0.13)	(0.078)	(0.04)	(0.07)
N	364	364	260	260
R^2	0.50	0.51	0.42	0.43

Notes: Pooled outright and mortgage homeowners. Regression includes controls for age, age-squared, lagged unemployment by region, the change in regional unemployment, homeownership, lagged LTV and DSR. Indebtedness has no additional impact on the wealth elasticity, we therefore only report the (bootstrapped) income MPCs for different debt levels. The regression coefficients are elasticities. We convert these to MPCs by multiplying the coefficient by ratio of the sample means of consumption to income (the Average Propensity to Consume).

5 Discussion

We find substantial differences in income MPCs for low- versus high-leverage households. This section discusses this key result in several dimensions. First, we emphasise the economic importance of the result by showing the extent to which the distribution of household leverage – both LTV and DSR – shifted sharply to the right during the credit boom and financial crisis. Next we highlight the importance of *'Fisher Dynamics'* in the evolution of debt-to-income ratios for different buyer cohorts over time. Specifically, we identify both the large negative downward shift in the *level* of nominal income, and the almost complete absence of nominal income *growth*

for boom-time borrowers as a key drag on consumption over the last decade. Finally, using self-reported data from the 2013 HFCS, we also present correlations that suggest a strong link between over-indebtedness and credit constraints. Taken together, the analysis shows how the combination of growing indebtedness, income shocks and credit constraints reinforced the consumption drop and magnified the recession.

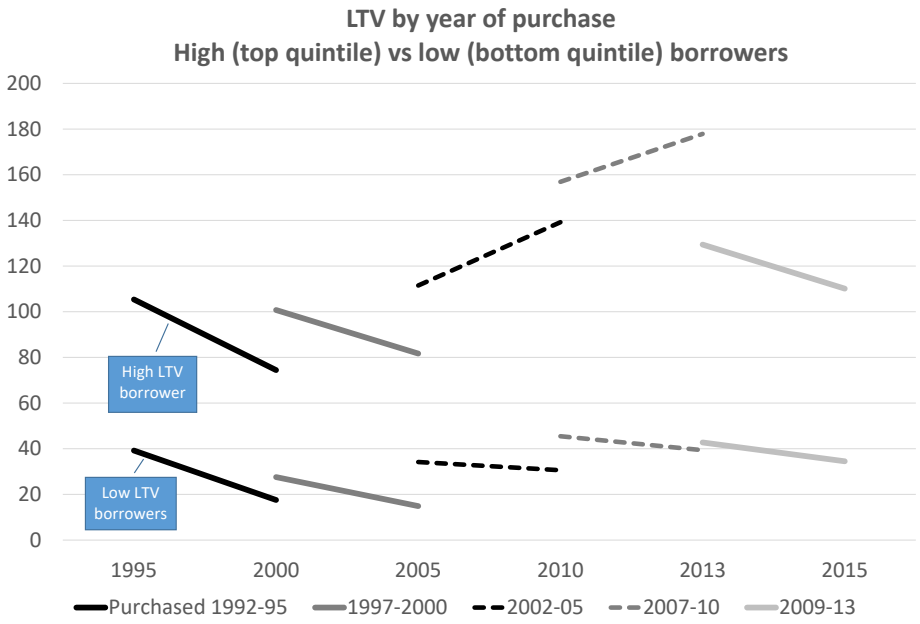
Growing indebtedness

In addition to the summary statistics in Tables 2 and 3, Figures 6 and 7 show the extent to which leverage moved sharply to the right during our sample period. This was driven both by housholds taking out ever increasing LTV debts, *and* by the house price collapse that left many borrowers in negative equity.

Figure 6 shows LTVs for mortgaged households who bought in the three years preceding the survey. Cohort composition is held constant between waves – i.e. the same buyer groups are compared. We condition on low-LTV (bottom quintile of the mortgaged household LTV distribution) and high-LTV (top quintile of the LTV distribution). There is a growing divergence of low- versus high-LTV borrowers as the credit bubble expanded during the mid-2000s. At the peak of the boom, more than half of new mortgages were high- or very-high LTV loans (i.e. greater than 90% LTV, see Kelly et al. (2019)). The shift from downward to upward sloping LTVs within buyer group in 2010 (high-leverage buyers only) and 2013 (all buyers) is driven by the house price collapse. The *fall* in LTVs after 2013 reflects two factors: the prioritisation of debt repayment by indebted households; and the large increase in house prices that occured between 2013 and 2015 (increasing by 27% on average).

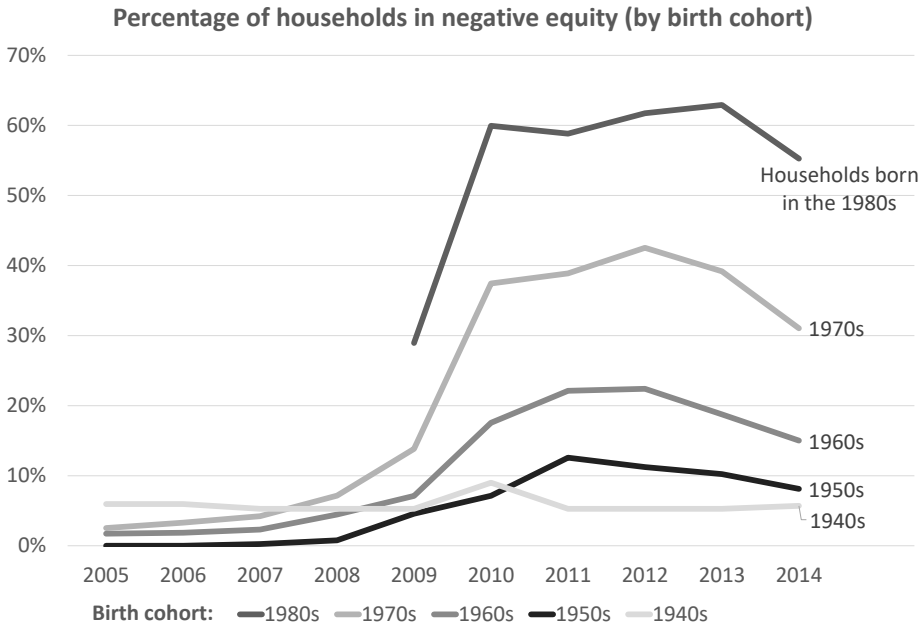
Figure 7 highlights the prevalence of negative equity amongst certain households in the sample. By 2013, almost *half* of owner-occupier mortgage households where the head was aged 25-44 were in negative equity, compared to around one-in-seven for 45-64 year old households. Even on its own, this is very large proportion. However, when we consider that between 1995 and 2005 almost 45% of *aggregate* consumer spending – on both durables and non-durables – is by the 25-44 year old age group, we can begin to see how indebtedness can exert a significant negative drag on aggregate spending in the presence of income shocks (this share fell to 35% in the 2015 wave).

