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A bigger house at the cost of an empty fridge? The effect of households' indebtedness on their consumption: Micro-evidence using Belgian HFCS data

by Philip Du Caju, Guillaume Périlleux, François Rycx and Ilan Tojerow

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Abstract

This paper investigates the potentially non-linear relation between households' indebtedness and their consumption between 2010 and 2014 in Belgium. To do so, we use panel data from the two waves of the Household Finance and Consumption Survey. Unlike previous studies, we find a negative effect of households' indebtedness on their consumption, even in the absence of any negative shock on their assets. Our findings suggest that, without such a shock, it is the day-to-day sustainability of the debt, rather than its overall sustainability, that leads households to reduce their consumption. To explore potential non-linearities in this effect, we perform a threshold analysis, whose results suggest that households should not have a debt-service-to-income ratio greater than 30% as this leads to a substantial reduction of their consumption. The effect appears to be robust to various specifications, including the inclusion of other European countries, to result from a trade-off between housing and consumption, and to be more prevalent among more fragile households.

JEL Codes: D12, D14, E21

Keywords: Households, Indebtedness, Consumption, Debt-Service-to-Income, Non-linear Heterogeneous Effects

Authors:

Philip Du Caju, Economics and Research Department, NBB.

Guillaume Périlleux (corresponding author), Université libre de Bruxelles (SBS-EM : CEB and ECARES), Brussels, Belgium – e-mail: guillaume.perilleux@ulb.be

François Rycx, Université libre de Bruxelles (SBS-EM : CEB and DULBEA), IRES, humanOrg, GLO & IZA, Brussels, Belgium.

Ilan Tojerow, Université libre de Bruxelles (SBS-EM : CEB and DULBEA) & IZA, Brussels, Belgium.

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Non-technical summary

The sovereign debt crisis that occurred in Europe following the financial crisis of 2007 put public as well as banks' indebtedness behaviour under the spotlight. Nonetheless, not much focus was put at the time on the individual debts. This was particularly the case for Belgium which saw three of its largest banks - Fortis, Dexia and KBC - bailed out, sold off and/or nationalised to avoid bankruptcy while the effects of the crisis were less clear-cut at the micro level. At the same time, most of the economic research focussed on the effect of indebtedness at the macro level. Only recently, some researchers have started focussing on the micro level by analysing the potential impact of household debt on their consumption, with some of them claiming that the overhang of households' debt has been holding their consumption back in the aftermath of the crisis, therefore slowing the economic recovery.

Following this recent and relatively limited literature, this study investigates the potential impact of household indebtedness on their consumption in Belgium between 2010 and 2014. To do so, we differentiate two potentially important aspects of the households' debt: stock and flow. Stock relates to the overall size and sustainability of debt, whereas flow relates to the financial obligations entailed by debt and therefore to its day-to-day sustainability. We further try to quantify the critical level of debt that would lead households to reduce their consumption, something that has not been done in previous studies. Finally, we analyse the potential heterogeneity of the effect found by seeing if it applies to some specific categories of households.

As opposed to previous studies, we find that, in the absence of a negative shock on the households' assets, it is the day-to-day sustainability of debt that has an impact on household consumption. We further find that it is when they use more than 30% of their income to reimburse their debts obligations that households end up reducing their consumption. This effect appears to be mainly driven by households with mortgages and could therefore be seen as ultimately resulting in a trade-off between housing and consumption. Finally, the effect appears to be more prevalent for poor households, households in which the reference person is unemployed, and those where the reference person has a lower level of education.

Policy implications would include monitoring households' indebtedness more closely, even in the absence of negative shocks on their assets. However, the results obtained for the different types of households urges one to combine such monitoring with housing policies that would help more fragile households to acquire housing without having to reduce their consumption.

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1. Introduction

The financial crisis of 2007 was a staggering event in recent economic history, because of its severity and its worldwide propagation: it threw many economies around the world into severe recession (Ivashina and Scharfstein, 2010). It is often claimed to have been the worst financial crisis since the Great Depression, to which it has been largely compared (Temin, 2010). The causes of this crisis and its severity have been debated extensively. However, researchers seem to agree on the fundamental role played by the credit boom and the housing bubble (Arachaya and Richardson, 2009; Financial Crisis Inquiry Commission, 2011).

Concerning the credit market, the 2007 crisis not only shed light on the risk-taking behaviour of banks, which led to the introduction of measures aiming to limit those risks, but, from an economics research point of view, it also put household indebtedness back in the spotlight. Indeed, although previous models of household behaviour, such as the life-cycle model, usually see debt as neutral, the sharp increase observed in household debt in the years leading up to the crisis and the overhang of debt in the following years have often been pointed out as causes for the crisis and the slow pace of the recovery that followed (Eggertsson and Krugman, 2012). In other words, researchers have claimed that the overhang of households' debt has been holding their consumption back in the aftermath of the crisis. This led researchers to try and analyse the possible impact of household debt on their consumption.[1] While most studies have been analysing this impact at the macro level (Bunn and Rostom, 2015; Cecchetti et al., 2011; Jordà et al., 2013; Mian et al., 2013), only recently have some researchers started to focus on the effect it has at the micro level (Andersen et al., 2014; Dynan, 2012; Kukk, 2016). Performing an analysis at the household level is of particular interest as it can help shed light on the mechanisms at play and allow to look at the impact of debt for different types of households, which could help to formulate better, more framed policies.

Our study enters this recent and relatively limited literature as we analyse the potential impact of household indebtedness on their consumption in Belgium between 2010 and 2014.[2] To do so, we use microdata from the Household Finance and Consumption Survey (HFCS), a database representative for Belgium and containing detailed information on household liabilities. We believe that Belgium is a particularly interesting case study and that focusing on this country will give

[1] Many recent studies have investigated the effect of households' balance sheets on their marginal propensity to consume out of an unexpected income shock. However, we enter another branch of the literature that investigates the link between households' balance sheets and their consumption while controlling for potential income or wealth changes.

[2] To be as general as possible, we will refer to the households' debt in general in this study. However, we will show that most of the debt is composed of mortgages contracted for housing purposes. We will even show that the effect found appears to result from a trade-off between housing and consumption.

somewhat different results from previous case studies. Belgium has not been spared by the financial crisis at the macro level. Three of its largest banks - Fortis, Dexia and KBC - had to be bailed out, sold off and/or nationalised to avoid bankruptcy. Those events received substantial media coverage and raised doubts about the indebtedness behaviour of banks. However, the effects at the micro level were less clear-cut. As can be seen in Figure A.1 in the appendix, the Belgian labour market was not severely hit, nor was household consumption. Furthermore, the indebtedness behaviour of households did not change drastically after the crisis. Indeed, Figure A.2 in the appendix shows that the debt-to-GDP ratio in Belgium continued to grow with the vast majority of the debt still composed of mortgages. The fact that Belgium did not suffer extensively from the crisis, unlike Spain or Greece, prevents the results from being drawn by such an extreme event. Finally, whereas most previous studies analysed countries that underwent strong shocks on households' assets, such as a sharp decline in the housing prices, no such shock was observed in Belgium (Figure A.3 in the appendix). The absence of a sharp decline in housing prices allows us to extend the existing literature, as a significant negative effect of indebtedness on consumption is found even without a sharp loss of asset values.

The present study further contributes to the literature in several ways. First, as opposed to previous studies and following Kukk (2016), we investigate two different aspects of debt: stock and flow. Stock relates to the overall size of debt and to its overall sustainability, whereas flow relates to the financial obligations entailed by debt and therefore to its day-to-day sustainability. To measure these two aspects, we focused on two ratios commonly used when referring to debt: the debt-to-asset (DTA) ratio and the debt-service-to-income (DSTI) ratio. In line with Kukk (2016), we will argue that the former captures the effect linked to the potential credit constraints faced by households, whereas the latter better captures the effect of debt distress. Furthermore, the DTA ratio can be related to the solvency of the households and the DSTI ratio to their liquidity. As opposed to other studies focusing on debt stock, we find that it is the day-to-day sustainability of debt that has an impact on household consumption. We therefore claim that, although the overall sustainability of debt has been found to push households to deleverage in the event of a negative shock on their assets, indebtedness can still have a negative effect on consumption in the absence of such shock. This effect is reflected mostly through the financial obligations entailed by debt.[3]

Second, most of the previous studies finding a negative effect of household indebtedness on their consumption argue, sometimes implicitly, that the effect is present when indebtedness is at or beyond a certain level. Using US state-level data, Albuquerque and Krustev (2018) even claim that the

[3] Note that we are certainly not claiming that one should disregard the DTA ratio taking on high values when there are no shocks on assets.

effect they find is driven by states with large imbalances, thus suggesting non-linearities. However, to the best of our knowledge, none of the previous studies have tried to quantify the critical level of debt leading to a reduction in consumption. Finding this critical level of indebtedness can also be interesting from a policy perspective as only a few euro area countries impose legal limits on macroprudential instruments such as the DTA or the DSTI (Lang et al., 2020). Our study will fill this gap by investigating the possibility of non-linearities in the effect of debt on consumption. In doing so, we will also propose a method (that we call the threshold analysis) to quantify the critical level of debt. We observe that households with a DSTI ratio greater than 30% ended up reducing their consumption significantly between 2010 and 2014. This result appears to be robust to several different specifications as well as to the inclusion of other European countries. In addition, we perform an instrumental variable analysis to ensure that our results do not suffer from an endogeneity bias. For this analysis, we propose an instrument that is new in the literature.

Third, we investigate the potential heterogeneity of the found effect taking advantage of the fact that the data is at the household level. This analysis allows us to disentangle some of the potential channels through which households' indebtedness impacts their consumption. It also allows us to check whether particular types of households are more affected than others. We find that the effect is stronger and already present from lower thresholds for households that are part of the lowest income tercile, those where the reference person is unemployed, and those where the reference person has a lower level of education. The effect found also seems to materialise as a trade-off between housing and food consumption.

Finally, as regards the theoretical literature, our results are in line with the predictions of the life-cycle/permanent income (LC-PI) model (Modigliani and Brumberg, 1954; Friedman, 1957) for low levels of debt. However, the LC-PI model in its simplest form is unable to describe the behaviours of highly indebted households in our dataset. Indeed, our results for those highly indebted households appear to support revisions of this model or the use of models such as those developed by Eggertsson and Krugman (2012). Finally, the prevalence of the effect through the DSTI ratio underlines the importance of taking the households' liquidity into account. This supports models such as the one developed by Kaplan et al. (2014), in which households can hold two types of assets: liquid and illiquid assets.

The rest of the present paper is organised as follows. Section 2 gives an overview of the existing literature and puts forward the particularities and contributions of this study. Section 3 describes the data used and its relevance to the question under study. Section 4 is dedicated to the empirical analysis and presents the results of both the linear and the threshold analyses. In Section 5, we perform an

instrumental variable analysis as well as sensitivity checks to test the robustness of our results. Section 6 looks at the potential heterogeneity in the effects found, and Section 7 finally concludes this study.

2. Literature review

The LC-PI and households' balance sheets

The life-cycle/permanent income (LC-PI) hypothesis (Modigliani and Brumberg, 1954; Friedman, 1957) has been a cornerstone of consumer theory for many years. In its simplest version, it states that agents know their expected lifetime income and will therefore smooth their consumption over time by using savings and borrowings. Over their lifetime, agents will typically borrow when they are young and have low income, then repay their debts when their income is at its highest and save in order to cover their spending after retirement, that is, when their income will be reduced again. Among its main predictions, the LC-PI hypothesis suggests that consumption should not react to anticipated income changes while it should react to unanticipated ones. It further suggests that the response should be stronger for permanent unanticipated income shocks than for transitory one (Jappelli and Pistaferri, 2014). However, the results predicted by the LC-PI hypothesis rely on the assumption of perfect credit markets, that is, where households can borrow and lend at the same interest rate as long as they satisfy the intertemporal budget constraint and do not violate the terminal condition on wealth[4,5] (Jappelli and Pistaferri, 2010). Overall, the standard version of the LC-PI hypothesis does not focus much on the balance sheets of the households. The later, buffer-stock version of the model (Carroll, 1997) introduced the idea of precautionary savings by the households. However, it still relied on perfect capital markets,[6] and its predictions have also been at odds with some empirical findings (Kaplan et al., 2014). The financial crisis of 2007 put the focus back on debt with more and more studies showing how households' balance sheets can influence their consumption and its elasticity with respect to income and, therefore, lead to different results than the ones suggested by the LC-PI hypothesis (Baker,2018). In our opinion, three branches of studies where the focus has been put back on households' balance sheets stand out.

The first branch is concerned with the excess sensitivity of consumption to anticipated income changes. Jappelli and Pistaferri (2010) provide a review of such studies. The authors point out that the

[4] This condition simply states that wealth should not be negative at the end of life.

[5] Note that, in case of uncertainty and if income can be null, both the intertemporal budget constraint and the terminal condition on wealth imply that wealth cannot be negative in any period. However, the link between households' balance sheets and their consumption observed in the data seems to go beyond that special case.

[6] Deaton (1991) set up a model with precautionary motives as well, in which he also introduced liquidity constrained households. However, the usual version of the buffer-stock model does not consider imperfections of the capital market.

excess sensitivity in the case of an income increase could be linked to unperfect capital markets. If consumers face liquidity constraints (e.g., due to restricted access to credit) they cannot borrow in order to anticipate a rise in their income, and their consumption will therefore increase at the time of the income increase, contrary to the LC-PI prediction. In their view, this should not happen in the case of an income decrease as savings (before the anticipated income decline) are always possible, even when facing credit constraints. However, the empirical evidence on the subject is mixed: some studies did find a decline in consumption following retirement (Banks et al., 1998; Bernheim et al., 2001), whereas Souleles (2000) found that households manage to smooth their consumption quite well when they have to pay for college tuition.

The second branch focuses on changes in consumption linked to unanticipated income shocks. This is referred to as the Marginal Propensity to Consume (MPC) in the literature. Although the MPC is supposed to be homogeneous across households in both the standard LC-PI model and its buffer-stock version, many empirical studies have found it to be heterogeneous depending on the households' balance sheets (see, for instance, Ampudia et al. , 2020; Fagereng et al., 2019; Jappelli and Pistaferri, 2014). More specifically, those studies underline the impact of the households' credit constraints and (il)liquidity on their MPC. Following this idea, Kaplan et al. (2014) have developed a model in which the assets held by households can be of two types: liquid or illiquid. In their model, the authors show that some type of households, which they call wealthy hand-to-mouth households[7], can have a high MPC even though they have a positive wealth. In their model, this happens because those households prefer holding high-return illiquid assets rather than large balances of cash even if this goes at the risk of foregoing consumption in the case of an income decline.[8] In this study, we will analyse the aspects of the households' debt that relate to both their solvency and their liquidity. Our results could therefore give some more credit to the importance of households' liquidity when considering the impact of their balance sheets on their consumption and could support models such as the one developed by Kaplan et al. (2014).

Finally, following the financial crisis of 2007, a third branch of the literature emerged, focusing on the link between households' debt and business cycles. Our study is based on this branch. Unlike those mentioned earlier, the studies in this branch investigate the potential direct link between

[7] Previous studies had already introduced the concept of hand-to-mouth (HtM) households. HtM households are households characterized by a high MPC as they have practically no net worth and spend all their available resources in every period. However, when applied to micro data, the HtM concept represented only a small fraction of the population. This led to results that were still at odds with the reality. The introduction of the "wealthy HtM households" concept allows to account for a larger fraction of the households and leads to results that are closer to reality.

[8] As pointed out above, they further show that this type of household can represent a substantial fraction of the population and hence influence the aggregated response to monetary policies.

households' balance sheets and their consumption rather than treating debt as a transmission channel or a moderating factor. The question of the link between households' indebtedness and their consumption has been analysed from both a theoretical and an empirical point of view. The studies performing these analyses are described hereafter.

Households' indebtedness, their consumption, and the business cycle

From a theoretical point of view, the literature on households' debt and its impact on the business cycle dates back to King (1994), who shows how households' debt accumulation in some countries in the 1930s and 1990s led to more severe recessions by depressing the aggregate consumption. He extends the debt-deflation theory advanced by Fisher (1933) and sets up a model in which adverse shocks on their future income expectations lead households to reduce their consumption. Eggertsson and Krugman (2012), for their part, develop a rather simple model comprising lenders and borrowers with a debt limit.[9] If this limit suddenly decreases,[10] highly indebted agents are forced to deleverage by cutting their spending sharply. This is particularly true in times of recession, when households are more likely to lower their debt limits. The reduced aggregate demand will, in turn, not help the economy to recover.

Other researchers have put forward the possibility that households take on too much debt, which forces them to deleverage (often by reducing their consumption). In the models we have just described, households are considered to be rational when it comes to indebtedness. However, the agents' rationality when thinking about debt naturally raises questions. In an attempt to define when a household becomes overindebted, Betti et al. (2007) express doubts about the possibility for households to forecast their future income accurately. Lusardi and Tufano (2009) put forward that most households might lack basic finance knowledge. Both limitations to households' rationality could lead them to take on too much debt.

