Housing Market Activity and Consumption: Macro and Micro Evidence

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Non-Technical Summary

Household consumption is a significant component of aggregate demand, accounting for over half of gross domestic expenditure in most developed economies. The purpose of this paper is to identify the structural factors which drive household consumption, paying particular attention to the role of the housing market.

The economics literature has identified three drivers of household consumption: (i) changes in lifetime wealth; (ii) credit conditions; and (iii) income expectations. Housing market developments are closely related to each of these factors: an increase in house prices increases household wealth; changes in credit conditions can both affect house prices *and* the ease with which individuals can access housing wealth; and changes in income expectations also affect house prices by impacting on the demand for housing. Relating to this final point, the complementarity of house purchases and certain types of consumption, most notably durable goods, is also factor in driving consumption trends. This is particularly true when house price booms (busts) are accompanied by very high (low) levels of housing turnover. Given the large-scale economic fluctuations caused by a housing boom and bust, Ireland is an ideal case study for analysing how the housing market impacts on consumption.

Using aggregate data, we show that housing wealth exerts a positive influence on the consumption of durable goods. However, the many ways in which the housing market can affect consumer spending complicates matters when it comes to modelling consumption. In particular, the identification of housing wealth effects separately from changes in credit conditions, income expectations or complementarity effects is difficult with aggregate data. Therefore, a common approach is to combine micro and macro data to quantify how the housing market affects consumption.

Using the micro data, we analyse households' consumption decisions at different points throughout the business cycle and assess whether or not the same factors that are influential at the aggregate level remain so at the individual household level. The results show that there appears to be a role for wealth effects and credit conditions in driving consumption. However, the observed strong house price effects for younger cohorts who are predominantly renters suggests that income expectations or changes to permanent income are also important. Finally, there is also evidence of a high degree of complementarity between house purchases and durable consumption in particular. This complementarity accounts for the strong positive correlation we observe between (total) consumption growth and housing market activity during periods of strong house price growth.

These finding highlights the importance of decomposing consumer spending into it's constituent parts to uncover the underlying factors driving aggregate consumption. Based on the results presented here, domestic demand may continue to be a drag on the recovery of the Irish economy following the property crash of 2007.

Housing Market Activity and Consumption: Macro and Micro Evidence[*]

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Abstract

This paper analyses how developments in the housing market affect consumer spending. Using aggregate data, we show that housing wealth exerts a positive influence on consumption. Whilst informative, the aggregate results not allow us to identify housing wealth effects separately from credit effects, income expectations and complementarity effects. Survey data is therefore used to assess whether behaviour at the household level can further explain consumption trends at the aggregate level. We observe a strong correlation between house price levels and consumption for young, middle- and older-aged cohorts. The strong house price effects for younger cohorts in particular, who are predominantly renters, suggests that house prices are also a proxy for changes in in permanent income. However, our analysis also suggests that significant housing wealth effects are present, particularly when it comes to spending on durable goods. Our research highlights not only the benefits of combining household and aggregate level data for understanding consumption, but also the importance of decomposing consumption into its constituent parts for understanding housing wealth effects in particular.

JEL Classification: D12, E21

Keywords: consumption, wealth effects, credit conditions, income expectations, business cycle, durable goods.

1 Introduction

Household consumption is a significant component of aggregate demand, accounting for over half of gross domestic expenditure in most developed economies. Multiplier effects also mean that changes in consumer spending have implications for production and employment. Surveys by De Nardi et al. (2012), Barrell et al. (2006) and, more recently, Mian and Sufi (2014) all highlight the role of consumption in driving economic growth during recent decades. The purpose of this paper is to identify the structural factors which drive household consumption, paying particular attention to the role of the housing market.

The economics literature has identified three drivers of household consumption: (i) changes in lifetime wealth; (ii) credit conditions; and (iii) income expectations. Housing market developments are closely related to each of these factors: an increase in house prices increases household wealth; changes in credit conditions can both affect house prices *and* the ease with which individuals can access housing wealth; and changes in income expectations also affect house prices by impacting on the demand for housing. Relating to this final point, the complementarity of house purchases and certain types of consumption, most notably durable goods, is also factor in driving consumption trends. This is particularly true when house price booms (busts) are accompanied by very high (low) levels of housing turnover. For example, a new home-owner will typically purchase white goods and housing-related durables, such as furniture, carpets, curtains, etc. Both Warren (2007) and Mian and Sufi (2014) highlight this 'complementarity effect' (our term) as one of the key drivers of US consumption growth during the early-2000s housing boom.

The many ways in which the housing market can affect consumer spending complicates matters when it comes to modelling consumption. In particular, the identification of housing wealth effects separately from changes in credit conditions, income expectations or complementarity effects is difficult with aggregate data. Therefore, a common approach is to combine micro and macro data to quantify how the housing market affects consumption. See, for example, Dynan (2012), Campbell and Cocco (2007) and

Attanasio et al. (2009).

Given the large-scale economic fluctuations caused by a housing boom and bust, Ireland is an ideal case study for analysing how the housing market impacts consumption. The steady build up in aggregate consumption expenditure over the 1980s and '90s, when consumption increased broadly in line with changes in disposable income, was dwarfed by the rapid increase in consumer spending which took place from the turn of the millenium onwards. Following the peak of the housing bubble in late 2007, however, consumption is 24% below the level it would have been at if the historical average was maintained during the same period.[1]

The paper first sets the scene by presenting the aggregate trends. Given the difficulty in dis-entangling the drivers of changes in consumption behaviour at the aggregate level, the macroeconomic analysis is followed by an examination of household behaviour using micro data spanning from 1987 to 2010. Using the micro data, we analyse households' consumption decisions at different points throughout the business cycle and assess whether or not the same factors that are influential at the aggregate level remain so at the individual household level. In addition to income, we find that levels of housing wealth can explain some of the differences in consumption across households. Although, relative to spending on non-durables and services, we find that a large proportion of the cross-sectional and time-series variation in durables spending remains unexplained. There is also strong evidence of housing-consumption complementarities, with durable consumption increasing significantly during periods of high housing turnover.

The remainder of this paper proceeds as follows. Section 2 discusses the literature. Section 3 summarises aggregate consumption trends. The results from models estimated using micro data are presented in Section 4. Finally, Section 5 concludes. We also include a data appendix which explains how the aggregate time-series are constructed.

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[1]To put this divergence into perspective, De Nardi et al. (2012) estimate that an equivalent figure for US consumption is approximately 11%, which they feel highlights the "severity and persistence of the Great Recession" (pp. 2). While US consumption expenditure returned to the level of its previous peak within 12 quarters, Irish consumer spending, in contrast, appears to be stabilising at a much lower level.

2 Overview of the consumption literature

The life-cycle model (Friedman 1957; Modigliani and Brumberg 1954, 1980; Ando and Modigliani 1963) is the starting point for much of the empirical literature in this area. According to this model, individual households prefer to keep their levels of spending relatively steady over time. The model predicts that consumption choices are based on both current levels of income, and other wealth, including the impact on lifetime wealth of future changes to income. A 'wealth effect' is therefore the causal effect of exogenous changes in wealth upon consumption behaviour (Case et al. 2005).

Studies using aggregate data, for example, Labhard et al. (2005), Case et al. (2005) and Slacalek (2009) have all found a significant and positive relationship between housing and/or stock market wealth and consumption for various panels of OECD countries. Consumers also appear to respond asymmetrically to changes in wealth, with Genesove and Mayer (2001), Apergis and Miller (2006) and Case et al. (2011) all showing that positive shocks generally leading to stronger responses.

For Ireland, Kenny (1998) and Ryan (2003) both find that changes in house prices are associated with positive deviations in consumption relative to income. Neither paper tests for a 'common driver' effect, such as changes in income expectations, which might drive both consumption and house prices. In contrast to the earlier papers, both O'Donnell (2007) and Hogan and O'Sullivan (2003) conclude that disposable income is the main driver of consumption trends. These papers largely pre-date the housing boom. More recently, McCarthy and McQuinn (2013) find evidence of a large wealth effect using a combination of regulatory and survey micro-data. Disaggregating further, Lydon and O'Hanlon (2012) and Lydon and O'Leary (2013) show that changes in durable consumption are positively correlated with housing equity withdrawal in Ireland, although the authors do not test for a causal relationship.

A number of papers (King 1990; Pagano 1990; Attanasio et al. 2009) argue that the wealth effect only arises due to the ommision of proxies for future income expectations and/or changes in credit conditions. Muellbauer, along with various co-authors (Aron and Muellbauer 2006, 2013; Aron et al. 2010, 2012; Duca et al. 2011; Muellbauer 2007;

Muellbauer and Murphy 2008), models the impact of expected income growth and credit conditions (in particular mortgage market liberalisation) on consumption. They argue that liquid assets are more spendable than illiquid assets, and that the liquidity of housing is dependent on credit conditions. Aron et al. (2006) show that failure to control for these effects leads to an overestimation of wealth effects. Case et al. (2011) point out that even if home-owners do not plan to access their home equity for consumption, their knowledge of the possibility may diminish the precautionary saving motive. Further evidence of the importance of the credit channel on consumer spending is provided by Bacchetta and Gerlach (1997) and Mian and Sufi (2009), who show that existing home-owners increase their borrowing significantly in response to changes in their home equity, and use the extra borrowing mainly for real outlays, such as consumption or home improvements.[2]

Micro studies by Engelhart (1996), Disney et al. (2010), Lehnert (2003) all find positive wealth effects on consumption. Of particular interest, in the context of post-crisis adjustment in Ireland, is the finding by Disney et al. (2010) of a much stronger effect of house prices on consumption for households who start out in a position of negative equity, as a revival in house prices seems to bring a substantial surge in spending. Gerlach-Kristen (2013) finds similar effects for Irish households in negative equity.

Key influences on this paper are the micro studies by Campbell and Cocco (CC, 2007), Attanasio, Blow, Hamilton and Leicester (ABHL, 2009) and Disney, Gathergood and Henley (DGH, 2010). Using the same raw data on UK households' expenditure as in ABHL, CC find that changes in house prices (i.e. wealth) do affect aggregate consumption. ABHL, on the other hand, attribute the effects to 'common causality' (i.e. income expectations). We employ a similar methodology to the above three papers, building on this earlier research in three important ways. First, in contrast to the UK papers which use regional and national house price trends to proxy for changes in housing wealth at the household level, we use the results from a hedonic house

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[2]Both Carroll (2004) and Canner et al. (2002) argue that effects of home equity withdrawal through refinancing in a time of rising prices are more likely to show up in investment (i.e. home improvements). For Ireland, Lydon and O'Hanlon (2012) show that over two-thirds of the value of home-equity release between 2000 and 2007 was used for home improvement.

price regression to obtain a more precise, and heterogeneous, measure of house prices. Second, whereas the earlier papers focus on non-durable consumption, mainly for reasons of data availability, we explicitly model the relationship between housing market developments and durable consumption. It is this distinction between durable and non-durable expenditure which is crucial for understanding how exactly the housing boom in Ireland impacted on overall consumption. Thirdly, we show that a high degree of complementarity between house purchases and durables expenditure is one reason why we tend to observe a strong correlation between house price growth and aggregate consumption. This last point is relevant for the interpretation of housing wealth effects, in particular when house price growth is *not* accompanied by high levels of housing turnover – for example, in the case of a run-up in house prices due to large excess demand.