FIGURE 6. LTV (ppts), conditional on year of purchase and indebtedness



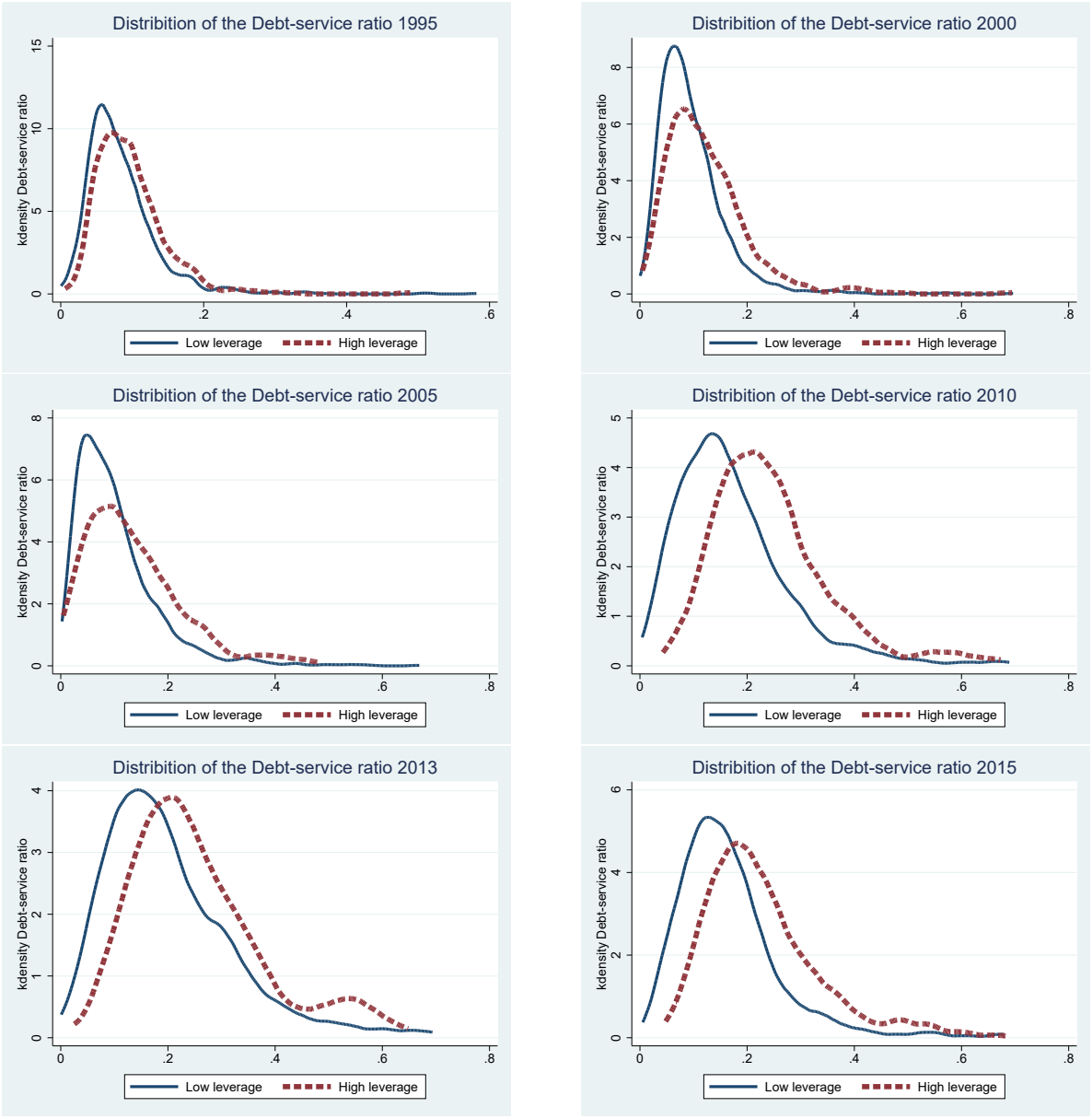
Notes: Cohorts are mortgaged homeowners who bought in the three years preceding the survey. Cohorts composition is constant between waves, i.e. comparing changes from 1995 to 2000, we look at mortgage borrowers who bought only between 1992 and 1995, conditioning on leverage. High leverage borrowers are those households in the top quintile of the Loan-to-Value (LTV distribition).

FIGURE 7. The rise of negative equity



Source: HFSC 2013 and Lydon and McIndoe-Calder (2018). Sample is households with a mortgage on their owner-occupied property (i.e. 'Household Main Residence' in HFCS parlance). Prior to 2009, there are two few mortgaged households in the 1980-89 birth cohort to estimate robust negative equity figures, hence the line starts in 2009.

FIGURE 8. Increasing DSRs over time



Notes: DSR is the 'debt service ratio' of mortgaged households only, i.e. the ratio of owner-occupier mortgage repayments to net disposable income.