Finally, some studies have also discussed potential channels through which the effect of debt on consumption could occur. A first potential channel could be the traditional wealth effect, namely that consumption is positively impacted by wealth. Since debt is negative wealth, it should have a negative impact on consumption. A second potential channel is through highly indebted households' current or future access to credit, as they might face credit refusal or might simply not ask for credit if they anticipate a possible refusal. A third channel, put forward by Dynan and Edelberg (2013), relies

[9] They argue that this limit comes from incentive constraints and can be viewed as the level of leverage that borrowers consider safe.
[10] For example, due to a sudden decrease in asset prices, e.g., the bursting of the housing bubble in the US.

more on precautionary motives. The reasoning behind this potential channel is very similar and close to the one developed by Eggertsson and Krugman (2012). Households may target a certain level of maximal indebtedness that they consider safe.[11] This would lead them, in some cases, to reduce their consumption in order not to exceed that level of indebtedness. This reasoning seems particularly plausible in times of uncertainty, such as a recession, during which households might adjust their targeted level of debt downwards. Finally, highly indebted households spend a large share of their income on servicing their debt and are therefore left with less cash on hand to spend on consumption goods.

The link between households' balance sheets and the business cycle as well as the idea that their indebtedness might have held back their consumption, leading to slower recovery after the crisis, has been tested empirically as well. For instance, in an attempt to assess on what grounds debt can be good or bad, Cecchetti et al. (2011) came to the conclusion that, despite being a source of growth and stability at low levels, debt becomes harmful at higher levels, as it increases volatility and lowers growth. Other studies have found that indebtedness can explain a statistically significant part of consumption spending at the aggregate level (Bunn and Rostom, 2015; Mian et al., 2013) or for the economy as a whole (Jordà et al., 2013; Murray, 1997). Only recently have researchers focused on this effect at the micro level. Among those studies, Dynan (2012) investigated whether debt overhang, i.e., a high level of debt relative to the value of owned assets, creates a need for deleveraging that, in turn, reduces consumption at the household level. Looking at the US in 2007-2009, she uses the burst of the housing bubble as an exogenous shock to study the effect that too high a debt-to-asset ratio can have on consumption spending. Her results support the view that excessive leverage has contributed to a weakening in consumption. Similar results are found by Andersen et al. (2014) and Kukk (2016), who analyse two European countries, Denmark and Estonia, respectively, that also experienced a sharp decrease in housing prices after the financial crisis of 2007-2008. Kim and Hwang (2016), analysing the case of Korea, also find a negative relation between high levels of indebtedness and consumption. Furthermore, they find that this effect is stronger for durable goods and that it is greater in the aftermath than at the heart of a crisis. Finally, Albuquerque and Krustev (2018), using US state-level data, find an overall modest effect of excessive indebtedness on consumption, mostly driven by states where the household sector has particularly severe imbalances. They thus claim that this may be indicative of non-linearities in the effect of debt over consumption.

[11] Note that Dynan thinks in terms of level of leverage as measured by the debt-over-asset ratio. Her reasoning remains nonetheless valid for indebtedness in a broader way.

Housing as an important driver of households' debt

Overall, the housing market appears to be often used as an external source of variation for identification in the above cited papers. We further believe that it plays a central role when it comes to households' indebtedness and the link it can have with their consumption. Mortgages often constitute most of the households' debt. For the euro area, it represented more than 82% of the households' total debt in 2010 (HFCN, 2013b). In the model developed by Kaplan et al. (2014), the illiquid asset held by households is typically thought of as "housing".

Some researchers have therefore also investigated the relation between housing and consumption. The results from such studies show that this relation often involves the credit market and households' indebtedness, both through its stock and flow aspects. More precisely, some studies have documented the positive link between house values and household consumption (Calcagno et al., 2009; Zhu et al., 2019). They further argue that this positive link exists not only through a simple wealth effect but also through households' improved access to credit. Garriga and Hedlund (2016), analysing the implication of the housing crash in the U.S. on the reduction of aggregate consumption during the financial crisis, further highlight that the deteriorated household balance sheets acted as a transmission channel. Those studies can be related to the stock aspect of debt, as increased house values improve the households' solvency. Other researchers have, sometimes indirectly, considered the flow aspect of debt as well. For instance, Di Maggio et al. (2017), investigating the effect of interest rates - and hence of monetary policy - on the real economy, show that a reduction of households' debt servicing obligations leads them to increase their consumption and/or to deleverage. The authors further find that the effect differs for different types of households, with poorer households having stronger consumption responses.

Contributions of the present study

Overall, more and more studies have shown that households' balance sheets can have an impact on their consumption, both directly and indirectly, through the response to an income change. It further appears that households' liquidity might be crucial in their ability to smooth their consumption. Finally, housing plays an important role in this question as mortgages represent an important part of the households' indebtedness, and real estate is quite illiquid. Given the implications this can have on the business cycle and therefore on the whole economy, we believe in the importance of understanding the link between households' balance sheets and their consumption for both financial and mortgage regulation, as suggested by Baker (2018).

The present study aims to add to this important topic in different ways. First, whereas previous

empirical studies focused on countries where housing prices decreased sharply, leading to a decrease in the value of households' assets and consequently to a (unexpected) increase in their debt-to-asset ratio, we will show that, even in the absence of such a price decline, households' debt can have a negative impact on their consumption, and even on their consumption of essential, inelastic goods, such as food. We will further show that this effect seems to result from a trade-off between housing and food consumption. Finding such a trade-off could be seen as supporting the idea, put forward in the model developed by Kaplan et al. (2014), that some households appear to prefer investing in a (potentially) high-return illiquid asset even if this goes at the risk of forgoing some consumption.[12] Second, most of the previous studies, when explaining the potential effect of indebtedness on consumption, seem to agree that this effect is negative only at or beyond certain high levels of debt. However, to the best of our knowledge, none of them have tried to define at what level debt becomes too high. We will fill this gap by allowing the effect of indebtedness to be non-linear in a way that allows us to quantify this critical level of indebtedness. The presence of non-linearities in the effect of debt on consumption and the absence of explicit ways to deal with it in the existing literature might have two consequences. First, the effects measured by previous studies might be biased downwards as only a small fraction of the distribution of the indebted is impacted, i.e. those with sufficiently high levels of debt. Second, estimating this critical level of debt could be particularly useful from a policy perspective. We will also try to disentangle the potential channels through which households' debt impacts their consumption. We will do so by including the household's change in income and in net wealth into the regression and by focusing on two aspects of debt: its overall sustainability and its day-to-day sustainability. Finally, following the literature on the heterogeneity in the households' Marginal Propensity to Consume (MPC), we will explore the potential heterogeneity of the effect across different types of households.

3. Data, sample, and descriptive statistics

3.1 Database and variables of interest

This study makes use of data representative for Belgium, drawn from the Household Finance and Consumption Survey (HFCS). A Eurosystem initiative, the HFCS aimed at collecting information on households' balance sheets. National central banks oversaw data collection, and the European Central Bank coordinated the efforts across countries. The HFCS data is very interesting for this study

[12] Note that even if we consider the investment in housing as a necessity (rather than investing in an asset with higher return), the illiquidity of housing could still lead households to forego some of their consumption. It also leads to the presence in the sample of wealthy hand-to-mouth (HtM) households as defined by Kaplan et al. (2014).

as it contains very detailed information on households' liabilities and finance. A key characteristic of the HFCS is that missing observations are filled using multiple imputation (HFCN,2013a). That method was first developed by Rubin (1976) to deal with nonresponse in surveys. The idea is to impute missing values a number m of times with different models (and with m typically being a small number). In so doing, one ends up with m *complete* versions (implicates) of the database. The regression is then performed on each version separately and the results are pooled. One of the advantages of multiple imputation is that it allows for a separation between the imputation step and the estimation step. In our case, as the first step was performed by the Household Finance and Consumption Network, the database we use already contains the imputed values. The HFCN chose $m = 5$. Therefore, all the findings presented in our study are based on all five implicates of the imputations.[13] The HFCS data has the advantage of containing not only panel information for Belgium between 2010 and 2014, but also longitudinal weights that allow us to control for unequal probability of household selection into the sample and differential unit nonresponse. To allow for more precise inference, the HFCS data also contains 1000 replicated weights constructed by bootstrap replication.[14] All statistics presented will be computed using the longitudinal weights, and inference will be made with the bootstrapped replicated weights.

The main variables of interest in our study are households' indebtedness and their consumption. There are different ways to consider and define debt. In this study, we will focus on two ratios often used in the economic literature: the debt-to-asset (DTA) ratio and the debt-service-to-income (DSTI) ratio. The former relates to the stock aspect of debt, whereas the latter relates to the flow aspect of debt, as it measures the share of its income that a household uses to pay its debt obligations every month. By extension, the DTA ratio can be indicative of a household's solvency, whereas the DSTI ratio can be indicative of its liquidity. We believe that using those two measures is of particular interest when considering the effect of the debt burden on consumption. Indeed, we argue, in line with Kukk (2016), that the DTA ratio will capture the overall sustainability of debt and, incidentally, the credit constraint channel, whereas the DSTI ratio will capture the day-to-day sustainability of debt and, therefore, the debt distress channel as more servicing entails larger financial obligations which, in turn,

[13] We performed our baseline estimates on each of the implicates separately, and the results are stable across all implicates. We thus decided to report only the pooled results. The results for each implicate are available upon request.
[14] See sections 6 and 9 of HFCN (2013a) for more information on the sampling design and weighting of the survey.

imply more conservative spending.[15,16] Finally, unlike previous studies focusing on the DTA ratio, we think that the DSTI ratio is of particular interest for a number of reasons. First, we argue that this ratio is more readable and understandable for the individuals than other measurements of debt burden. Indeed, it seems plausible that, most of the time, households do not know the exact value of their assets or the exact outstanding balance of their liabilities, whereas they know how much they are paying every month for their loan, i.e., their DSTI ratio. Furthermore, a higher DSTI ratio leaves the household with less disposable income, which they will obviously notice. Finally, although it is an important measure often negotiated in debt contracts, there are no legal requirements regarding the DSTI ratio in Belgium.[17]

Table 1: Households' share of food consumption in total consumption in 2010 (using the HBS)

Data from the HBS for Belgium in 2010	
Share of food consumed at home	0.152
	(0.00122)
Share of total food consumed	0.200
	(0.00149)
N	3578

Notes: Standard errors are reported in parentheses; The share of food was computed using data from the Household Budget Survey for Belgium in 2010; Total food is composed of food at home and food outside home.

Regarding consumption, the HFCS contains information on households' food consumption. Although food consumption might seem to be a very restrictive part of consumption, we argue that it is a good measurement for at least two reasons. First, food consumption represents an important share of a household's total consumption, among its three largest items.[18] As shown in Table 1, food at home represented more than 15% of the average household's total consumption in 2010. This proportion even goes up to 20% when considering total food consumption, i.e., at home and outside the home.

[15] To remain as neutral as possible, in the rest of the paper, we will use the concepts of overall sustainability and day-to-day sustainability. Nonetheless, the parallel with the household's solvency and liquidity, as well as with the credit constraint and debt distress channels can be easily made.

[16] This last interpretation could as well be reconciled with the debt limit developed by Eggertsson and Krugman (2012) or the life-cycle model if we consider that households with too high a DSTI ratio end up reducing their income expectations (and hence their debt limit), which would lead them to reduce, in turn, their consumption.

[17] There seems to be an informal rule of thumb, used by banks, that the DSTI ratio should not exceed 30%. However, this value can vary. Moreover, households with a DSTI ratio equal to or greater than 30% represent a substantial share of the indebted households in our sample (almost 10%).

[18] The items are defined according to the Classification of Individual Consumption According to Purpose (COICOP). The other two largest items are Housing and Utilities, and Transport.

Moreover, the share of total consumption devoted to food is even larger for more fragile households.[19] Second, food consumption is supposed to be quite inelastic, as it represents an essential part of households' consumption. It can therefore be viewed as a conservative measurement. If high indebtedness is found to have a negative impact on food consumption, we strongly expect total consumption to be declining as well.

Food consumption is recorded in two variables in the HFCS: the consumption of food at home and the consumption of food outside the home. In this study, to try to be as conservative as possible and following the reasoning explained above, we will focus on the consumption of food at home because it is supposed to be very inelastic.[20] Moreover, food consumed at home represents the largest share of households' food consumption (80% on average in our sample), and the reported value spent on food consumed outside the home appears to be very small for some households, leading to (very) high growth values that raise some doubts on the reliability of this variable for the exercise at hand. This is especially true for poor households, a category that will prove to be central in our analysis.[21]

Finally, observing a negative effect of indebtedness on consumption may simply indicate that households reduce their expenses on food at home by reducing the quality of the food consumed, rather than its quantity. Although this might be the case, we believe it to still be problematic because cheap processed food has been shown to be detrimental to health: it increases, for instance, the risk of overweightness or obesity (Asfaw, 2011).

3.2 Sample selection

The HCFS data contains information on 2,327 Belgian households in 2010 and 2,238 in 2014. For this study, we selected the 1,006 Belgian households with panel information, i.e., those that were surveyed in both waves. We then excluded households with a debt-service-to-income (DSTI) ratio greater than 150% as these can be considered as extreme outliers (indeed, such value would mean that they are using more than one and a half time their income to repay their debt every month) and one household that had inconsistent values for its DSTI ratio across the implicates.[22] This reduces our sample down to 997 households observed both in 2010 and 2014. Table 2 shows the distribution of the

[19] For instance, this share represents 16.7% of total consumption for the households where the reference person has a low level of education, compared to 13.8% for the households where the reference person has a high level of education. Detailed results are available upon request.

[20] We also performed the analysis using total food consumption, and the results, presented in Table A.4 and Figure A.4 in the appendix, are very similar. Therefore, to be as conservative as possible, we have decided to focus on food consumed at home throughout the paper.

[21] Five percent of the households reported spending less than 1€ per person per month on food outside the home and ten percent reported spending less than 10€. This leads to outlying growth values and hence to a mean growth of 800% for the indebted households (2100% if we consider only the poor ones).

[22] The DSTI ratio was set as missing for 4 implicates and equal to 0 for the 2 remaining ones.

households by groups of indebtedness in 2010 and 2014.

A first striking feature of Table 2 is the presence of non-integers in a frequency table. This is due to the multiply imputed nature of the data: if a household's debt level was missing and therefore imputed, this household can be found in different categories of indebtedness for different implicates. This results in non-integers when pooling the results obtained for the different implicates. There are 13 such observations of households ending up in different groups according to the implicates. To be in line with the essence of multiple imputation, we will keep those observations in our sample whenever possible. They will only be dismissed for some descriptive statistics performed by groups of debt, for the sake of having an exact number of observations.[23]

Table 2: Number of households in each group of indebtedness in 2010 and 2014

		No debt in 2014	Debt in 2014 DSTI<30%	Debt in 2014 DSTI≥30%	
No debt in 2010		444.600***	82.200***	1.200	528.000***
		(0.600)	(0.917)	(.)	(0.000)
Debt in 2010	DSTI<30%	124.200***	278.600***	21.400***	424.200***
		(1.200)	(1.470)	(0.980)	(1.800)
	DSTI≥30%	5.600***	32.000***	7.200***	44.800***
		(0.980)	(1.732)	(0.917)	(1.800)
		574.400***	392.800***	29.800***	997
		(0.600)	(1.800)	(1.428)	

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses; The presence of non-integers, variability and, hence, standard errors is due to the multiply imputed nature of the data; DSTI stands for the debt-service-to-income ratio; The last column shows the total number of households in each debt group defined in 2010; The last row shows the total number of households in each debt group defined in 2014

We can also observe that 469 households were indebted in 2010, compared to only 422.6 in 2014.[24] The number of indebted households with a DSTI ratio ≥30% was also higher in 2010 than in 2014.[25] Finally, we observe that, among the households that were highly indebted in 2010, only a small share remained highly indebted in 2014. Overall, there seems to be a general trend of a decreasing DSTI ratio, which could be indicative of deleveraging. However, a more in-depth analysis is needed.

[23] Indeed, if a household for which indebtedness was imputed is in the group with a DSTI ratio < 30% for some implicates and in the group with a DSTI ratio ≥ 30% for others, the total number of observations in each group changes from one implicate to another.

[24] This represents 47% and 42% of the studied sample for 2010 and 2014, respectively.

[25] The choice of 30% as a threshold is borrowed from the work of D'Alessio and Iezzi (2013), who show, using Italian data, that households with a DSTI ratio larger than 30% can be considered as overindebted. This threshold will prove to be central in our study as well.

3.3 Descriptive statistics

The intake of debt and its size may depend on many household characteristics. In this section, we will attempt to determine whether there are differences, on average, in the characteristics of the households composing the groups under study. As we did in Section 3.2, we will consider three groups stemming from our two analyses: households without debt, households with debt and a DSTI ratio lower than 30%, and households with a DSTI ratio greater than 30%.