3   Consumption Trends: 1980 - 2013

Consumption relative to income in the sample period falls into three broad phases, as shown in Figure 1(a).[3] In the first phase, which lasts up until the late-1990s, consumption growth closely tracked income growth. The ratio of consumption to income averaged 0.91 (standard deviation=0.002) throughout this period. Between 1998 and 2003, consumption increased significantly relative to income, and remained elevated throughout the period of the housing boom. The ratio of consumption to income averaged 0.97 (0.004) between 1998 and 2007. The final phase is triggered by the general economic downturn, giving a consumption to income ratio since 2010 of 0.92 (0.006).[4]

[FIGURE 1 HERE]

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[3]A detailed description of all data sources used and their construction is contained in the Data Appendix. Consumption is total household consumption in real terms, measured on a per capita basis. Income is real disposable per capita income. See the data appendix for futher details.

[4]Bai and Perron (2003) tests for unknown structural breaks in a bivariate regression of consumption on disposable income identifies breaks at 1998 and 2008. The results are available on request.

An important element of consumption story from the late 1990s through to the end of the housing boom is the significant growth in expenditure on *durable* goods.[5] This is highlighted in Figure 1(b) which plots the share of durables consumption in total consumption.[6] Durables accounted for 7% of consumption in the 1980s and 90s, increasing to 12% in the 2000s, before falling back to 10% in 2009. Over half of the fall in consumer spending since 2007 is attributable to the decline in durables consumption. Comparing Ireland with the UK (also shown in the chart), the initial growth in spending on durable goods appears to be a 'catchup' story, as set out in Honohan and Walsh (2002). However, it is important to note that the UK durables growth from the mid-1990s was largely driven by increased purchases of electronic and 'information processing' equipment by households, whereas, for Ireland, 'Household equipment and operation' durable goods were also a key factor behind the growth. Table 1 shows a break-down of average annual growth rates for the main categories of durable consumption.

[TABLE 1 HERE]

The value of housing assets, which rises and falls in line with house prices, accounts for the bulk households' overall wealth (see Appendix A3). Consequently, a major pre-occupation in the consumption literature is estimating the marginal propensity to consume out of housing wealth. Figure 2 compares annual growth in spending on non-durables (including services), durables and housing wealth (net of debt). Spending on durable goods appears to be particularly sensitive to changes in housing wealth.

[FIGURE 2 HERE]

To control for changes in income and other potential drivers of consumption we estimate an error correction model[7] for total, non-durable (including services) and

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[5]We follow Roche (1995) in defining the following as expenditure on durable goods: clothing and footwear, durable household goods, personal transport equipment and equipment for recreation, entertainment and education. All other categories of household expenditure are treated as non-durable (including services).

[6]Rudd and Whelan (2006) find a similar pattern holds for the U.S., where total real consumption expenditures have consistently grown faster than real consumption of non-durables and services.

[7]This methodology has a long history in consumption analysis, beginning with the seminal work of Davidson et al. (1978). We estimate the model using non-linear least squares as in Barrell and Davis

durable consumption. The results are shown in Table 2.

[TABLE 2 HERE]

The dependent variable in the first column in Table 2 is the log of total personal consumption per capita at constant prices, from 1980:02 to 2013:04. The second column is the same dependent variable for the period 1996:02 onwards, as this is the period for which we have separate series on non-durable and durable consumption (see the data appendix for further details). The third and fourth columns use non-durable and durable consumption series respectively as the dependent variable. We include the log of net housing wealth, equal to the value of housing assets minus the stock of outstanding moretgage debt. The estimated model also includes the log of the stock market index (ISEQ) as a proxy for non-housing wealth,[8] the change in unemployment as a proxy for income uncertainty (Muellbauer, 1994); survey-based measures of consumer expectations;[9] and controls for changes in consumption taxes and other tax incentive schemes which affect consumption in the short-run (such as car scrappage schemes[10]).

As expected, disposable income is a key determinant of total consumption over the long-run, with a coefficient ranging from 0.83 to 0.87, depending on the specification. For total consumption, the marginal propensity to consume (hereafter, MPC) out of net housing wealth ranges from 4.8 to 7.6%. This is broadly similar to MPCs reported for other developed countries in the literature using similar techniques. However, when we disaggregate consumption into it's non-durable and durable components, we find that the bulk of this effect relates to durable consumption. This has a very large estimated MPC of 29%. Non-housing wealth also has a marginally larger MPC than in the baseline case, although it is only statistically significant in the non-durable regression.

(2003).

[8]Data on aggregate stocks of non-housing wealth is available in the Quarterly Financial Accounts from 2002 onwards. Comparing the ISEQ with trends in this series shows that it is a good proxy for non-housing wealth.

[9]This is the KBC Ireland/ESRI Consumer Sentiment Index, available from 1996 onwards; see the ESRI website for further details. We also estimated specifications which included direct estimates of expected income growth, such as the 'perfect foresight' estimated of permanent income growth in Aron et al. (2012). However, trends in these variables proved to be highly correlated with trends in the survey-based measures of consumer expectations, hence we only include the latter in the estimated model.

[10]These were from July 1995 to end-1997 and December 2009 to June 2011. A control was also included for the first quarter in 2000, which saw a spike in car registrations unrelated to policy.

To capture expected changes in income (Flavin, 1981), we also include the log of the Consumer Expectations Index, which is available from 1996 onwards. However, it has no significant impact in the regression.

The change in credit conditions is an important development during the latter period of the sample in particular. For example, there was a six-fold increase in the stock of mortgage debt between 1998 and 2007, and the average loan-to-income ratio for house purchases doubled from around two to four over the same period (Figure 3). Following the start data of EMU, a number of previously high interest countries, including Ireland, experienced a sharp decline in real interest rates (Honohan and Lane, 2003). Consequently, mortgage interest rate spreads fell steadily from 2000 onwards reducing the cost of home-buying and driving demand (Figure 3).[11] In a time series model, one difficulty is that credit conditions and income growth are highly correlated with other variables, in particular with house price growth. This makes it difficult to isolate their individual impact on aggregate consumption. Nonetheless, we include loan-to-income and mortgage spreads (the rate on new mortgage loans minus the deposit rate) in the regression, as proxies for credit conditions. Interest rate spreads are, as expected, negatively correltated with consumption, although this is only significant when we look at the full sample from 1980 to 2013. The loan-to-income ratio (LTI) is negatively correlated with consumption, a result which is difficult to explain.[12] It is possibly that the correlation with house prices (and therefore housing wealth) is contributing to this result in the non-linear regression. In fact, when we drop housing wealth, LTI remains negative, but is no longer statisically significant.

[FIGURE 3 HERE]

In-line with much of the macroeconomic research, our results suggest that trends in personal consumption are closely related to movements in housing wealth and house prices. We find that the strongest correlation is for expenditure on *durable* goods, with

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[11]Increased competition in retail banking was also a factor. For a more detailed summary of the changes in credit conditions during this period, see Lydon and O'Hanlon (2012), McCarthy and Mc-Quinn (2013b) and Kennedy and McIndoe-Calder (2012).

[12]We found consistent results, when we ran the regressions for different indicators of credit conditions, such as the loan-to-value ratios.

limited impact on non-durable consumption. In the absence of better controls for expected income growth and credit conditions, amongst other factors, we are reluctant to interpret these results as causal relationships. To shed more light, we next analyse expenditure patterns at the household level, controling for house prices, housing wealth (for owners), households' use of credit and the number of years in the home.

4   Consumption at the household level

Household level expenditure data is available from the Household Budget Survey (HBS) in five-yearly intervals since 1987. The data is representative of all households in the State, with the sample summarised in Table 3. The five waves broadly coincide with the various phases of growth in the consumption-to-income ratio identified in Figure 1. Figure 4(a) summarises trends in the HBS data, which, when grossed-up, closely track aggregate consumption trends.

[TABLE 3 HERE]

Figures 4(b) and 4(c) compares trends in consumption growth and house prices by age-group and housing tenure status. A basic premise in the theoretical literature is that older home-owners ('long' housing) are expected to be more sensitive to changes in wealth (and therefore house prices) than younger home-owners ('short' housing).[13] However, if anything, the data suggests that older cohorts are relatively less sensitive to changes in house prices. Similarly, the consumption patterns of private renters (and younger households) appear to be the most sensitive to changes in house prices.[14] These trends suggest than an underlying 'common factor', such as credit growth, expected income growth or housing consumption complementarities, plays a role in consumer behaviour in addition to direct housing wealth effects.

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[13]See Buiter (2008) for a development of these ideas. Not only are older groups more likely to have more housing equity (for a given house value), but, as a group, there is more scope for realising that equity, through trading-down, for example.

[14]Private renter households account for approximately 8% of households between 1987 and 2005, rising to 20% between by 2009/10. The proportion of local authority renters remained constant at around 10%.

Figure 5 show durables and non-durables consumption by housing tenure status. In general, the trends from the household data tally closely with those in the aggregate data, in particular the observation that large upswings in consumption growth appear to be driven by spending on durables. Table A5 in the Appendix provides a detailed breakdown of the trends in the four sub-divisions of consumption, by housing tenure.

[FIGURE 4 HERE]

[FIGURE 5 HERE]

4.1 Modelling framework

Our empirical approach is based on a basic life-cycle model where household expenditure (X_t^h) is a function of age ($\kappa(age^h)$), and expected lifetime wealth (W^h):

$$X_t^h = \kappa(age^h)W^h exp(\epsilon_t^h). \tag{1}$$

Log-linearising (hereafter represented by lower-case variables) we get:

$$x_t^h = f(age^h) + \gamma' z_t^h + w^h + \epsilon_t^h, \tag{2}$$

where Z_t^h is a vector of observable variables which affect consumption, such as family size and composition. ABHL (2009) exclude current disposable income from their reduced form life-cycle model on the basis that it is captured by deterministic and constant terms. They argue that unexpected changes in income and wealth are captured by the error term ϵ_t^h. This motivates an analysis of how the (average) error terms in the regression change when controls for housing wealth (house prices) and expected income growth (changes in house prices) are added to the specification.

We construct a pseudo-panel from the HBS repeated cross-sections using birth year to identify cohorts.[15] The birth cohorts are defined in ten-year intervals from 1934 to 1984. The average cohort size is 5,350 households, and ranges from 1,710 (born after

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[15]See Browning et al. (1985), Deaton (1985) and Baltagi (1995) for examples of the use of pseudo-panel techniques in the consumption literature.

1984) to 9,016 (1934). As with any pseudo-panel exercise, there is a trade-off between the number of cohorts and the number of individuals per cohort (n_c). In these dimensions, our pseudo-panel is almost identical to those constructed by ABHL (2009) and CC (2007) for similar exercises. Furthermore, the use of birth cohorts ensures homogeneity within cohorts and heterogeneity across cohorts, thereby minimising measurement error and maximising model precision (see Verbeek and Nijman, 1992).

The pseudo panel specification of equation (2) is as follows:

$$x_t^c = f(age^c) + \gamma' z_t^c + \alpha^c + \epsilon_t^c, \tag{3}$$

where the superscript c denotes the cohort means. The retention of the observable variables z_t is justified on a number of grounds, such as differences in sampling techniques across waves or differences in attrition rates by cohort, both of which could be correlated with consumption. Given the wide time-span covered by the five HBS waves – 1987 to 2010 – there may be some characteristics correlated with consumption which not only vary over the life-cycle but *also* vary across cohorts, and this needs to be controlled for. For example, controlling for age, later cohorts tend to have fewer children, consistent with the long-run trends of couples having fewer children.