Indebtedness also exerts a drag on spending through the debt-service ratio (DSR). Figure 8 shows the shift to the right in DSRs over time. From 1995 to 2005, DSRs tended to be concentrated around 0.15, in other words, the typical household with an owner-occupier mortgage spent 15% of their net disposable income on repaying mortgage debt – although there is significant variation either side of this, the distribution is skewed to the right. Significantly, there is little difference between high- and low-leverage households. By 2010, the DSR distriution had shifted significantly to the right, in particular for high-leverage households. The increasing mass in the

right-hand tail is also very clear, with heavy debt service burdens for a significant minority of households.

Fisher dynamics and the debt burden

Mason and Jayadev (2014) decompose movements in the debt-to-income ratio for US households into so-called 'Fisher variables'. Taking the starting stock of debt as given, the fisher variables are changes in household liabilities, incomes changes, inflation rates and interest rates. In the Irish case, it is a useful approach because it highlights how changes in incomes, inflation and interest rates can drive indebtedness, *outside* of any changes in the supply of or demand for credit. The decomposition is based on the approach commonly used for analysing the sustainability of *public debt*. In the household setting, a sufficient condition for ensuring that an initial mortgage debt position does not become unsustainable – i.e. an increasing debt-to-income ratio – is for the nominal interest rate on mortgage debt to be less than the growth rate of nominal income.[12] There is a parallel in the PIH framework: income shocks can prompt even greater saving amongst indebted households if permanent income surprises on the downside, that is, if the *ex-post* level of debt is inconsistent with *ex-ante* income expectations.

Figure 9 sheds some light on the scale of this income 'surprise', plotting age-income profiles for different education groups pre- and post-2010. There is clear downward shift in incomes after 2010 – driven by a combination of job losses, wage cuts, tax increases and reductions in social transfers – particularly amongst the 25-55 age group which accounts for 95% of all mortgage debt. It is hard to argue that this is anything other than a negative permanent income shock.

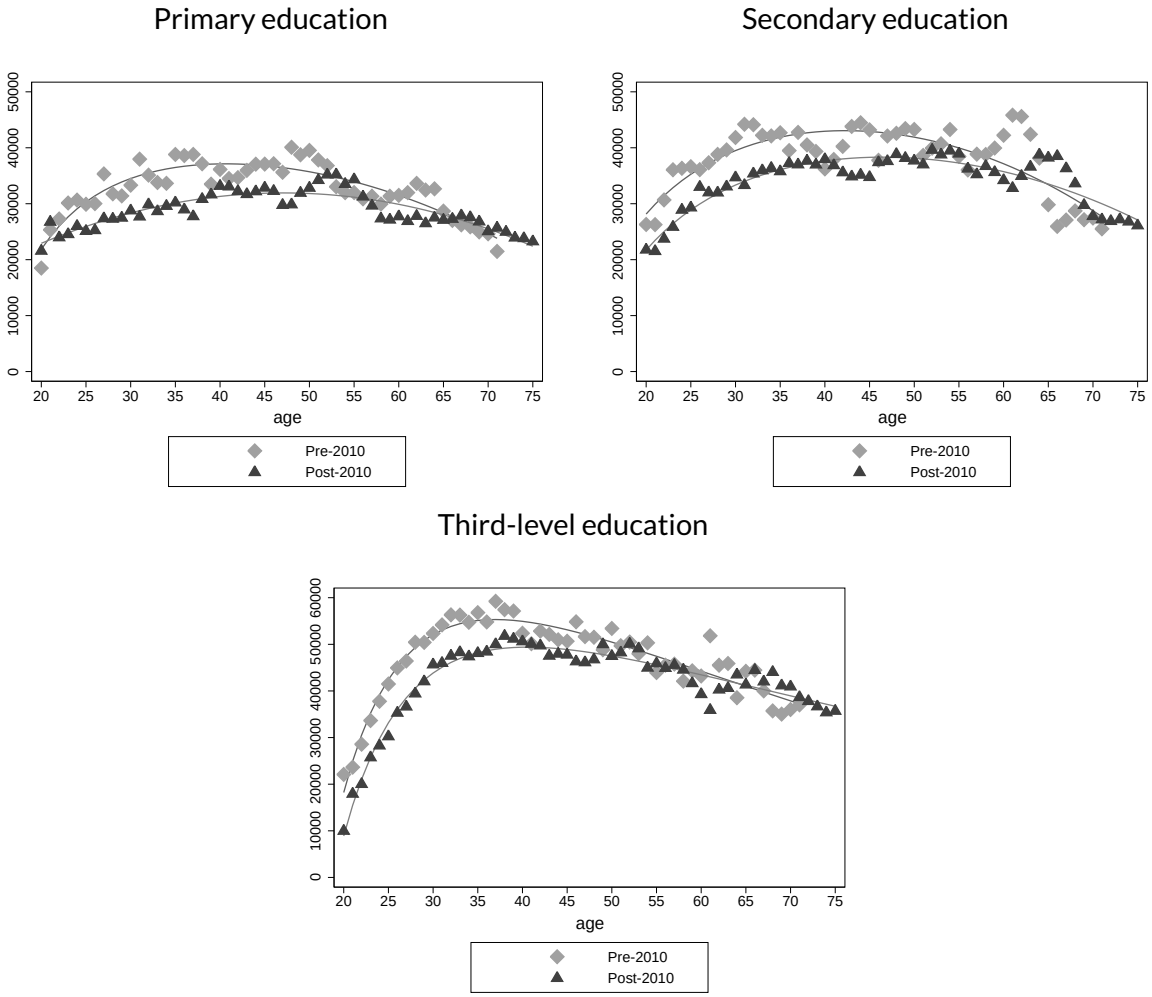
In addition to a shock to income *levels*, the long-duration of the recession, combined with a low-inflation environment (the price level was practically unchanged between 2008 and 2013) was particularly unfavourable to households who took out debt at the peak. As Figure 10 shows, the income realisations for buyers who bought around 2008 were particularly negative. In nominal terms, their incomes were actually 20% *lower* six years later. Compare this with the experience of earlier cohorts, such as 1995 or 2000 borrowers, who saw nominal incomes grow by between 50 and 80% after purchasing (inflation was particularly strong between 2000 and 2005, with prices rising by almost 25% over the period, compared with 11% for 1995 to 2000).

