



BANK OF ENGLAND

Staff Working Paper No. 554

Household debt and spending in the United Kingdom

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Household debt and spending in the United Kingdom

Philip Bunn⁽¹⁾ and May Rostom⁽²⁾

Abstract

Household debt rose sharply in the United Kingdom in the decade before the financial crisis. This paper uses household level microdata to investigate the relationship between mortgage debt and consumption. We find evidence that more highly indebted groups of households made larger cuts in spending following the financial crisis: spending cuts associated with debt may have reduced the level of aggregate private consumption by up to 2% after 2007. Survey data suggest that large cuts in spending by indebted households after 2007 may reflect a combination of tighter credit conditions and increased concerns about ability to make future debt repayments. The potential for household indebtedness to lead to large adverse impacts on aggregate demand was an important reason why the Bank of England's Financial Policy Committee took policy action at its June 2014 meeting.

Key words: Household spending, debt.

JEL classification: D10, D11, D14, E21.

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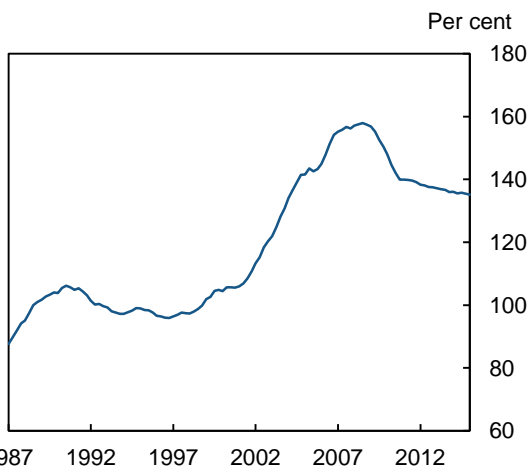
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1 Introduction

In the United Kingdom, a major development in household balance sheets over the period between 1992 and 2007 was the build-up of household debt. The stock of debt more than trebled from around £500 billion in 1992 to £1.5 trillion in 2007. Most of the increase took place from the late 1990s onwards, primarily due to increases in mortgage debt which, by 2007, accounted for around three-quarters of all household debt. In relation to annual disposable income, debt rose by around 60 percentage points over this period to a peak of almost 160% (Chart 1).

During the financial crisis, household spending fell sharply in the United Kingdom. It subsequently remained subdued, and took until 2014 for consumption growth to get back to its historical average rate (Chart 2). To what extent were the run up in debt before the financial crisis and the subsequent weakness in consumption related? And did the households with higher levels of debt provide any support to spending before 2007? These are important questions for policymakers.

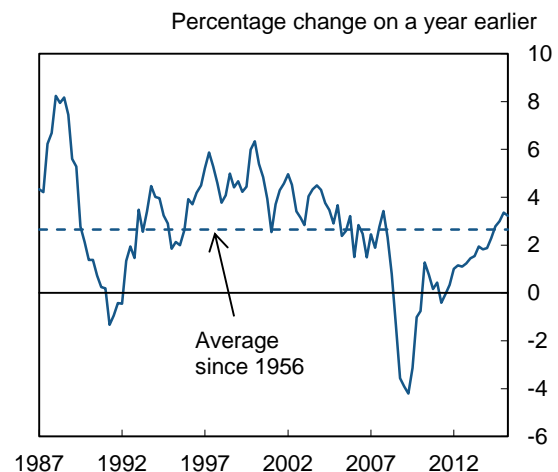
Chart 1: Household debt to income ratio^(a)



Sources: ONS and authors calculations.

(a) Gross debt as a percentage of a four-quarter moving sum of disposable income. Includes all liabilities of the household sector except for the unfunded pension liabilities and financial derivatives of the non-profit sector. The household disposable income series is adjusted for financial intermediation services indirectly measured (FISIM).

Chart 2: Household spending^(a)



Sources: ONS and authors calculations.

(a) Chained-volume measure.

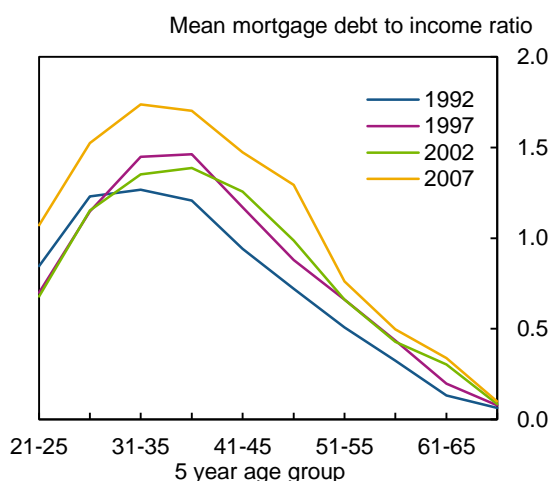
Understanding how households with debt respond to shocks has important implications for both financial stability and monetary policy. At higher levels of indebtedness, households are more likely to encounter payment difficulties following adverse shocks to income or interest rates. Concern about the possibility of financial distress may also lead to sharp falls in spending, even if that distress does not eventually materialise. Increases in realised financial difficulties and in the risk of distress could pose direct risks to the resilience of the banking system and indirect risks via the impact on wider economic stability. If cuts in spending associated with debt weigh on aggregate household consumption (which accounts for around two thirds of GDP) that affects the balance between supply and demand in the economy and is therefore also highly relevant for monetary policy decisions.

In conventional consumption theory, debt plays no causal role in determining spending decisions. But a basic life-cycle model includes a number of simplifying assumptions and, in practice, households are uncertain about their future incomes and do face restrictions on their ability to borrow. Incorporating these features can allow a more direct role for debt in affecting spending decisions by allowing changes in income expectations or credit conditions to interact with debt (King (1994) and Eggertson and Krugman (2012)).

A number of micro-level studies in other countries have found evidence of a link between high pre-crisis debt and subsequently weak consumption (eg Dynan (2012), Mian, Rao and Sufi (2013) for the United States and Andersen, Duus and Jensen (2014) for Denmark). But there is no previous work for the United Kingdom that looks at this issue in detail.¹ Our study aims to fill this gap in the literature by using household level microdata to examine whether indebted UK households made larger adjustments to spending than other households in the aftermath of the financial crisis.

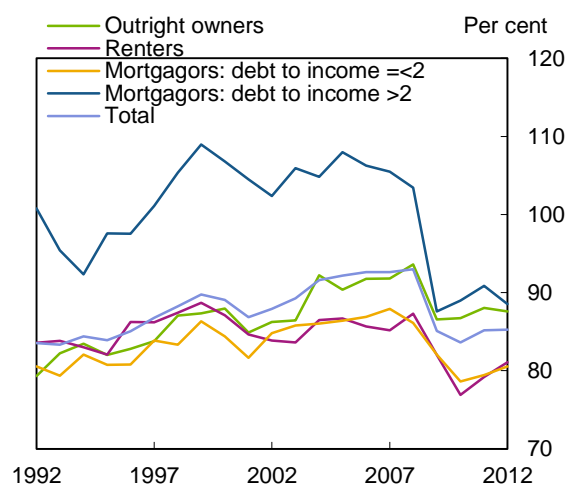
It is difficult to assess how debt has affected household spending using aggregate data. Aggregate data can mask a large degree of heterogeneity across households: some households will be net borrowers while others will be net savers, and amongst borrowers, debt is not evenly distributed. At the start of the financial crisis, debt was heavily concentrated among younger cohorts, and relative to their income, they had more debt than previous generations at similar points in their life cycle (Chart 3). To establish whether a debt overhang did play a role in explaining the weakness of aggregate spending during the financial crisis, and to what extent increases in debt helped to support spending growth in earlier years, it is important to use microdata to assess differences in spending patterns across households with different levels of debt.

Chart 3: Household debt to income ratio by age^(a)



Sources: Living Costs and Food (LCF) Survey and authors calculations.
(a) Outstanding mortgage debt relative to annual post-tax income.

Chart 4: Non-housing consumption as a share of income^(a)



Sources: LCF Survey, ONS and authors calculations.
(a) Household non-housing consumption as a share of post-tax income net of mortgage interest payments. LCF data are scaled to match equivalent data from the National Accounts (excluding imputed rental income, income received by pension funds on behalf of households and FISIM). Debt to income ratio is calculated using secured debt only.

¹ An early version of this paper was published in the Bank of England *Quarterly Bulletin* (Bunn and Rostom (2014)).

Data from the Living Costs and Food (LCF) Survey suggest that the fall in spending during the financial crisis, relative to income, was larger for more indebted households. Chart 4 shows that renters, owner occupiers and households with mortgage debt to income ratios below 2 all reduced spending, relative to income, to some extent. But by far the biggest reduction was among households with mortgage debt to income ratios above 2. We examine this finding in more detail and investigate whether it still holds after controlling for other influences on spending.

An important limitation of our study is that the LCF data are a repeated cross-section and not a panel. That makes it difficult to prove how spending changed for individual households because the households in the survey are different in each year. We use two different methodologies to try and address this shortcoming in the data. The first is to create a pseudo or synthetic panel, as suggested by Deaton (1985) to look at how spending changed across cohorts. The second approach uses the repeated cross-sectional data to compare spending patterns of households with similar characteristics from one year to the next. While we lose the advantage of having a panel using this cross sectional approach, we are able to control for a richer set of household characteristics. Both approaches yield similar results: we find that spending cuts associated with debt may have reduced the level of aggregate private consumption by up to 2% after 2007, thus making the recession deeper.

While our work establishes that there are differences in spending patterns between households with different levels of debt, it does not prove that debt was the cause of those differences. There could also have been other factors such as income expectations that were correlated with debt that led to lower spending. We make use of survey evidence from the Bank of England/NMG survey to try and better understand the reasons behind households' spending decisions. That evidence suggests that large cuts in spending by indebted households after 2007 are likely to have reflected a combination of tighter credit conditions and increased concerns about ability to make future debt repayments, which would be consistent with debt being a causal factor contributing to those spending patterns.

The potential for household indebtedness to have a large adverse impact on aggregate demand in the United Kingdom, which is highlighted in this paper, was an important reason why the Bank of England's Financial Policy Committee (FPC) took policy actions in June 2014 to insure against the risks from a further significant increase in the number of highly indebted households.² The Committee recommended that mortgage lenders should apply a stress test to assess affordability if Bank Rate rose by 3 percentage points within the first five years of the loan and that lenders should limit the proportion of mortgages at loan to income ratios of 4.5 or above to 15% of new mortgage lending.

The paper is organised as follows. First we discuss the theory and previous literature around the relationship between debt and consumption. We then describe our research design, the data, present some descriptive results and then our econometric results. We then attempt to quantify their aggregate significance, present some evidence on why households may have cut spending after 2007 and compare our results to other studies before concluding.