Table 3 presents the median values of households' food consumption at home, income, and net wealth in 2010 and in 2014 for the three groups of indebtedness. The first line of the table is already indicative of our main result. Namely, it appears that the decrease in the median value of equalized consumption[26] is the largest for highly indebted households. More precisely, we see that the three groups had median levels of food consumption at home that were not very different in 2010 but that, although a decreasing trend is observed for the two indebted groups, the highly indebted one presents a substantially lower level of consumption of food at home in 2014. Looking at the rest of Table 3, we see that the income of 'reasonably' indebted households is higher[27] and that households without debt have the largest net wealth. The evolution of income and net wealth in highly indebted households is also interesting: both values have grown quite substantially. The increase of these households' net wealth could be explained by the fact that they partly reimbursed their debt between 2010 and 2014, considering that they did not take on any new debt in the meantime. As for their income, the low initial value could explain the high DSTI ratio, but the sharp increase observed leads us to think that the drop in consumption is not due to an income shock.[28] However, it should be recognized that the highly indebted group is quite small and potentially characterised by a high dispersion as the standard errors presented in the table are higher for this group than for the two other ones. Nonetheless, what we observe in Table 3 leads us to believe that the decrease in consumption can hardly be linked to an income or wealth shock. We further believe in the importance of focusing on such groups, which are at risk financially, even if they often turn out to be quite small.[29] This urges us to deepen our analysis

[26] We used the OECD modified scale to compute the equalized consumption. Accordingly, household members received the following weights: 1 for the first adult, 0.5 for the second adult and each subsequent person aged 14 and over, and 0.3 for each child under 14. The household's total consumption was then divided by the sum of the household weights to obtain an equalized consumption. The use of equalized consumption throughout our analysis therefore allows us to control for household size.

[27] The income is presented as equalized as well. Note, however, that the differences across groups and the dynamics within groups between 2010 and 2014 are the same before applying the equivalence scales.

[28] Note that this sharp increase in income could be embedded in the LC-PI framework, as it may simply be that highly indebted households expected their income to increase and took on debt accordingly. However, the decrease in their consumption levels should not be observed within the LC-PI.

[29] The literature on households in financial distress has previously focused on such small groups. For instance, Ampudia et al. (2016) have developed a new metrics for measuring households' financial distress and find an exposure at default (EAD) for only 4.2% of households.

of this highly indebted group, as we will do in Section 4.2.

Table 3: Summary statistics (medians) for the different groups under study

	No debt in 2010		Indebted in 2010			
			DSTI[a] < 30%		DSTI[a] ≥ 30%	
	2010	2014	2010	2014	2010	2014
Food consumption at home (equalized)	300.000*** (11.149)	303.030*** (13.911)	300.000*** (12.327)	282.468*** (10.820)	319.508*** (51.770)	259.740*** (29.157)
Monthly gross income (equalized)	1765.556*** (74.279)	1796.308*** (86.662)	2601.256*** (84.579)	2671.545*** (161.686)	1257.936*** (269.506)	2119.658*** (289.350)
Net wealth	279306.8*** (25642.2)	253988.5*** (16769.1)	200534.8*** (14679.9)	216866.7*** (15633.5)	185940.4** (84644.0)	220360.0*** (65738.0)
N	528		416		40	

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses were computed using a set of 1000 replicated weights constructed by bootstrap replication; [a] DSTI stands for the debt-service-to-income ratio; Medians are shown to avoid the impact of outliers on the statistic; All values are expressed in 2010 prices.

Table A.1 in the appendix gives more information on some of the characteristics of the households composing each group: the number of members and the homeownership status of the household, as well as the age, level of education, work status, and marital status of the head of the household.[30] It appears that households without any debt are much older (over 60 years old, compared to between 45 and 50 for the other groups). They also include relatively more widowed households where the head is retired. Otherwise, we can see that both indebted groups are composed of slightly more homeowners and that the highly indebted group contains a larger share of households with a self-employed and unemployed head.

Finally, as our variable of interest will be the growth of households' consumption of food at home between 2010 and 2014, Table 4 reports the median values of this growth for the three groups. This table also gives us a grasp of our main result: highly indebted households have a significant negative median growth much higher (in absolute value) than that of the two other groups (-21.6% vs -9.1% respectively). This already casts some doubts on the neutrality of debt assumption present in the life-cycle model. This result also seems to be in line with the idea that debt becomes harmful only at or beyond certain high levels. Overall, this calls for a further analysis using regression techniques, which we will perform in Section 4.

[30] The head of the household, or reference person, was chosen following the UN/Canberra definition, according to which the household reference person is uniquely determined by applying the following steps sequentially: one of the partners in a *de facto* or registered marriage with, then without dependent children, lone parent with children, the person with the highest income, and finally the eldest person (United Nations Economic Commission for Europe, 2011).

Table 4: Growth of food consumption at home per indebtedness group

	No debt in 2010	**Indebted in 2010**	
		DSTI[a] < 30%	DSTI[a] ≥ 30%
Growth of food consumption at home	-0.091*** (0.017)	-0.091 (0.020)	-0.216* (0.121)
N	528	416	40

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors reported in parentheses were computed using a set of 1000 replicated weights constructed by bootstrap replication; The table displays the median of the growth of food consumption at home; [a] DSTI stands for the debt-service-to-income ratio.

Before getting into the regression analysis, it is interesting to look at the indebtedness behaviour of the different types of households. For this purpose, we define categories of households depending on four dimensions: income, work status, age, and level of education.[31] For income, we divide our sample into three terciles that we will, for the sake of clarity, call 'poor', 'middle', and 'rich'. For the work status, 3 categories are created, based on the work status of the reference person: the employed and self-employed, the retired, and the unemployed and others.[32] For age, the sample is divided into 3 categories based on the age of the household's reference person: 17-46, 47-60, and 61+.[33] Finally, for the level of education, our sample is divided into three groups according to the educational attainment of the reference person: primary or no education, secondary, and tertiary.[34]

Table 5 shows the mean DSTI ratio (for the full sample and conditional on debt) as well as the frequencies of each indebtedness group for each category created in those four dimensions.

We can see from this table that the different dimensions are indeed linked to the indebtedness level. Starting with income, it appears that the majority of 'poor' households are not indebted, but those who are indebted present a rather high DSTI ratio.[35] As for work status, it appears that, in line with the LC-PI model, the majority of retired households are not indebted. Then, conditional on debt, households in the 'unemployed and others' category present the highest DSTI ratio. That category also holds the largest share of highly indebted households. Concerning the age dimension, we see that younger households tend to have a higher DSTI ratio, although the difference is less pronounced when conditional on debt, as there are fewer young households without any debt and more old households

[31] The same four dimensions will be used in Section 6 when analysing the potential heterogeneity of the effect of household indebtedness on their consumption.
[32] This last group is composed of two third of unemployed and one third of others. Among the others, 80% are households in which the reference person is permanently disabled and 20% are households in which the reference person is fulfilling domestic tasks.
[33] Those three categories are very close to the three terciles.
[34] As mentioned earlier, the reference person was chosen following the UN/Canberra definition.
[35] Note that a high DSTI ratio for 'poor' indebted households could almost be mechanical.

without any debt. Furthermore, young households appear to be found mainly in the 'normally' indebted group. However, 5.3% of them still have a DSTI ratio above 30%. Finally, the indebtedness behaviour does not seem to be substantially different depending on the education level, although we find a larger number of highly indebted households among those where the reference person's level of education is secondary or tertiary. This could reflect an easier access to credit for these households.

Table 5: Mean of DSTI ratio and frequency of debt group for each category in the four dimensions

	Mean DSTI	Mean DSTI (conditional on debt)	Frequencies		
			No debt	DSTI<30%	DSTI≥30%
Income:					
Poor	0.078***	0.210***	0.641***	0.279***	0.080***
	(0.011)	(0.016)	(0.036)	(0.034)	(0.019)
Middle	0.104***	0.145***	0.372***	0.576***	0.052***
	(0.008)	(0.008)	(0.035)	(0.036)	(0.017)
Rich	0.088***	0.122***	0.290***	0.694***	0.015
	(0.007)	(0.010)	(0.035)	(0.035)	(0.010)
Work status:					
(Self-)Employed	0.130***	0.168***	0.224***	0.707***	0.068***
	(0.007)	(0.007)	(0.022)	(0.026)	(0.017)
Unemployed and others	0.084***	0.196***	0.573***	0.337***	0.089*
	(0.026)	(0.046)	(0.078)	(0.075)	(0.048)
Retired	0.019***	0.098***	0.810***	0.182***	0.008*
	(0.004)	(0.017)	(0.028)	(0.028)	(0.005)
Age:					
17-46	0.158***	0.175***	0.193***	0.754***	0.053
	(0.016)	(0.008)	(0.069)	(0.073)	(0.036)
47-60	0.099***	0.148***	0.373***	0.562***	0.065***
	(0.007)	(0.015)	(0.024)	(0.025)	(0.013)
61+	0.014***	0.136***	0.865***	0.127***	0.008
	(0.005)	(0.022)	(0.030)	(0.029)	(0.006)
Educational attainment:					
Primary or no education	0.053***	0.152***	0.649***	0.333***	0.018
	(0.018)	(0.038)	(0.087)	(0.089)	(0.019)
Secondary	0.087***	0.164***	0.468***	0.475***	0.058***
	(0.008)	(0.011)	(0.030)	(0.030)	(0.014)
Tertiary	0.097***	0.163***	0.402***	0.548***	0.050***
	(0.007)	(0.010)	(0.031)	(0.031)	(0.013)
N	990	469	990		

Note: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses were computed using a set of 1000 replicated weights constructed by bootstrap replication; Except for the second column, this exercise considers the full sample; The first two columns present the mean debt-service-to-income (DSTI) ratio for each category for the full sample and conditional on debt (resp.); The last three columns represent the frequency in each debt group for each category.

The LC-PI states that households choose their consumption level depending on their lifetime income, i.e., the forecast of their income. Households then take on debt if they expect their income to increase. Although the exercise on income in Table 5 is interesting, it does not explore the link between indebtedness and income forecasts, as income groups are defined on the basis of their income in 2010. To further explore said link, we created income categories in 2014 and then observed which households changed categories, and which did not, between the two periods. We can use this observation as a proxy for the households' income forecast, in the absence of a better measurement.

Table 6: Proportion and mean of DSTI ratio of each 'change in income' group

Panel A: Full sample

	rich to poor	1 cat. lower	same cat.	1 cat. higher	poor to rich
Proportion	0.024***	0.123***	0.675***	0.155***	0.024***
	(0.008)	(0.014)	(0.023)	(0.019)	(0.008)
Mean DSTI	0.040***	0.051***	0.088***	0.128***	0.145***
in 2010	(0.014)	(0.010)	(0.006)	(0.015)	(0.055)
N			990		

Panel B: Conditional on debt

	rich to poor	1 cat. lower	same cat.	1 cat. higher	poor to rich
Proportion	0.022**	0.125***	0.661***	0.181***	0.011*
	(0.009)	(0.024)	(0.039)	(0.030)	(0.006)
Mean DSTI	0.078***	0.126***	0.188***	0.199***	0.488***
in 2010	(0.023)	(0.011)	(0.012)	(0.019)	(0.169)
N			469		

Note: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses were computed using a set of 1000 replicated weights constructed by bootstrap replication; The columns represent the 'change in income' category between 2010 and 2014, from worst to best; The first line in Panels A and B represents the proportion of each of the 'change in income' groups within the sample considered; The second line shows the mean debt-service-to-income (DSTI) ratio in 2010 for each group.

Table 6 reports the proportion and the mean DSTI ratio of each of those 'change in income' groups. Since we had defined three categories of income (poor, middle, and rich), we end up with five possible changes of category: households can go two categories higher (i.e., from poor to rich), one category higher (e.g., from medium to rich), remain in the same category, or go one or two categorie(s) lower. We first observe that the majority of households (more than 65%) remained in the same income category between 2010 and 2014. Then, looking at the mean DSTI ratio, it appears that households with the highest increase in income were those with the highest DSTI ratio in 2010. This is supported by the LC-PI model, as one could argue that these households had high income expectations in 2010. However, together with the large negative growth of food consumed at home observed in Table 4 for

households with a DSTI ratio higher than 30%, this also casts doubts on the debt neutrality in the permanent-income hypothesis, as it questions the capacity of households to forecast their future income correctly.[36] This hypothesis was already put forward by Betti et al. (2007) to explain household overindebtedness.

However, these are only descriptive statistics that do not take other potential differences between groups into account, which could influence the households' consumption. In an attempt to take those differences into account, we will perform a regression analysis in the next section.

4. Empirical Analysis and Results

In this section, we will analyse the effect of indebtedness on consumption for Belgian households between 2010 and 2014. We will first perform a regression analysis using a linear specification where we will try to isolate both the credit constraint and debt distress effect described earlier. With this analysis, we will already observe that, in the absence of a negative shock on households' assets, the debt distress channel is prevalent.

We will then explore the possibility that the effect under study is non-linear. More precisely, we will consider that indebtedness does not have a negative effect on consumption at every level but only for some high enough levels. We will try to quantify such a level of indebtedness.

4.1 Linear Analysis

As a first step in our analysis, we perform a linear regression similar to what has been most often done in the literature studying the impact of households' indebtedness on their consumption (Dynan, 2012; Andersen et al., 2014; Kukk, 2016). As mentioned earlier, the objective is to see if households' indebtedness can have an impact on their consumption when controlling for potential income or wealth changes. What we aim to estimate here is therefore not a marginal propensity to consume but rather whether, all else being equal, having too high a level of debt might lead households to reduce their consumption, and if so, by how much.

To try to capture this effect, our strategy will include three main features. First, following previous studies (e.g., Dynan, 2012), we will use the lagged indicators of indebtedness (i.e., the indicators in 2010) to explain the growth of consumption between 2010 and 2014. This is to avoid any simultaneity bias. Taking the lag of the indebtedness indicators is standard in this literature as it is presumably the ex-ante indebtedness level that will impact households' consumption. Second, to get a

[36] Or, at least, it seems that, even if households are rational in the long term as they expect an increase in their income, this forecast might not be accurate enough because the households still end up reducing their consumption.

grasp of the causal effect of indebtedness on consumption, we will try to be as close as possible to a regression with individual fixed effects that are dealt with by using first differencing. We are unfortunately unable to perform a true first-difference regression as we only have two waves of data and need to take the lagged indicators of indebtedness to fulfil our first condition. Instead, we will take the first difference of every continuous variable included in the analysis. We acknowledge, nonetheless, that this only partially addresses the problem of potential unobserved heterogeneity. We will also take the growth of consumption instead of the level of consumption to try to account for the possible differences in food consumption preferences across households.[37] Finally, we will control for income and net wealth, which should partial out the potential wealth effect described earlier.

We will perform this analysis on two distinct samples: the full sample derived after the selection explained in Section 3.2, and a sample conditional on debt (i.e., where we consider only the households with debt). The results presented in this section are based on the following equation:

$$\frac{C_{2014}-C_{2010}}{C_{2010}} = \alpha + \theta\ Indebted_{2010} + \beta\ DSTI_{2010} + \delta\ DTA_{2010} + \phi\ \Delta Z_{2014} + \gamma\ X_{2014} + \zeta \quad (1)$$

Where C_t represents the equalized consumption in period t[38]; $DSTI_{2010}$ the lagged debt-service-to-income ratio; DTA_{2010} the lagged debt-to-asset ratio; $Indebted_{2010}$ a dummy variable indicating whether the household was indebted or not in 2010; X_{2014} a vector containing the demographic control variables that are categorical, including the level of education, marital status, work status, sex, and age[39] of the reference person, taken in 2014;[40] and ΔZ_{2014} a vector containing the changes in monthly gross income and net wealth between 2010 and 2014. Note that, as usually done in similar studies, the log of the monthly gross income and the inverse hyperbolic sine of the net wealth were taken before differencing. The latter transformation is close to the log transformation, except for small values, and has the advantage of allowing for negative values (Dynan, 2012). This last feature of the inverse hyperbolic sine is of particular interest to studies such as ours.

The coefficients of interest here are β and δ. They represent the effect of higher DSTI and DTA ratios, respectively. Note that when we consider only the indebted households, the variable $Indebted_{2010}$ is simply omitted.

[37] We also performed every analysis using the delta of food consumption instead of its growth, and the results were similar. Those results are available upon request.

[38] The use of equalized consumption allows us to control for the size of the household. Note that all our models have also been re-estimated using the growth of 'unequalized' food consumption at home as dependent variable and including household size as an additional covariate. Results, available on request, support our conclusions.

[39] Although age is continuous in our database, we decided not to difference it as this difference would be the same for all households unless there was a change of reference person between the two waves.

[40] We also used the 2010 values as controls and obtained the same results. Those results are available upon request.