In terms of Fisher effects, relatively lower interest rates offset some of the weaker income for the 2005-10 and 2008-13 cohorts, as shown in Table 6. During the 1995-2000 and 2000-05

[12] In the regressions, we used the debt-service burden to look at debt-sustainability. An alternative would be to use debt-to-income, although the two are highly correlated (0.92), as Table 11 in the appendix shows.

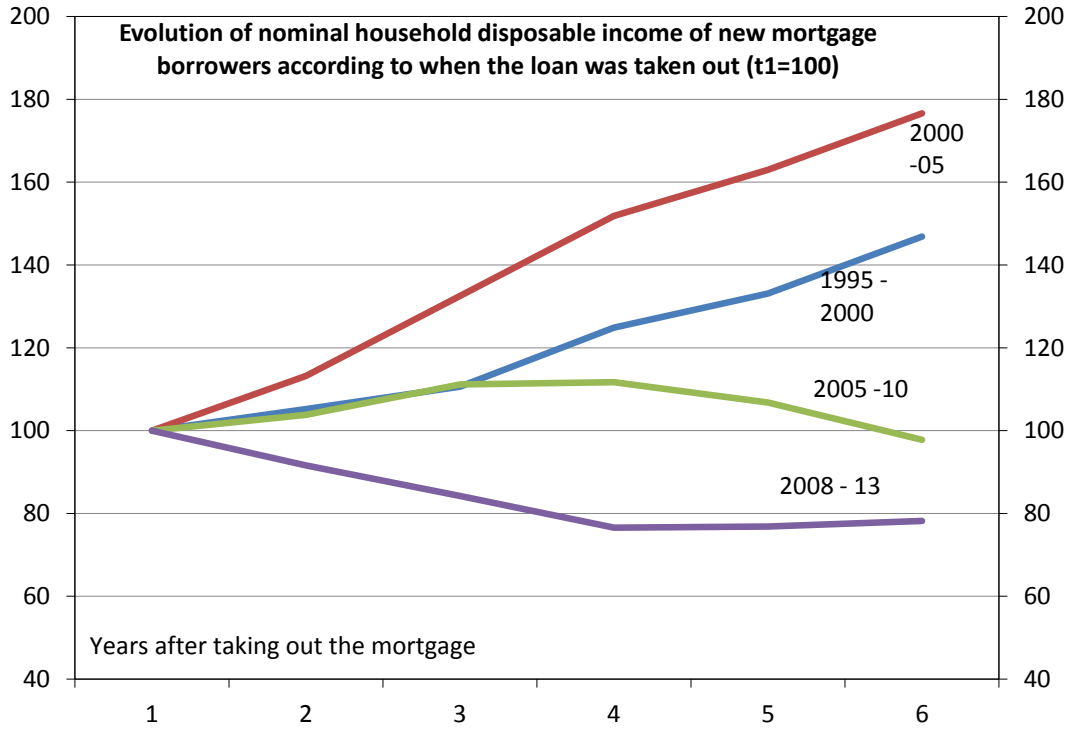
periods, nominal mortgage interest rates averaged 6.6 and 4.35% respectively. Between 2005-10 and 2008-13 the averages were 3.9 and 3.2%. However, these relatively lower rates came nowhere close to offsetting the impact of negative income shocks. Against these interest rates, borrowers who took out mortgage debt around the peak of the credit and property price boom either experienced slightly negative (-0.4% for the 2005-2010 group) or *very* negative average annual income growth (-4.0% for the 2008-13 group) after taking on debt. The Irish experience shows that changes in leverage can reflect mechanical effects of changes in inflation, interest rates or incomes that are independent of borrowing decisions.

FIGURE 9. Age-income profiles, by education



Notes: Income data is from 2005-14 panel data from tax returns, linked to the HFCS (2013). The dataset is described in detail in Lydon and Lozej (2018).

FIGURE 10. Income growth after buying a home with a mortgage



Notes: For a given buyer cohort, the chart shows the evolution of nominal household income (indexed to 100) up to six years after the property purchase. Buyer cohorts are mortgaged households who bought a home in the three years prior to the survey wave. For example: the '2000-05' line shows the evolution of household incomes for mortgaged households who bought between 1997 and 2000 *from* 2000 and 2005. Income growth is specific to each buyer cohort (with a mortgage) and is taken from EU SILC (from 2003 onwards) and the fore-runner to EU-SILC, the *Living in Ireland Survey* from 1995-2002.

TABLE 6. Fisher variables for mortgage borrowers

	1995-2000	2000-05	2005-10	2008-13
Nominal income growth (annual)	7.0%	9.95%	-0.38%	-4.02%
Mortgage interest rates	6.6%	4.3%	3.9%	3.2%

Notes: Income growth is specific to each buyer cohort (with a mortgage) and is taken from EU SILC (from 2003 onwards) and the fore-runner to EU-SILC, the *Living in Ireland Survey* from 1995-2002. Nominal mortgage interest rates are provided by the Central Bank of Ireland and are simple averages of annual figures within each time-period.