Equation (3) can be estimated using cohort means or with the individual household data. In the latter case, the specification is as follows:

$$x_t^{ch} = \alpha^c + f(age^c) + \gamma' z_t^{ch} + \epsilon_t^c + u_t^{ch}, \tag{4}$$

where α^c is a cohort fixed effect, and the slope of age-consumption relationship is assumed to be identical across cohorts (controlling for z_t^{ch}). The variable u_t^{ch} measures the deviation of each household from average consumption within their cohort. Equation (4) is the baseline specification. We also include the total number of loans each household has in order to control for credit trends. We then assess the changes in the performance of the baseline model as house price variables are added to the specification. We next describe the construction of the house price variables at the micro level.

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4.1.1 Estimates of house prices at the household level

The studies by CC (2007), ABHL (2009) and DGH (2010) all use average regional house prices to proxy for housing wealth at the household level. We adopt a different approach, instead using the predicted house prices from a hedonic house price regression as an explanatory variable, the output of which is a predicted value for the house or apartment each household is living in. The hedonic regression uses a data-set of 690,000 monthly house price observations from 1991 to 2010, controlling for geographic location (Rural, Urban-Dublin, Urban-Other), house type (terrace house, detached house, apartment, other) and year built.[16] We then use the parameters from this regression to predict a house value for each household-wave in the HBS, controlling for the same characteristics. The loan-level data is rich enough to allow us to vary all parameters by wave and quarter of the HBS, with the exception of 1987, where, due to a low number of housing transactions in the database, the regression fit is very poor (R-squared 0.11). As no data on outstanding mortgage debt is available for the 1987 wave, we drop it from the regression sample. We also calculate estimated house prices at one, two and three year lags, thereby allowing us to construct a measure of house price growth for each household. Figure 6 shows that the house price index from our hedonic regression closely tracks published house price indices.[17]

[FIGURE 6 HERE]

4.1.2 Households' use of credit

Figure 7 indicates that, over the last three decades, households relied increasingly on personal credit (i.e. excluding mortgages) to finance spending. Between 1987 and 2004, the proportion of households with *at least one* personal loan rose from 35 to 50%. With the onset of a severe recession in 2008, this proportion fell to just 27% in 2009/10. A similar patter is observed for the *number of loans per household*. Data on debt repayments shows the repayment to income ratio on personal loans rising over the same period.

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[16]This information is sourced from loan-level data collected by the Central Bank of Ireland for the March 2011 stress-testing exercise, and is described in detail in Kennedy and McIndoe-Calder (2012).

[17]The results of the hedonic house price regression are available on request.

[FIGURE 7 HERE]

If home purchases and and durable goods consumption are complementary, as argued above, then changes in households' borrowing constraints which make it easier to purchase a home could also increase consumption. Figure 3 showed a trend towards higher loan-to-income ratios for new loans from the late 1990s onwards. Mortgage debt-to-disposable income (DTI) ratios in the household data display a similar pattern. The DTI ratios in 1987/88 and 1994/95 were not significantly different from one another, ranging from 1.20 to 1.25. However, following this the ratio increased rapidly to 2.00, 3.00 and 4.00 in each of the 1999/2000, 2004/05 and 2009/10 HBS Waves. We therefore include the DTI, or household leverage, as an explanatory variable in the expenditure regressions below (for homeowners only).

4.2 Estimation results

This section summarises the main econometric results, with the baseline regression described by equation (4). In our discussion of the results we focus on the coefficients of interest, namely house prices (for all households), housing wealth (for home-owners only) and the use of credit. We also control for a range of household characteristics which could impact on expenditure, including the age and education of the head of the household, composition of the household, a rural/urban dummy variable, and the birth cohort. We estimate regressions for total expenditure (excluding mortgage or rent) as well as non-durable and durable expenditure.[18] All variables are real, and, where appropriate, in logs. The deflators for each category of expenditure are taken from the National Income and Expenditure Accounts (NIE), i.e. for expenditure on durable goods we use the (NIE) deflators for clothing and footwear, durable household goods, personal transport equipment and equipment for recreation, entertainment and education[19]. The analysis proceeds in stages, first looking at house prices, then wealth

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[18]We focus on the key parameters in reporting the result. The full regression results are available on request.

[19]Palumbo et al. (2006) highlight the importance of choosing the correct deflator for durable goods when conducting consumption analysis.

for homeowners only.

4.2.1 House price levels and consumption

We begin by estimating log expenditure regressions, for total, non-durable and durable
spending respectively. We examine how the coefficient on house prices varies across
age groups, thereby allowing us to test our prior that older age groups are likely to be
most sensitive to changes in house prices (as a proxy for wealth). We observe signif-
icantly higher levels of housing equity (in real terms, €177,500) for older households,
when compared to younger households (€23,800). The age groups are defined as fol-
lows: the young are aged less than 34 and represent 24% of the population in 2010;
the middle are aged between 35-54 (and represent 42%); and the old are over 55 (and
represent 34%).[20]

Differences in income are the major driver of consumption across households and
time, with a coefficient ranging from 0.474 to 0.678 in the non-durables and durables
specifications respectively (Table 4. For total expenditure, the coefficients on house
prices are positive and significant for the middle- and older-age groups, which sug-
gests a housing wealth effect. The estimated MPCs themselves, ranging from 0.031 to
0.045 are similar to those in the literature. House prices have no impact on non-durable
consumption, in-line with the results from the macro regression. We find that house
prices exert a large positive influence on the durable expenditure of *all* age groups,
including younger households, half of whom are renters. However, we do not reject
the hypothesis that the effect for older age groups (more likely to be 'long' housing)
is significantly larger (p-value 0.0195). Nonetheless, the fact that house prices appear
to explain a significant proprotion of *renters'* (i.e. a group with no housing equity)
durable expenditure suggests that the variable is also picking up other effects, such
as unobserved income and/or income growth expectations. In point of fact, if one as-
sumed some relationship between house prices and rent, one could even argue for the
coefficient to be negative for renters.

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[20] As discussed in ABHL (2009), an alternative would be to use housing tenure as the interaction term.
This, however, raises the issue of endogeneity.

[TABLE 4 HERE]

We control for the *number* of personal loans in each household (0-9) and find that consumption is increasing with the number of personal loans a household has, with little difference across age-groups.[21] The coefficients are, unsurprisingly, larger for durable consumption, and imply that an additional personal loan increases durable consumption by 12 to 14%, on average. Between 1994 and 2004 , a period when durables expenditure per household roughly doubled, disposable incomes increased by 84% and the average number of personal loans per household increased by 0.5. Overall this suggests that both factors can explain some of the increase in spending over this period. However, a considerable fraction of consumer spending remains un-explained.

Overall, we find that the household characteristics which explain a high proportion of the differences in non-durables expenditure across households and time do not explain a similarly high proportion of the expenditure on durables. This is apparent from a comparison of the R-squared across the three regressions. To a certain extent this is to be expected. As Meullbauer (1981) points out, modelling the decision to purchase a durable good in an intertemporal optimisation framework requires, amongst other things, knowledge of the consumers existing stock of durables. Due to data limitations, this is a factor which is omitted from our regressions.

4.2.2 Housing equity and consumption

The regressions in this section replace house prices with housing equity. This model specification, an advance on much of the literature which tends to focus solely on house prices, can be thought of as the household level counterpart of the aggregate model estimated earlier. Equity is calculated as the house value from the hedonic regression minus the stock of outstanding mortgage debt (equal to zero for outright owners). Mortgage debt is not reported in the 2009 waves. We therefore estimate the stock of mortgage debt per household as the predicted values from a regression of mortgage

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[21]Expenditure is also increasing in the average loan repayment, a proxy for loan size. However, as personal loan repayments are not captured in the 2009 wave, we do not report the results here.

debt on mortgage repayments, interest rates, years in the home, regional dummies and property type, using loan-level data from December 2009.[22]

Housing wealth is only observable for owner-occupiers, that is outright owners and mortgage-owners, which accounted for 70% of households in 2009/10. OLS estimates of the MPC out of housing wealth based on this group may be biased for a number of reasons. For example, unobserved characteristics which affect both the decision to become (and remain) a home-owner and households' consumption decisions, such as shocks to future income or wealth expectations, could bias the MPC upwards. Conversely, a negative bias could result from measurement error in the home equity variable, which relies on the estimate of house prices from the parameters in the hedonic regression. Whilst we do not explicitly address these endogeneity concerns in this paper, it is important to be aware of them when interpreting the results.

Table 5 shows mean housing wealth by wave for all owner-occupiers (outright owners and those with a mortgage), in 2009 prices. For the most part the change in housing equity from wave-to-wave is driven by changes in house prices. However, in the latter waves, increasing mortgage debt is also a factor. These estimated housing equity values are also reflective of those published elsewhere. For example, we find that 23% of households in the 2009 wave are in negative equity, whereas figures from McGuinness (2011) for end-December 2010, give a figure of 36% (with property prices declining by 11% in 2010). Less than 5% of mortgaged households in earlier waves are in negative equity. As we are interested in how negative equity affects consumption, we estimate separate regressions for outright and mortgage home-owners respectively.

[TABLE 5 HERE]

Table 6 shows the regression results for outright home-owners, i.e. those without a mortgage. Unsurprisingly, very few households in this sub-sample are under the age of 35 (2.5% of the sample), whilst over two-thirds are aged 55 or over. Therefore, to

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[22]Further details are provided in the data appendix. It is also possible to calculate outstanding mortgage debt from the annuity formula, given mortgage repayments, interest rates (averages from the loan-level data) and remaining loan term (average original term in the loan-level data minus years lived in the home from the HBS). This methodology gives almost identical results to our regression approach.

avoid small cell-size problems associated with our age-group variable, we interact housing equity with a dummy variable equal to one if a home-owner also has dependent children (under the age of 18) in the household. The sample split is roughly 50:50 with/without dependent children. The presence of younger children in the household could affect the willingness or ability to spend out of housing equity for two main reasons. Firstly, it could reduce the scope to realise equity through trading down. Secondly, it may make parents more reluctant to spend out of equity if that equity is also a potential source of savings for future education costs.[23] For total expenditure, the MPC out of housing equity is 0.075 for home-owners with no dependent children, and insignificantly different from zero for those with dependent children. The durables MPC for home-owners with no dependent children is particularly high at 0.684, which is signifcantly different from the coefficient for households with children (F-test 0.403-0.684 = 0, critical value 18.45, p-value 0.000).

[TABLE 6 HERE]

In order to capture house-purchase consumption complementarities, the regression includes a dummy variable equal to one if the home-owner moved into their home in the last year ('new' home-owners). The proportion of new home-owners is quite procyclical, as shown in Figure 8 below. We find that durables expenditure is 27% higher for 'new' home-owners relative to existing home-owners. Further evidence of the complementarity of durable goods expenditure and house purchases is provided in Table 7, which lists the shares of total durable expenditure accounted for by the four main components of durable expenditure. The share of expenditure on the two expenditure categories most closely related to house-purchases, housing related durable goods and household equipment, is significantly higher for 'new' home-owners (60%), compared with existing home-owners (34%).

[TABLE 7 HERE]

[FIGURE 8 HERE]

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[23]Lydon and O'Hanlon (2012) show that, outside of home improvements, investment in education is one of the reasons home-owners cite for using top-up loans to realise housing equity.