² See the June 2014 Financial Stability Report for more details on these measures, available at www.bankofengland.co.uk/publications/Documents/fsr/2014/fsrfull1406.pdf.

2 Theory and literature

2.1 Theory

In conventional consumption theory, debt plays no causal role in determining household spending. In the permanent income/life-cycle model, consumption depends only on expected lifetime income and wealth, with households smoothing spending over their lifetimes. Typically, households should borrow when they are young and their incomes are relatively low, and then repay their debt later in life as their incomes rise, before building up savings ahead of retirement, when incomes fall back again.

A simple life-cycle model assumes that households can borrow as much as they choose; that assets and debt are riskless; that the cost of borrowing is constant; that there is no uncertainty in lifetime income and expectations do not get revised. In practice, these underlying assumptions do not always hold. For example, households may have unrealistic expectations about their future income stream or be subject to unanticipated shocks which change those expectations. Households may also face constraints which mean that they may be unable to borrow against their future income, or borrow as much as they would like to fully smooth their consumption. Some theoretical models in the literature have relaxed those assumptions to find a direct role for debt in determining spending, for example by allowing changes in income expectations or credit conditions to interact with debt.

The literature on how debt might affect spending dates back to Fisher's (1933) debt deflation theory. Fisher argued that in the US Great Depression, debt helped to amplify the initial shock as it propagated through the economy. King (1994) discusses how Fisher's work might have been relevant in explaining the weakness of UK consumption during the 1990s recession. He puts forward a model in which indebted households, who had borrowed on the expectation of higher future income, suffer adverse shocks to their future income expectations that lead them to consume less and repay debt. Even if other households experience offsetting positive shocks, they do not increase consumption by enough to fully offset the effect on aggregate spending.

Since the recent financial crisis, new research on the role of debt has typically tried to incorporate some type of reduction in households' ability to borrow. Eggertsson and Krugman (2012) assume that there is a limit on how much debt individuals can hold, and if that limit is revised down (for example because of sudden realisation that collateral constraints were too lax), highly indebted households are forced to reduce spending sharply with no offsetting response from non-debtors. Other models such those of Guerrieri and Lorenzoni (2011) and Philippon and Midrigan (2011) also try to explain weak consumption by incorporating a tightening in the ability of households to borrow to smooth consumption and by a reduction in the ability of households to withdraw equity from their homes. Korinek and Simsek (2014) and Fahri and Werning (2015) extend these types of models by also considering the earlier credit boom period. They show how borrowers who behave rationally at an individual level undertake excessive leverage from a social point of view, which can create an aggregate demand externality when households are forced to delever.

Changes in ability to borrow can also potentially help to amplify the impact of other shocks through the financial accelerator type mechanism discussed by Bernanke et al (1999). In a similar vein, Iacoviello (2005) builds a model in which rising debt burdens help to amplify the impact of demand shocks. Increases in demand boost asset prices and increase the borrowing capacity of debtors, allowing them to spend more, whilst consequent increase in prices erode the real value of debt and boost net worth. But high debt levels only amplify the effects of demand shocks in this model – they help to dampen the impact of supply shocks.

2.2 *Empirical literature*

There are two main strands of empirical literature that investigate the link between household debt and spending: analysis of how consumer spending varies with debt levels across (i) countries or (ii) households within a given country.

Cross-country evidence typically finds that the recessions preceded by large increases in household debt tend to be more severe and protracted (eg IMF (2012), Jorda et al (2013)). Whilst this relationship is evident during the recent crisis, the evidence is not restricted to recent experience. King (1994) shows that the same was true in the early 1990s, and going back to the 1870s, Jorda et al (2013) show how excess credit growth is correlated with stronger booms and subsequent deeper recessions and slower recoveries. Even though this relationship is strongest when the recession coincides with a systemic financial crisis, it can also be detected in ‘normal’ business cycles where a financial crisis is absent.

There is, however, less evidence that the aggregate level of pre-crisis household debt is a good predictor of the size of the subsequent adjustment in spending in cross-country work. Consistent with that, Cecchetti et al (2011) find that the level of household debt does not have a statistically significant effect on future growth in a cross country dataset going back to 1980 (although they do find a significant role for public debt, and in some instances corporate debt). However, Flodén (2014) argues that there is a clearer relationship between the level of debt and changes in consumption after 2007 once the level of consumption is adjusted for prior growth in debt, past consumption and the current account balance.

Empirical work for the household level from the United States has found evidence of a relationship between high pre-crisis debt levels and weak post-crisis consumption. Dynan (2012) uses household panel data to show that households with high loan-to-value (LTV) ratios experienced larger declines in spending between 2007 and 2009, after controlling for wealth and other factors. Baker (2013) finds that spending by highly indebted US households was more sensitive to income fluctuations than was the case for other households, although these effects become smaller and sometimes statistically insignificant once credit and liquidity constraints are controlled for.

Mian, Rao and Sufi (2013) analyse evidence across regions in the United States. They show that the decline in consumption following the crisis was greater in areas that had higher outstanding LTV

ratios prior to the crisis. Based on car sales data, they estimate that households in ZIP codes with high levels of pre-crisis leverage subsequently had larger marginal propensities to consume out of the negative shocks to housing wealth that were associated with the financial crisis.

In Europe, Andersen et al (2014) find similar evidence of a negative correlation between pre-crisis leverage and consumption during the crisis in Denmark, and they find that this result cannot be fully explained by a contraction in credit supply. They also show that the highly indebted households who made larger adjustments in spending during the crisis had been consuming a greater share of their income before the crisis.

We know of no household level empirical work for the United Kingdom that examines whether indebted households made larger cuts in spending than other households during the financial crisis. Our work aims to fill this gap. There is, however, related work from the period before the crisis. Cloyne and Surico (2014) show how between 1978 and 2009, the consumption response of mortgagors to income tax shocks (that were not associated with the state of the economy) was significantly larger than the response of outright owners – although they do not differentiate between households with different levels of debt. In contrast, Benito et al (2007) find little evidence that high and low debt households responded differently to changes in their financial positions between 1997 and 2004. But that was over a period of relative stability and the shocks experienced by households since 2007 are likely to have been much larger.

The literature discussed above is all related to whether the liability side of the balance sheet affects spending decisions. But there is also a wider literature on how changes in asset values affect spending, which is of some relevance. In the United Kingdom, house prices and consumption are well correlated in the macro data, yet there is no consensus on whether that reflects causality via a distributional wealth effect or rising house prices creating more collateral to borrow against (as argued by Campbell and Cocco (2007)) or whether the two simply move together because they are determined by similar factors such as expectations of future income (Attanasio et al (2009)).

3 Research design and data

Ideally, we would like to use household level panel data to investigate the relationship between pre-crisis levels of debt and subsequent changes in consumption. But unfortunately, household level panel data containing both good consumption and balance sheet information are not available for the United Kingdom. Instead, we use repeated cross-section microdata from the Living Costs & Food (LCF) Survey (often referred to in the academic literature by its previous name – the Family Expenditure Survey).

A repeat cross-sectional dataset cannot prove how spending changed for individual households. We use two different methodologies to try and address this shortcoming in the data. The first is to create a pseudo or synthetic panel, as suggested by Deaton (1985). This approach involves using a deterministic variable, such as date of birth, to track changes in spending for a cohort of individuals

over time. The advantage of that approach is that it allows us to condition on levels of pre-crisis debt and examine changes in consumption whilst controlling for the changes in income and wealth. The disadvantage of this approach is that it reduces the degree of heterogeneity in the data – and the number of observations – that are otherwise available in household level data.

The second approach is to use the repeated cross-sectional data to compare the spending of households with similar characteristics from one year to the next. That means we are unable to condition on pre-crisis levels of debt to income and instead have to rely on contemporaneous data, which could be affected by large changes in income over the crisis for some households. Using this approach we are unable to estimate an equation for consumption growth. We instead test whether households with higher levels of debt had different levels of consumption to lower debt households after controlling for all observable characteristics. We also allow the coefficient on the debt to income variable to vary over time, in order to see whether that relationship changed over the financial crisis. This approach does allow us to include more control variables than using a pseudo panel, there is a larger sample size and more variation between households in explanatory variables such as debt.

Both the pseudo panel and cross-sectional approaches face the drawback that they can only identify correlations between levels of indebtedness and household spending: they cannot prove that debt was the direct cause of those spending patterns. For example, households with more optimistic expectations of future income may be more willing to take on debt and consume more because of those expectations. But if the financial crisis led those households to realise that their expectations were unrealistic, more highly indebted households may have made larger spending adjustments afterwards with no causal link if debt was simply correlated with income expectations. US studies such as Mian, Rao and Sufi (2013) and Baker (2013) have tried to address this endogeneity issue by instrumenting debt using local level housing supply elasticities. But our data does not contain detailed geographic data below government office region level, which makes it difficult to use any instruments based on geographic characteristics. We do not instrument debt in our regressions and therefore take care not to interpret the observed relationships as being proved to be causal.

3.1 *The synthetic panel approach*

Creating a synthetic panel involves converting a time-series of cross-sections into panel data by calculating mean values for each cohort in each year (Deaton (1985)). It assumes that representative estimates of spending (and other data) for individual cohorts can be derived for each year from the cross-sectional data, even though the actual households used to produce those estimates will be different.

We estimate the following equation at the cohort level:

$$\Delta c_{it} = \alpha_0 + \alpha_1 LTI_{it-1} + \alpha_2 \Delta y_{it} + \alpha_3 \Delta w_{it} + \alpha_4 \Delta hh_{it} + e_{it}$$

Where Δc_{it} is the change in the log of non-housing consumption for cohort i between 2006/07 and 2009/10, Δy_{it} is the change in log of income for the same time period, Δw_{it} is the log change in wealth and Δh_{it} the change in household composition. In all regressions, measures of consumption, income and wealth are all deflated using the National Accounts consumption deflator. LTI_{t-1} is the ratio of outstanding mortgage debt to post-tax income in 2006/07, and this is the main measure of indebtedness we use in our analysis. This equation is very similar to that estimated by Dynan (2012) on US data, other than that we estimate the equation at the cohort level rather than the household level. Similar cohort level equations have also been estimated for the UK based on LCF data, albeit without the debt variable (eg Campbell and Cocco (2007)).

When creating a synthetic panel from repeated cross-sectional data there is a trade-off between the number of cohorts that are used and the number of data points used to create each cohort observation. A greater number of cohorts increases the degree of heterogeneity within the dataset, but fewer data points are used to create each cohort observation, which is likely to reduce the reliability of those estimates. Vice versa, fewer cohorts mean less variation between cohorts, but more reliable cohort level estimates. In order to increase the number of data points used to create the cohort level data we pool two years together when defining the pre and post crisis periods. We define 2006 and 2007 as the pre-crisis period and 2009/10 as post crisis, although we also assess the sensitivity of our results to alternative definitions and examine the period before 2007. We do not include any cohort data points that are based on less than 50 observations as estimates based on a very small number of observations are likely to prove unreliable.