Credit constraints

Campbell and Cocco (2007) and Cooper (2013) argue that the collateral constraints channel means that more heavily indebted households have a higher MPC because credit constraints are more binding for this group. This section uses the 2013 HFCS to assess the role of the 'borrowing

collateral constraints' channel during the recession.[13] In the 2013 HFCS, a household is defined as being credit constrained if it answers yes to either of the two following questions:

1. *In the last three years, has any lender or creditor turned down any request you [or someone in your household] made for credit, or not given you as much credit as you applied for?*; or

2. *In the last three years, did you [or another member of your household] consider applying for a loan or credit but then decided not to, thinking that the application would be rejected?*

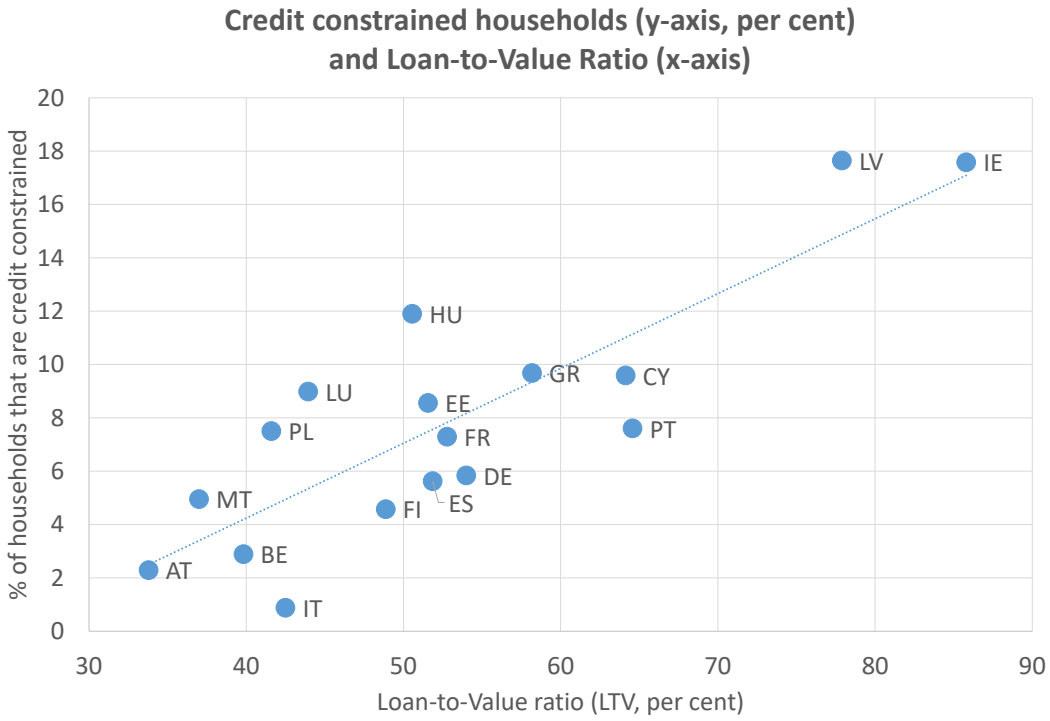
Figure 11 plots the percentage of owner-occupier mortgage households that say they are credit constrained against the average LTV at the country level for countries in the HFCS wave 2 dataset (2013). It shows a positive correlation between indebtedness and the incidence of credit constraints. Along with Latvia, which also experienced a housing boom-bust, Ireland has the largest proportion of credit constrained households *and* the most indebted households in the sample. The correlation could be explained by demand constraints, arising from over-indebtedness for example, or supply constraints in the credit market. A tightening of credit supply is undoubtedly part of the explanation for the cross-country variation in the prevalence of credit constraints – there was, afterall, a severe banking crisis in Ireland.

To better understand the relationship between credit constraints and indebtedness for Irish households, we estimate a probit regression where the dependent variable equals one if a household is credit-constrained, and zero otherwise. The key explanatory variables are net disposable income – both the log of the level in 2013 and the change in income from 2008 to 2013 – and LTV or DSR on the homeowners main residence (i.e. owner-occupied property). We chose 2008 as a reference point for income as this is peak year for incomes in the sample, just predating income reductions from job losses, wage cuts, tax increases and changes in social transfers. The income panel is taken from tax returns for each household member matched to the HFCS 2013 cross section, aggregated up to the household level.[14] Referring back to the earlier discussion on BTL debt, as we are solely using the HFCS 2013 dataset here, we also include a dummy variable for whether or not a household has BTL debt.

[13] See Jappelli et al. (1998) for an early paper using self-reported credit constraints. Kelly et al. (2019) also examine the link betweeen indebtedness and the incidence of credit contraints in a cross-country setting.

[14] This is the same data used for Figure 9. The income tax return refers to income from work only. We use a tax benefit model for the years in question to calculate taxes, social transfers, and, finally, net disposable income. A full description of the data set can be found in Lydon and Lozej (2018) and Lydon and McIndoe-Calder (2018).

FIGURE 11. Credit constraints and indebtedness (HFCS 2013)



Source: ECB (2013). The chart is for mortgaged households only. The x-axis shows the average Loan-to-Value (LTV) ratio at the country level on the x-axis and the percentage of credit constrained households at the country level on the y-axis.

The results, in Table 7, show a strong positive correlation between indebtedness and credit constraints, even after controlling for income levels and changes, which are both negatively correlated with credit constraints, as expected. The linear effects – shown for all households (1), all homeowners (2) and mortgaged homeowners (3) – are all statistically significant, but small. For example, in specification (3), a 10 percentage point increase in LTV increases the likelihood of being credit constrained by 0.83% (the mean of the dependent variable is 17%).

The debt-credit constraints relationship could be non-linear. The obvious example is negative equity, where households are 'collateral constrained' by definition. Specification (4) replaces the continuous LTV variable with a dummy variable equal to one if a household is in negative equity (one-third of mortgaged owners in the sample). We get large marginal effects: controlling for income and observable characteristics including household composition, age and education, negative equity households are 9% more likely to be credit constrained (the predicted probability with/without credit constraints is 23.5/13.9%).

TABLE 7. Probit regression: credit constrained=1, LTV marginal effects (x10)

	(1) All hhlds	(2) Homeowners hhlds	(3) Mortgaged hhlds	(4) Non-linear Mortgaged
Log (Income)	-0.20***	-0.30***	-0.54***	-0.54***
	(0.07)	(0.09)	(0.15)	(0.15)
Δ Income (2008-13)	-0.26***	-0.28***	-0.63***	-0.65***
	(0.09)	(0.10)	(0.20)	(0.20)
Has BTL mortgage	3.10*	4.40***	4.80	4.82*
	(1.80)	(1.70)	(2.98)	(2.90)
LTV (main residence, ppt)	0.30***	0.60***	0.83***	
	(0.08)	(0.09)	(0.16)	
Neg. equity [0,1]				9.00***
				(1.95)
N	5,336	3,787	1,849	1,849

Notes: HFCS 2013 sample only. 'Homeowners' (column 2) includes both outright (no mortgage on owner-occupier property) and mortgaged homeowners. 'Has BTL mortgage' is a dummy variable equal to one if a household has a mortgage on a buy-to-let property. Marginal effects are the change in the probability of being credit constrained for a 10 percentage point change in the explanatory variable, with the exception of negative equity and the BTL dummies which are a 0:1 change. LTV is for owner-occupier households only. Additional controls for household composition, age and education are also included.