Turning to households with a mortgage, we first compare the spending patterns of households in positive/negative equity, recalling that the bulk of the latter are in the 2009/10 wave of the survey following the property crash in 2007. To do this, we estimate the full basic specification (equation 4) for mortgaged households only, including a dummy variable equal to one if a household is in positive equity. The coefficient on the dummy variable is reported in Table 8. Ex-ante, the sign on the coefficient is not obvious. Some households in negative equity may decide to save more in order to pay down debt. However others, possibly those in very deep negative equity (more than half of those in negative equity in 2009/10 have an estimated loan-to-value greater than 1.4), might choose not to change their spending habits. We find that, controlling for the same observables as before, the average household in negative equity spends around 4% less, with most of the impact felt in non-durable consumption. In aggregate terms, this is not a very large effect, if we consider that only around 10% if households in the State were in negative equity at the end of 2010 (i.e. 35% of households have a mortgage, and around on-third of these were estimated to be in negative equity at the end of 2010 (McGuinness, 2011)).

[TABLE 8 HERE]

Finally, we analyse the spending patterns of mortgage households with positive equity only, the results are shown in Table 9. For total household spending, the MPC out of housing wealth, conditional on housing equity is 0.064. As per the earlier results, the effects are mainly present for the consumption of durable goods, where the coefficient on housing equity is 0.481, with little or no effect for spending on non-durables (including services). In general, we find that the level of spending across all four main categories of durable consumption (Table 7) are higher for households with more housing equity. We also investigated whether wealthier households concentrate their durables spending on certain categories of consumption, such as personal transport. However we found no evidence of this in the data.

[TABLE 9 HERE]

The mortgage debt-to-income ratio is included to control for leverage at the household level. Ex ante, it is not obvious what the sign on this coefficient might be. On the one had, higher repayment burdens for more indebted households could reduce consumption; on the other, highly leveraged households might have to save less to acquire a house, leading to higher levels of consumption (Mian and Sufi, 2014). Different leverage ratios might also reflect different approaches to debt and spending by households. That is, some households might choose to take on more debt to finance consumption of items such as car loans and credit card spending, while other, more prudent, households choose to live within their means and adjust spending accordingly. For all of these reasons, we specify the leverage variable non-linearly in piece-wise form. Leverage does have a positive impact on consumption, but only at higher leverage ratios, i.e. in excess of 3.5. In aggregate terms, the overall effect is not very large: for example, a linear extrapolation of the coefficient suggests that the increase in debt-to-income ratios from 2 to 4 from the mid-1990s through to the end of the housing boom added approximately 7% to overall expenditure on durable goods.

As with the earlier regressions, we also include a dummy variable equal to one for 'new' home-owners. The coefficient is similar to the previous one estimated for outright home-owners (Table 6): new owners with a mortgage who have moved into their home within the last year spend almost 30% more on average on durable goods, even *after* controlling for other observable characteristics. This result should not be overlooked, as it goes to the heart of how housing market activity, and housing bubbles in particular, can distort macroeconomic outcomes over a prolonged period. Figure 8 shows that amongst mortgage home-owners, the proportion of new owners increased from 4% in 1994/95 to over 11% by 2004/05, before falling again in 2009/10 to just under 6%. Figure 9 provides further evidence of the extent to which the housing boom effectively 'brought forward' the home ownership decision for many borrowers. Within certain age groups, the average number of years in the home declined significantly in 2004/05 and 2009/10, as more and more borrowers sought to get 'on the housing ladder' in a rising market. For example, for the 35 to 44 age group, the average number-

22

of-years in the home declined from around 10 in 1994/95 (the level it had been at for the previous twelve years) to 7.5 in 2009. We view this as strong evidence of a house-purchase consumption complementarity effect.

[FIGURE 9 HERE]

5 Conclusion

This paper builds on a growing literature which combines macro and micro evidence to inform our understanding of household consumption. Using aggregate data for Ireland we find evidence of a housing wealth effect, with estimated MPCs ranging from 0.048 to 0.075. We also show that the relationship between housing wealth and consumption holds primarily for expenditure on durable goods, with an MPC of 0.294. The emphasis on the housing-durable expenditure relationship is an aspect which, we feel, has been largely overlooked in the empirical literature on housing wealth effects.

Whilst informative, the results from the aggregate model do not allow us to identify income growth effects, credit liberalisation effects and complementarity effects separately from housing wealth effects. The complementarity effect – where we assert that new homeowners will naturally spend more on durable goods in particular – are of particular interest in the case of Ireland, where the housing boom of the late 1990s and early 2000s brought with it an enourmous increase in housing market turnover.

Our basic model of expenditure at the household level finds house prices effects on *total* consumption for middle and older-age groups, consistent with direct wealth effects. The scale of the estimated coefficients, in the range of 0.031 to 0.045, is similar to the results from the aggregate model. Again, we find that the house price effect influences durable expenditure only, with MPCs of 0.455, 0.493 and 0.611 for young, middle and older-aged households respectively. The fact that we observe strong house price effects for the younger age group at all, almost two-thirds of whom are renters by 2009/10, suggests that house price effects are also picking up the role of income expectations or changes in permanent income.

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In the final specifications, we focused on homeowners (70% of households in 2009/10) and examined how changes in consumption are affected by changes in housing equity (housing wealth minus outstanding mortgage debt). For total expenditure, the estimated MPC out of housing wealth is around 0.06 - 0.07, and for durable expenditure the MPC is 0.481. However, the MPC varies considerably according to family circumstances. For example, for households with dependent children, the evidence for a significant MPC out of housing wealth for total consumption is weak.

Credit effects are also evident, with leverage (mortgage debt to income ratio) and personal debt both positively correlated with consumption. Finally, the results imply strong house-purchase consumption complementarities, with new homeowners exhibiting substantially higher levels of expenditure on durable goods in particular, such as electrical items and household furnishings. These complementarities are likely to have played a significant part in driving up durable consumption in Ireland during the housing boom.

In conclusion, our results highlight the difficulties inherent in modelling and forecasting household consumption on the basis of aggregate models alone. For example, a forecast of household consumption for 2013 and 2014 using the macroeconometric model estimated in the first half of this paper would point to significant increases solely on the basis of wealth effects arising from the recovery in the housing market which commenced in the second half of 2013. However, this would inevitably lead to an over-projection of consumption, as the levels of housing market turnover or transactions are substantially below levels seen in previous years. Thus, household's ability to realise equity, and the associated complementarity effects, are not present to the same degree as they were historically. To illustrate: in the second-half of the 1990s, the ratio of new mortgage loans to the existing housing stock was around 1.2%, by 2006/07, this had risen to 2.7%. In the four quarters to Q1 2014, this ratio stood at 0.2%. Based on the findings presented here, domestic demand may continue to be a drag on the recovery of the Irish economy following the property crash of 2007.

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FIGURES 1 - 9

Figure 1: Consumption & Income trends
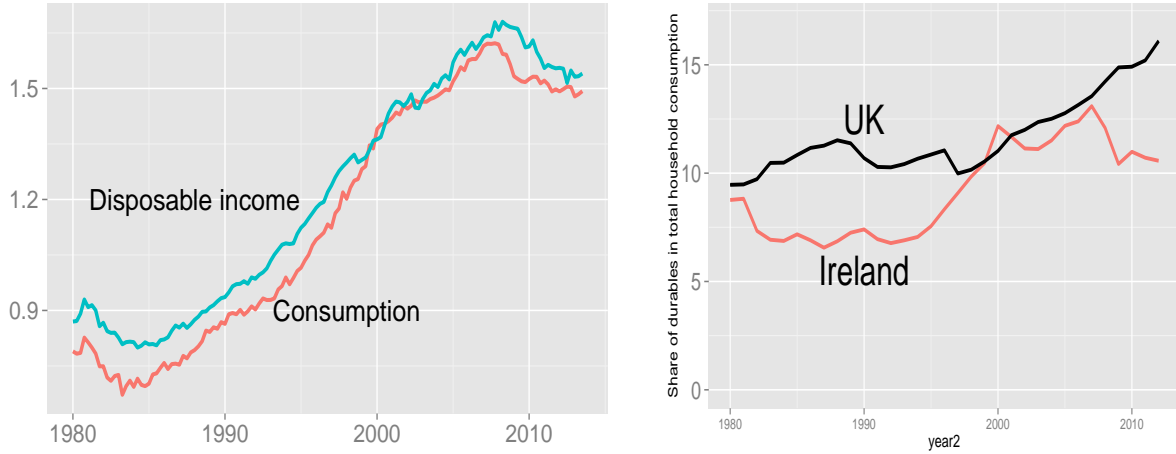
(a) Consumption & income (log, per capita) (b) Share of durable goods in consumption

Source: CSO and UK ONS. For both countries, durables expenditure excludes spending on materials relating to housing maintenance and repair, as this series is not available separately in the Irish expediture date. It accounts for between 5 and 6% of spending on durables by UK households.

Figure 2: Annual % growth in non-durable/durable spending and net housing wealth

(a) Non-durable spending (b) Durable spending

Figure 3: Mortgage interest rate spreads and loan-to-deposit ratios

(a) Spreads

(b) Loan-to-income ratio
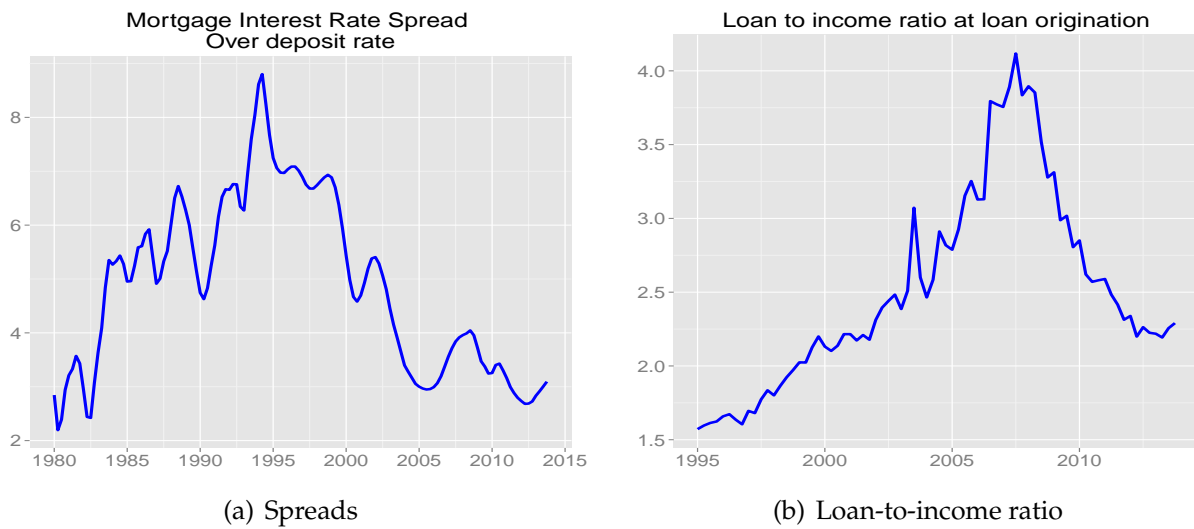
Source: Central bank of Ireland. The mortgage interest spread (four quarter moving average) is the interest rate on new mortgage loans minus the overnight deposit rate. The loan to income ratio is a combination of loan-level data (available from 1997 onwards, see Kennedy and McIndoe-Calder (2012) for a description of the data) and Government Housing Statistics on average loan size for data prior to 1997.