This setting, and in particular the use of the two debt indicators, should allow us to discriminate between the debt distress channel and the credit constraint channel. In other words, it will allow us to observe whether it is the day-to-day sustainability of the debt, its overall sustainability, or both, that has an effect on the households' consumption. β should capture the effect of indebtedness on consumption through the debt distress channel whereas δ should capture the effect through the credit constraint channel.[41] Moreover, finding an effect that is more prevalent for the DSTI ratio could point towards an effect linked to the liquidity of the households. This would argue in favour of models such as the one developed by Kaplan et al. (2014), explicitly considering two types of assets held by the households: a liquid and an illiquid one. It would also support the idea of a potential presence of (wealthy) hand-to-mouth households in the sample.[42]

Table 7: Main results of the regressions based on equation (1)

	Full sample			Conditional on debt		
Dependent variable:	Growth of equalized food consumption at home					
	(1)	(2)	(3)	(4)	(5)	(6)
Indebted in 2010	-0.016	0.057	0.053			
	(0.062)	(0.073)	(0.074)			
DTA in 2010	-0.000		-0.000	-0.000		-0.000
	(0.000)		(0.000)	(0.000)		(0.000)
DSTI in 2010		-0.005***	-0.005**		-0.005***	-0.005**
		(0.002)	(0.002)		(0.002)	(0.002)
Δ Net wealth	0.013	0.011	0.012	0.014	0.011	0.012
	(0.009)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)
Δ Income	0.026	0.040	0.038	0.065*	0.094**	0.090**
	(0.030)	(0.031)	(0.031)	(0.036)	(0.038)	(0.037)
Constant	0.169	0.206	0.203	-0.206	-0.058	-0.060
	(0.202)	(0.201)	(0.199)	(0.243)	(0.249)	(0.246)
N	990	990	990	469	469	469

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed with a 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; The log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The first three columns show the results for the full sample whereas the last three columns show the results conditional on debt; All regressions presented here include the level of education, marital status, work status, sex, and age of the reference person as control variables; The coefficients for those variables can be found in Table A.2 and Table A.3 in the appendix.

[41] We believe that, as it is the case for the Marginal Propensity to Consume(MPC), the effect found here could vary from one household to the next. Therefore, in Section 6, we will try to explore this potential heterogeneity by analysing whether the effect differs according to specific household characteristics.

[42] Using the HFCS, Kaplan et al. (2014) show the fractions of hand-to-mouth households in Germany, France, Italy, and Spain. Although we believe it could be interesting to estimate this fraction for Belgium as well, it is beyond the scope of this paper.

Table 7 presents a summary of the main results.[43,44] The first three columns report the results based on the full sample, and the last three columns report those conditional on debt. We can see, from Table 7 that the coefficient found for the DSTI ratio (β) is negative and significantly different from 0 in every specification, whereas the coefficient found for the DTA ratio (δ) is not significantly different from 0 in any specification. This seems to indicate that, in the situation under study, when there was no negative shock to households' assets, it is more the day-to-day aspect of debt, and thus its impact on households' financial obligations, that is seen as a burden rather than the size of the debt itself.[45] Overall, we find that, all else being equal, having a one percentage point increase in the DSTI ratio leads to a 0.5 percentage point decrease in consumption growth.[46] This result is also valid for our sample conditional on debt (i.e., taking only indebted households into account).[47]

We complement this first analysis by performing additional regressions in which we relax the first condition mentioned earlier (i.e., taking the lag of the indebtedness indicators). This should allow to see if consumption is affected by the growth of debt between 2010 and 2014 rather than by its level in 2010. We do so in two ways. First, by regressing the growth of food consumption at home on the growth of the indebtedness indicators while keeping everything else as before. Then, by regressing the delta (i.e., the change between 2010 and 2014) of food consumption on the delta of the indebtedness indicators as well as the delta of monthly gross income and net wealth, in order to perform a true fixed-effects regression by first differencing. The results of those analyses are available in Table A.5 in the appendix. The first two columns of Table A.5 report the results of the first type of regression described for the full sample and conditional on debt. The last two columns report the results of the regressions with individual fixed effects that are dealt with by first differencing, for the full sample and conditional

[43] The different results are presented extensively in Table A.2 and Table A.3 in the appendix. Those two tables present the results for different combinations of the controls. For instance, columns (2) to (8) report the results when only one of the controls is considered, whereas columns (12) to (18) report them when only one of the controls is omitted. This allows us to detect whether the results are driven by specific controls. As it does not seem to be the case here, we focus on the specifications reported in Table 7, which include all the controls.

[44] As stated before, we report only the pooled results here, as is usually done when using multiply imputed data. Nonetheless, we also performed the regressions on each implicate separately. The results, available upon request, appear to be stable across implicates.

[45] As explained above, this could also indicate an effect related to household liquidity. The fact that there is a positive and significant effect of income variation when considering only indebted households could be seen as further evidence in this direction.

[46] Given that the unconditional mean of the equalized consumption of food at home in 2010 amounts to slightly more than 340€, this means that having a one percentage point increase in the DSTI ratio lowers the consumption of food at home by 1.7€. For individuals with a DSTI=30%, this would therefore amount to 51€. We will show in Section 4.3 that the effect is actually greater.

[47] The results found here are similar when considering the households' total food consumption (i.e., both food consumed at home and food consumed outside the home). The results, presented in Table A.4 in the appendix, are very similar. Given the presence of many low values for the 'food consumed outside the home' variable, which could lead to artificially high growth, we have decided to focus on food consumption at home for the rest of the paper, in order to be as conservative as possible.

on debt. Looking at the results presented in the table, we cannot conclude that the consumption dynamics can be explained by the growth of debt, as the coefficients obtained are never significant. This finding already leads us to believe that the effect found results from a trade-off between housing and consumption. Indeed, we believe that what actually impacts households' consumption is more often the important event of taking on a (significant) mortgage loan to buy a house, rather than the evolution of their debt outside this event.[48] Given this observation, and in order to stay as consistent as possible with the methodologies of previous studies on this topic, we will consider only the lagged indicators of indebtedness in the rest of the paper.

Although this linear analysis reveals interesting results, we think that a more in-depth analysis may be needed. Indeed, as mentioned earlier, most previous studies argue for an effect of indebtedness on consumption at or beyond certain high levels of indebtedness. However, none of them attempt to quantify such levels. Albuquerque and Krustev (2018), using US state-level data, find that the negative effect is mostly driven by highly indebted states. They claim that this points towards non-linearities in the effect of households' indebtedness on their consumption. Following this idea, we argue that there may be some threshold of indebtedness, at which a household is forced to reduce its consumption. In the next section, we will aim to determine such threshold.

4.2 Threshold analysis

This section explores the possibility that the effect of indebtedness on consumption occurs in a non-linear way. The basic premise of this analysis is that indebtedness does not have the same effect on consumption at every level. Cecchetti et al. (2011) have already shown it at the macro level. We believe that it is also true at the micro level. Indeed, on the one hand, it is easy to believe that low levels of indebtedness are not harmful for households and that debt is (even) playing the role it is given in the life-cycle model, that is, allowing households to smooth their consumption over time. On the other hand, as argued earlier, high levels of debt might harm households by forcing them to reduce their consumption in order to deleverage or even simply to fulfil their debt obligations. Since the linear analysis revealed that only the DSTI ratio has a significant impact on households' consumption, we will now explore the non-linearity in the effect of indebtedness, only for its day-to-day sustainability dimension (i.e., only for the DSTI ratio).

There are several ways to account for non-linearities in the effect of the DSTI ratio on consumption growth. In our case, we aim to find a threshold for the DSTI ratio that could be used for

[48] This would explain why we do not find any significant effects when we use the evolution of the debt (i.e., its growth or delta) as only a few households (14) bought a house between 2010 and 2014.

policy purposes (e.g., limiting banks' ability of to give credits to households who would end up with a DSTI ratio higher than this threshold).[49] In other words, we would like to quantify the critical threshold at which or beyond which debt servicing pushes households to reduce their consumption of food at home. To do so, and given our limited sample size, we create an overindebtedness indicator that classifies a household as overindebted[50] when its DSTI ratio exceeds a certain threshold. We then vary this threshold to see at what level indebtedness becomes critical. This non-linear feature and the attempt the quantify the critical level of indebtedness is, to the best of our knowledge, unique to our study. The results are based on the following equation, which shares the same features as in the linear analysis:

$$\frac{C_{2014}-C_{2010}}{C_{2010}} = \alpha + \theta\ Indebted_{2010} + \beta\ OVER_{2010} + \delta\ DTA_{2010} + \phi\ \Delta Z_{2014} + \gamma\ X_{2014} + \zeta \quad (2)$$

Where $OVER_{2010}$ represents the lagged overindebtedness indicator, taking the value of 1 if the debt-service-to-income ratio of the household in 2010 exceeded a predetermined threshold; and $Indebted_{2010}$ is a binary variable taking the value of 1 if the household was indebted with a DSTI ratio lower than the threshold in 2010.[51] Those two variables can naturally be seen as two dummy variables forming a categorical one with three categories: the households without debt, the households with debt and a DSTI ratio lower than the threshold, and the households with debt and a DSTI ratio greater than the threshold. The other variables are the same as for equations (1). As in the linear case, the analysis was performed on the full sample and on a sample conditional on debt.

The coefficient of interest is, again, β. Namely, we want to see whether being overindebted in 2010 led households to reduce their consumption. This regression was performed for the threshold defining overindebtedness, varying from 20% to 50% by steps of 5%.[52] The results found for the estimated β for the different thresholds and for the two samples are presented in Figure 1.

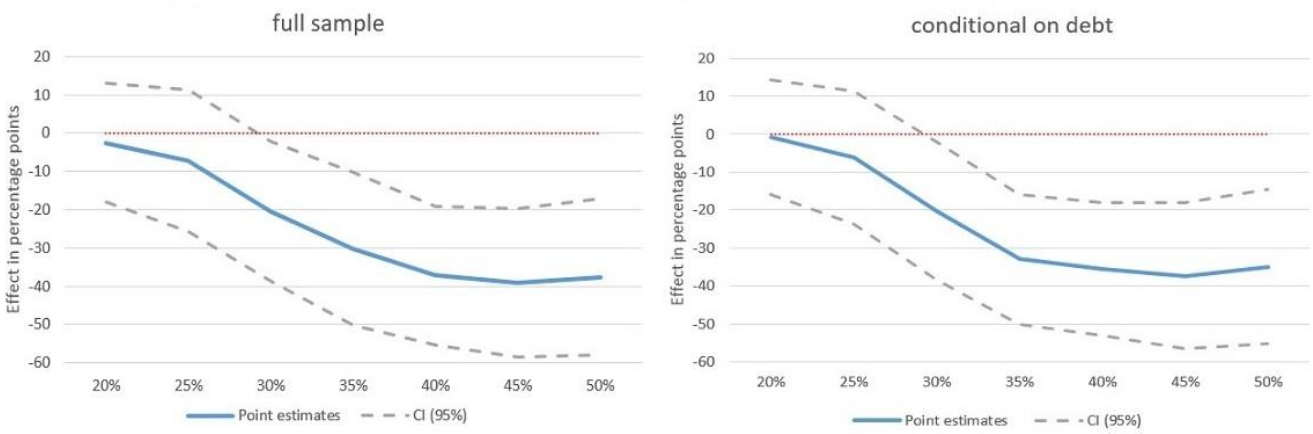
[49] As said before only a few euro area countries impose limits on the DSTI, and Belgium is not one of those (Lang et al., 2020).

[50] For the ease of notation and the sake of clarity, in the rest of the paper we will refer to a household as being 'overindebted' if its DSTI ratio is greater than the threshold, and 'normally indebted' if its DSTI ratio is lower than the threshold.

[51] Note that this variable was logically omitted in the analysis conditional on debt.

[52] The frequencies of the groups defined by those varying thresholds are presented in Table A.6 in the appendix. We can see that, among indebted households, almost 10% have a DSTI ratio above 30% and can thus be considered as overindebted at this threshold.

Figure 1: Coefficients β for varying thresholds



Note: The two graphs plot the coefficients (solid blue line) and confidence intervals at 95% (grey dashed line) obtained for the different thresholds when performing equation (2) on both the full sample and conditional on debt; The confidence intervals were computed using a set of 1000 replicated weights constructed by bootstrap replication.

It appears, from Figure 1, that the effect is negative for every threshold considered. Moreover, as soon as the threshold becomes greater than 30%, the effect is significant at the 95% level. It then seems to stabilise after 40%, which might be due to the small difference in those samples, as the number of overindebted households decreases when the threshold is raised.[53,54] For a threshold set at 30%, it appears that highly indebted households have a consumption growth 20.5 percentage points lower than households without debt. Given that the unconditional mean of the equalized consumption of food at home in 2010 amounts to slightly more than 340€, this means that highly indebted households ended up with a consumption of food at home per person reduced by almost 70€. This reduction is larger when considering 35% as the threshold. Indeed, highly indebted households then suffer a consumption growth 30.6 percentage points lower than those without debt. This is equivalent to 104€ less per month. The results are even more marked when we consider only indebted households, with effects of 21.5 percentage points and 34.5 percentage points when we set the threshold at 30% and 35%, respectively. However, this amounts more or less to the same absolute value, given that the mean of the equalized consumption of food at home in 2010 amounts to 327€ for the sample conditional on debt. Note that this magnitude of the effect in absolute value is confirmed when we take the simple difference of consumption levels as a dependent variable rather than consumption growth

[53] The tables with the results of the regressions used to make the graphs can be found in the appendix (Table A.7 and Table A.8). As for the linear case, the regressions were also performed with different combinations of the controls. The results are robust to those changes. Therefore, the specification used for Figure 1 is the one with full controls.

[54] As for the linear case, we report here only the pooled results as is usually done when using multiply imputed data. We, however, performed the regressions as well on each implicate separately when the threshold is set at 30%. The results, available upon request, are very similar across implicates.

(i.e., $C_{2014} - C_{2010}$ instead of $\frac{C_{2014}-C_{2010}}{C_{2010}}$).[55] To ensure that our results are not dependent on how we perform this non-linear analysis, we also ran regressions similar to the one defined by equation (1), including the DSTI ratio as a categorical variable with four categories and the following boundaries: 0%, 10%, 20%, and 30%. This analysis reveals that only the fourth category (i.e., households with a DSTI≥30%) has a negative and significant coefficient for both the full sample and the sample conditional on debt. Furthermore, the coefficient size is very similar to the one found in the threshold analysis, therefore confirming our results.[56]

The effects found above are substantial, even more so as we are only considering the consumption of food at home.[57] Indeed, this type of consumption, being essential, should be quite inelastic. Therefore, we expect the effect to be in the same direction and potentially greater for total consumption. Furthermore, our analysis reveals that being indebted at a 'reasonable' level does not have any significant impact on the consumption of food at home.[58] This supports the idea, expressed by Albuquerque and Krustev (2018), that the effect of indebtedness on consumption is non-linear.

Finally, we observe, as we did in the linear case, that the δ coefficient is never significant and is almost null. Again, this supports the idea that, in the absence of unexpected shocks on assets, the debt distress channel is more prevalent.

Although the linear analysis suggested that the overall sustainability of the debt had no impact on consumption within our framework, we still chose to perform the threshold analysis for the DTA ratio. We varied this ratio from 55% to 175%. Overall, the results are in line with what was found earlier: we find an effect of overindebtedness only when the DTA ratio is very high, that is, when its threshold is set at 135%. This means that there is an effect only for presumably highly insolvent households; given the relatively small size of the group of households with a DTA≥135%, we decided not to report those results and to focus on the DSTI ratio instead. The results are, nevertheless, available upon request.

5. Robustness and sensitivity checks

In this section, we will perform robustness checks as well as more in-depth analyses. Although we followed what has been done in the literature and therefore took some precautions such as taking the lagged indicator of the debt burden to avoid any simultaneity bias and taking the first difference of

[55] The results are available upon request.
[56] We wish to thank an anonymous referee for suggesting this. The results are available upon request.
[57] We also performed the regressions using total food consumption (i.e., at home and outside) and found similar results, as presented in Figure A.4 in the appendix.
[58] This result can be found in Table A.7 in the appendix.

the continuous variables to be as close as possible to an individual fixed-effect specification, one could still suspect a risk of endogeneity if, for instance, some unobserved variable affects both the lagged debt indicator and consumption growth. To address this issue, we will perform an instrumental variable analysis, where our debt indicator variable will be instrumented, and then perform the endogeneity test to see whether or not we can reject the assumption that our variable of interest is exogenous. Not being able to reject the null would make our estimates more reliable, as they would less likely be biased. This further allows us to test the usually taken approach in the literature.

We have already seen that our results hold when we change how the dependent variable is considered (growth of total food consumption, delta of food consumption at home), when we take the control variables in 2010 instead of 2014, or when we try to capture the non-linearity of the effect in a different way. Nonetheless, in this section, we will still verify whether our results hold under different specifications or whether they are drawn by some specificities of our previous analysis.

5.1 Instrumental variable analysis

For this analysis, we propose a new instrument, which has not yet been used in the literature, for the debt indicator: the *number of collateralised loans* held by a household. We believe that this variable will make a good instrument because it will definitely have a positive impact on the household's debt servicing while not impacting their consumption of food at home directly but only through the impact this instrument has on debt. In other words, we believe that our instrument will both have a strong predictive power and respect the exclusion restriction. In what follows, we will try to motivate those two points.

Regarding the predictive power, not all indebted households hold collateralised loans, and those are likely to be important loans. Therefore, the more collateralised loans a household has, the higher this household's DSTI ratio is likely to be.