Table 8 shows the results from the same regressions, replacing LTV with DSR (debt-service ratio). The marginal effects for a ten percentage point change in the DSR are larger than the LTV effects –as high as 3.23% for mortgaged households – reflecting the fact that they measure two different things. Much like LTV, the DSR-credit constraints nexus appears to be non-linear, with a stronger positive correlation for households using at least 30% of their income to repay mortgages.[15] Almost one-fifth (18%) of mortgaged households in 2013 have a DSR greater than 30% of net disposable income, and these households are almost 7% more likely to be credit constrained.

In the final column in Table 8 we include a dummy variable for households that are in *both* negative equity and have DSRs in excess of 30%. This accounts for one-in-ten mortgaged households in the sample of mortgaged households in HFCS 2013. The marginal effect for these households is 13.13%. This suggests that both factors play a role at the household level. It is important to point out that the individual negative equity and 'high-DSR' results also still hold.

[15]Unlike LTVs, where negative equity is a obvious threshold, there no clear threshold for DSRs. The macro-prudential policy literature cites a DSR above 30% as at risk of being unsustainable. Hence, we use that threshold here.

In terms of the the scope for indebtedness to impact *aggregate* spending outcomes via credit-constraints, over 11% (34%) of (mortgaged) households satisfied one or both conditions in the data.

TABLE 8. Probit regression: credit constrained=1, DSR marginal effects (x10)

	(1) All hhlds	(2) Homeowners hhlds	(3) Mortgaged hhlds	(4) Non-linear Mortgaged	(5) Neq. eq + Hi-DSR
Log (Income)	-0.17**	-0.15*	-0.28*	-0.43**	-0.52**
	(0.08)	(0.09)	(0.21)	(0.20)	(0.19)
Δ Income (2008-13)	-0.26**	-0.31***	-0.75***	-0.70***	-0.72***
	(0.10)	(0.10)	(0.21)	(0.21)	(0.22)
Has BTL mortgage	2.50	3.40**	3.11	3.33	3.55
	(1.82)	(1.70)	(3.14)	(3.15)	(3.13)
DSR (ppt)	1.16***	2.10***	2.70***		
	(0.03)	(0.33)	(0.74)		
DSR$>$30 [0,1]				6.80***	5.00*
				(2.28)	(3.00)
Neg. equity					8.85***
					(2.43)
DSR$>$30 + neg. eq.					13.13***
					(2.86)
N	5,230	3,681	1,735	1,735	1,735

Notes: HFCS 2013 sample only. We drop 116 households with excessively high debt service burdens (in excess of 80% of disposable income).

6 Conclusion

Using detailed micro data on consumption, wealth and income, we analyse the impact of income and wealth changes on consumption growth before and after the Great Recession. We construct a cohort dataset to understand the drivers of household consumption behaviour over time. Ireland is a useful case study to examine the variation in consumption growth as not only was it one of the worst hit economies in terms of wealth and income shocks, but it also experienced a rapid build-up of debt in the run-up to the crash.

We find statistically and economically significant wealth and income effects on consumption. We also find that heavily indebted households – measured by either loan-to-value or debt-service ratios – are more sensitive to income shocks in particular, and, less so, wealth shocks. When the housing crash came, these households faced sharp income declines, leading to a disproportionate drop in overall consumption. We argue that the sheer scale of the increase in indebtedness

during the early- to mid-2000s means that it had to have played an important role in consumer spending dynamics during the recession and early years of the recovery. Apart from the increase in households' demand for debt, the Fisher dynamics additionally suppressed spending.

Our results are consistent with the predictions of the PIH framework, where households experience a 'surprise' negative income shock after taking on debt. These are the households that save the most during a downturn. The Irish experience is also consistent with a 'collateral constraints' channel leading indebted households to reduce spending by more in response to a given income or wealth shock. For example, controlling for income changes and levels, we show that households in negative equity are almost twice as likely to be credit constrained in 2013, the trough of the recession in Ireland. We get similar results for households with high debt-service burdens.

To prevent similar boom and bust cycles, many Central Banks have introduced macroprudential rules to ensure financial stability and to counter the dangers of excessive indebtedness of the household sector on the macroeconomy. The example of Ireland both in the exceptional boom as well as the bust illustrates how damaging the effects of shocks to income in particular, but also wealth, can be for indebted household groups and subsequently on the recovery of the entire economy. Whilst negative housing wealth shocks directly impact spending via the wealth MPC, there are also large indirect effects via the collateral constraints channel that impede consumption smoothing in response to an income shock. After the bust of 2008-13, house prices have recovered strongly, with prices up by over 70% between 2013 and 2019. The key difference versus the early-2000s period is that this has not been accompanied by a run-up in household debt. Using the next wave of HFCS (2018) and household budget surveys, future work could study how the recovery in asset values has affected household spending.

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Data Appendix

Consumer spending measures in the HFCS 2013

Unlike the diary-based measures of spending in the HBS, HFCS households report how much they *typically* spend on certain *categories* of goods, including:

- **Food in the home** – "About how much does (you/your household) spend in a typical month on food and beverages at home?"
- **Food outside the home** – "About how much does (you/your household) spend in a typical month on food and beverages outside the home? I mean expenses at restaurants, lunches, canteens, coffee shops and the like."
- **Utilities** – "About how much does your household spend on utilities (e.g., electricity, water, gas, telephone...) in a typical month?"
- **Goods & services overall** – "So overall, about how much does your household spend in a typical month on all consumer goods and services? Consider all household expenses including food, utilities, etc. but excluding consumer durables (e.g. cars, household appliances, etc.), rent, loan repayments, insurance policies, renovation, etc."