Figure 4: Consumption trends in the HBS data
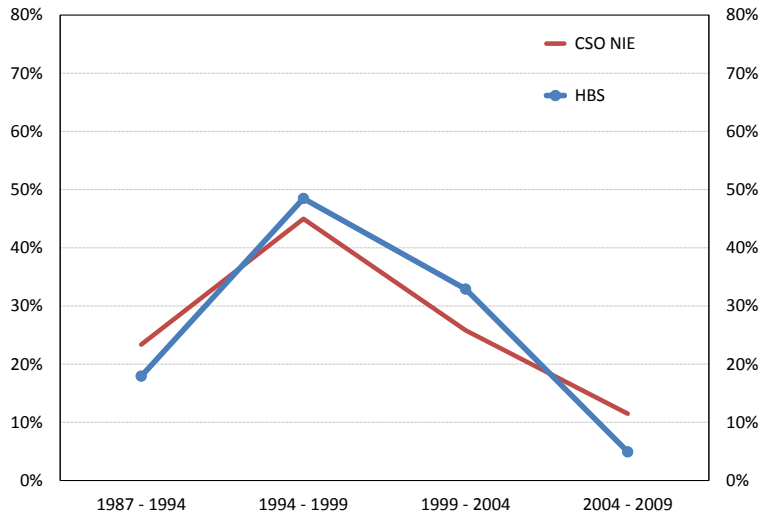
(a) Comparison with aggregate trends
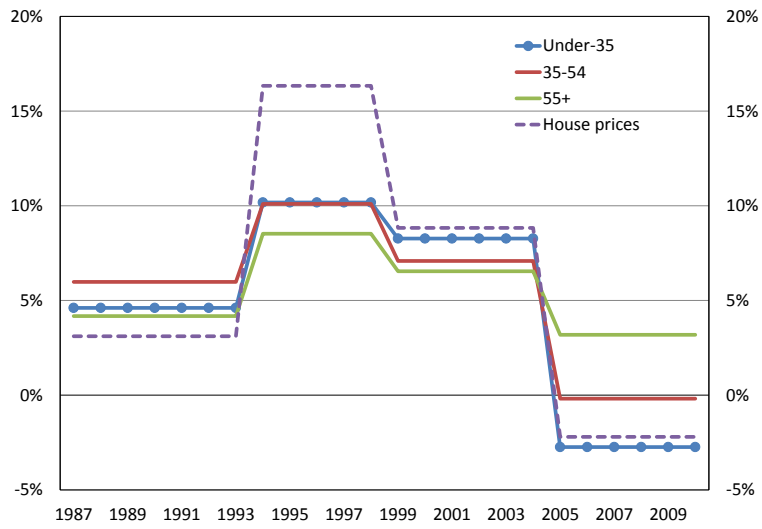
(b) Average annual consumption growth, by age
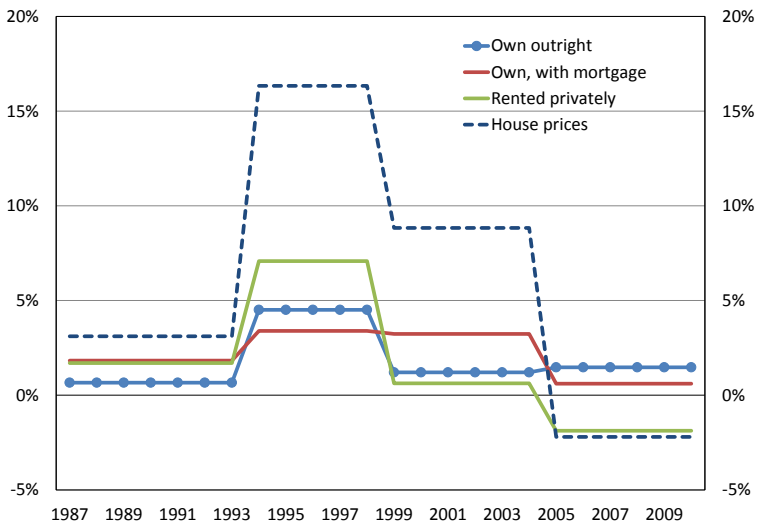
(c) Average annual consumption growth, by housing tenure

Figure 5: Growth in household consumption
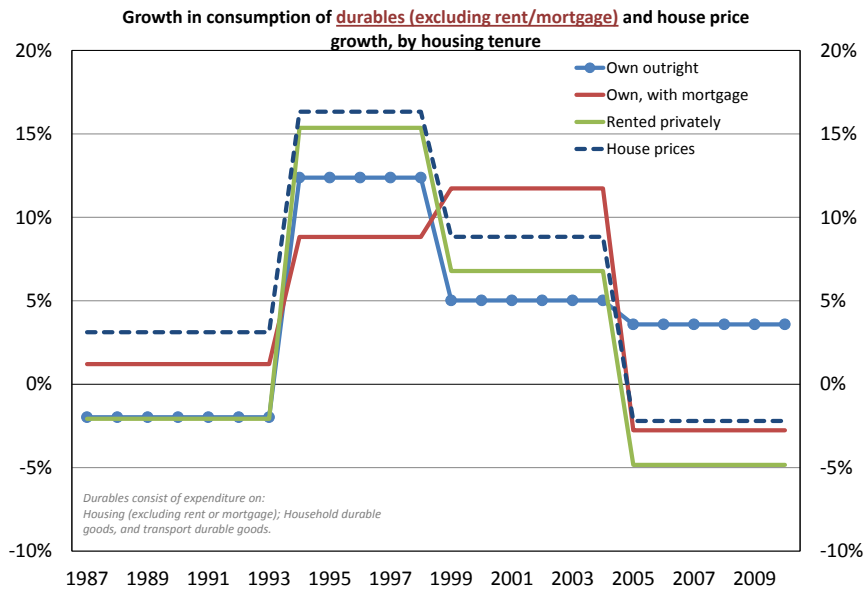
(a) Durables consumption
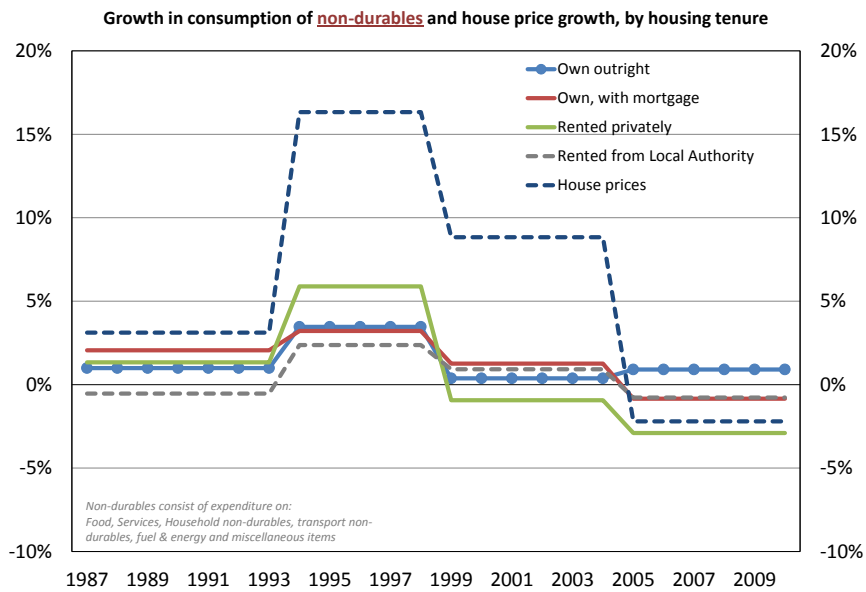
(b) Non-durables (including services) consumption

Figure 6: Nominal house prices index and levels for HBS households
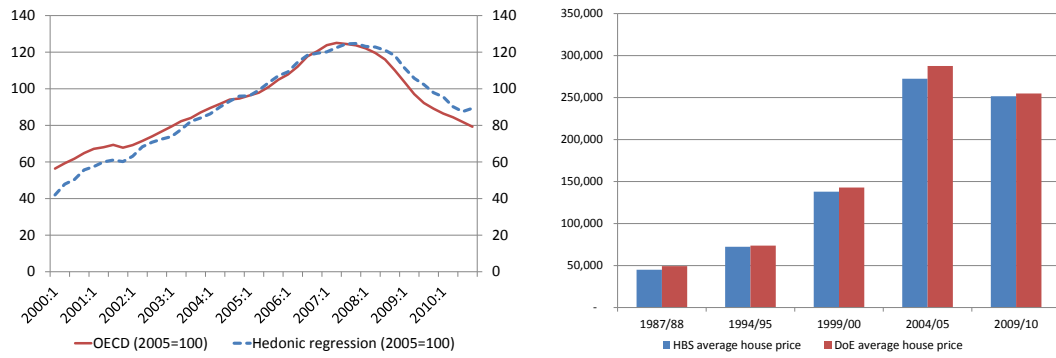
Figure 7: Households' use of personal credit
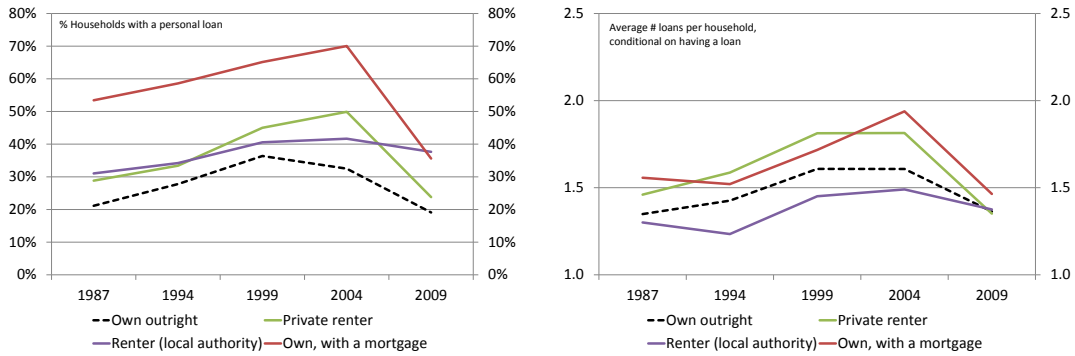
(a) Households with a personal loan (%)

(b) Number of personal loans
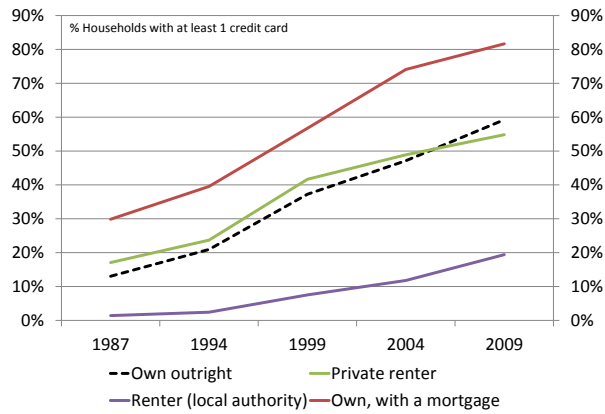
(c) Households with a credit card (%)