Table 8 shows the means and frequencies of the number of collateralised loans held by the households in each group. We can clearly observe that highly indebted households tend to hold more collateralised loans than the ones in the two other groups. The mean for this group is 1.26, compared to 0.81 for the 'normally' indebted group. Furthermore, looking at the frequencies, we see that highly indebted households tend to have relatively more collateralised loans, whereas only one third of the 'normally' indebted group has no collateralised loan at all. Finally, first stage estimates further suggest that our instrument is not weak.[59]

[59] Those results can be found in Table A.9 in the appendix

Table 8: Frequencies and mean of the number of collateralised loans

		Indebted 2010	DSTI<30%	DSTI ≥ 30%
Number of collateralised loans	0	0.312***	0.332***	0.111
		(0.029)	(0.031)	(0.060)
	1	0.545***	0.540***	0.597***
		(0.031)	(0.033)	(0.091)
	2	0.123***	0.112***	0.237***
		(0.020)	(0.021)	(0.070)
	3	0.017**	0.015**	0.042
		(0.008)	(0.007)	(0.051)
	4	0.001	0.001	
		(0.002)	(0.002)	
	5	0.001		0.013
		(0.001)		(0.014)
Mean		0.854***	0.815***	1.261***
		(0.043)	(0.044)	(0.148)
N		456	416	40

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; Statistics shown are frequencies above the dashed line and means under the dashed line; DSTI stands for the debt-service-to-income ratio; Only households with positive debt are considered in this exercise.

As for the exclusion restriction, collateralised loans in Belgium are mainly used to buy expensive assets, such as houses. In other words, it is very unlikely that households will use any collateral for consumer credit or, to an even greater extent, for the consumption of food at home. This can be observed in Table A.10 in the appendix, which presents the proportions of collateralised loans per purpose. We can see that the great majority of those loans are indeed used for housing-related expenses, with only a small, non-significant number used "To cover living expenses or other purchases". This supports the idea that the number of collateralised loans has an effect on the growth of food consumption at home only through the debt burden. However, caution is required here. Indeed, the exclusion restriction might not be perfectly satisfied if a potentially unobserved common factor is influencing both our instrumental variable and consumption growth and if this factor is omitted in the regressions. The income and the wealth of households could be suspected as such influencing factors. However, those two factors are controlled for in the first and second stages of our instrumental variable analysis. Although other potentially unobserved factors could still compromise the exclusion

restriction, there are unfortunately not many tools that allow to test their existence. A possible solution is to look at the correlation between the instrument and the outcome variable. If this correlation is low, one can have more confidence in the assumption that the instrument is exogenous with respect to the outcome variable. We computed the correlation between our instrument and the growth of equalized food consumption at home; Table A.11 in the appendix presents the correlation coefficients for the different implicates.[60] We can see that the coefficients are all very small and fluctuate around -0.04. Accordingly, although we should remain cautious about the exogeneity of our instrumental variable, the low correlation found supports the assumption that the instrument is fairly exogenous.

Having some confidence in our instrument, we therefore use it to perform the endogeneity test to reinforce the confidence in our previous findings. The results of the weak identification and the endogeneity tests can be found in Table 9.[61]

Table 9: Results of the weak identification and endogeneity tests for each implicate

Panel A: Linear analysis

	m=0	m=1	m=2	m=3	m=4	m=5
Cragg-Donald version of the Wald F statistic	61.9	64.557	62.619	61.213	56.248	54.195
Endogeneity test	0.806	0.668	0.485	0.312	0.548	0.505
p-value	0.3694	0.4136	0.4864	0.5767	0.4591	0.4772

Panel B: Non-linear analysis with the threshold set at 30%

	m=0	m=1	m=2	m=3	m=4	m=5
Cragg-Donald version of the Wald F statistic	38.942	31.012	31.877	32.882	16.885	16.85
Endogeneity test	1.21	1.327	0.702	0.514	1.078	1.275
p-value	0.2713	0.2493	0.4022	0.4734	0.2992	0.2589

Notes: The endogeneity test statistics are distributed as chi-squared with degrees of freedom equal to 1 as there is only one regressor being tested; The table below gives the Stock-Yogo weak ID test critical values to which the Cragg-Donald statistics must be compared.

Stock-Yogo weak ID test critical values:	10% maximal IV size	16.38
	15% maximal IV size	8.96
	20% maximal IV size	6.66
	25% maximal IV size	5.53

Source: *Stock and Yogo (2005)*.

Since the literature on multiple implication offers, to the best of our knowledge, no way to aggregate the results for the tests from the different implicates, we performed both the weak identification and the endogeneity tests for each implicate separately. If we find the same results for each implicate, i.e., if the estimates show that we should not reject the null hypothesis of no

[60] To be as conservative as possible, we computed the correlation for each implicate. As we find very close correlations for each implicate, aggregating them should lead to a similar estimate.

[61] The results of the first and second stages of the instrumental variable analysis can be found in Table A.9 in the appendix.

endogeneity with a sufficiently high confidence level, then the pooling phase of the multiple imputation analysis should give the same result. Put simply, given that the result in a binary situation is either true or false, there is no logical way of aggregating the results obtained for the different implicates to obtain a 'false' if all those results are true.

The first line of panels A and B in Table 9 reports the Cragg-Donald version of the Wald F statistics for the weak identification test, which should then be compared to the Stock and Yogo critical values provided at the bottom of the table. We can see that the instrument passes the weak identification test in every case with a 90% confidence level. Those results are in line with the results obtained for the first stage: the instrument is a significant predictor of the DSTI ratio and the overindebtedness indicator for the linear and non-linear analyses, respectively.[62]

As for the endogeneity test, the results show that we can never reject the null hypothesis with a sufficiently high confidence level. Since the null hypothesis of this test is that the regressor is not endogenous, this gives us some more confidence about the exogenous nature of the debt indicator.

Given the outcomes of this analysis, we claim with confidence that the results presented in Section 4 are not likely to suffer from an endogeneity bias. This is even reinforced by the precaution taken when setting up the specification, namely, taking the first difference of every continuous variable to be as close as possible to an individual fixed-effect specification and taking the lagged debt indicators to avoid any simultaneity bias.

5.2 Sensitivity of the results

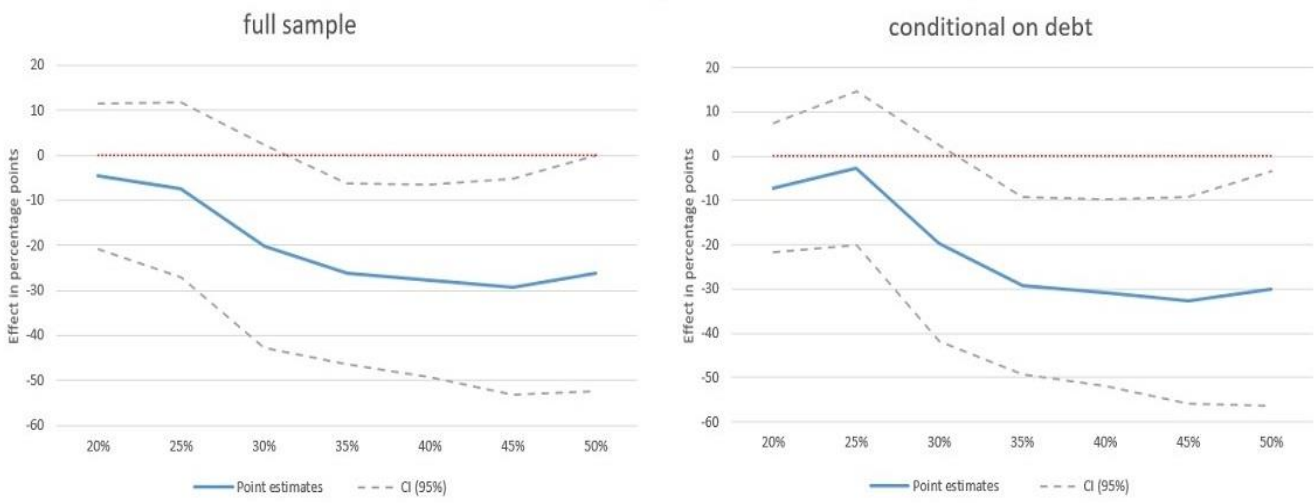
In this section, we will examine whether our results hold under different specifications or whether they are drawn by some specificities of our previous analysis.

We stated earlier that most Belgian households' debt is composed of mortgages. However, we do not know whether our results can truly be attributed to mortgages. We will therefore investigate whether the effect found also holds when considering only mortgage debts.

Figure 2 shows the results of the estimation when considering only mortgage debts.[63] We directly see that the results, although they are significant at lower levels of confidence, are similar to those found when considering all debts. The critical level of indebtedness appears to be 30%, even when considering only mortgage debts. The broader size of the confidence intervals could simply be due to the reduction of the sample size when considering only mortgage debts. This result seems to indicate that households end up facing some trade-off between housing and consumption.

[62] As stated above, those results can be found in Table A.9 in the appendix.
[63] The full results of the regressions can be found in Table A.12 and Table A.13 in the appendix.

Figure 2: Effect of mortgage debt for varying thresholds



Note: The two graphs plot the coefficients (solid blue line) and confidence intervals at 95% (grey dashed line) obtained for the different thresholds when performing equation (2) on both the full sample and conditional on mortgage debt; For those graphs, only mortgage debts were considered; The confidence intervals were computed using a set of 1000 replicated weights constructed by bootstrap replication.

Another specificity of our analysis is the use of equivalence scales to compute equalized consumption for the different households. While equivalence scales are well accepted in the literature on household economics, this choice is not innocent in our case, given our interest in the evolution of consumption between 2010 and 2014. Indeed, if the household composition changed in some systematic way between the two periods, our results could be biased. More precisely, given the definition of the equivalence scale used: 1+0.5*(household members aged 14 or more - 1)+0.3*(household members aged 13 or less), if highly indebted households are found to have had systematically more children born or turning 14+ between 2010 and 2014, their equalized consumption would be systematically biased downwards in 2014, leading to an overestimation of our effect.

To explore the possibility of a systematic difference in the change of household composition between the different groups of indebtedness, we constructed the difference in equivalence scale between the waves for each household, which then enables us to compare the means of those changes in equivalence scale across the debt groups and to check whether they statistically differ. Finding a statistical difference would cast some doubts on our results.

Table 10 reports the means and the differences in means of the changes in equivalence scale for each indebtedness group. First, looking at the means, we observe that the group of households with no debt is the only one with a change in equivalence scale significantly different from zero, which could be worrying because it could be indicative of a systematic higher consumption in 2014 for that group, simply by construction of the equalized consumption. However, the bottom of Table 10 is

reassuring: we see that the differences in change in equivalence scale are never significant for any two groups. We can therefore rely on the use of equalized consumption without much worry about the effect of the equivalence scales on our results.

Table 10: Means and t-test of the difference in means of the change in equivalence scale

	(1) No debt	(2) Indebted	(3) DSTI<30%	(4) DSTI≥30%
Mean change in equivalence scales	-0.055***	-0.003	-0.006	0.022
	(0.019)	(0.028)	(0.030)	(0.078)
N	528	456	416	40
	(5) (1)-(2)	(6) (1)-(3)	(7) (1)-(4)	(8) (3)-(4)
Difference in means	-0.052	-0.050	-0.078	-0.028
	(0.033)	(0.035)	(0.079)	(0.083)

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; Above the dashed line, the four columns report the mean change in equivalence scale for each of the indebtedness groups; Below the dashed line, the four columns report the difference of those means computed using the t-test method; DSTI stands for the debt-service-to-income ratio.

Finally, in this study, we decided to focus on the case of Belgium. In Section 1, we exposed the reasons that led us to believe that Belgium is a good candidate for such an exercise. We further believe that focusing on a single country can allow us to avoid difficulties related to how data was collected or to the differences in institutions and rules in different countries.[64]

Nonetheless, since the Household Finance and Consumption Survey (HFCS) contains information on other European countries with a panel dimension for some of those countries, we will take advantage of this information, in this section, to test the robustness of our results to the inclusion of other countries. This should also support the external validity of our results. We will, therefore, perform regressions based on equations (1) and (2) on a sample that includes all households for which we have panel information in the HFCS.[65]

An important remark concerning the HFCS is that the reference periods are not fully harmonized.[66] Furthermore, in Italy and Spain, the only information collected for food consumption

[64] Concerning indebtedness, for instance, Lang et al. (2020) report the differences in the legal limits to macroprudential instruments such as the DTA ratio or the DSTI ratio for euro area countries. They show that there is a lot of heterogeneity between countries. The DSTI ratio, for instance, is not limited in some countries, such as Belgium, whereas other countries have limits on this ratio, varying from 10% to 80%.

[65] The countries with panel information in the HFCS are Belgium, Cyprus, Germany, Spain, Italy, Malta, and the Netherlands.

[66] In particular, the reference periods for the first and second waves are 2008/2009 and 2011 for Spain, 2010 and 2013 for Malta, 2009 and 2013 for the Netherlands, and 2010 and 2014 for all other countries with panel information.

was the aggregate amount spent on both food at home and meals eaten regularly outside the home. The aggregate amount was then attributed to the item "Amount spent on food at home", leaving the item "Amount spent on food outside home" as missing. To allow for the comparison across countries in the analysis, we therefore summed the two items (i.e., food at home and food outside the home), treating the missing values as null unless the value was missing for both items. We will therefore be analysing this constructed value of households' total food consumption.

There are also differences between countries in terms of households' indebtedness behaviour. The number of households holding debt varies greatly across countries, from around 25% in Italy in the first wave up to 65.7% in the Netherlands. The median values of debt are quite different as well: they are found to be less than 20,000€ for Germany, Italy, and Malta, whereas they amount to more than 100,000€ for the Netherlands. Moreover, whereas Belgium and Germany have low proportions of adjustable-rate mortgages, with less than 35% and around 10%, respectively, this share is larger in Italy, the Netherlands, and Spain, representing more than 55%, 70%, and 80% of mortgages, respectively (HFCN, 2016).

The sample selection for the analysis performed here is similar to the one described earlier.[67] However, some countries, such as Germany, had the particularity of taking into account households that had split between the first and second wave, thus including information on the different resulting households in their panel dimension. As those households only represented 1.29% of the households for which panel information was available for Germany, we decided, for the sake of simplicity, to remove them from the analysis. This results in a sample of 11,693 households, 4,980 of which were indebted in the first wave.

We performed both the linear analysis based on equation (1) and a non-linear analysis. Given the larger sample size, we introduced a categorical variable for the non-linear analysis, with categories based on the thresholds that seemed important in the previous analysis. The selected thresholds are: 10%, 20%, and 30%. This results in a categorical variable with 4 categories when we consider only indebted households and 5 categories when we add households without any debt in the first wave. The frequencies of each of the categories are presented in Table A.14 in the appendix. We can see that, although the majority of households have a DSTI ratio lower than 30%, more than 15% of the indebted households have a DSTI ratio higher than 30%.

The results of the linear analysis are presented in the first two columns of Table 11. It appears that, with the addition of the other panel countries and the inclusion of the indebtedness indicators as continuous variables, the coefficient found for the DSTI is no longer significant. Nonetheless, our

[67] Households with a DSTI ratio above 100% were excluded from the analysis.

previous analysis has shown that the effect of households' indebtedness on their consumption can occur in a non-linear way.

Table 11: Results of the analyses (linear and non-linear) including other countries

Dependent variable: Growth of the equalized consumption of food at home

	Linear analysis			Non-linear analysis		
	Full sample (1)	Conditional on debt (2)			Full sample (3)	Conditional on debt (4)
Cyprus	-0.129**	-0.133***		Cyprus	-0.126***	-0.123**
	(0.057)	(0.042)			(0.043)	(0.059)
Germany	0.005	0.028		Germany	0.017	-0.016
	(0.044)	(0.033)			(0.033)	(0.046)
Spain	0.081*	0.106***		Spain	0.109***	0.081*
	(0.044)	(0.033)			(0.033)	(0.044)
Italy	0.083*	0.084***		Italy	0.083***	0.071
	(0.045)	(0.031)			(0.031)	(0.046)
Malta	0.240***	0.264***		Malta	0.261***	0.225***
	(0.067)	(0.047)			(0.048)	(0.068)
Netherlands	0.172*	0.129*		Netherlands	0.118*	0.159*
	(0.092)	(0.070)			(0.069)	(0.093)
DTA in 2010	0.000	0.000		DTA in 2010	0.000	0.000
	(0.000)	(0.000)			(0.000)	(0.000)
DSTI in 2010	-0.001	-0.000	DSTI	0%	-0.061	
	(0.001)	(0.001)	categories		(0.043)	
			(OC: 0%-10%)	10%-20%	-0.074	-0.077
					(0.055)	(0.055)
				20%-30%	-0.105*	-0.098
					(0.060)	(0.060)
				30%+	-0.085*	-0.083*
					(0.050)	(0.049)
Δ Net wealth	-0.000	-0.000		Δ Net wealth	-0.000	-0.000
	(0.003)	(0.003)			(0.003)	(0.003)
Δ Income	0.074**	0.045**		Δ Income	0.047**	0.078**
	(0.029)	(0.019)			(0.019)	(0.030)
Constant	-0.178	-0.106		Constant	-0.054	-0.129
	(0.121)	(0.081)			(0.085)	(0.121)
N	4980	11693		N	11623	4910

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; The samples used include households with panel information for Belgium, Cyprus, Germany, Spain, Italy, Malta, and the Netherlands, and with a DSTI≤100%; All monetary variables are expressed in 2010 prices (2008 for Spain) ; The omitted category for the countries is Belgium; Columns (1) and (2) present the results of the linear analysis, and columns (3) and (4) those of the non-linear analysis; For the non-linear analysis, the omitted category for the DSTI variable is 0%-10%.