We use four different cohort definitions to assess the reliability of our results. The first definition uses single birth-year cohorts. For example, everybody born in 1956 is one cohort. Birth years are the cleanest definition of a cohort because it is a deterministic variable: people cannot move between different cohorts over time. However, they also combine households with and without mortgage debt, which potentially makes it more difficult to identify the relationship between debt and spending. We therefore also consider a second cohort definition where we split those single birth year cohorts into mortgagors and non-mortgagors. The third definition uses 5-year date of birth buckets and also splits the sample by mortgagor and non-mortgagor status to try and improve the reliability of the cohort level data, but at the expense of having fewer observations. The final cohort definition uses 10-year birth date groups and region as there may also be differences in debt and housing market dynamics between region that can help to identify the link between debt and household spending.³

The main disadvantage of using the second and third cohort definitions is that mortgagor status is a choice variable (you decide whether or not to buy a house and take on a mortgage), so the results may suffer from some selection bias. Over long periods of time, households will move between different housing tenures. However, data from the Wealth and Assets (WA) Survey, which is a household panel survey (and which is discussed in more detail below) show that 90% of the households who had a mortgage in the first wave of the survey between mid-2006 and mid-2008 still

³ The mean number of observations used to construct each datapoint for each the four cohort definitions (in 2006/07 and 2009/10) are 198, 110 and 475 and 159 respectively.

had a mortgage two years later. This suggests that over relatively short periods – such as when looking at changes over the financial crisis period – this is less of a problem. However, we also carry out a further cross-check on our results by defining cohorts on the basis of predicted mortgagor status in 2006/07 using a similar approach to that of Attanasio, Banks and Tanner (2002), and show that this does not substantively change the main results.

3.2 *The cross-sectional approach*

In order to cross-check the synthetic panel results, our second method estimates the equation at the household level using the cross-sectional data. As the data are a repeated cross-section, we are unable to condition on pre-crisis levels of leverage and have to estimate the equation in levels. Using this method, we test whether households with higher levels of debt had different consumption to lower debt households after controlling for all observable characteristics, including cohort effects.⁴ Specifically, we estimate the following equation at the household level:

$$c_{it} = \beta_0 + \beta_1 LTI_{it} + \beta_2' LTI_{it} * year_{it} + \beta_3' year_t + \beta_4' cohort_i + \beta_5' X_{it} + e_{it}$$

Where c_{it} is the log of real non-housing consumption for household i at time t , LTI is the ratio of outstanding mortgage debt to households post-tax income, $year$ is a vector of time dummies to capture time specific shocks, and $cohort$ is a vector of 5-year date-of-birth buckets. X is a vector of controls for age, sex, marital status, highest qualification, economic activity, household composition, tenure, income, region and house prices. The data being a cross section means that we cannot control for unobserved individual heterogeneity in the way that would be possible if our data were a panel. But we do include cohort dummies (based on 5 year birth intervals) which capture a pseudo fixed effect for all the households within a particular cohort.

We estimate this equation from 1992 to 2012 and assess whether the relationship between debt and spending has changed by allowing the coefficient on the debt to income variable to vary over time. The β_1 coefficient shows how consumption varies by debt level in the reference year (2007) while the vector β_2 captures how that impact changes over time, relative to 2007. Our approach allows us to test whether higher debt households consumed more or less than lower debt households at different points in time, but as discussed above, it does not prove how spending actually changed.

3.3 *Data*

The LCF Survey data is annual time-series of cross-sections containing approximately 6,000 households per year, although the sample size does decline gradually over time. The data are collected continually during the year. The survey contains a number of detailed questions about households' expenditure, complemented by a two-week expenditure diary, and therefore provides the

⁴ By controlling for as many factors as possible, we are aiming to compare the consumption of two households of similar income, age, education etc, but where one household has high debt and the other has low debt.

best-quality source of consumption data at the household level in the United Kingdom. Importantly for our purpose, the survey also contains information on outstanding mortgage debt and on income.

We make use of data covering the period between 1992 and 2012. Although the LCF Survey has been running in some form since 1957, mortgage debt data have only been collected since 1992. The survey also switches between calendar and fiscal year collection more than once. For consistency, we convert all data to calendar years. In our analysis, we only include households where the head of the household is aged above 21 and below 70, since very few other households in the survey have any mortgage debt.

We use weekly non-housing expenditure as our measure of consumption. In part, that is because the methodology for calculating housing consumption in the LCF Survey is not consistent with that used in the National Accounts – for homeowners, the LCF Survey only measures mortgage payments rather than using a measure of imputed rents like the National Accounts. All data are deflated using the National Accounts consumption deflator.

The LCF Survey does not include wealth data. But when assessing the role of the liabilities side of the balance sheet in determining consumption decisions, it is also important to try and control for developments in the asset side. To address this we construct cohort level wealth estimates from the Wealth and Assets (WA) Survey and merge them with other cohort level data derived from the LCF Survey. We construct data on self-reported housing wealth and gross non-financial wealth (excluding deposits), both deflated by the National Accounts consumption deflator.⁵ Incorporating housing wealth data also allows us to calculate outstanding loan-to-value ratios (LTVs) and assess the sensitivity of our cohort results to using pre-crisis LTVs rather than LTIs. This also has the advantage of making it easier to compare our results to other studies in the literature, which have typically used LTVs rather than LTIs.

The WA Survey is the most comprehensive source of household wealth data for the United Kingdom. It is a panel survey covering 20-30,000 households in each wave. It began in 2006 and currently has three waves of data available (wave 1 from mid-2006 to mid-2008, wave 2 from mid-2008 to mid-2010 and wave 3 from mid-2010 to mid-2012). Our pseudo panel analysis of changes in consumption over the financial crisis using LCF Survey compares 2006/07 as the pre-crisis period to 2009/10 as post crisis. We use changes in wealth between wave 1 and wave 2 of the WA Survey to proxy changes in wealth of that period. Whilst those time periods are not exactly the same, only using data from part of a WA Survey wave risks that data not being fully representative and they are likely to provide a reasonable approximation.

⁵ Housing wealth is for main residence only because mortgage debt data within the LCF Survey data are for the main home only. Gross financial wealth includes only assets held directly and not those owned within pension funds on households' behalf. We exclude deposits from gross financial wealth because we want to try and capture the impact on consumption of changes asset prices, and deposits would not be affected by such changes in asset prices. Moreover, changes in spending and deposits may be endogenous to some extent. For example, if households were to reduce spending in order to build up precautionary saving that would likely lead to an increase in deposits and a negative relationship between changes in financial wealth and spending rather than the expected positive one (assuming that precautionary saving is typically done in the form of deposits).

We cannot easily control for wealth in the cross-sectional analysis at the household level because the WA data are only available from 2006, and it is harder to merge in wealth data from other surveys into the LCF Survey at the household level than it is at the cohort level. Instead we use house price data from the ONS House Price Index at the government office region level to proxy for regional differences in changes in housing wealth, as has typically been done in other studies using the LCF Survey (such as Campbell and Cocco (2007) and Attanasio et al (2009)).⁶

Our analysis focuses primarily on mortgage debt. That is partly because mortgage debt accounts for 75% of all household debt, and, as there are fewer consequences of walking away from unsecured debt, households with unsecured debt might be less concerned about having to default and therefore be less willing than mortgagors to reduce spending sharply rather than risk default. But our focus on mortgage debt also reflects data availability because the LCF Survey only contains data on whether households have unsecured debt and not on the amount that is outstanding. However, the WA Survey does contain information on levels of unsecured debt, and so we use that to investigate the relationship between changes in spending and unsecured debt in our cohort analysis.

The final section of the paper, which looks at the reasons why more heavily indebted households made larger cuts in spending over the financial crisis period, also makes use of data from the Bank of England/NMG Survey of households. This is a cross-sectional survey commissioned by the Bank. It contains data on balance sheets and attitudes to spending, which we use to try and assess the reasons behind the spending decisions of particular groups, although it does not contain data on actual consumption. The survey has been running since 2004, although we only make use of the 2010 and 2013 surveys, since the most relevant questions were not asked in earlier years. The 2010 survey covered approximately 2000 households and was carried out face-to-face, while the 2013 survey included around 6000 households and was conducted online. Nielsen et al (2010) and Bunn et al (2013) respectively contain a detailed discussion of the 2010 and 2013 NMG surveys.

4 Results

4.1 Descriptive results

Table 1 reports some summary statistics from the LCF and WA Surveys at the household level. In nominal terms, weekly mean household non-housing consumption rose by £10 a week to £405 between 2006/07 and 2009/10 within our LCF Survey sample. However, once the effects of inflation are taken into account that translates into a fall of 5.5%.

⁶ In principle it would be possible to impute household level housing wealth within the LCF Survey for earlier period using the British Household Panel Survey, although given that our main focus is on the financial crisis period, where we have data from the WA Survey for the pseudo panel analysis, we just use the simpler alternative of regional house price data in our cross-sectional analysis.

Table 1: Descriptive statistics

	2006/07			2009/10		
	All	All mortgagors	Mortgage debt to income>2	All	All mortgagors	Mortgage debt to income>2
LCF data						
Nominal data						
Weekly non-housing consumption	£395	£474	£460	£405	£486	£458
Weekly post-tax income	£539	£666	£628	£579	£730	£695
Weekly mortgage interest payments	£39	£83	£112	£30	£70	£93
Weekly income net of mortgage interest payments	£501	£587	£516	£551	£665	£603
Non-housing consumption/income net of mortgage interest (%)	78.8%	80.6%	89.0%	73.4%	73.1%	75.9%
Outstanding mortgage debt	£36,768	£77,543	£112,034	£38,637	£89,298	£126,617
Mortgage debt to annual income ratio	1.1	2.4	3.6	1.0	2.5	3.7
Real data (2010 prices)^(a)						
Weekly non-housing consumption	£437	£524	£509	£413	£496	£467
Weekly income net of mortgage interest payments	£555	£650	£572	£563	£680	£616
Other characteristics						
Head of household age	47	43	40	47	45	41
Number of observations	10199	4836	2382	8839	3825	1959
Share of sample (%)	100%	47%	23%	100%	43%	22%
WAS data^(b)						
Nominal data						
Unsecured debt	£4,149	£5,744	-	£4,590	£6,346	-
Gross housing wealth ^(c)	£159,925	£225,934	-	£154,591	£215,326	-
Financial wealth (ex deposits)	£18,670	£18,539	-	£21,009	£19,853	-
Real data (2010 prices)^(a)						
Gross housing wealth ^(c)	£181,630	£256,597	-	£165,781	£230,913	-
Financial wealth (ex deposits)	£21,204	£21,055	-	£22,529	£21,290	-

Sources: LCF Survey, Wealth and Assets (WA) Survey and authors calculations.