Figure 8: Percentage of new home-owners (Tenure ≤1 year)
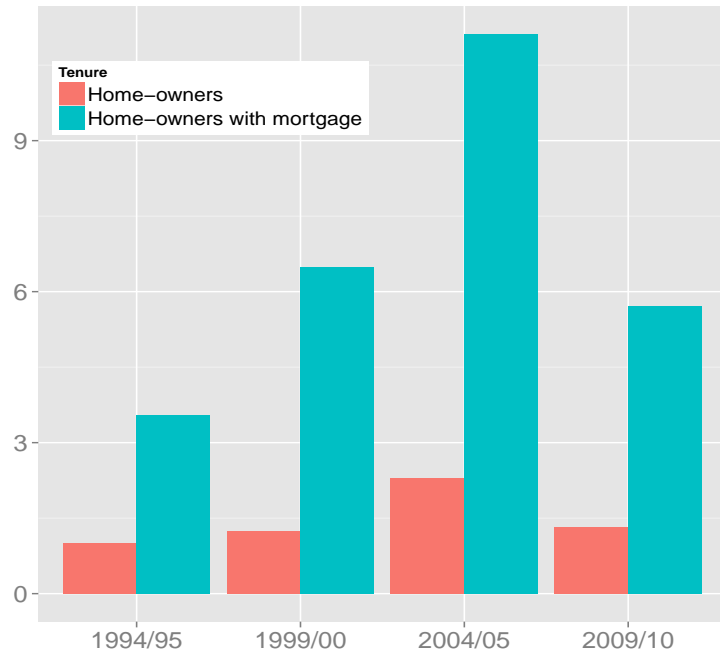
Figure 9: Percentage of new home-owners (≤1 year) in the population
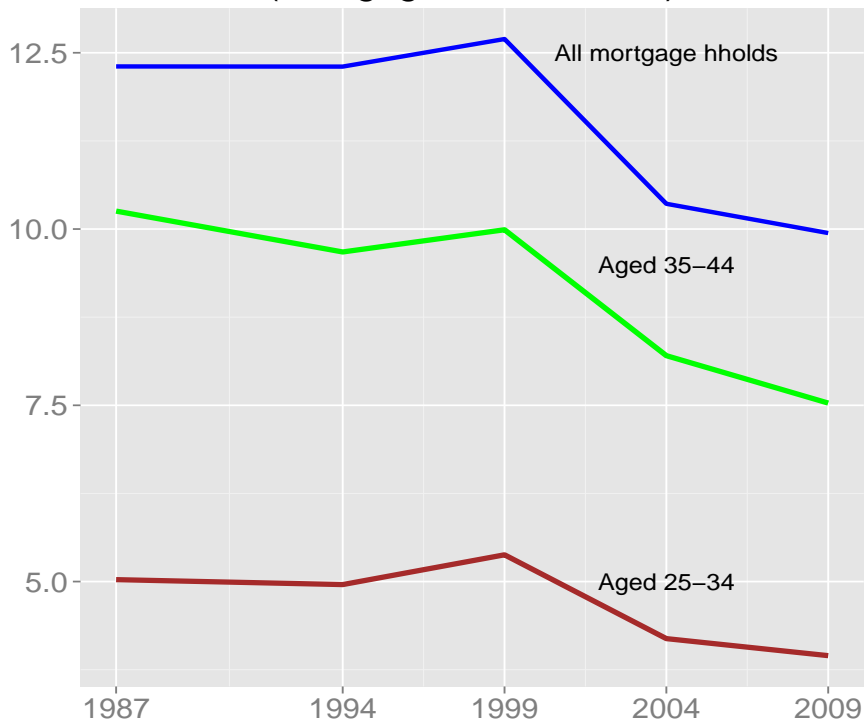
TABLES 1 - 9

Table 1: Average annual growth rates for durable and non-durable consumption

	1980-1998	1998-2007	2008-2012
Total nondurables (less housing)	2.5%	5.8%	-1.3%
Total Durables	3.2%	9.5%	-5.4%
Consisting of . . .			
Clothing and footwear	5.0%	8.7%	-0.3%
Household equipment and operation	3.5%	10.8%	-10.5%
Personal transport equipment	3.7%	7.9%	-9.6%
Recreation, entertainment and education equipment	0.8%	11.2%	-1.3%

Source: CSO, National Income and Expenditure accounts.

Table 2: Aggregate consumption functions

	(1) Total cons 1980-2013	(2) Total cons 1996-2013	(3) Non-dur. cons 1996-2013	(4) Durable cons 1996-2013
Error correction term	-0.246***	-0.187**	-0.218***	-0.125**
	(-4.78)	(-2.95)	(-3.74)	(-2.24)
Income	0.866***	0.826**	0.810**	0.785
	(16.81)	(2.47)	(2.83)	(0.97)
Housing wealth	0.048*	0.0763*	0.0496	0.294**
	(1.84)	(1.66)	(1.24)	(2.15)
Non-housing wealth	0.0649***	0.109**	0.100**	0.213
	(3.51)	(1.85)	(2.48)	(1.44)
Consumer expectations		-0.0404	-0.0366	-0.0948
		(-0.78)	(-0.81)	(-0.84)
Mortgage spread	-0.0132**	-0.0138	-0.0124	-0.0294
	(-2.91)	(-0.72)	(-0.75)	(-0.68)
Loan-to-income ratio	-0.0406*	-0.0673**	-0.0538*	-0.172
	(-2.19)	(-1.76)	(-2.11)	(-1.93)
Δ Income	0.319***	0.116	0.138	-0.0547
	(3.94)	(1.15)	(1.34)	(-0.37)
Δ Housing wealth	0.0547	0.124***	0.111**	0.204**
	(1.91)	(3.05)	(3.15)	(3.29)
Δ Other wealth	0.00128	0.00999	0.00514	0.0433*
	(0.11)	(0.56)	(0.28)	(1.66)
Δ Unemp. rate	-0.612*	-0.479	-0.335	-1.80***
	(-2.31)	(-1.11)	(-0.76)	(-3.12)
R^2	0.43	0.50	0.46	0.61
$Durbin - watson$	2.39	2.45	2.51	2.31
N	134	70	70	70

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Household Budget Survey, 1987-2009

Wave	N	Time-period
1987	6,975	1987q1-1988q2
1994	7,037	1994q2-1995q2
1999	6,958	1999q2-2000q3
2004	6,196	2004q3-2005q4
2009	4,972	2009q3-2010q3
Total	32,138	

Table 4: Microeconomic consumption function

	(1) Total exp.[a]	(2) Non-dur. exp.	(3) Durables exp.
Income	0.496***	0.474***	0.678***
	(93.39)	(92.57)	(46.53)
House price*young	0.0283	-0.0257	0.455***
	(1.32)	(-1.25)	(7.71)
House price*middle	0.0313*	-0.0210	0.493***
	(1.97)	(-1.37)	(11.45)
House price*old	0.0452**	-0.00323	0.611***
	(3.25)	(-0.24)	(15.54)
Loans*young	0.0768***	0.0673***	0.144***
	(12.33)	(11.22)	(8.44)
Loans*middle	0.0572***	0.0492***	0.117***
	(14.59)	(13.04)	(11.05)
Loans*old	0.0699***	0.0622***	0.142***
	(11.87)	(10.98)	(8.89)
N	25,122	25,122	23,767
$Adj - R2$	0.70	0.71	0.38

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a] Excluding mortgage repayments and rent.

Table 5: Estimates of housing equity (mean, €2009 prices)
Outright owners and owners with a mortgage

	Outright owners	Owners with a mortgage
Wave	Housing equity	Housing equity
1994/95	€121,792	€82,404
1999/2000	€197,212	€116,409
2004/05	€299,520	€143,452
2009/10	€266,666	€111,753

No data on outstanding mortgage debt available for the 1987 wave.

Table 6: Housing equity & expenditure by **outright** home-owners

	(1) Total exp.[a]	(2) Non-dur. exp.	(3) Durables exp.
Income	0.417***	0.402***	0.551***
	(26.61)	(26.36)	(19.90)
Housing equity * No dependent kids	0.0708***	0.00585	0.698***
	(3.36)	(0.29)	(13.48)
	(3.54)	(0.67)	(13.00)
Housing equity * dependent kids	0.00885	-0.0277	0.426***
	(0.39)	(-1.29)	(7.17)
	(0.60)	(-0.97)	(6.81)
'New' home-owner	0.0873**	0.0481	0.273**
	(2.65)	(1.50)	(3.14)
Number of personal loans	0.0651***	0.0576***	0.130***
	(13.84)	(12.76)	(9.82)
N	10,941	10,941	10,366
$Adj - R2$	0.71	0.72	0.38

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a] Excluding mortgage repayments and rent.

Table 7: Share of durable expenditure, by category

	Existing home-owners	New home-owners
Housing-related durable goods	13%	26%
Household equipment durable goods	21%	33%
Personal transport equipment	37%	17%
Clothing & footwear	28%	24%
Total	100%	100%

Source: Household level data for HBS waves 1994/95 - 2009/10.
Housing-related durable goods includes furniture and furnishings, maintenance, fittings, etc;
Household equipment includes white goods, tools, recreational and entertainment equipment, etc;
Personal transport equipment is largely the purchase of vehicles

Table 8: Positive/negative equity & expenditure by mortgaged houssholds

	(1) Total exp.[a]	(2) Non-dur. exp.	(3) Durables exp.
Positive equity=1	0.0353*	0.0435**	0.0491
	(2.11)	(2.69)	(1.00)
N	8975	8975	8923
$Adj - R2$	0.57	0.57	0.32

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a] Excluding mortgage repayments and rent.

Table 9: Housing equity & expenditure by **mortgaged** home-owners

	(1) Total exp.[a]	(2) Non-dur. exp.	(3) Durables exp.
Income	0.535***	0.513***	0.810***
	(55.83)	(55.21)	(28.19)
Housing equity	0.0596***	0.0205	0.470***
	(3.80)	(1.35)	(10.00)
Mortgage debt to income X			
Leverage < 0.50	0.0251	0.0312	0.0991
	(0.56)	(0.72)	(0.74)
Leverage $\geq 0.50, < 1.50$	-0.0191	-0.0128	-0.0501
	(-1.67)	(-1.16)	(-1.46)
Leverage $\geq 1.50, < 2.50$	0.00489	0.00430	0.0213
	(0.76)	(0.69)	(1.10)
Leverage $\geq 2.50, < 3.50$	0.00559	0.00493	0.0180
	(1.10)	(1.00)	(1.18)
Leverage $\geq 3.50, < 4.50$	0.00625	0.00220	0.0426**
	(1.25)	(0.46)	(2.85)
Leverage ≥ 4.50	0.0177***	0.0159***	0.0334***
	(12.55)	(11.60)	(7.91)
New home-owner	0.0408*	-0.0308	0.296***
	(2.01)	(-1.57)	(4.89)
Number of personal loans	0.0398***	0.0308***	0.109***
	(10.47)	(8.36)	(9.54)
N	7,956	7,956	7,904
$Adj - R2$	0.58	0.57	0.32

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a] Excluding mortgage repayments and rent.
'New' home-owner is a dummy variable equal to one
if the home-owner moved in within the last year.

Appendix A: Data appendix

A1. Consumption

Annual data on personal consumption expenditure is available from the National Income and Expenditure Accounts (NIE 2013).[24] Following Roche (1995), we define durable goods in the annual data as follows: clothing and footwear, household goods, personal transport equipment and equipment for recreation, entertainment and education. All other categories of household expenditure are treated as non-durable.

A quarterly series for personal expenditure on consumer goods and services is available from the CSO from Q1 1997 onwards. We construct a longer quarterly time series by merging the (nominal) CSO series with a 'backcast' series constructed for earlier macro-modelling exercises by the Central Bank of Ireland (CBI). This backcast series, which begins in Q1 1980, takes the annual NIE series (1970-2012) and interpolates quarterly data using high-frequency (monthly or quarterly) retails sales indices.[25] The real series deflates the nominal series using the personal consumption deflator in the Quarterly National Accounts (QNA) current/constant price series, whilst the pre-1997 deflator is based on the Consumer Price Index.