To test for the possibility of a non-linear effect, we also performed a regression with the DSTI indicator introduced as a categorical variable. The results of this non-linear analysis are presented in the last two columns of Table 11.

When considering the whole sample, it appears that households with a DSTI ratio greater than 20% have a growth of food consumption that is negatively and significantly lower than that of indebted households with a DSTI ratio lower than 10%. This negative effect remains significant for households with a DSTI ratio above 30% when we consider only indebted households. This confirms our previous results and the point made in Cecchetti et al. (2011) that, despite being a source of growth and stability at low levels, debt can become harmful at higher levels.

Overall, our main results are found to be robust to the inclusion of other countries in the analysis. Furthermore, the results presented in Table 11 support the external validity of our results and the importance of choosing 30% as a threshold for households' DSTI ratio.

6. Heterogeneity of the effect

Having found a negative effect of indebtedness on consumption, we will now verify whether this effect holds for specific types of households. To do so, we will use the categories of households defined in Section 3.2 for the four dimensions: income, work status, age, and level of education.

The four dimensions are not chosen at random: they all have ties with the level of indebtedness chosen by a household, they are of interest from a policy perspective, or they could allow to investigate some of the transmission channels of the effect. Indeed, in the life-cycle/permanent income (LC-PI) model, indebtedness is linked to income: households take on debt because they expect their income to grow in the future. It is also linked with age: the LC-PI model predicts that, in order to smooth their consumption, households will take on debt at an early stage in life and will repay it later on. Age is also interesting from a policy perspective, since the young generation's access to housing is an important issue raising concern in many countries. The work status dimension is of interest because it may be indicative of the sustainability of the debt. One can easily assume that the same level of debt will translate into a larger burden for the unemployed. Finally, the education dimension will help us to investigate the financial literacy channel developed by Lusardi and Tufano (2009), who argue that overindebtedness might be due to the households' lack of financial literacy. Taking the education level as a proxy for financial literacy, we should therefore find stronger effects for households with a lower level of education.

To deepen the analysis according to the households' characteristics, we will replicate the analysis performed in Section 4 while allowing for differences in the effect of indebtedness on

consumption for the different dimensions. To do so, we will interact each category in each dimension with the variable of interest, i.e., the categorical variable composed by $OVER_{2010}$ and $Indebted_{2010}$ in equation (2). This will allow us to check, for instance, whether the negative effect is more prevalent for poor households than for rich ones. Each of the four dimensions will be analysed separately. The regressions performed in this section will be based on an equation similar to equation (2) except that we will allow for different intercepts for the different categories of households. The adapted equation is formulated as:

$$\frac{C_{2014} - C_{2010}}{C_{2010}} = (\alpha + \theta\ Indebted_{2010} + \beta\ OVER_{2010})\, HHcat + \delta\ DTA_{2010} + \phi\ \Delta Z_{2014} + \gamma\, X_{2014} + \zeta \quad (3)$$

Where $HHcat$ is a categorical variable. For the analysis by income, for instance, $HHcat$ can take the three following values: *Poor, Middle, Rich*.

Table 12: Threshold analysis with interactions with the income tercile in 2010

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
	X=	20%	25%	30%	35%	40%	45%	50%
Poor	No debt	-0.093	-0.097	-0.134	-0.128	-0.122	-0.122	-0.122
		(0.097)	(0.092)	(0.092)	(0.090)	(0.090)	(0.090)	(0.090)
	DSTI<X	0.060	0.066	-0.013	-0.005	0.004	0.002	-0.005
		(0.118)	(0.107)	(0.097)	(0.098)	(0.097)	(0.096)	(0.096)
	DSTI≥X	-0.127	-0.211*	-0.264	-0.380***	-0.481***	-0.487***	-0.469***
		(0.136)	(0.124)	(0.162)	(0.136)	(0.119)	(0.125)	(0.132)
Middle	No debt	0.084	0.078	0.042	0.051	0.055	0.055	0.055
		(0.114)	(0.110)	(0.108)	(0.106)	(0.106)	(0.106)	(0.106)
	DSTI≥X	0.080	0.100	-0.205	-0.292	-0.097	-0.031	-0.017
		(0.127)	(0.174)	(0.132)	(0.516)	(2.625)	(3.478)	(3.781)
Rich	No debt	0.130	0.119	0.083	0.096	0.098	0.098	0.099
		(0.136)	(0.133)	(0.130)	(0.127)	(0.126)	(0.125)	(0.125)
	DSTI<X	0.004	-0.008	-0.041	-0.031	-0.028	-0.027	-0.026
		(0.097)	(0.088)	(0.084)	(0.081)	(0.080)	(0.080)	(0.080)
	DSTI≥X	0.004	-0.055	-0.255*	-0.193	-0.193	-0.263*	-0.262*
		(0.123)	(0.155)	(0.144)	(0.176)	(0.174)	(0.159)	(0.159)
	Constant	0.166	0.192	0.226	0.198	0.205	0.204	0.204
		(0.183)	(0.179)	(0.184)	(0.184)	(0.184)	(0.183)	(0.182)
	N	990						

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The columns show the results of the regressions when the threshold (X) goes from 20% -column (1)- to 50% -column (7); The omitted category for columns (1) to (7) is Middle with DSTI<X; All regressions presented here include the household's DTA ratio, monthly gross income and net wealth, as well as the level of education, marital status, work status, sex, and age of the reference person as control variables.

Table 12 presents the results of the threshold analysis for the income dimension. As before, columns (1) to (7) report the results when the threshold defining a household as overindebted goes from 20 to 50% by steps of 5%. The effect found is stronger for poor households and present from lower thresholds onward. There seems to be an effect for rich households as well. However, it is only significant at the 10% level. Furthermore, as there are only a few rich households with a DSTI ratio greater than 30%, the results for this category might depend on some outliers. We find that poor households with a DSTI ratio equal to or greater than 35% saw their growth of consumption of food at home 38 percentage points lower than the indebted households in the middle income tercile with a DSTI ratio lower than 35%. This is particularly large: it amounts to almost 130€ less per month per person.

Table 13: Threshold analysis with interactions with the work categories in 2010:

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
	X=	20%	25%	30%	35%	40%	45%	50%
Unemployed and others	No debt	-0.047	-0.054	-0.067	-0.062	-0.058	-0.058	-0.057
		(0.111)	(0.109)	(0.110)	(0.107)	(0.106)	(0.106)	(0.105)
	DSTI<X	-0.006	-0.006	-0.024	-0.017	-0.013	-0.013	-0.013
		(0.147)	(0.133)	(0.124)	(0.123)	(0.114)	(0.114)	(0.113)
	DSTI≥X	-0.230	-0.314*	-0.369*	-0.364*	-0.646**	-0.647**	-0.662**
		(0.161)	(0.168)	(0.210)	(0.212)	(0.278)	(0.279)	(0.281)
(Self-) Employed	No debt	0.104	0.099	0.088	0.093	0.095	0.096	0.096
		(0.091)	(0.090)	(0.089)	(0.088)	(0.088)	(0.088)	(0.088)
	DSTI≥X	0.009	-0.022	-0.176*	-0.279***	-0.241**	-0.253**	-0.230*
		(0.084)	(0.105)	(0.103)	(0.099)	(0.101)	(0.114)	(0.116)
Retired	No debt	0.040	0.037	0.027	0.030	0.031	0.032	0.033
		(0.121)	(0.119)	(0.119)	(0.117)	(0.117)	(0.116)	(0.116)
	DSTI<X	0.169	0.204	0.183	0.182	0.183	0.183	0.177
		(0.140)	(0.137)	(0.134)	(0.131)	(0.131)	(0.131)	(0.132)
	DSTI≥X	0.239	-0.102	-0.173	-0.345	-0.345	-0.344	-0.246
		(0.261)	(0.218)	(0.223)	(0.285)	(0.285)	(0.285)	(0.379)
	Constant	0.125	0.148	0.165	0.140	0.147	0.147	0.148
		(0.175)	(0.170)	(0.173)	(0.170)	(0.171)	(0.171)	(0.172)
	N	990						

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The columns show the results of the regressions when the threshold (X) goes from 20% -column (1)- to 50% -column (7); The omitted category for columns (1) to (7) is (Self-)Employed with DSTI<X; All regressions presented here include the household's DTA ratio, monthly gross income and net wealth, as well as the level of education, marital status, sex, and age of the reference person as control variables.

Looking at the effect for households with different work statuses presented in Table 13, we find a significant negative effect of high levels of indebtedness (from 30% on) for both (self-)employed

households and the unemployed and others. However, the effect is much larger for the latter category of households. Indeed, with the threshold set at 30%, the highly indebted in the 'unemployed and others' category have a consumption growth 36.9 percentage points lower than the reference category, i.e., indebted (self-)employed with a DSTI<30%. This difference is much lower for the highly indebted (self-)employed households, for whom it amounts to 17.6 percentage points.

Table 14: Threshold analysis with interactions with the age categories

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
	X=	20%	25%	30%	35%	40%	45%	50%
17-46	No debt	0.155	0.148	0.148	0.151	0.151	0.153	0.156
		(0.150)	(0.149)	(0.147)	(0.146)	(0.146)	(0.146)	(0.145)
	DSTI<X	0.060	0.066	0.088	0.088	0.084	0.085	0.087
		(0.074)	(0.068)	(0.066)	(0.063)	(0.062)	(0.061)	(0.062)
	DSTI≥X	0.101	0.085	-0.069	-0.184	-0.313*	-0.385*	-0.347
		(0.097)	(0.125)	(0.129)	(0.166)	(0.167)	(0.203)	(0.210)
47-60	No debt	0.110	0.106	0.108	0.112	0.112	0.113	0.115
		(0.092)	(0.089)	(0.088)	(0.088)	(0.088)	(0.088)	(0.088)
	DSTI≥X	-0.090	-0.160*	-0.225**	-0.253**	-0.261**	-0.257*	-0.233
		(0.079)	(0.089)	(0.101)	(0.120)	(0.126)	(0.132)	(0.161)
61+	No debt	-0.173*	-0.171*	-0.174*	-0.172*	-0.169*	-0.168*	-0.165*
		(0.099)	(0.097)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)
	DSTI<X	-0.058	-0.019	-0.025	-0.025	-0.024	-0.023	-0.019
		(0.156)	(0.152)	(0.147)	(0.145)	(0.144)	(0.144)	(0.144)
	DSTI≥X	-0.026	-0.305	-0.460**	-0.631**	-0.631**	-0.629**	-0.624**
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Constant	-0.015	-0.011	-0.007	-0.023	-0.017	-0.019	-0.022
		(0.132)	(0.130)	(0.128)	(0.131)	(0.130)	(0.130)	(0.130)
	N				990			

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The columns show the results of the regressions when the threshold (X) goes from 20% -column (1)- to 50% -column (7); The omitted category for columns (1) to (7) is 47-60 with DSTI<X; All regressions presented here include the household's DTA ratio, monthly gross income and net wealth, as well as the level of education, marital status, work status, and sex of the reference person as control variables.

The results in Table 14 suggest that the story is less clear-cut for age categories than for categories in the other dimensions. We find a negative effect for every age category once the threshold is 40% or higher. Furthermore, the effect appears to be significantly negative for mid-aged and old households, from 30% on, and to be larger for the oldest households. This could reflect the fact that those households are closer to the end of their active lives and might feel the need to deleverage while they still have a revenue. In this case, however, it is harder to claim that indebtedness affects the

different age categories differently.[68]

Table 15: Threshold analysis with interactions with the education categories

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
	X=	20%	25%	30%	35%	40%	45%	50%
Primary or no education	No debt	0.167	0.156	0.157	0.157	0.156	0.156	0.158
		(0.157)	(0.156)	(0.155)	(0.154)	(0.153)	(0.153)	(0.153)
	DSTI<X	-0.070	-0.082	-0.081	-0.081	-0.083	-0.084	-0.082
		(0.176)	(0.176)	(0.155)	(0.153)	(0.150)	(0.150)	(0.150)
	DSTI≥X	-0.129	-0.145	-0.405*	-0.520**	-0.581***	-0.581***	-0.579***
		(0.168)	(0.177)	(0.209)	(0.171)	(0.070)	(0.070)	(0.070)
Secondary	No debt	0.020	0.009	0.010	0.011	0.009	0.009	0.011
		(0.093)	(0.088)	(0.086)	(0.083)	(0.082)	(0.081)	(0.082)
	DSTI≥X	-0.020	-0.091	-0.132	-0.227	-0.429**	-0.438**	-0.423
		(0.100)	(0.112)	(0.122)	(0.182)	(0.192)	(0.193)	(0.359)
Tertiary	No debt	0.066	0.055	0.056	0.057	0.056	0.057	0.058
		(0.098)	(0.096)	(0.093)	(0.091)	(0.089)	(0.089)	(0.089)
	DSTI<X	0.117	0.107	0.127*	0.124*	0.120*	0.119*	0.119*
		(0.081)	(0.078)	(0.076)	(0.073)	(0.072)	(0.072)	(0.072)
	DSTI≥X	0.104	0.076	-0.144	-0.226**	-0.188**	-0.206**	-0.189*
		(0.118)	(0.138)	(0.143)	(0.100)	(0.095)	(0.101)	(0.103)
	Constant	0.075	0.089	0.081	0.069	0.062	0.062	0.062
		(0.161)	(0.160)	(0.161)	(0.162)	(0.163)	(0.163)	(0.163)
	N	990						

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The columns show the results of the regressions when the threshold (X) goes from 20% -column (1)- to 50% -column (7); The omitted category for columns (1) to (7) is Secondary with DSTI<X; All regressions presented here include the household's DTA ratio, monthly gross income and net wealth, as well as the marital status, work status, sex, and age of the reference person as control variables.

Finally, as regards the level of education, the results presented in Table 15 are mitigated, and we find a significant negative effect of high indebtedness for several combinations of education and threshold. However, the effect appears to be larger for households whose reference person has a lower level of education. Households with a DSTI ratio greater than 30% whose reference person has primary education or no education at all are found to have a consumption growth 40 percentage points lower than those with a DSTI lower than 30% whose reference person has secondary education. This result

[68] The same analysis was performed with different age categories. In particular, the first category presented here was divided in two groups: households with a reference person aged between 17 and 34 and those with a reference person aged between 35 and 49. This second analysis confirmed the results: no significant effect was found for the youngest households for any threshold, whereas a significant negative effect was found for the other groups. Furthermore, the effect found was larger for the older households. However, it appeared that there were no households with a DSTI ratio greater than 40% in the '17-34' category. We therefore preferred the analysis presented here, based on the categories that are close to the terciles, because there are more observations in each category.

is in line with the financial literacy explanation developed by Lusardi and Tufano (2009), as we see that households with a lower education level are more impacted by overindebtedness.

To sum up, when studying the impact of the debt burden on different types of households, we find that poor households, households whose reference person is unemployed, and those whose reference person has a lower education are the ones facing a lower consumption growth between 2010 and 2014. The age of the household does not appear to have a clear impact on the effect found, as opposed to the other dimensions. We further see that, although households' indebtedness behaviour seems to be more or less in lines with the LC-PI predictions, the debt neutrality assumption is not fulfilled in our analysis: we observe that too high a level of indebtedness leads households to reduce their consumption. This is more in line with models such as the one developed by Eggertsson and Krugman (2012). Furthermore, our results corroborate the financial literacy explanation for overindebtedness as we find a larger effect for households with lower education. Overall, overindebtedness appears to be particularly harmful for households that are already at risk.

7. Conclusion

This study examines the impact of households' indebtedness on their consumption. We further refine the question by analysing what aspects of indebtedness might cause households to reduce their consumption. We consider two main aspects of indebtedness: the overall sustainability of the debt, as measured by the debt-to-asset (DTA) ratio, and the day-to-day sustainability of the debt, as measured by the debt-service-to-income (DSTI) ratio. We argue that the former relates to the solvency of a household and could capture the effect of credit constraints, whereas the latter relates to the household's liquidity and could capture the debt distress effect. Whereas most previous studies find an effect for the first aspect, we observe that it is the second that is crucial in our case. We believe that the importance given to the DTA ratio was linked to the countries and periods under study. Most of the previous studies analysed countries that underwent a sharp decline in housing prices, leading to a shock in households' assets. In this study, we find that households' indebtedness has a negative impact on their consumption, even in the absence of a negative shock on their assets. It further appears that, in such a case, it is the day-to-day sustainability of the debt rather than its overall sustainability that becomes critical for the households, which pushes them to reduce their consumption of food at home.

Previous studies finding a negative relationship between indebtedness and consumption often claim, sometimes implicitly, that this is for some high enough level of indebtedness. However, to the best of our knowledge, none of them try to quantify this critical level of debt. In this study, we try to define such a level by performing a threshold analysis in which high indebtedness would impact

consumption in a non-linear way. To do so, we define a household as being overindebted when its DSTI ratio is above a certain threshold, and we then vary this threshold. This variation of the threshold allows us to investigate when debt servicing becomes binding for the households, ultimately leading them to cut down on essential expenses such as the consumption of food at home. We find that the households that used more than 30% of their income per month to repay their debt ended up having a growth of monthly equalized consumption of food at home substantially lower than that of non-indebted households. This effect is robust to several changes in the specification and to the inclusion of other European countries in our analysis, which further supports the external validity of our results.