(a) Deflated using National Accounts consumption deflator.

(b) WA data shown above for 2006/07 are from wave 1 of the survey which ran from mid-2006 to mid-2008. 2009/10 data are from wave 2 (mid-2008 to mid-2010).

(c) Self-reported valuation of main home.

Nominal post-tax income increased by £40 a week to £579 over the 2006/07 to 2009/10 period in the LCF data. In most of our analysis we use a measure of income that is net of mortgage interest payments. That is how income is measured in the National Accounts and it captures the amount of income that households have to spend on non-housing items at any point in time.⁷ As the interest receipts of savers are a component of income, reductions in interest rates would make the household sector in aggregate unambiguously worse off if the impact of lower interest payments were not also

⁷ In the National Accounts income is measured net of all interest payments. But since we do not have data on unsecured debt interest repayments in the LCF data we only deduct mortgage interest payments.

considered. The sharp reduction in interest rates in late 2008/early 2009 boosted average income net of mortgage interest payments by an additional £9 a week for all households, but by significantly more for households with larger mortgages: mortgage interest payments fell by the equivalent of £20 a week for households with a mortgage debt to income ratio above 2. But in real terms, household incomes (net of mortgage interest payments) only grew very modestly, increasing by around 1.5% in total over three years. These movements in the LCF data are broadly consistent with developments in aggregate data.⁸

Within our sample, just under half of households had a mortgage before the financial crisis, although that is based on a sample of households where the head is aged 22 to 69 and not the full population. Their average outstanding level of secured debt going into the financial crisis was just under £80,000. That was equivalent to around 2.5 times their annual post-tax income. Around half of households with a mortgage had an LTI above 2 in 2006/07, but only 7% had an LTI above 5 (Chart 5).⁹ The proportion of mortgagors with high debt to income ratios rose substantially over the decade before the financial crisis. In 1997/98, only 35% of households with a mortgage had a debt to income ratio above 2, and the share of mortgagors with debt to income ratios above 3 increased from 11% in 1997/98 to 29% in 2006/07.

Data from the WA survey show that average housing wealth is estimated to have fallen by around 3% in nominal terms and 9% in real terms between 2006/07 and 2009/10, which is close to what is implied by aggregate data. In real terms, financial wealth is estimated to have been little changed.

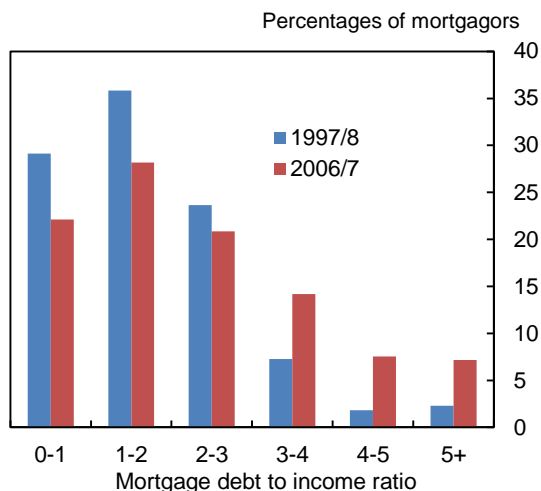
On average, households with a mortgage had higher levels of both spending and income before the financial crisis than households in general. After 2007, the average spending of mortgagors fell by a similar proportion to all households, but they experienced more growth in disposable income (even before mortgage interest payments are taken into account) and therefore their spending fell by more relative to income.

Within mortgagors, the fall in spending during the financial crisis, both in absolute real terms and relative to income, was greater for households with higher levels of mortgage debt. That can be seen from Table 1 by comparing households with a mortgage debt to income ratio above 2 to mortgagors in general. Disaggregating the data further, largest adjustment in spending relative to income after 2007 came among households with a mortgage debt to income ratio above 4 (Chart 6). Cuts in spending were more modest for those with debt to income ratios below 2.

⁸ Nominal non-housing consumption rose by just under 3% between 2006/07 and 2009/10 in the LCF data, compared to a fall of 0.3% in the in the National Accounts, although income rose by close to 10% in both datasets. Over a longer period of time, the LCF data has tended to under-record the growth of consumption relative to aggregate data, although income growth has been closer to aggregate data (Barrett et al (2013)). It also tends to be more volatile on a year to year basis. Given this degree of under-recording in the LCF Survey we scale up the microdata to match non-housing consumption in the National Accounts in the charts shown, and similarly we also adjust income. We use the unadjusted microdata in our regressions since all the regressions include year dummies, and any scaling factor applied to all households would only be reflected in the coefficients on these year dummies.

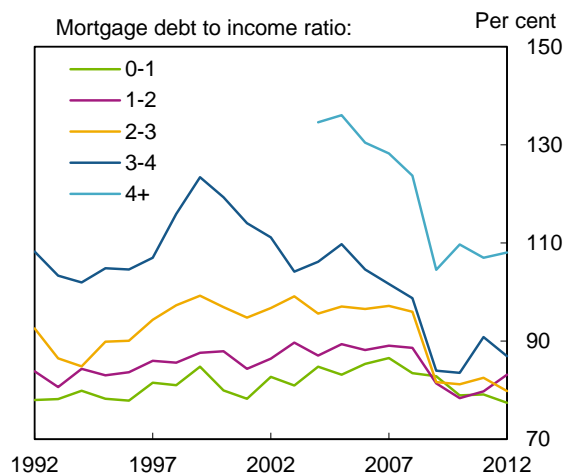
⁹ We exclude the top 1% of households with highest debt to income ratios. In practice that means that households with debt to income ratios above 11 are not included.

Chart 5: Distribution of mortgage debt to income ratios^(a)



Sources: LCF Survey and authors calculations.
(a) Outstanding mortgage debt relative to annual post-tax income.

Chart 6: Non-housing consumption as a share of income^(a)



Sources: LCF Survey, ONS and authors calculations.
(a) Data for 4+ are not shown before 2004 as they appear erratic and are based on a small sample. Household non-housing consumption as a share of post-tax income net of mortgage interest payments. LCF data are scaled to match equivalent data from the National Accounts (excluding imputed rental income, income received by pension funds on behalf of households and FISIM). Debt to income ratio is calculated using secured debt only.

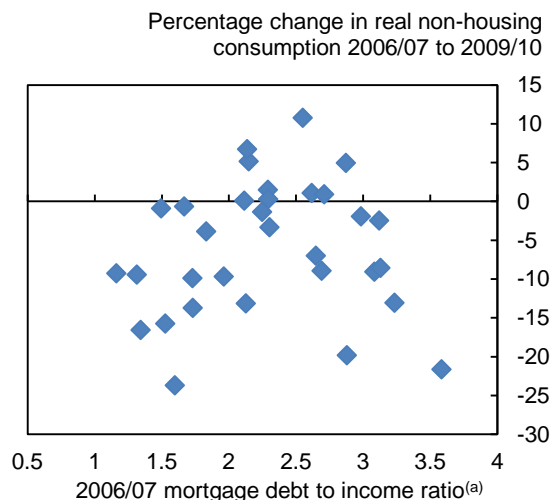
To illustrate how consumption changed for particular cohorts, we turn to some descriptive analysis using the cohort-level data. Chart 7 shows that there is a clear negative correlation between mortgage debt to income ratios in 2006/07 and the subsequent change in non-housing consumption relative to income, and that relationship appears relatively linear. This relationship is robust to different cohort definitions.

Chart 7: Changes in consumption relative to income and pre-crisis debt to income for single birth year mortgagor cohorts



Sources: LCF Survey and authors calculations.
(a) Household non-housing consumption as a share of post-tax income net of mortgage interest payments.
(b) Outstanding mortgage debt relative to annual post-tax income.

Chart 8: Changes in consumption and pre-crisis debt to income for single birth year mortgagor cohorts



Sources: LCF Survey and authors calculations.
(a) Outstanding mortgage debt relative to annual post-tax income.

There is, however, less evidence that cohorts who had higher levels of pre-crisis debt made larger adjustments in spending if they are not considered relative to income (Chart 8). But this analysis does not take account of how spending would be expected to evolve for those cohorts given the normal life cycle pattern of consumption (which is shown in Chart 11 of the appendix). Younger cohorts, who are typically the most indebted, should be the ones who would expect to experience faster consumption growth, and so all else equal, those more indebted cohorts might have expected to have seen faster spending growth between 2006/07 and 2009/10. That was typically the case over the pre-crisis period (see Chart 13 in the appendix). This illustrates the importance of controlling for changes in income in our analysis.

4.2 *Synthetic panel econometric results*

4.2.1 *Synthetic panel results for non-housing consumption*

Our pseudo panel results suggest that cohorts with higher pre-crisis debt to income ratios did make larger adjustments in spending over the financial crisis after controlling for other factors. Table 2 reports regression estimates based on the four different cohort definitions described above. The odd numbered columns show results including pre-crisis LTIs, and even numbered columns show results when using LTVs instead. Examining LTIs first, the coefficient on the pre-crisis debt to income ratio is negative and statistically significant, except when cohorts are defined on the basis of region and 10 birth years (column 7), where it is not quite significant at the 10% level. The size of that coefficient is broadly similar across the different cohort definitions. Cohorts with a one unit higher debt to income ratio (such as 3 rather than 2) are estimated to have reduced their spending by an extra 2.4-3.0%, depending on the cohort definition chosen.

Changes in income and average number of adults in the households are the other explanatory variables that are typically statistically significant in our regressions. In most cases the coefficients on the wealth variables are not clearly identified. That may be because the small sample sizes make it difficult to estimate these coefficients precisely although as discussed above, there is some disagreement in the literature about whether changes in housing wealth are an important determinant of household spending or not.

More indebted cohorts are still estimated to have made larger cuts in spending over the financial crisis using pre-crisis LTV rather than LTI ratios. The odd number columns in Table 2 show that cohorts with a 0.1 unit higher LTV ratio in 2006/07 (such as 0.6 rather than 0.5) are estimated to have made a 1.3-1.6% larger cut in spending between 2006/07 and 2009/10. These coefficients are all statistically significant, although only at the 10% level for the single birth year cohorts. This result is not particularly surprising given that there is a very strong correlation between pre-crisis debt to income and loan-to-value ratios, at least at the cohort level.¹⁰

¹⁰ The correlation coefficient for mortgagor cohorts defined by single birth year is 0.94 in 2006/07. Chart 14 in the appendix shows a scatter plot of the relationship between debt to income and LTV ratios in 2006/07.