As noted in the text, it is important to differentiate between spending on non-durable and durable goods when analysing aggregate consumption. Whilst annual data on both types of consumption is available in the NIE accounts from 1970 onwards, no official quarterly series exists. However, sectoral retail sales data is available monthly from 1996. We therefore construct a quarterly series for spending on durable goods using the retail sales indices (volume changes) for clothing and footwear, motor trades, furniture and lighting and electrical goods. Each index is weighted using the corresponding share of durable consumption in the NIE for that year. The quarterly non-durable spending index (including services) is calculated as the residual growth after (weighted) growth in durables has been taken into account. The annual growth rates for the quarterly durable and non-durable spending series are shown alongside their NIE annual counterparts below.

A2. Disposable income

The CSO compile two household income time series: personal disposable income (PDI), and household disposable income (HDI), published in the NIE, and the Institutional Sectoral Accounts (ISA), respectively. PDI is available on an annual basis from 1970 onwards. HDI is available quarterly, but only from Q1 2002. The two series are inconsistent with each other due to differing national accounts' definitions. For this analysis, we developed a consistent measure of quarterly PDI from Q1 1980 to Q3 2012. From Q1 1998 onwards, the individual components of PDI were attained either from quarterly sources consistent with the NIE series, or by interpolating the annual NIE data using quarterly indicators. As outlined in Table A1, the absence of quarterly data sources for the Q1 1980 to Q4 1997 period meant that the quarterly NIE data relied entirely on CBI interpolations of the components of the annual NIE data for this period.

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[24]See National Income and Expenditure: Annual Results for 2012.
[25]See Ryan (2003), McQuinn et al. (2005) and O'Donnell (2007) for further details.

Figure 10: Durable and non-durable consumption spending (annual % change)

(a) Spending on durable goods

(b) Spending on non-durables (including services)
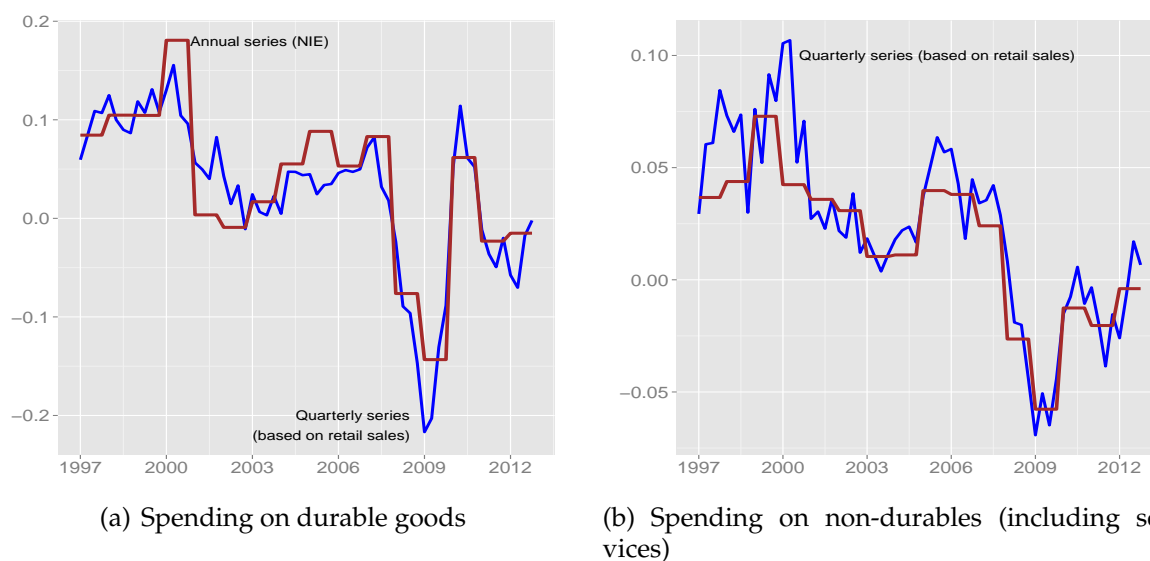
Table A1: Construction of personal disposable income series

Time period	Compensation	Net interest	Other income	Taxes/transfers
1980:01 – 1997:04	NIE	NIE	NIE	NIE
1998:01 – 2013:01	QSA	QSA	NIE	NIE

NIE = Interpolation of annual NIE accounts

QSA = Actual data from Quarterly Sectoral Accounts

A3. Wealth

Housing assets form by far the largest component of total Irish household wealth (Figure A1). During the peak of the housing bubble, these assets constituted 67% of total wealth. This had declined to 49% by Q3 2013. In contrast, quoted equity formed on average just under 2% of total wealth between Q1 2002 and Q1 2013. Insurance technical reserves were the second largest component of total wealth. These assets, however, are extremely illiquid and are therefore valuation changes are not expected to impact consumption. Table A2 summarises the net (assets minus liabilities) housing wealth measure used in the analysis, along with the source data.

Table A2: Housing wealth and debt variables

Variable	Source/Notes
Housing wealth (A, Q)	= Housing stock $*$ Average house price
Consumer debt (A, Q)	Central Bank 1970 - 2013
Mortgage debt (A, Q)	Central Bank 1970 - 2013

'A' and 'Q' indicates annual (1970 – 2012) and quarterly (1980:1 – 2013:1)

Figure A1: Components of household wealth

a. Decomposition of changes in Household Wealth   b. Household Wealth
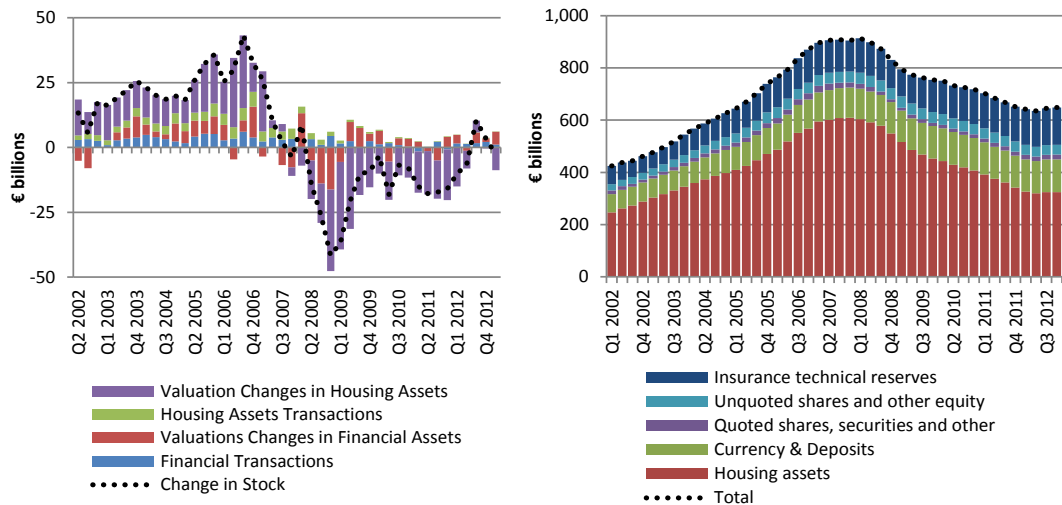
Table A5: Share (%) of expenditure types (HBS)

Wave/tenure	Durables	Semidurables	Nondurables	Mortgage/rent
Own (Outright)				
1987	11.4	2.0	86.7	
1994	9.3	2.1	88.6	
1999	12.3	3.0	84.6	
2004	14.6	4.0	81.4	
2009	16.0	5.0	79.1	
Own (with a mortgage)				
1987	9.8	1.7	76.4	12.1
1994	9.5	1.9	77.5	11.1
1999	11.7	2.9	76.9	8.5
2004	15.9	3.9	70.4	9.8
2009	13.3	4.4	65.4	16.9
Rent (Privately)				
1987	6.9	1.7	77.9	13.5
1994	5.3	1.7	76.2	16.9
1999	6.9	2.6	72.8	17.7
2004	8.9	3.8	67.3	20.0
2009	7.5	5.0	63.5	24.0
Rent (Local Authority)				
1987	5.7	1.6	85.7	7.0
1994	4.3	2.2	85.7	7.9
1999	6.9	2.9	83.6	6.6
2004	10.6	5.0	76.2	8.2
2009	10.5	6.2	71.4	11.9

Semi-durables consist of clothing and footwear.
In the analysis they are included in durables.

A.4 Stock of mortgage debt for 2009/10 HBS

Data on the outstanding stock of mortgage debt on the principal dwelling is not available in either the 1987 or 2009 waves of the survey. We estimate the mortgage debt for the 2009 (2009Q3 – 2010Q3) waves as the fitted value from a regression of mortgage debt per household on a number of other variables including: mortgage repayment amount, current mortgage interest rates (from Central Bank Money and Banking Statistics), number of years living in the home (as a proxy for how far into the mortgage term

the borrower is), geographic controls and property type. We use the loan-level data described above for the hedonic house price regression, which provides a snapshot of the loan books for the Irish domestic banks (aproximately two-thirds of the market) as at end-2010. The regression is a good fit for the data with an R-squared of 0.74. Furthermore, the average of the predicted values for mortgage debt are very close to published figures. For example, we estimate the average value of outstanding mortgage debt per household at €142,000 for the 2009/10 wave, whereas the same figure based on loan level data in Kennedy and McIndoe-Calder for end-2010 is €150,000.

Table A6: Regression to estimate value of outstanding mortgage debt

VARIABLES	Log outstanding mortgage balance Dec-2010
Monthly mortgage repayment	0.984***
	(0.00142)
6-10 years in the home	-0.425***
	(0.00216)
11-15 years in the home	-1.013***
	(0.00367)
16+ years in the home	-1.530***
	(0.00939)
Current mortgage interest rate	-0.0405***
	(0.000601)
Constant	5.142***
	(0.0102)
Observations	336,436
R-squared	0.735
	Loan data, Dec 2010

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
$\leq$ 5 years in the home omitted.
Regressions include controls for region (3) and household type (4).