When looking at the potential heterogeneity of the effect by category of households, we find that it is more prevalent for more fragile households. Poor households, households whose reference person is unemployed and households in which the reference person has a lower level of education are found to suffer larger impacts of indebtedness on their consumption and for lower levels of DSTI ratio. Furthermore, we find that the effect holds when we consider only mortgage debts. This seems to indicate that households might face a certain trade-off between housing and consumption of food, and that this trade-off might be more prevalent for more fragile households.

When confronting the results with the theoretical literature on the subject, we find that the life-cycle/permanent income (LP-CI) model is backed up by our data for indebtedness levels that are reasonable, but not for high levels. Our results therefore argue for some revision of the LC-PI or for models that explicitly include a debt limit such as the one put forward by Dynan (2012) and Eggertsson and Krugman (2012). Our findings also seem to point towards an effect linked to the liquidity of the households, which thus supports models, such as the one developed by Kaplan et al. (2014), that specifically take the liquidity of the assets held by the households into account. Both the households' limited ability to forecast income (Betti et al., 2007) and their financial literacy (Lusardi and Tufano, 2009) appear to be plausible explanations within our framework, although with some limitations.

Policy implications would include monitoring households' indebtedness more closely, even in the absence of negative shocks on their assets. Such monitoring is not present in most of the euro area countries as only a few countries impose limits on the DSTI ratio. Setting up a limit at 30% on the DSTI ratio may appear as the most natural implication, given our initial finding.[69] However, the results obtained for the different types of households put some nuance to this: as homeownership can be seen as a stepping stone out of poverty, limiting the poor's access to credit could further trap them in poverty. A solution could therefore be an enforced limit to the DSTI ratio, combined with a housing

[69] There is no such limit at the moment in Belgium. Although most banks have their own internal rules, they face no legal obligations regarding the DSTI ratio.

policy targeted at fragile households. Such a policy should aim to help poor households to become homeowners without having to reduce their food consumption.

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Appendix

Figure A.1: Employment rates and HH consumption expenditures for Belgium, Spain, and the EU. *Sources: Eurostat (2018a,b)*

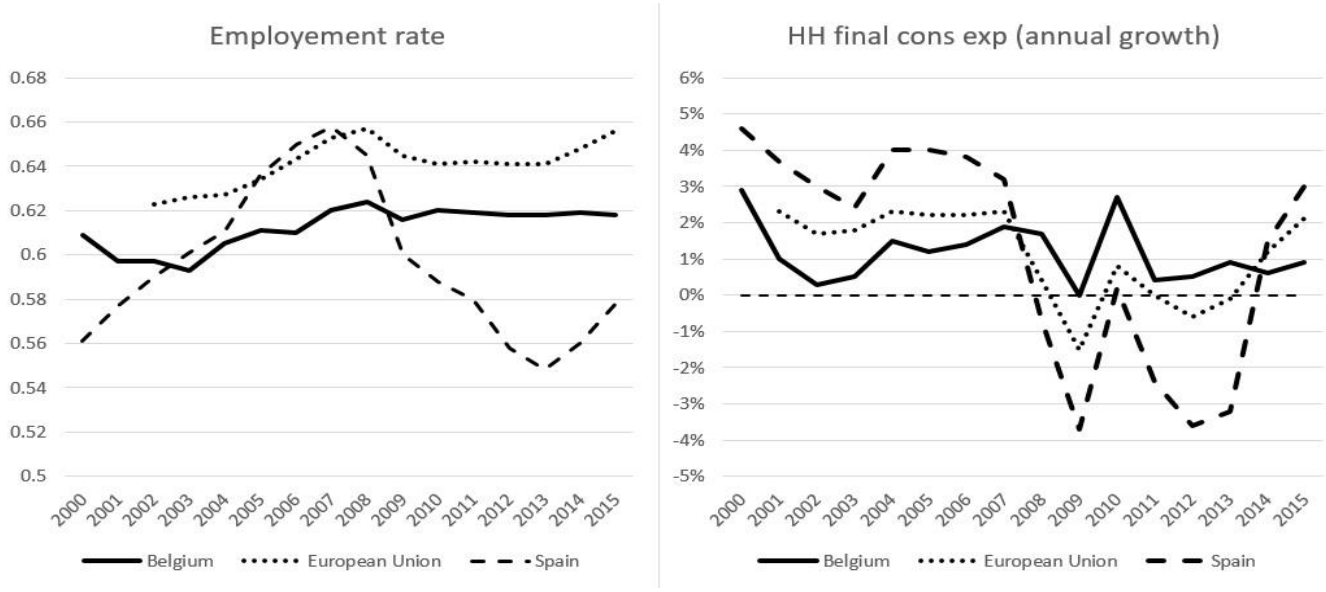


Figure A.2: Evolution and composition of debt in Belgium. *Source: Du Caju et al. (2014)*

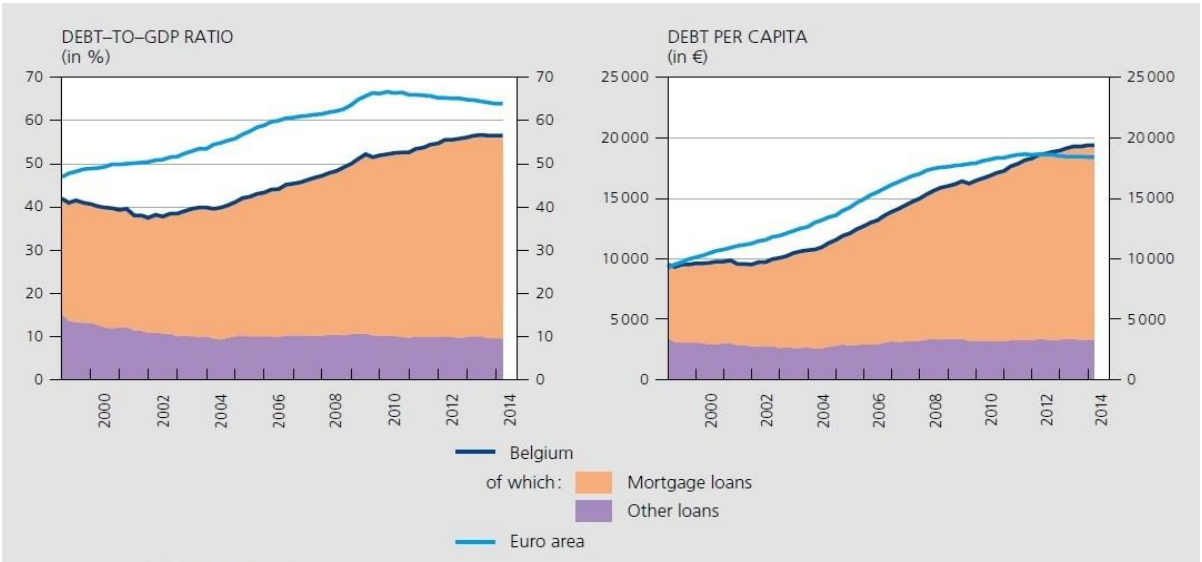


Figure A.3: House price index in Belgium, Spain, Denmark, and the EU. *Source: Eurostat (2018c)*

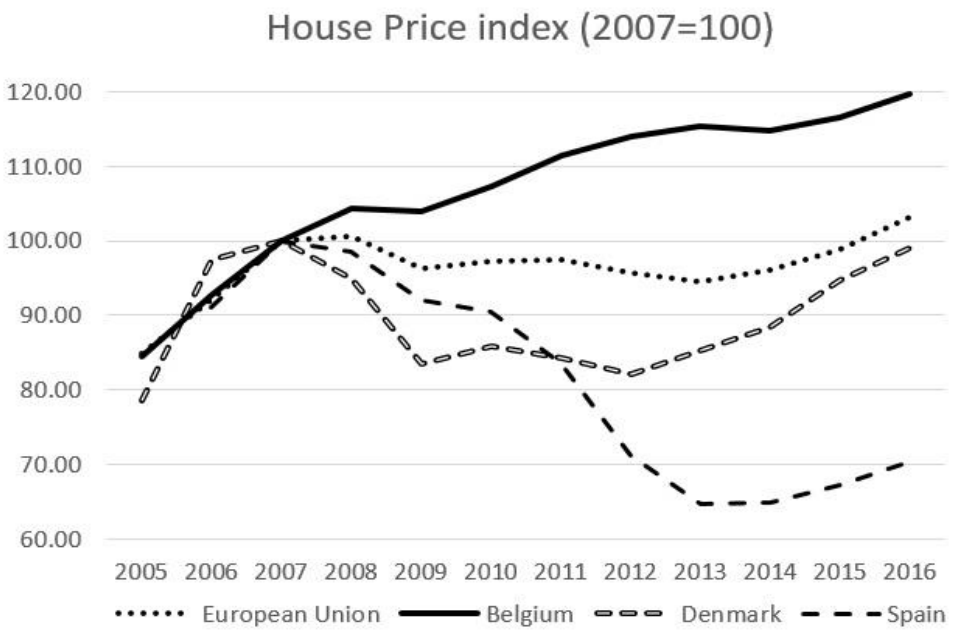
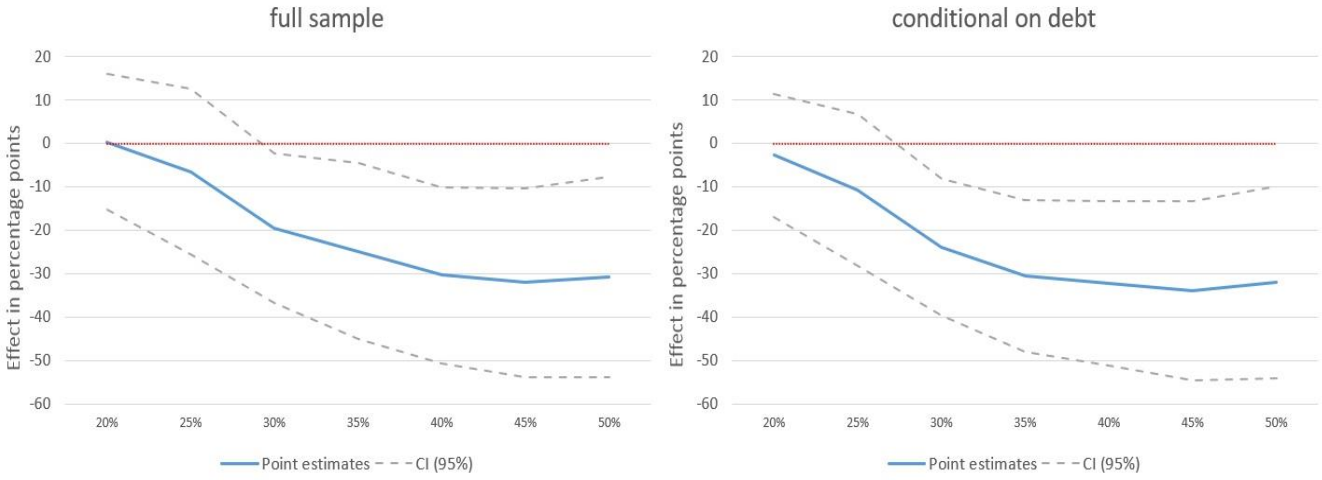


Figure A.4: Coefficients β for varying thresholds when total food consumption is used as the dependent variable



Note: The two graphs plot the coefficients (solid blue line) and confidence intervals at 95% (grey dashed line) obtained for the different thresholds when performing equation (2) on both the full sample and conditional on mortgage debt and when total food consumption (i.e., food at home and food outside the home) is used as a dependent variable; The confidence intervals were computed using a set of 1000 replicated weights constructed by bootstrap replication.

Table A.1: Rest of the summary statistics for the different groups of households

				Indebted in 2010			
		No debt in 2010		DSTI < 30%		DSTI ≥ 30%	
		2010	2014	2010	2014	2010	2014
Number of members in the household		2.029***	1.915***	2.863***	2.851***	2.782***	2.794***
		(0.067)	(0.094)	(0.083)	(0.086)	(0.282)	(0.289)
Age of the household head		61.20***	64.06***	45.16***	49.35***	45.61***	47.82***
		(0.859)	(1.042)	(0.739)	(0.756)	(2.221)	(2.801)
Female head		0.422***	0.422***	0.373***	0.400***	0.469	0.461
		(0.028)	(0.032)	(0.032)	(0.034)	(0.094)	(0.108)
Work status	Employee	0.246***	0.263***	0.752***	0.698***	0.638***	0.587***
		(0.024)	(0.028)	(0.029)	(0.029)	(0.101)	(0.104)
	Self-employed	0.030***	0.035***	0.060***	0.055***	0.087	0.090**
		(0.011)	(0.012)	(0.016)	(0.014)	(0.058)	(0.042)
	Unemployed	0.089***	0.045**	0.049***	0.049***	0.119*	0.160*
		(0.021)	(0.019)	(0.017)	(0.015)	(0.072)	(0.087)
	Retired	0.567***	0.602***	0.119***	0.157***	0.056	0.084**
		(0.028)	(0.029)	(0.020)	(0.022)	(0.035)	(0.041)
	Other	0.068***	0.054***	0.020*	0.041***	0.100	0.078
		(0.014)	(0.017)	(0.011)	(0.013)	(0.072)	(0.079)
Head's level of education	Primary or no education	0.097***	0.122***	0.042**	0.035***	0.014	0.081
		(0.016)	(0.020)	(0.017)	(0.011)	(0.021)	(0.080)
	Secondary	0.511***	0.511***	0.463***	0.478***	0.522***	0.439
		(0.029)	(0.032)	(0.034)	(0.037)	(0.098)	(0.105)
	Tertiary	0.392***	0.367***	0.495	0.487***	0.464***	0.480***
		(0.027)	(0.030)	(0.033)	(0.037)	(0.097)	(0.106)
Marital status	Single	0.148***	0.138***	0.184***	0.187***	0.137*	0.182*
		(0.020)	(0.025)	(0.026)	(0.029)	(0.077)	(0.096)
	Married	0.496***	0.459***	0.497***	0.535***	0.487	0.436***
		(0.028)	(0.029)	(0.032)	(0.033)	(0.097)	(0.103)
	Consensual union	0.003	0.013**	0.159***	0.083***	0.131*	0.118
		(0.003)	(0.007)	(0.024)	(0.019)	(0.078)	(0.085)
	Widowed	0.198***	0.244***	0.032***	0.057***	0.115	0.115
		(0.022)	(0.028)	(0.008)	(0.014)	(0.072)	(0.083)
	Divorced	0.155***	0.146***	0.129***	0.138***	0.130***	0.148**
		(0.019)	(0.025)	(0.023)	(0.023)	(0.046)	(0.066)
Home-ownership	Homeowner	0.285***	0.285***	0.179***	0.179***	0.092	0.092
		(0.028)	(0.032)	(0.026)	(0.028)	(0.057)	(0.081)
	Non-homeowner	0.715***	0.715***	0.821***	0.821***	0.908	0.908
		(0.028)	(0.032)	(0.026)	(0.028)	(0.057)	(0.081)
	N	528	528	416	416	40	40

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; The presence of variability and hence standard errors is due to the multiply imputed nature of the data; The table shows the means and frequencies of each sub-category for the different indebtedness groups.