Table 2: Regressions using synthetic panel dataDependent variable: $\Delta \ln(\text{non-housing consumption } 06/07 \text{ to } 09/10)$

Cohort definition	Single birth year		Single birth year, mortgagor/non-mortgagor		5 birth year, mortgagor/non-mortgagor		10 birth year, region	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$\Delta \ln(\text{Income net of mortgage interest})$	0.675*** (0.122)	0.743*** (0.124)	0.599*** (0.118)	0.607*** (0.117)	0.766*** (0.123)	0.857*** (0.130)	0.450*** (0.148)	0.520*** (0.155)
$\Delta \text{Number of adults}$	0.267** (0.118)	0.232* (0.121)	0.212** (0.098)	0.205** (0.097)	0.115 (0.103)	0.081 (0.100)	0.342*** (0.121)	0.283** (0.119)
$\Delta \text{Number of children}$	0.036 (0.036)	0.048 (0.037)	0.010 (0.031)	0.018 (0.031)	0.016 (0.060)	0.046 (0.057)	0.075 (0.048)	0.088* (0.046)
06/07 mortgage debt to income ratio	-0.030** (0.014)		-0.028*** (0.007)		-0.026** (0.009)		-0.024 (0.014)	
06/07 mortgage loan-to-value ratio		-0.128* (0.064)		-0.153*** (0.038)		-0.160** (0.054)		-0.129** (0.050)
$\Delta \ln(\text{Housing wealth})$	0.035 (0.070)	0.123 (0.096)	0.060 (0.036)	0.060 (0.036)	0.049 (0.059)	0.018 (0.061)	0.008 (0.101)	0.096 (0.104)
$\Delta \ln(\text{Financial Wealth})$	-0.000 (0.020)	0.004 (0.020)	0.006 (0.023)	0.007 (0.023)	0.064*** (0.021)	0.072*** (0.021)	0.002 (0.032)	-0.004 (0.032)
Constant	-0.018 (0.023)	-0.011 (0.029)	-0.027** (0.012)	-0.026** (0.012)	-0.036** (0.013)	-0.034** (0.013)	-0.026 (0.020)	-0.010 (0.020)
Observations	45	45	76	76	19	19	53	53

All equations are estimated by OLS. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

At least over this short period, it does not appear that using a choice variable (mortgagor status) as well as a deterministic one (date of birth) to define cohorts has a large impact on the results. The results are also robust to using predicted rather than actual mortgagor status to define the cohorts. Table A in the Appendix reports tobit model estimates for household outstanding mortgage debt in 2006/07 using LCF data with age, educations and interactions of the two as explanatory variables. Those households predicted to have positive mortgage debt in 2006/07 are defined as mortgagors and with others as non-mortgagors.¹¹ Column 1 in Table 3 shows that the coefficient on predicted pre-crisis debt to income in the consumption equation is negative and significant when cohorts are defined by predictor mortgagor status and actual birth year, and that coefficient is of a similar order to magnitude to the estimates shown in Table 2 based on actual mortgagor status.¹²

Given that differences between the different cohort definitions are relatively modest we focus on cohorts defined by single birth year and actual mortgagor status in the more detailed analysis below, although the broad conclusions are robust to the other definitions used in the paper.

¹¹ Approximately 70% of households with a mortgage are correctly predicted to be mortgagors in 2006/07, although the model underpredicts actual debt levels on average. Using predicted mortgagors status also reduces the number of observations that can be used in the regressions because we retain the rule that all cohort data points must be based on at least 50 data points, and there are some age groups where the model predicts households to be mostly mortgagors and others where they are mostly non-mortgagors.

¹² We exclude wealth from this specification because that would also involve trying to impute housing wealth for households who are predicted to be homeowners and would add complexity to this robustness check.

Table 3: Regressions using synthetic panel: alternative specifications^(a)

Changes 2006/07 to 2009/10. Single birth year, mortgagor/non-mortgagor cohorts.

Mortgagor definition Dependent variable	Predicted			Actual		
	$\Delta\ln(\text{Non-housing consumption})$ [1]	$\Delta\ln(\text{Non-housing consumption})$ [2]	$\Delta\ln(\text{Non-housing consumption})$ [3]	$\Delta\ln(\text{Non-housing consumption})$ [4]	$\Delta\ln(\text{Durables})$ [5]	$\Delta\ln(\text{Non-durables})$ [6]
$\Delta\ln(\text{Income net of mortgage interest})$	0.778*** (0.106)	0.606*** (0.117)		0.602*** (0.117)	0.934*** (0.195)	0.447*** (0.147)
$\Delta\ln(\text{Income before mortgage interest})$			0.612*** (0.120)			
$\Delta\text{Number of adults}$	0.186 (0.121)	0.211** (0.096)	0.202** (0.099)	0.211** (0.098)	0.165 (0.179)	0.409*** (0.141)
$\Delta\text{Number of children}$	-0.020 (0.039)	0.021 (0.031)	0.012 (0.031)	0.010 (0.032)	-0.015 (0.073)	0.037 (0.051)
Predicted 06/07 mortgage debt to income ratio	-0.028* (0.016)					
Share with mortgage debt to income > 2		-0.119*** (0.031)				
Actual 06/07 mortgage debt to income ratio			-0.017** (0.008)	-0.027*** (0.007)	-0.051*** (0.013)	-0.010 (0.012)
06/07 unsecured debt to income ratio				-0.020 (0.122)		
$\Delta\ln(\text{Housing wealth})$		0.059 (0.036)	0.059 (0.037)	0.060 (0.036)	0.005 (0.069)	0.145*** (0.045)
$\Delta\ln(\text{Financial Wealth})$		0.006 (0.023)	0.005 (0.023)	0.007 (0.024)	0.028 (0.042)	-0.001 (0.033)
Constant	-0.047*** (0.015)	-0.027** (0.012)	-0.027** (0.012)	-0.024 (0.021)	-0.055** (0.023)	-0.031 (0.020)
Observations	47	76	76	76	76	76

All equations are estimated by OLS. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

(a) See Table A in the Appendix for details of the model used to predict mortgagor status and mortgage debt in column 1.

Rather than including the average debt to income ratio of each cohort as a continuous explanatory variable, we also test the robustness of our results to instead including the share of highly indebted households within each cohort. Defining having a mortgage debt to income ratio above 2 as being highly indebted (consistent with what is shown in Chart 4), a cohort with 10% more high debt mortgagors (for example 30% rather than 20% of the cohort falling into this category) is estimated to have reduced spending by 12% more over the financial crisis period, and these differences are statistically significant (column 2 in Table 3).

Our preferred specifications include income net of mortgage interest payments. Column 3 in Table 3 shows the sensitivity of our result to using an alternative income measure which is not net of mortgage interest. The coefficient on the debt to income ratio becomes smaller, implying that

cohorts with a one unit higher pre-crisis debt to income ratio reduced spending by just under 2% more rather than almost 3% more, although that coefficient is still statistically significantly different from zero. Bank Rate in the United Kingdom was reduced from 5% to 0.5% between October 2008 and March 2009. That would have helped to cushion the squeeze on disposable incomes for mortgagors and particularly for those households with high levels of mortgage debt. Using income net of mortgage interest payments takes account of that boost to mortgagors' disposable income and so it is not surprising that the coefficient on the debt variable becomes smaller if it is ignored.

4.2.2 Synthetic panel results incorporating unsecured debt

Our analysis so far has focussed only on mortgage debt which accounts for around three-quarters of all household debt. But it is also possible that high levels of unsecured debt could have played a role in explaining why some households reduced spending during the financial crisis. As discussed above, data on the outstanding amounts of unsecured debt are not available in the LCF data, but unsecured debt can be included in the regressions at the cohort level by using the WA Survey.

Pre-crisis levels of unsecured debt are not estimated to have had a significant impact on the change in household spending over the financial crisis period. Although the coefficient on the unsecured debt to income ratio in column 4 of Table 3 variable is negative and of a similar order of magnitude to that on the mortgage debt to income ratio, it is not close to being statistically significant.

4.2.3 Synthetic panel results for different categories of spending

When households face financial pressure they do not necessarily reduce all forms of spending equally, and it is possible that they will reduce forms of spending that are less essential first. Splitting our regressions into durable spending (which may be considered more discretionary) and non-durable spending (columns 5 and 6 in Table 3) suggests that the larger cuts in spending by indebted households were concentrated in durable goods, consistent with that intuition.¹³ The coefficient on the mortgage debt to income ratio implies that cohorts with a debt to income ratio of 3 rather than 2 reduced durables spending by an extra 5% between 2006/07 and 2009/10. The coefficient on debt in the non-durables equation is smaller than this and is not significantly different from zero.

4.2.4 Sensitivity of synthetic panel results to different time periods

The analysis so far has focussed on assessing the extent of the larger cuts in spending by indebted households over the financial crisis, but it is also important to understand whether those cuts have been persistent or whether they have been reversed. Extending our estimation period to cover the

¹³ Durables are defined as vehicles, household goods, recreational goods, and clothing and footwear. Non-durables are food and beverages, transport costs and fares, recreational services, household services, personal goods and services, alcohol and tobacco.

change in consumption from 2006/07 out to 2011/12 rather than 2009/10, the coefficient on the pre-crisis debt to income ratio is little changed and remains statistically significant (column 2 in Table 4). That suggests that the larger cuts in spending by indebted households had not dissipated, at least up to 2012, which is a period over which aggregate consumer spending remained subdued.

Table 4: Regressions using synthetic panel for different sample periods

Dependent variable: $\Delta \ln(\text{non-housing consumption})$
 Single birth year, mortgagor/non-mortgagor cohorts

Time period	06/07 to 09/10	06/07 to 11/12	00/01 to 03/04	03/04 to 06/07
	[1]	[2]	[3]	[4]
$\Delta \ln(\text{Income net of mortgage interest})$	0.599*** (0.118)	0.647*** (0.096)	0.531*** (0.059)	0.573*** (0.107)
$\Delta \text{Number of adults}$	0.212** (0.098)	0.205** (0.088)	0.219*** (0.073)	0.157* (0.093)
$\Delta \text{Number of children}$	0.010 (0.031)	0.082** (0.032)	0.077** (0.031)	0.009 (0.044)
Mortgage debt to income ratio at start of period	-0.028*** (0.007)	-0.031*** (0.007)	0.009 (0.009)	0.006 (0.008)
$\Delta \ln(\text{Housing wealth})$	0.060 (0.036)	0.013 (0.031)		
$\Delta \ln(\text{Financial Wealth})$	0.006 (0.023)	-0.011 (0.021)		
Constant	-0.027** (0.012)	-0.031** (0.012)	-0.013 (0.011)	-0.031** (0.014)
Observations	76	73	78	78

All equations are estimated by OLS. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Estimating our equation over different time periods can also be used to assess whether indebted households made larger increases in spending in the period before the financial crisis.¹⁴ Columns 3 and 4 in Table 4 report similar equations estimated over earlier pre-crisis periods. The coefficient on the debt to income ratio at the start of the period is positive, but not statistically significant, making it hard to draw a strong conclusion. A similar result is achieved by carrying out the same exercise with different cohort definitions.