Households are asked about one type of durables spending: namely, conditional on purchasing a car, truck or motorcycle in the last year (14% of households), what was the total amount paid (net of trade-ins, etc). Table 9 compares the mean values for reported household expenditure in the survey with the corresponding categories in the National Income and Expenditure accounts (NIE).

The level of spending on food and vehicles is very close to the household average from the national accounts (NIE, 2013). Utilities spending is higher, however much of this difference is explained by the fact that 'Utilities' in the HFCS include gas, electricity, telephone (fixed & mobile), internet, waste & water, whereas the NIE is for 'Fuel and power' only. The more concerning statistic is the low level of reported spending in the *overall* category versus National Accounts data. Furthermore, a large number (25%) of households do not even answer this question. High levels of item non-response is a common finding in surveys that do not use diary-based methods to elicit overall consumption spending (see Browning et al. (2003)). Browning et al. (2003) also present evidence from surveys in Canada and Italy which would lead us to question the accuracy of these recall questions on *total* consumption.[16]

Rather than use the under-reported consumption variable, we impute total consumption from other consumption expenditures, which, based on the comparisons and in-line with the existing literature, appear to be more accurately recorded. The basic idea is to use data on food, utlities and total nondurables consumption from another household survey (the Household Budget Survey) to impute a measure of total nondurables consumption in the HFCS. Browning et al. (2003) propose this methodology for non-diary based consumer spending syurveys. Blundell,

[16] Table 3 in the Browning et al. (2003) paper shows a remarkable similarity with our own data, both in terms of item non-response, and in terms of the difference between *recalled* spending and diary-based estimates of monthly spend.

Postaferri and Prestion (2008, 2004) use this technique to impute consumption in the US Panel Study of Income Dynamics (PSID), as do Arrondel et al. (2015) for the French HFCS.

TABLE 9. Comparison of HFCS and NIE consumption data (household means)

	HFCS (2013)	NIE (2013)
Food (in + out of the home, €/month)	€692 n=5,014 [682, 703]	€655
Utilities (€/month)	€235 n=5,014 [231, 240]	€169
Goods & services overall (€/month)	€1,383 n=3,728 [1356, 1410]	€2,597
Purchase of vehicles in the last year (€/year)	€1,382 n=5,014 [1183, 1478]	€1,266

Source: NIE (2013) and HFCS (2013)
Notes: 95% confidence interval in square brackets.

We specify household spending on expenditure item i (c_i) i.e. food and/or utilitities, as a function of *total* expenditure on non-durables and services (**C**):

$$c_i = f^i(\mathbf{C}) + u_i \rightarrow \hat{\mathbf{C}} = (f^{-1})(c_i), \tag{2}$$

The second expression inverts the share equation to give $\hat{\mathbf{C}}$, our imputed variable. For $i = 1, ...m$, there are *m*-possible imputations of $\hat{\mathbf{C}}$. One approach is to use weights of c_i in **C**, another is to linearise and estimate the following regression:

$$\mathbf{C} = \alpha + \pi_1 c_{i=1} + \pi_2 c_{i=2} + \ldots + \pi_m c_{i=m} + \varepsilon, \tag{3}$$

The fitted value from this regression can be used as the imputed value for $\hat{\mathbf{C}}$, i.e. using the OLS coefficients as weights. Therefore, using the Household Budget Survey micro data for 2009-10, we estimate the following:

$$\mathbf{C} = \alpha + \Pi_1 F_{in} + \Pi_2 h(F_{out}) + \Pi_3 Utils + \Omega \mathbf{X} + \varepsilon \tag{4}$$

where $h(\cdot)$ is a quadratic in F_{out} (spend on food and beverages outside the home), $Utils$ is monthly spending on utilities and **X** are other controls for spending levels, including age, region and quarter.

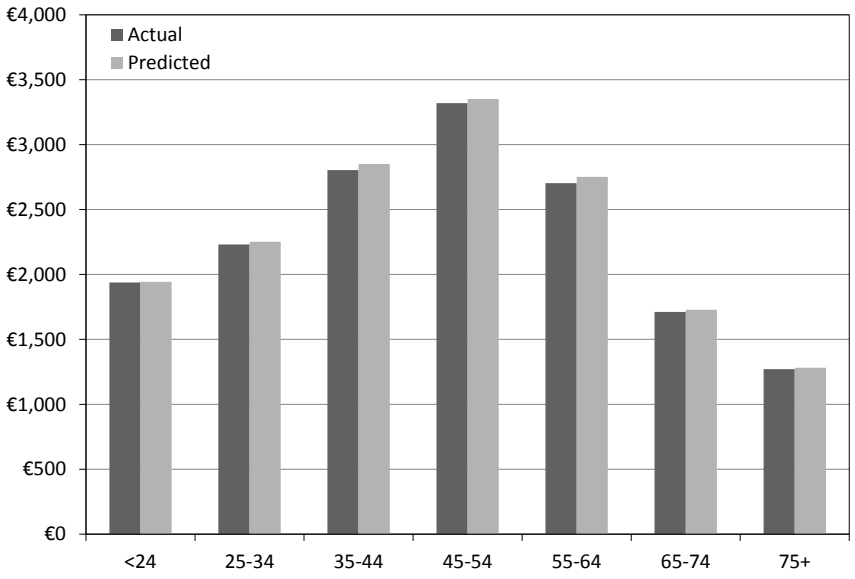
TABLE 10. OLS regression for imputing total consumption (HBS 2009/10)

	Coefficient	Std. error
Food spend, in the home	2.082***	0.0525
Food spend, outside the home	4.526***	0.1006
Food spend, outside the home (squared)	-0.0008***	0.00008
Utilities	2.796***	0.1003
Other controls: age, region and quarter, N = 5,876, Adj R-squared = 0.68		

Source: HBS 2009/10, *** signficant at the $\leq$1% level

The consumption regressions in the paper include wealth and income as control variables, and we therefore exlcude them from the imputation regression to avoid spurious results. Typically, this type of regression explains around two-thirds of the cross-sectional variation in non-durable and services spending. In HBS 2009/10, the R-squared is 0.68 (Table 10). Overall, our results are very similar to those in Browning et al. (2003). For example, they obtain coefficients ('weights') on Food at home in Canada and Italy of 2.74 and 2.48 respectively; and on food outside the home of 3.69 and 2.55; and on Utlities of 2.72 and 1.5. Figure 12 provides further support for the imputation approach, comparing the fitted and actual values across the HBS age distribution.