Full Regression Results

Microeconomic consumption function – full results (Table 4 in text)

VARIABLES	(1) Total exp. (log) coef	(2)	(3) Nondurable exp. coef	(4)	(5) Durables exp. coef	(6)
Disposable income (log)	0.496***	(0.00532)	0.474***	(0.00512)	0.678***	(0.0146)
House prices X young age	0.0283	(0.0214)	-0.0257	(0.0206)	0.455***	(0.0590)
House prices X middle age	0.0313**	(0.0159)	-0.0210	(0.0153)	0.493***	(0.0431)
House prices X older age	0.0452***	(0.0139)	-0.00323	(0.0134)	0.611***	(0.0393)
# Personal loans (young age)	0.0768***	(0.00623)	0.0673***	(0.00599)	0.144***	(0.0170)
# Personal loans (middle age)	0.0572***	(0.00392)	0.0492***	(0.00377)	0.117***	(0.0106)
# Personal loans (older age)	0.0699***	(0.00588)	0.0622***	(0.00566)	0.142***	(0.0160)
1 adult household	[omitted]					
Married couple, no children	0.408***	(0.0114)	0.411***	(0.0110)	0.314***	(0.0328)
Married couple, 1 child	0.529***	(0.0154)	0.537***	(0.0149)	0.483***	(0.0433)
Married couple, 2 children	0.592***	(0.0148)	0.615***	(0.0143)	0.494***	(0.0416)
Married couple, 3 children	0.613***	(0.0140)	0.640***	(0.0135)	0.478***	(0.0395)
Married couple, 4+ children	0.334***	(0.0152)	0.362***	(0.0146)	0.259***	(0.0431)
Single adult with kids	0.732***	(0.0155)	0.774***	(0.0150)	0.570***	(0.0436)
rural	0.0180***	(0.00562)	-0.000176	(0.00541)	0.0920***	(0.0155)
Age head of household ≤24	[omitted]					
25-34	-0.0351*	(0.0184)	-0.0718***	(0.0177)	0.308***	(0.0525)
35-44	-0.0273	(0.291)	-0.0845	(0.281)	0.0279	(0.801)
45-54	0.0336	(0.295)	-0.00734	(0.284)	0.166	(0.809)
55-64_hh	-0.132	(0.287)	-0.232	(0.276)	-1.090	(0.802)
65-74	-0.236	(0.289)	-0.358	(0.278)	-1.038	(0.808)
75+	-0.399	(0.290)	-0.513*	(0.279)	-1.204	(0.811)
No formal education	[omitted]					
Primary education	0.149***	(0.0341)	0.141***	(0.0328)	0.0623	(0.105)
Lower secondary	0.268***	(0.0344)	0.244***	(0.0331)	0.294***	(0.106)
Higher secondary	0.356***	(0.0345)	0.331***	(0.0332)	0.398***	(0.106)
Post leaving cert	0.411***	(0.0352)	0.383***	(0.0339)	0.464***	(0.108)
First degree	0.469***	(0.0357)	0.444***	(0.0343)	0.487***	(0.109)
Higher degree	0.488***	(0.0355)	0.461***	(0.0342)	0.453***	(0.108)
Still in education	0.554***	(0.0384)	0.541***	(0.0369)	0.443***	(0.116)
Quarter=1	[omitted]					
Quarter=2	0.0315***	(0.00772)	0.0390***	(0.00744)	-0.0385*	(0.0212)
Quarter=3	0.0228***	(0.00822)	0.0283***	(0.00791)	0.0214	(0.0226)
Quarter=4	0.0294***	(0.00931)	0.0235***	(0.00896)	0.108***	(0.0256)
Born 1934	[omitted]					
Born 1944	-0.0246*	(0.0145)	-0.0533***	(0.0139)	0.190***	(0.0400)
Born 1954	-0.0338*	(0.0187)	-0.0594***	(0.0180)	0.376***	(0.0515)
Born 1964	-0.0525**	(0.0238)	-0.0800***	(0.0229)	0.498***	(0.0651)
Born 1974	-0.130***	(0.0274)	-0.158***	(0.0263)	0.581***	(0.0751)
Born 1984	-0.286***	(0.0320)	-0.308***	(0.0308)	0.654***	(0.0879)
Constant	1.956***	(0.255)	2.701***	(0.245)	-7.640***	(0.706)
Observations	25,122		25,122		23,767	
R-squared	0.702		0.703		0.380	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Housing equity & expenditure by outright home-owners (Table 6 in text)

VARIABLES	(1) Total exp. (log) coef	(2)	(3) Nondurable exp. coef	(4)	(5) Durables exp. coef	(6)
Disposable income (log)	0.417***	(0.0157)	0.402***	(0.0152)	0.551***	(0.0277)
Housing equity (log, kids)	0.00885	(0.0224)	-0.0277	(0.0215)	0.426***	(0.0594)
Housing equity (no, kids)	0.0708***	(0.0210)	0.00585	(0.0202)	0.698***	(0.0518)
Years in home< 1	0.0873***	(0.0329)	0.0481	(0.0322)	0.273***	(0.0869)
# Personal loans	0.0651***	(0.00470)	0.0576***	(0.00452)	0.130***	(0.0132)
1 adult household	[omitted]					
Couple, no kids	0.417***	(0.0178)	0.420***	(0.0172)	0.374***	(0.0422)
Couple, 1 kid	1.381***	(0.277)	1.052***	(0.266)	3.949***	(0.796)
Couple, 2 kids	1.426***	(0.276)	1.113***	(0.266)	3.945***	(0.794)
Couple, 3 kids	1.433***	(0.276)	1.109***	(0.265)	3.937***	(0.792)
Couple, 4+ kids	1.279***	(0.275)	0.954***	(0.265)	3.900***	(0.793)
Single adult with kids	1.600***	(0.276)	1.290***	(0.265)	4.107***	(0.791)
Rural	-0.0326***	(0.00872)	-0.0421***	(0.00833)	0.00660	(0.0239)
Age head of household ≤24	[omitted]					
25-34	0.176*	(0.0968)	0.106	(0.0985)	0.117	(0.228)
35-44	0.280***	(0.0993)	0.203**	(0.101)	0.394*	(0.236)
45-54	0.379***	(0.102)	0.310***	(0.103)	0.605**	(0.245)
55-64	0.454***	(0.105)	0.376***	(0.106)	0.867***	(0.254)
65-74	0.369***	(0.108)	0.264**	(0.109)	0.977***	(0.264)
75+	0.202*	(0.109)	0.108	(0.109)	0.781***	(0.268)
No formal education	[omitted]					
Primary education	0.117***	(0.0442)	0.114**	(0.0470)	0.0566	(0.138)
Lower secondary	0.235***	(0.0449)	0.215***	(0.0477)	0.261*	(0.139)
Higher secondary	0.319***	(0.0454)	0.299***	(0.0482)	0.367***	(0.140)
Post leaving cert	0.418***	(0.0474)	0.397***	(0.0500)	0.480***	(0.143)
First degree	0.462***	(0.0487)	0.450***	(0.0512)	0.416***	(0.146)
Higher degree	0.489***	(0.0503)	0.475***	(0.0527)	0.419***	(0.147)
Still in education	0.473***	(0.0741)	0.423***	(0.0707)	0.589***	(0.194)
Quarter=1	[omitted]					
Quarter=2	0.0147	(0.0118)	0.0224**	(0.0113)	-0.0643**	(0.0311)
Quarter=3	0.0244*	(0.0129)	0.0302**	(0.0124)	-0.0378	(0.0336)
Quarter=4	0.0555***	(0.0153)	0.0446***	(0.0147)	0.132***	(0.0383)
Born 1934	[omitted]					
Born 1944	0.00845	(0.0185)	-0.0228	(0.0179)	0.234***	(0.0481)
Born 1954	0.0433	(0.0269)	0.0127	(0.0258)	0.461***	(0.0714)
Born 1964	0.0872**	(0.0359)	0.0472	(0.0345)	0.687***	(0.0977)
Born 1974	0.104**	(0.0508)	0.0438	(0.0483)	0.877***	(0.137)
Born 1984	0.00307	(0.0916)	-0.0420	(0.0856)	0.576**	(0.275)
Constant	1.561***	(0.243)	2.431***	(0.235)	-9.873***	(0.638)
Observations	10,941		10,941		10,366	
R-squared	0.713		0.721		0.382	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Housing equity & expenditure by mortgage home-owners (Table 9 in text)

VARIABLES	(1) Total exp. (log) coef	(2)	(3) Nondurable exp. coef	(4)	(5) Durables exp. coef	(6)
Disposable income (log)	0.535***	(0.00958)	0.513***	(0.00929)	0.810***	(0.0287)
Housing equity (log)	0.0596***	(0.0157)	0.0205	(0.0152)	0.470***	(0.0470)
Mortgage debt to income X						
Leverage < 0.50	0.0251	(0.0447)	0.0312	(0.0434)	0.0991	(0.135)
Leverage $\geq 0.50, < 1.50$	-0.0191*	(0.0114)	-0.0128	(0.0111)	-0.0501	(0.0342)
Leverage $\geq 1.50, < 2.50$	0.00489	(0.00644)	0.00430	(0.00625)	0.0213	(0.0194)
Leverage $\geq 2.50, < 3.50$	0.00559	(0.00508)	0.00493	(0.00492)	0.0180	(0.0152)
Leverage $\geq 3.50, < 4.50$	0.00625	(0.00498)	0.00220	(0.00483)	0.0426***	(0.0149)
Leverage ≥ 4.50	0.0177***	(0.00141)	0.0159***	(0.00137)	0.0334***	(0.00423)
Years in home< 1	0.0408**	(0.0203)	-0.0308	(0.0197)	0.296***	(0.0607)
1 adult household	[omitted]					
Couple, no kids	0.469***	(0.0397)	0.466***	(0.0385)	0.283**	(0.126)
Couple, 1 kid	0.569***	(0.0412)	0.568***	(0.0399)	0.417***	(0.130)
Couple, 2 kids	0.595***	(0.0406)	0.615***	(0.0394)	0.391***	(0.129)
Couple, 3 kids	0.634***	(0.0404)	0.654***	(0.0391)	0.417***	(0.128)
Couple, 4 kids	0.404***	(0.0424)	0.411***	(0.0411)	0.382***	(0.134)
Single adult with kids	0.746***	(0.0412)	0.782***	(0.0400)	0.488***	(0.130)
No formal education	[omitted]					
Primary education	-0.0338	(0.0934)	-0.0275	(0.0906)	0.131	(0.279)
Lower secondary	0.0446	(0.0934)	0.0437	(0.0906)	0.333	(0.279)
Higher secondary	0.123	(0.0934)	0.124	(0.0906)	0.395	(0.279)
Post leaving cert	0.154	(0.0939)	0.154*	(0.0911)	0.429	(0.281)
First degree	0.220**	(0.0942)	0.216**	(0.0913)	0.481*	(0.282)
Higher degree	0.203**	(0.0941)	0.206**	(0.0913)	0.413	(0.282)
Still in education	0.215**	(0.0984)	0.221**	(0.0954)	0.535*	(0.294)
Born 1934	[omitted]					
Born 1944	0.0395	(0.0248)	0.0178	(0.0241)	0.373***	(0.0749)
Born 1954	0.00755	(0.0297)	-0.0298	(0.0288)	0.515***	(0.0896)
Born 1964	-0.0504	(0.0326)	-0.0979***	(0.0317)	0.525***	(0.0982)
Born 1974	-0.105***	(0.0366)	-0.169***	(0.0355)	0.624***	(0.110)
Born 1984	-0.223***	(0.0439)	-0.279***	(0.0426)	0.600***	(0.132)
Rural	0.0129	(0.00841)	-0.00460	(0.00816)	0.0980***	(0.0252)
Quarter=1	[omitted]					
Quarter=2	0.0475***	(0.0115)	0.0547***	(0.0111)	-0.0181	(0.0343)
Quarter=3	0.0393***	(0.0121)	0.0440***	(0.0117)	0.0343	(0.0362)
Quarter=4	0.0314**	(0.0138)	0.0369***	(0.0133)	0.0278	(0.0413)
Young age group	[Omitted]					
Middle age group	0.0228	(0.0151)	0.0217	(0.0147)	0.0790*	(0.0453)
Older age group	0.0208	(0.0284)	0.00599	(0.0275)	0.259***	(0.0851)
loans_all	0.0398***	(0.00380)	0.0308***	(0.00369)	0.109***	(0.0114)
Constant	1.545***	(0.198)	2.067***	(0.192)	-8.253***	(0.595)
Observations	7,956		7,956		7,904	
R-squared	0.578		0.573		0.321	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1