¹⁴ These equations do not include wealth data because there is not wealth data for that period. The WA Survey only begins in 2006.

4.3 *Cross-sectional econometric results*

When we cross-check our synthetic panel estimates using a household level equation from the cross-sectional data we get similar results. We estimate our cross-sectional equation from 1992 to 2012 and assess whether the relationship between debt and spending has changed by allowing the coefficient on the debt to income variable to vary by year.

Relative to a base year of 2007, the coefficient on the debt to income becomes smaller in subsequent years, as can be seen from the negative coefficients on the debt year/interactions from 2008 to 2012 in column 2 of Table 5. These differences are statistically significant from 2009 onwards. The results indicate that households with higher mortgage debt to income ratios spent relatively less after 2007, consistent with the pseudo panel analysis which showed that indebted cohorts made larger cuts in spending after 2007. A coefficient of -0.025 on the mortgage debt to income year interaction for 2009 means that a household with a debt to income ratio of 3 rather than 2 consumed 2.5% less in 2009 than a comparable household in 2007. That compares to our estimate that a cohort with a debt to income ratio of 3 rather than 2 reduced spending by around 3% more between 2006/07 and 2009/10, so the estimates are of a similar order of magnitude. Again the coefficients become a smaller if income before mortgage interest payments is used rather than income after mortgage interest, but the coefficients are still significant in 2009 and 2012 (column 4 of Table 5).

Over the pre-crisis period, the cross-sectional results imply that more indebted households did provide some additional support to spending. Relative to 2007, the coefficient on the debt to income was negative in the mid-1990s, but it rose into positive territory by the early 2000s, before falling back a little just before 2007. The differences are relatively small from one year to the next, but they cumulate up over a longer period. They suggest that at least some of the larger spending cuts by indebted households after 2007 might reflect an unwinding of faster spending growth by this group over the previous period.

Although we focus on how the coefficient on the debt to income ratio changes over time it is also worth commenting on the absolute coefficient. That coefficient is positive in specifications that include current income (column 1 in Table 5), indicating that households with high levels of debt have typically consumed more, all else equal. That could just reflect the point in their life cycle if those households are borrowing to bring forward consumption at a point in their lives when their current income is relatively low. If current income is taken out of the equation (shown in column 3), the debt to income coefficient becomes negative, implying that those higher debt households do not consume more in an absolute sense, consistent with the interpretation that indebted households may consume more relative to current income because they expect faster than average income growth in the future.

Table 5: Regression results using cross-sectional household level data^(a)

Dependent variable	ln(Non-housing consumption)			
	[1]	[2]	[3]	[4]
ln(Income net of mortgage interest)	0.495*** (0.008)	0.496*** (0.008)		
ln(Income before mortgage interest)				0.509*** (0.008)
Mortgage debt to income ratio	0.042*** (0.002)	0.048*** (0.005)	-0.030*** (0.002)	0.016*** (0.005)
Mortgage debt to income ratio year interactions:				
1992		-0.007 (0.008)		-0.026*** (0.007)
1993		-0.023*** (0.007)		-0.028*** (0.007)
1994		-0.020*** (0.008)		-0.023*** (0.007)
1995		-0.007 (0.007)		-0.016** (0.007)
1996		-0.013* (0.007)		-0.019*** (0.007)
1997		0.002 (0.007)		-0.002 (0.007)
1998		0.005 (0.008)		-0.005 (0.007)
1999		0.005 (0.008)		0.002 (0.007)
2000		0.006 (0.008)		0.003 (0.008)
2001		0.020** (0.008)		0.018** (0.007)
2002		0.012 (0.007)		0.013* (0.007)
2003		0.020*** (0.007)		0.024*** (0.007)
2004		0.004 (0.007)		0.009 (0.007)
2005		0.010 (0.007)		0.011* (0.007)
2006		0.002 (0.007)		0.005 (0.006)
2008		-0.008 (0.007)		-0.007 (0.006)
2009		-0.024*** (0.007)		-0.013*** (0.007)
2010		-0.017** (0.007)		-0.006 (0.007)
2011		-0.022*** (0.007)		-0.009 (0.007)
2012		-0.029*** (0.007)		-0.015** (0.007)
Observations	106,954	106,954	107,076	106,988

All equations are estimated by OLS. Robust standard standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

(a) Base year for mortgage debt to income ratio year interactions is 2007. Equations also control for age, gender, marital status, education, employment status, region, number of children by age group in the household, household tenure status, year and quarter dummies. Coefficient estimates for other explanatory variables are reported in Table B of the Appendix. Equations are estimated at the household level using data from 1992 to 2012.

4.4 *Estimating the implications for aggregate consumption*

The results presented above show that more indebted groups of households made cuts in spending over the financial crisis period that were significantly larger than lower debt groups. Nevertheless, the policy implications of this finding also depend on the economic significance of those results.

We estimate the economic significance of larger cuts in spending among indebted households by estimating how different aggregate spending would have been had there been no differences in spending by debt level. More precisely, in the pseudo panel model, we compare the fitted values for the change in spending over the crisis period for each cohort to counterfactual fitted values which assume that the coefficient on pre-crisis debt is zero rather than the negative estimate from our equation, but with all other coefficients and explanatory variables taking their estimated values.¹⁵ We then aggregate up the differences across cohorts. That gives an estimate of the impact of larger cuts in spending by indebted households on the non-housing consumption of households where the head is aged from 22 to 69, i.e. those within our sample used to estimate the regressions. To get an estimate of the impact on total aggregate private consumption, we scale the impact on the non-housing consumption of households aged 22 to 69 by the share of total private consumption accounted for by that group. That assumes that debt had no impact on the other components of aggregate private consumption: the non-housing consumption of households where the head is aged below 22 or above 69; all housing consumption; and the consumption of non-profit institutions serving households.

In the cross-sectional household level regressions, we perform a similar exercise, but rather than assume that debt had no influence on the change in consumption over the crisis period we look at how different our regressions suggest spending for each household would have been if debt had had the same estimated influence on spending patterns in each year as it did in 2007, keeping all other characteristics unchanged.¹⁶ In practical terms that involves comparing the actual fitted values to counterfactual fitted values where the coefficients on the debt/year interactions are set equal to zero rather than their observed values (given that 2007 was the reference year for the debt/year interactions). Again the results are aggregated up and are scaled down to account for other components of private consumption where debt is assumed to have no impact.

Spending cuts associated with mortgage debt are estimated to have reduced aggregate private consumption by up to 2% over the course of the financial crisis, and at least up until 2012, these effects had not unwound (Chart 9). The estimated impacts are of a broadly similar magnitude using both the cross-sectional and synthetic panel approaches and are economically significant. To place these in context, aggregate real private consumption fell by around 2% in absolute terms between 2006/07 and 2009/10 and by 5 percentage points relative to income.¹⁷

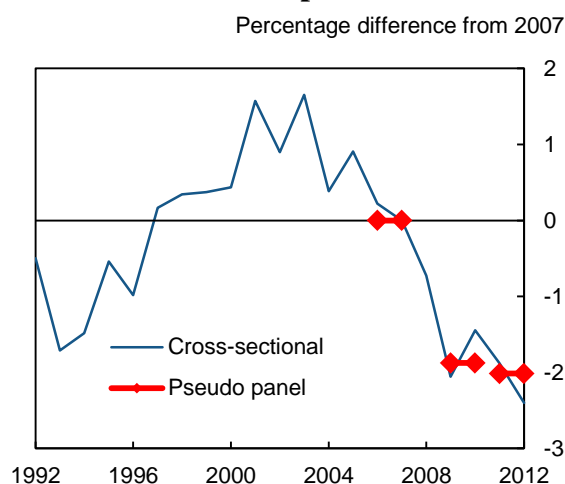
¹⁵ We use the equation reported in column 3 of Table 2 to do this.

¹⁶ We use the equation from column 2 of Table 5.

¹⁷ Relative to income excluding changes in pension entitlements.

The cross sectional results also allow an assessment of how differences in spending patterns by more indebted households affected aggregate spending before the financial crisis. They imply that the larger adjustment in spending by indebted households after 2007 reflects an unwinding of faster growth in spending by this group before the crisis. The estimates suggest that indebted households added around 2.5% to the level of aggregate private consumption between 1996 and 2003. On average, that equates to a 0.35 percentage point a year contribution to annual consumption growth, which averaged approximately 4.5% over that period. However, the estimated effect of debt on the level of consumption falls back between 2003 and 2007, implying that it weighed modestly on growth during that period, despite debt continuing to rise rapidly.

Chart 9: Estimated impact of debt on level of aggregate private consumption^(a)



Sources: LCF Survey, ONS and authors calculations.

(a) See main text for a description of how this chart is constructed. The pseudo panel diamonds show the average effects for 2009/10 and 2011/12 relative to 2006/07.

These estimates of the impact of debt on aggregate spending implicitly assume that most aspects of the economy were not affected by developments in household debt. Growth in debt could have had macroeconomic effects that may have fed back into consumption, for example, through its effects on employment, the public finances and asset prices. And for some households to hold debt, others have to hold assets, which could affect their behaviour. Evaluating these channels is beyond the scope of our work.

Overall, these results suggest that cuts in spending associated with debt were economically significant and did help to increase the depth of the recession following the financial crisis. They are estimated to have been worth up to 2% off aggregate household spending, equivalent to 1.2% of overall GDP. The next section of the paper considers some evidence on why indebted households may have made larger cuts in spending in more detail.

4.5 *Explaining why more highly indebted households made larger cuts in spending*

The analysis presented so far has focussed on establishing how spending has varied across households with different levels of debt, but that does not prove that debt was the cause of those differences. Those larger spending cuts could reflect more indebted households being: (i) disproportionately affected by tighter credit conditions; (ii) becoming more concerned about their ability to make future debt repayments; or (iii) making larger adjustments to income expectations. It is difficult to distinguish between these different channels. We take two approaches to this: firstly we include some additional variables in our pseudo panel regressions that may be related to some of these channels and, secondly, we examine data on attitudes to spending from the Bank of England/NMG Survey to assess which channels may be most relevant.