FIGURE 12. Predicted and actual spending on non-durables by age (€/month)



Source: HBS 2009/10

We use the results in Table 10 to impute consumption in the HFCS 2013. The mean imputed value for spending on nondurables and services is €2,527, compared with the NIE figure for 2013 (Table 9) of €2,597. One potential flaw with this approach is that the HBS data is for the period 2009Q3 to 2010Q3, whereas HFCS data is for food and utilities spending between March and September 2013. The issue is whether relative expenditure shares have shifted significantly over

time for this to be a problem.[17] From the National Income and Expenditure (NIE) accounts, there are only small differences in the shares of the various categories between the two periods. For example, spending on Food (excluding meals out which we take as equivalent to our measure of 'Food in the home') accounted for 14.6 per cent of nondurables and services spending in 2009/10 and 16.2 per cent in 2013. Similarly, alchoholic beveridges in the NIE (which could be a proxy for food and beveridges outside the home) accounted for 12.6% of spending on nondurables and services in 2009/10 and 12.4% in 2013. As a further test of the stability of the weights (i.e. coefficients) we estimate the shares of food consumption in an earlier HBS waves (2004/05), obtaining very similar results (these results are available from the authors on request).

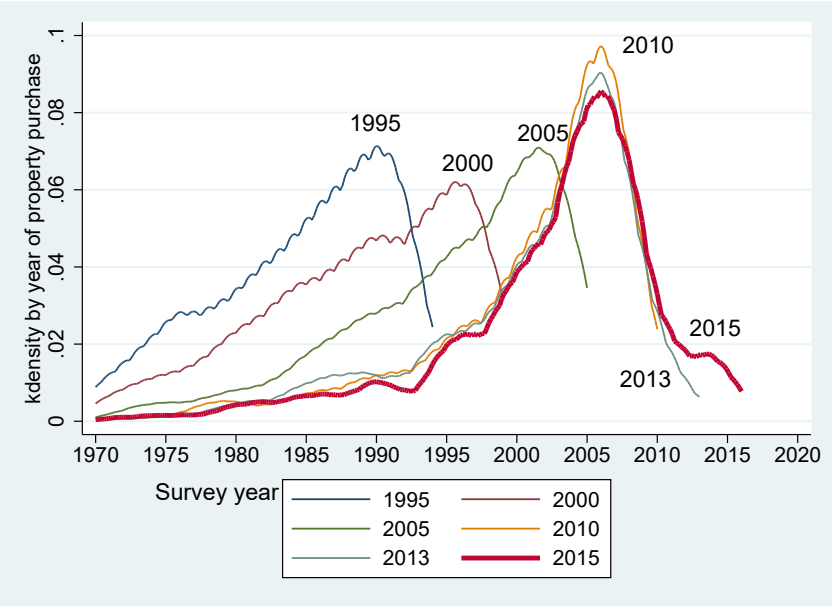
Imputation of gross housing wealth

The value of the home is recorded directly in the HFCS 2013, but not collected in any of the HBS waves. In these cases we impute the value of the home from a hedonic regression of house prices (from a Central Bank housing transaction database) on the following characteristics: region (8 Nuts III regions), an urban/rural identifier, and property type (detached, semi-detached, terraced, apartment). The coefficients are allowed to vary by year and quarter. The housing transaction database, including house price and other characteristics, is drawn from an administrative database collected by the Central Bank of Ireland for financial stability analysis. Lydon and McCarthy (2013) has a detailed description of the administrative database. Similar approaches to imputing house prices between wealth survey waves are used in Lydon and McIndoe-Calder (2018) and Krimmel et al. (2013). Figure 4 in the text shows that, at an aggregate level, the micro data closely tracks other published data sources – in this case real house prices in the Dallas Federal Reserve House Price Database (Mack and Martinez-Garcia (2011)). Given that our regressions aggregate up the micro data by year and region, we believe that this approach provides an accurate picture of housing wealth trends for the purposes of our paper.

[17] Papers which used early waves of the Panel Study on Income Dynamics (PSID) suffered from similar problems as researchers used expenditure on food to model aggregate consumption. As Deaton (1992) points out, an additional implicit assumption is that the elasticity of the two types of food consumption – *in* and *out* of the home – are constant across households.

Buyer-cohorts by survey wave

FIGURE 13. Distribution of households with a mortgage by year of purchase (x-axis) and survey wave



Source: HBS 1995-2015, HFCS 2013.

Correlation between different indebtedness measures at the birth cohort-region level

TABLE 11. Correlation coefficients for indebtedness measures

	LTV	Lag LTV	DSR	Lag DSR	DTI	Lag DTI
LTV	1.00					
	[0.00]					
Lag LTV	0.88	1.00				
	[0.00]	[0.00]				
DSR	0.68	0.63	1.00			
	[0.00]	[0.00]	[0.00]			
Lag DSR	0.74	0.74	0.60	1.00		
	[0.00]	[0.00]	[0.00]	[0.00]		
DTI	0.35	0.34	0.92	0.28	1.00	
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	
Lag DTI	0.81	0.85	0.63	0.89	0.31	1.0
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]

Notes: The LTV, or loan to value, ratio is the ratio of mortgage debt to house value. The DSR, or Debt-service, ratio is the ratio of mortgage repayments to income. DTI is the ratio of debt to income. P-values in parentheses.

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