If larger cuts in spending by more highly indebted households after 2007 were associated with increased concerns about ability to make future repayments that should imply a larger spending response among indebted households to a given shock, which suggests interacting pre-crisis debt with a proxy for revisions to expected future income. It is difficult to measure the revision to expected future income, but concerns about ability to make future repayments should be related to the likelihood of a large fall in income or unemployment. We add the change in the unemployment rate for a given cohort between 2006/07 and 2009/10 to our regressions and interact that with the mortgage debt to income ratio of that cohort before the crisis.

As a measure of how different cohorts were affected by tight credit conditions we use data from the Bank of England/NMG Survey on the proportion of households within each cohort reporting that they had cut spending due to concerns about credit availability in 2009/10. Unfortunately because of the small sample size in the NMG Survey it was only possible to do this and maintain a minimum number of 50 data points per cohort if the cohorts were defined on the basis of 5 birth years and mortgagor status.

In most cases, the changes in the cohort unemployment rate and the interaction with pre-crisis debt have coefficients with the expected negative sign signs (columns 1 to 4 in Table 6), but they are not statistically significant, except the unemployment/debt interaction in column 4. But including these additional variables does reduce the size of the coefficients on the pre-crisis debt to income ratio and in some cases makes them less statistically significant. The proportion of credit constrained households also has a negative coefficient – again is not statistically significant – but it does further reduce the coefficient on debt to income to zero (column 4). Including an interaction between changes in housing wealth and pre-crisis debt is also not significant and has less effect on the debt to income coefficient than other interaction terms (column 5).

The finding that including a proxy for credit conditions and interactions between changes in unemployment and debt reduces the size of the estimated coefficient on the pre-crisis LTI provides some tentative evidence that more indebted households being particularly affected by tighter credit conditions and concerns about ability to make future debt repayments could help to explain why they made larger cuts in spending after 2007. But it is hard to draw strong conclusions because these

additional variables tend not to be statistically significant: the small sample sizes may make it difficult to precisely identify these effects. We therefore complement this synthetic panel analysis by analysing household level data from the Bank of England/NMG Survey.

Table 6: Regressions using synthetic panel: alternative specifications

Dependent variable: $\Delta \ln(\text{non-housing consumption } 06/07 \text{ to } 09/10)$

Cohort definition	Single birth year, mortgagor/ non-mortgagor	5 birth year, mortgagor/ non-mortgagor	5 birth year, mortgagor/ non-mortgagor	10 birth year, region	10 birth year, region
	[1]	[2]	[3]	[4]	[5]
$\Delta \ln(\text{Income net of mortgage interest})$	0.563*** (0.127)	0.586** (0.257)	0.598* (0.280)	0.415*** (0.139)	0.453*** (0.151)
$\Delta \text{Number of adults}$	0.227** (0.109)	0.277 (0.202)	0.337 (0.274)	0.330*** (0.122)	0.349*** (0.117)
$\Delta \text{Number of children}$	0.008 (0.032)	0.016 (0.070)	0.044 (0.073)	0.126** (0.058)	0.073 (0.049)
06/07 mortgage debt to income ratio	-0.022*** (0.008)	-0.014 (0.014)	-0.002 (0.027)	0.004 (0.015)	-0.018 (0.023)
$\Delta \ln(\text{Housing wealth})$	0.070* (0.039)	0.098 (0.086)	0.149 (0.189)	-0.154 (0.108)	-0.079 (0.287)
$\Delta \ln(\text{Financial Wealth})$	0.012 (0.024)	0.039 (0.033)	0.033 (0.040)	0.016 (0.029)	0.001 (0.032)
$\Delta \text{Cohort unemployment}$	-0.280 (0.261)	-0.466 (0.456)	-0.451 (0.727)	0.079 (0.478)	
$\Delta \text{Cohort unemployment x } 06/07 \text{ mortgage debt to income ratio}$	-0.429 (0.384)	-0.563 (0.677)	-1.517 (1.457)	-0.961** (0.453)	
% Credit constrained			-0.192 (0.354)		
$\Delta \ln(\text{Housing wealth}) \times 06/07 \text{ mortgage debt to income ratio}$					0.055 (0.189)
Constant	-0.023* (0.014)	-0.029 (0.017)	0.015 (0.067)	-0.052** (0.022)	-0.036 (0.034)
Observations	76	19	17	53	53

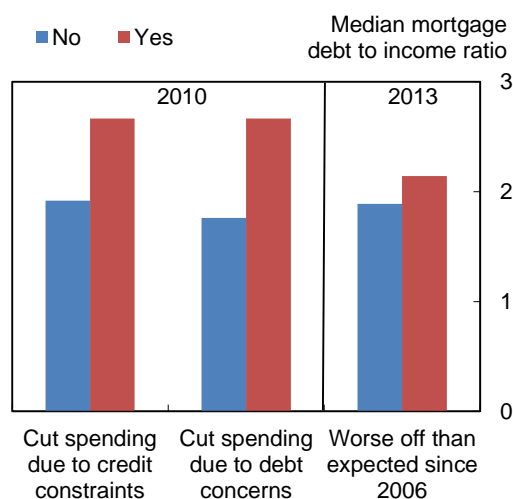
All equations are estimated by OLS. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The NMG Survey does not contain spending data, but it does contain information on attitudes to spending that can be used to help distinguish between the underlying reasons why households with

higher levels of mortgage debt were more likely to have cut spending. The survey asks households whether they had cut spending due to credit constraints, if they have cut spending because they are concerned about their debt position or if they are worse off than expected since 2006 (which may be correlated with downward revisions to future income expectations). The relevant data are, however, only available from 2010, and 2013 in the case of being worse off since 2006. The 2013 survey also included more detailed questions on the reasons for debt concerns.

Mortgagors who reported that they had cut spending due to concerns about credit availability had higher-than-average mortgage debt to income ratios in the NMG Survey (Chart 10). Debt to income ratios were also higher for households who had cut spending in relation to concerns about debt, although there was substantial overlap between these households and those concerned about credit availability.¹⁸ However, there is less evidence that households who were worse off than they had previously expected were disproportionately highly indebted, which would imply placing less weight on the income expectations channel.

Chart 10: Average mortgage debt to income ratio by household characteristics^(a)



Sources: NMG Consulting Survey and authors calculations.

(a) Mortgage debt to income ratio is defined as outstanding mortgage debt as a percentage of gross annual income. Questions: ‘Have you been put off spending because you are concerned that you will not be able to get further credit when you need it, say because you are close to your credit limit or think your loan application will be turned down?’; ‘How concerned are you about your current level of debt?’; ‘What actions, if any, are you taking to deal with your concerns about your current level of debt?’; and ‘Would you say you are better or worse off than you would have expected at the end of 2006, before the start of the financial crisis?’. Question about whether a household is worse off than expected since 2006 was only asked in 2013. Question about whether a household has cut spending due to debt concerns was first asked in 2010.

We can also use the 2013 NMG Survey to assess the reasons behind households’ concerns about debt: the evidence suggests they are largely related to worries about the ability to make future debt repayments. When asked directly, the most common reasons cited by mortgagors for why they were concerned about debt were related to about being able to keep up with repayments in the future if either interest rates were to rise or income were to fall (Table 7). Households who had cut spending due to debt concerns were also more likely to have been worse off than expected since the start of the financial crisis and to be uncertain about their future income (Table 8). Both of those factors are likely to have contributed to those concerns about their ability to make loan repayments in the future.

¹⁸ In the 2010 survey, 50% of mortgagors who said they had cut spending in response to debt concerns also reported that they had cut spending due to credit availability.

Table 7: Reasons for concerns about debt^(a)

	Percentages of mortgagors who have cut spending due to debt concerns
Concerned about keeping up with repayments if interest rates rise	45
Concerned about keeping up with repayments because income could fall	28
Current income lower than expected when took out loan	23
Currently having repayment difficulties	20
Banks unwilling to lend more because of current level of debt	10
Other	9
House borrowed against worth less than expected	4

Sources: NMG Consulting Survey and authors calculations.

(a) Data from 2013 survey. Households were able to choose up to three responses. Questions: ‘How concerned are you about your current level of debt?’; ‘Why are you concerned about your current level of debt?’.

Table 8: Characteristics of mortgagors who have cut spending due to debt concerns^(a)

	Reduced spending in response to debt concerns (2013 data)	
	Yes	No
Median mortgage debt to income ratio	2.4	1.7
Proportion who are worse off than they expected in 2006	73%	39%
Proportion who are think that a sharp fall in income is quite likely over the next year	33%	19%

Sources: NMG Consulting Survey and authors calculations.

(a) Data from 2013 survey. Mortgage debt to income ratio is defined as outstanding mortgage debt as a percentage of gross annual income. Questions: ‘Would you say you are better or worse off than you would have expected at the end of 2006, before the start of the financial crisis?’ and ‘To the best of your knowledge, how likely is it that your household income will fall sharply over the next year or so (for example, because you or someone in your household are made redundant)?’.

Overall, the evidence from the NMG Survey suggests that debt is a factor that can help to explain why highly indebted households made large cuts in spending after 2007. Households who had cut spending because of concerns about their debt position and their ability to make future repayments tended to have higher-than-average debt, as did those who reported that they had cut spending on account of the tightening in credit conditions. It is less clear, however, from the NMG Survey evidence that households who made large revisions to expected future income expectations had disproportionately high debt.

4.6 Comparison of results to other studies

Our results are consistent with studies for other countries which also find that households with higher levels of pre-crisis debt subsequently made larger cuts in spending. The two studies that are most directly comparable to ours are Dynan (2012) for the United States and Andersen et al (2014) for Denmark. Both estimate whether LTV ratios in 2007 affected the change in spending over the crisis at the household level. Our pseudo panel results do the same thing at the cohort level and so are comparable with the caveat that were comparing household and cohort level estimates. There are also clearly differences in the data sources and definitions which could have an impact on the results.

Our estimates suggests that spending cuts by households with higher levels of debt in the UK over the financial crisis may have been larger than those undertaken by US households, although only marginally bigger than those made by Danish households. Dynan (2012) estimates that households with a 0.1 unit higher loan-to-value ratio in 2006/2007 (such as 0.5 rather than 0.6) reduced

consumption by an additional 0.6% between 2007 and 2009. In their linear specification Andersen et al (2014) find that having a 0.1 unit high LTV in 2007 led to a 1 to 1.2% large spending cuts between 2007 and 2009 or 2010. These compare to our estimates of 1.3 to 1.6% for the change in spending between 2006/07 and 2009/10. Andersen et al also find evidence on a non-linear relationship between pre-crisis LTVs and consumption above LTVs of 60%. We do not find a clear non-linear relationship for the UK, although that would be harder to identify using cohort rather than household level data. Comparing coefficient estimates from the regressions does not necessarily imply the macro impact was bigger in the UK because that will also depend on the number of households who actually had high levels of leverage.

Strictly, our results are not comparable to those of Mian, Rao and Sufi (2013) because they focus on differences between regions of the US rather than households or cohorts of households. We do find that more highly indebted cohorts made larger cuts in spending using government office region as one of the criteria to define cohorts, but unlike Mian, Rao and Sufi (2013), we do not find evidence that cohorts with higher pre-crisis leverage had a larger spending response to negative shocks to housing wealth (see column 5 of Table 6 for regression results). That could be because there is less heterogeneity between regions within our more aggregated data, but it could also reflect different housing market dynamics between the US and UK.

5 Conclusion

A major development in UK household balance sheets over decade before the financial crisis was the build-up of household debt. This paper investigates uses household level microdata to assess the extent to which those high levels of debt helped to increase the depth of the recession following the financial crisis in the United Kingdom.

We find evidence that highly indebted groups of households made larger cuts in spending after 2007, after controlling for other factors. Based on our econometric analysis, spending cuts associated with debt are estimated to have reduced the level of aggregate private consumption by up to 2% after 2007. These results are robust to using either a synthetic cohort or cross-sectional approach. There is also some tentative evidence from the cross-sectional results that these larger spending cuts by indebted households represent an unwinding of faster-than-average spending growth among this group before the crisis. Our work adds to the growing body of evidence showing high levels of debt were an important factor in deepening the Great Recession by providing the first evidence for the United Kingdom.

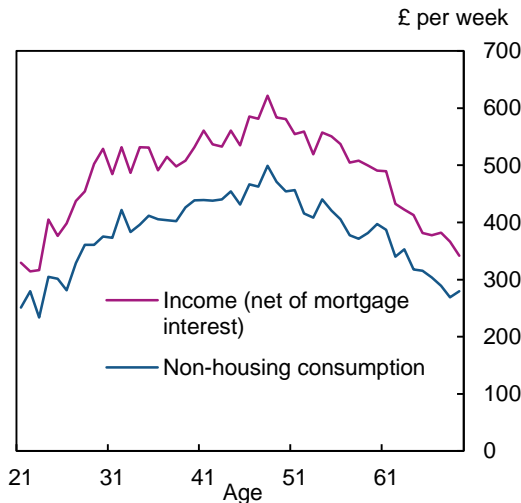
It is difficult to prove that more highly indebted households who made large cuts in spending after 2007 did so specifically because of their debts. However, survey evidence that suggests those spending cuts may have reflected a combination of tighter credit conditions and increased concerns about ability to make future debt repayments, which is consistent with high indebtedness being the cause of those spending patterns.

The potential for high levels of household indebtedness to have a large adverse impact on aggregate demand was an important reason why the Financial Policy Committee (FPC) took policy action at its June 2014 meeting. Those measures were designed to insure against a further significant increase in the number of highly indebted households. The FPC recommended that mortgage lenders should apply a stress test to assess affordability if Bank Rate rose by 3 percentage points within the first five years of the loan and that lenders should limit the proportion of mortgages at loan to income ratios of 4.5 or above to 15% of new mortgage lending.



Appendix

Chart 11: Non-housing consumption and income over the life cycle (2006/07 data)



Sources: LCF Survey and authors calculations.

Chart 12: 2000/1 to 2003/4 changes in consumption relative to income and debt to income for single birth year mortgagor cohorts

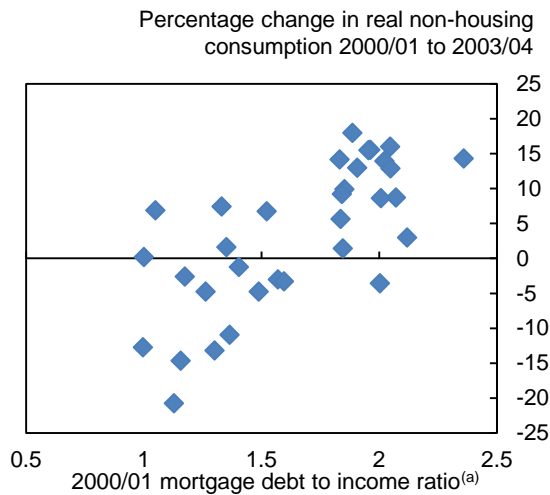


Sources: LCF Survey and authors calculations.

(a) Household non-housing consumption as a share of post-tax income net of mortgage interest payments.

(b) Outstanding mortgage debt relative to annual post-tax income.

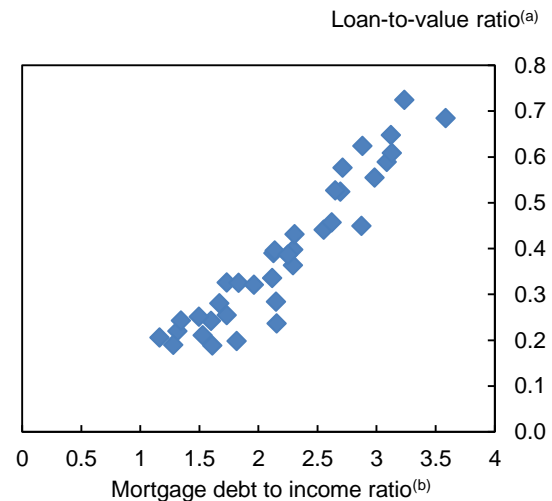
Chart 13: 2000/1 to 2003/4 changes in consumption and debt to income for single birth year mortgagor cohorts



Sources: LCF Survey and authors calculations.

(a) Outstanding mortgage debt relative to annual post-tax income.

Chart 14: Cohort level mortgage debt to income and loan-to-value ratios in 2006/07 (single birth year mortgagor cohorts)



Sources: LCF Survey and authors calculations.

(a) Outstanding mortgage debt relative to self-reported property value.

(b) Outstanding mortgage debt relative to annual post-tax income.

Table A: Tobit regression results used to predict mortgagor status and mortgage debt

Dependent variable: Outstanding mortgage debt in 2006/07

	[1]
Age	230,077.511*** (81,211.681)
Age squared	-9,216.527** (3,843.477)
Age cubed	188.151** (88.468)
Age ⁴	-1.938* (0.992)
Age ⁵	0.008* (0.004)
Highest qualification GCSE dummy	111,203.029** (44,721.835)
Highest qualification A level dummy	147,493.763*** (45,286.719)
Highest qualification Degree dummy	206,892.188*** (45,741.971)
Age x GCSE dummy	-1,716.732** (809.371)
Age x A level dummy	-2,054.026** (827.091)
Age x Degree dummy	-2,865.735*** (840.976)
Constant	-2370839.783*** (668,426.207)
Observations	10,199

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

Table B: Regression results using cross-sectional household level data – additional coefficients

Dependent variable	ln(Non-housing consumption)			
	[1]	[2]	[3]	[4]
Cohort dummies ^(a)				
Born 1926-1930	-0.091*** (0.019)	-0.097*** (0.019)	-0.078*** (0.021)	-0.097*** (0.019)
Born 1931-1935	-0.068*** (0.014)	-0.065*** (0.014)	-0.060*** (0.015)	-0.065*** (0.014)
Born 1936-1940	-0.037*** (0.009)	-0.033*** (0.009)	-0.039*** (0.010)	-0.032*** (0.009)
Born 1946-1950	0.002 (0.008)	0.001 (0.008)	0.002 (0.009)	-0.000 (0.008)
Born 1951-1955	-0.003 (0.012)	-0.006 (0.012)	-0.019 (0.014)	-0.006 (0.012)
Born 1936-1960	0.000 (0.017)	-0.003 (0.017)	-0.014 (0.019)	-0.003 (0.017)
Born 1961-1965	0.008 (0.022)	0.005 (0.022)	0.004 (0.024)	0.005 (0.022)
Born 1966-1970	0.009 (0.027)	0.005 (0.027)	0.019 (0.030)	0.005 (0.027)
Born 1971-1975	-0.002 (0.032)	-0.005 (0.032)	0.019 (0.035)	-0.005 (0.031)
Born 1976-1980	-0.040 (0.037)	-0.039 (0.037)	-0.010 (0.041)	-0.041 (0.037)
Born 1981-1985	-0.053 (0.043)	-0.054 (0.043)	-0.018 (0.048)	-0.058 (0.043)
Born 1986-1990	-0.042 (0.052)	-0.056 (0.052)	-0.013 (0.057)	-0.062 (0.051)
Age	-0.377*** (0.103)	-0.368*** (0.103)	-0.275** (0.114)	-0.376*** (0.103)
Age squared	0.018*** (0.005)	0.017*** (0.005)	0.015*** (0.005)	0.017*** (0.005)
Age cubed	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Age ⁴	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Age ⁵	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Male dummy	-0.020*** (0.004)	-0.021*** (0.004)	0.013*** (0.004)	-0.022*** (0.004)
Married dummy	0.085*** (0.004)	0.086*** (0.004)	0.133*** (0.005)	0.085*** (0.004)
Highest qualification A level dummy ^(b)	0.084*** (0.004)	0.083*** (0.004)	0.163*** (0.004)	0.082*** (0.004)
Highest qualification degree dummy ^(b)	0.123*** (0.005)	0.123*** (0.006)	0.309*** (0.005)	0.119*** (0.006)
Self employed dummy ^(c)	0.072*** (0.005)	0.072*** (0.005)	0.015** (0.006)	0.072*** (0.005)
Unemployed dummy ^(c)	-0.060*** (0.010)	-0.060*** (0.010)	-0.453*** (0.010)	-0.053*** (0.010)
Inactive dummy ^(c)	-0.004 (0.006)	-0.003 (0.006)	-0.267*** (0.005)	0.003 (0.006)
Number of children under 5	0.018*** (0.003)	0.018*** (0.003)	0.023*** (0.003)	0.018*** (0.003)
Number of children aged 5-18	0.074*** (0.002)	0.075*** (0.002)	0.100*** (0.002)	0.074*** (0.002)
Number of adults	0.194*** (0.003)	0.193*** (0.003)	0.357*** (0.003)	0.190*** (0.003)
Mortgagor dummy ^(d)	-0.091*** (0.006)	-0.095*** (0.006)	0.024*** (0.006)	-0.101*** (0.006)
Renter dummy ^(d)	-0.244*** (0.006)	-0.244*** (0.006)	-0.393*** (0.006)	-0.242*** (0.006)
Log real regional house prices	0.069*** (0.018)	0.057*** (0.018)	0.120*** (0.020)	0.061*** (0.018)
Observations	106,954	106,954	107,076	106,988

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Coefficients on income and debt variables are reported in Table 5 of the main text. Other variables included, but not reported above are year and quarter dummies, Government Office region dummies and a constant. All equations are estimated by OLS from 1992 to 2012.

- (a) Relative to those born between 1941 and 1945.
(b) Relative those whose highest qualification is GCSE's or lower.
(c) Relative to employees.
(d) Relative to owner occupiers.

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