Table A.2: Linear regressions for the full sample - Dependent variable: growth of the (equalized) consumption of food at home

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	Indebted in 2010	0.050	0.038	0.066	0.042	0.065	0.055	0.050	0.049	0.053	0.046	0.064	0.038	0.058	0.051	0.051	0.052	0.060	-0.016	0.057	0.053
		(0.060)	(0.061)	(0.063)	(0.060)	(0.064)	(0.068)	(0.060)	(0.069)	(0.063)	(0.062)	(0.073)	(0.071)	(0.075)	(0.073)	(0.073)	(0.074)	(0.071)	(0.062)	(0.073)	(0.074)
	DTA in 2010	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000		-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
	DSTI in 2010	-0.004**	-0.004**	-0.005**	-0.004**	-0.004**	-0.003*	-0.004**	-0.004**	-0.004**	-0.004**	-0.005**	-0.004**	-0.004**	-0.004**	-0.005**	-0.004**	-0.004**		-0.005***	-0.005**
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		(0.002)	(0.002)
	Δ Net wealth		0.012							0.011	0.011		0.013	0.013	0.011	0.012	0.012	0.013	0.013	0.011	0.012
			(0.010)							(0.010)	(0.009)		(0.010)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)
	Δ Income			0.048						0.044	0.041	0.042		0.040	0.037	0.043	0.037	0.041	0.026	0.040	0.038
				(0.034)						(0.031)	(0.030)	(0.033)		(0.032)	(0.032)	(0.030)	(0.031)	(0.031)	(0.030)	(0.031)	(0.031)
Head's level of education (OC: Primary or no education)	Secondary				-0.078						-0.081	-0.077	-0.094		-0.093	-0.073	-0.082	-0.068	-0.079	-0.082	-0.087
					(0.100)						(0.102)	(0.098)	(0.100)		(0.101)	(0.099)	(0.100)	(0.102)	(0.103)	(0.101)	(0.101)
	Tertiary				0.053						0.049	0.069	0.050		0.040	0.074	0.054	0.072	0.063	0.065	0.058
					(0.103)						(0.103)	(0.103)	(0.104)		(0.105)	(0.102)	(0.102)	(0.106)	(0.106)	(0.104)	(0.104)
Head's marital status (OC: Single)	Married					0.008						0.028	0.036	0.027		0.033	0.061	0.018	0.042	0.039	0.039
						(0.083)						(0.086)	(0.084)	(0.081)		(0.084)	(0.084)	(0.080)	(0.084)	(0.085)	(0.085)
	Consensual union					0.051						0.058	0.081	0.068		0.077	0.097	0.071	0.066	0.079	0.081
						(0.127)						(0.127)	(0.125)	(0.121)		(0.122)	(0.127)	(0.122)	(0.125)	(0.124)	(0.125)
	Widowed					0.097						0.183	0.196	0.156		0.188	0.173	0.153	0.192	0.191	0.195
						(0.118)						(0.130)	(0.129)	(0.124)		(0.129)	(0.127)	(0.126)	(0.130)	(0.130)	(0.130)
	Divorced					0.042						0.115	0.131	0.139		0.114	0.143	0.117	0.144	0.135	0.143
						(0.107)						(0.113)	(0.110)	(0.109)		(0.107)	(0.110)	(0.104)	(0.110)	(0.111)	(0.111)
Head's working status (OC: Employee)	Self-employed						-0.044					-0.072	-0.074	-0.030	-0.071		-0.056	-0.069	-0.075	-0.068	-0.069
							(0.094)					(0.092)	(0.093)	(0.094)	(0.094)		(0.093)	(0.094)	(0.094)	(0.093)	(0.093)
	Unemployed						-0.127					-0.092	-0.106	-0.150	-0.063		-0.091	-0.100	-0.109	-0.091	-0.097
							(0.099)					(0.104)	(0.095)	(0.097)	(0.103)		(0.100)	(0.095)	(0.096)	(0.099)	(0.098)
	Retired						0.018					0.074	0.064	0.046	0.060		0.066	-0.004	0.058	0.063	0.063
							(0.064)					(0.087)	(0.086)	(0.087)	(0.084)		(0.086)	(0.066)	(0.087)	(0.087)	(0.086)
	Other						-0.072					-0.037	-0.069	-0.086	-0.030		-0.064	-0.072	-0.078	-0.057	-0.061
							(0.105)					(0.111)	(0.111)	(0.113)	(0.112)		(0.114)	(0.117)	(0.120)	(0.116)	(0.115)
	Female head							-0.013				-0.069	-0.069	-0.052	-0.038	-0.070		-0.068	-0.069	-0.072	-0.073
								(0.056)				(0.058)	(0.057)	(0.058)	(0.055)	(0.057)		(0.058)	(0.057)	(0.058)	(0.058)
	Head age								-0.000			-0.004	-0.004	-0.003	-0.001	-0.001	-0.003		-0.003	-0.003	-0.003
									(0.002)			(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)		(0.003)	(0.003)	(0.003)
	Constant	0.049	0.053	0.046	0.070	0.015	0.050	0.054	0.052	0.050	0.073	0.224	0.229	0.146	0.161	0.104	0.147	0.037	0.169	0.206	0.203
		(0.038)	(0.038)	(0.039)	(0.095)	(0.081)	(0.060)	(0.040)	(0.158)	(0.039)	(0.097)	(0.204)	(0.196)	(0.183)	(0.200)	(0.174)	(0.205)	(0.123)	(0.202)	(0.201)	(0.199)
	N	997	997	992	995	997	997	997	997	992	990	990	995	992	990	990	990	990	990	990	990

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed with a 1000 replicated weights constructed by bootstrap replication; The dependent variable is the growth of the equalized consumption of food at home defined as: (x2-x1)/x1; The log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The head is the reference person in the household; OC stands for Omitted Category; All monetary variables are expressed in 2010 prices; For the controls, the delta was taken for the income and the net wealth, the other variables are taken in 2014.

Table A.3: Linear regressions for the indebted only - Dependent variable: growth of the (equalized) consumption of food at home

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	DTA in 2010	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000		-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
	DSTI in 2010	-0.004**	-0.004*	-0.005***	-0.004*	-0.004**	-0.003*	-0.004**	-0.004**	-0.005***	-0.005**	-0.005**	-0.003*	-0.005**	-0.004**	-0.005**	-0.005**	-0.004**		-0.005***	-0.005**
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		(0.002)	(0.002)
	Δ Net wealth		0.013							0.012	0.012		0.014	0.012	0.012	0.013	0.012	0.013	0.014	0.011	0.012
			(0.012)							(0.011)	(0.011)		(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)
	Δ Income			0.101**						0.094***	0.087***	0.100**		0.091**	0.092***	0.086**	0.089**	0.091**	0.065*	0.094**	0.090**
				(0.043)						(0.035)	(0.033)	(0.044)		(0.037)	(0.036)	(0.035)	(0.037)	(0.037)	(0.036)	(0.038)	(0.037)
Head's level of education (OC: Primary or no education)	Secondary				0.193						0.195*	0.190	0.175		0.194	0.218*	0.192	0.203	0.218	0.210	0.194
					(0.119)						(0.115)	(0.142)	(0.146)		(0.125)	(0.130)	(0.140)	(0.139)	(0.150)	(0.142)	(0.143)
	Tertiary				0.273**						0.260**	0.256*	0.255*		0.251*	0.292**	0.255*	0.270*	0.285*	0.279*	0.262*
					(0.120)						(0.113)	(0.143)	(0.147)		(0.130)	(0.130)	(0.139)	(0.142)	(0.151)	(0.145)	(0.144)
Head's marital status (OC: Single)	Married					-0.024						-0.033	-0.002	-0.011		-0.013	-0.009	-0.021	-0.009	-0.017	-0.016
						(0.110)						(0.107)	(0.104)	(0.101)		(0.104)	(0.103)	(0.102)	(0.103)	(0.104)	(0.104)
	Consensual union					0.005						0.001	0.045	0.027		0.042	0.038	0.031	0.023	0.029	0.033
						(0.150)						(0.147)	(0.144)	(0.142)		(0.139)	(0.144)	(0.143)	(0.142)	(0.143)	(0.144)
	Widowed					0.258						0.305	0.333	0.317		0.313	0.316	0.311	0.322	0.309	0.324
						(0.213)						(0.235)	(0.242)	(0.234)		(0.234)	(0.238)	(0.229)	(0.241)	(0.241)	(0.240)
	Divorced					-0.139						-0.074	-0.050	-0.042		-0.061	-0.041	-0.052	-0.043	-0.057	-0.044
						(0.120)						(0.118)	(0.113)	(0.111)		(0.113)	(0.116)	(0.110)	(0.114)	(0.115)	(0.115)
Head's working status (OC: Employee)	Self-employed						-0.014					-0.029	-0.031	0.001	-0.030		-0.025	-0.029	-0.037	-0.027	-0.028
							(0.117)					(0.114)	(0.116)	(0.118)	(0.117)		(0.115)	(0.114)	(0.115)	(0.114)	(0.114)
	Unemployed						-0.183**					-0.125	-0.151	-0.201**	-0.130		-0.146	-0.142	-0.160	-0.127	-0.141
							(0.089)					(0.109)	(0.108)	(0.101)	(0.102)		(0.105)	(0.104)	(0.107)	(0.108)	(0.107)
	Retired						0.065					0.085	0.086	0.075	0.086		0.073	0.052	0.072	0.070	0.073
							(0.082)					(0.105)	(0.104)	(0.103)	(0.101)		(0.103)	(0.087)	(0.105)	(0.104)	(0.103)
	Other						-0.046					0.144	-0.032	0.058	0.070		0.077	0.071	0.022	0.092	0.080
							(0.170)					(0.165)	(0.175)	(0.182)	(0.171)		(0.175)	(0.174)	(0.182)	(0.173)	(0.174)
	Female head							0.039				-0.019	-0.019	-0.003	0.021	-0.028		-0.023	-0.018	-0.023	-0.023
								(0.072)				(0.071)	(0.070)	(0.069)	(0.072)	(0.070)		(0.071)	(0.070)	(0.071)	(0.071)
	Head age								-0.000			-0.002	-0.002	-0.002	0.000	0.001	-0.001		-0.000	-0.001	-0.001
									(0.003)			(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)		(0.004)	(0.004)	(0.004)
	Constant	0.099**	0.090*	0.126**	-0.128	0.114	0.094*	0.083*	0.116	0.116**	-0.108	0.007	-0.043	0.195	-0.135	-0.172	-0.071	-0.116	-0.206	-0.058	-0.060
		(0.047)	(0.047)	(0.050)	(0.117)	(0.105)	(0.053)	(0.047)	(0.176)	(0.049)	(0.114)	(0.262)	(0.248)	(0.192)	(0.220)	(0.213)	(0.251)	(0.158)	(0.243)	(0.249)	(0.246)
	N	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469	469

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed with a 1000 replicated weights constructed by bootstrap replication; The dependent variable is the growth of the equalized consumption of food at home defined as: (x2-x1)/x1; The log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The head is the reference person in the household; OC stands for Omitted Category; All monetary variables are expressed in 2010 prices; For the controls, the delta was taken for the income and the net wealth, the other variables are taken in 2014.

Table A.4: Results of the linear analysis performed on total food consumption (at home and outside)

	Full sample			Conditional on debt		
Dependent variable:	Growth of equalized total food consumption					
	(1)	(2)	(3)	(4)	(5)	(6)
Indebted in 2010	0.015	0.089**	0.084**			
	(0.034)	(0.035)	(0.034)			
DTA in 2010	-0.000		-0.000	-0.000		-0.000
	(0.000)		(0.000)	(0.000)		(0.000)
DSTI in 2010		-0.005***	-0.005***		-0.005***	-0.005***
		(0.002)	(0.001)		(0.002)	(0.001)
Δ Net wealth	0.015	0.014	0.015	0.014	0.011	0.012
	(0.015)	(0.014)	(0.015)	(0.012)	(0.011)	(0.012)
Δ Income	0.056*	0.070**	0.068**	0.073***	0.101***	0.097***
	(0.031)	(0.032)	(0.031)	(0.026)	(0.026)	(0.026)
Constant	0.062	0.100	0.097	-0.180	-0.030	-0.031
	(0.170)	(0.172)	(0.170)	(0.219)	(0.216)	(0.227)
N	990	990	990	469	469	469

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed with a 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; The log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; The first three columns are based on equation (1), whereas the last three columns are based on equation (2); All regressions presented here include the level of education, marital status, work status, sex, and age of the reference person as control variables.

Table A.5: Results of the regressions when the first condition is relaxed

Dependent variable:	Growth of equalized food consumption at home		Delta of equalized food consumption at home		
	Full sample	Conditional on debt		Full sample	Conditional on debt
	(1)	(2)		(3)	(4)
DTA growth	-0.000	0.003	Δ DTA	0.011	0.040
	(0.000)	(0.006)		(0.063)	(2.047)
DSTI growth	-0.000	-0.004	Δ DSTI	78.265	67.839
	(0.001)	(0.004)		(62.887)	(93.009)
Δ Net wealth	0.011	0.026*	Δ Net wealth	5.450	9.418
	(0.010)	(0.015)		(5.034)	(8.214)
Δ Income	0.015	0.011	Δ Income	6.174	8.309
	(0.035)	(0.054)		(5.998)	(22.746)
Constant	0.171	-0.357	Constant	-35.304***	-28.205***
	(0.184)	(0.331)		(5.781)	(10.116)
N	984	334		984	334

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed with a 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; The log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); DTA stands for the debt-to-asset ratio and DSTI for the debt-service-to-income ratio; In columns (1) and (2), the growth of food consumed at home was regressed on the growth of the indebtedness indicators, the change in monthly gross income and net wealth, as well as the level of education, marital status, work status, sex, and age of the reference person as control variables; Columns (3) and (4) report the results of regressions with individual fixed-effects dealt with by first differencing; Households with a DSTI >1.5 in 2010 or in 2014 were excluded from this analysis, thus resulting in a different sample size than that of the other analyses.

Table A.6: Frequencies of the indebted groups (OVER vs not) for the different thresholds

OVER if DSTI >=	OVER	Others
20%	0.298***	0.702***
	(0.030)	(0.030)
25%	0.176***	0.824***
	(0.026)	(0.026)
30%	0.094***	0.906***
	(0.020)	(0.020)
35%	0.052***	0.948***
	(0.014)	(0.014)
40%	0.040***	0.960***
	(0.011)	(0.011)
45%	0.037***	0.963***
	(0.011)	(0.011)
50%	0.035***	0.965***
	(0.011)	(0.011)
N	469	

Note: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; The presence of variability and hence standard errors is due to the multiply imputed nature of the data.

Table A.7: Threshold analysis for the full sample

Dependent variable:	Growth of the (equalized) consumption of food at home						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Threshold:	20%	25%	30%	35%	40%	45%	50%
DTA in 2010	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Indebted in 2010	-0.014	-0.005	0.004	0.001	-0.000	-0.000	-0.002
(DSTI<threshold)	(0.067)	(0.065)	(0.064)	(0.063)	(0.063)	(0.063)	(0.063)
DSTI ≥ threshold	-0.021	-0.068	-0.205**	-0.306***	-0.371***	-0.389***	-0.374***
in 2010	(0.079)	(0.094)	(0.093)	(0.102)	(0.093)	(0.099)	(0.104)
Δ Net wealth	0.013	0.013	0.012	0.012	0.012	0.012	0.012
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Δ Income	0.026	0.029	0.033	0.036	0.036	0.035	0.034
	(0.031)	(0.031)	(0.030)	(0.031)	(0.030)	(0.030)	(0.030)
Constant	0.170	0.178	0.176	0.156	0.160	0.160	0.162
	(0.199)	(0.200)	(0.201)	(0.201)	(0.201)	(0.201)	(0.201)
N	990	990	990	990	990	990	990

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; The omitted category for the indebtedness variable is "no debt in 2010"; To avoid outliers' effects, the log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); All regressions presented here include the level of education, marital status, work status, sex, and age of the reference person as control variables.

Table A.8: Threshold analysis, conditional on debt

Dependent variable:	Growth of the (equalized) consumption of food at home						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Threshold:	20%	25%	30%	35%	40%	45%	50%
DTA in 2010	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DSTI ≥ threshold	-0.019	-0.068	-0.215**	-0.345***	-0.367***	-0.384***	-0.360***
in 2010	(0.077)	(0.089)	(0.091)	(0.087)	(0.089)	(0.098)	(0.103)
Δ Net wealth	0.013	0.013	0.012	0.012	0.012	0.012	0.012
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Δ Income	0.068*	0.072*	0.080**	0.089**	0.086**	0.085**	0.084**
	(0.038)	(0.038)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Constant	-0.191	-0.174	-0.157	-0.195	-0.184	-0.182	-0.183
	(0.244)	(0.238)	(0.243)	(0.241)	(0.243)	(0.243)	(0.243)
N	469	469	469	469	469	469	469

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; To avoid outliers' effects, the log of the income was taken as well as the inverse hyperbolic sine of the net wealth. This last transformation allows us to keep negative values and is similar to the log (except for very small values); All regressions presented here include the level of education, marital status, work status, sex, and age of the reference person as control variables.

Table A.9: First and second stages of the robustness checks

		Linear analysis		Non-linear analysis		
				1st stage		
		1st stage	2nd stage	OLS	Probit	2nd stage
	Number of collateralised loans	0.066***		0.099***	0.574***	
		(0.013)		(0.036)	(0.195)	
	Instrumented DSTI in 2010		-0.803			-0.570
			(0.619)			(0.476)
	Δ Net wealth	-0.000	0.011	-0.003	-0.019	0.009
		(0.002)	(0.010)	(0.004)	(0.033)	(0.010)
	Δ Income	0.059***	0.104**	0.076***	0.666**	0.100**
		(0.015)	(0.049)	(0.025)	(0.291)	(0.047)
Head's level of education (OC: Primary or no education)	Secondary	-0.040	0.181	-0.095	-0.502	0.158
		(0.061)	(0.131)	(0.182)	(0.698)	(0.156)
	Tertiary	-0.065	0.256*	-0.132	-0.712	0.234
		(0.059)	(0.138)	(0.183)	(0.709)	(0.163)
Head's marital status (OC: Single)	Married	-0.018	-0.025	-0.036	-0.179	-0.028
		(0.019)	(0.100)	(0.055)	(0.437)	(0.099)
	Consensual union	0.010	0.020	-0.034	-0.084	0.001
		(0.031)	(0.139)	(0.092)	(0.645)	(0.149)
	Widowed	0.019	0.311	0.058	0.426	0.328
		(0.034)	(0.231)	(0.112)	(0.860)	(0.233)
	Divorced	0.007	-0.055	-0.031	-0.031	-0.073
		(0.032)	(0.108)	(0.080)	(0.576)	(0.111)
Head's working status (OC: Employee)	Self-employed	0.024	-0.007	0.064	0.425	0.009
		(0.029)	(0.115)	(0.070)	(0.445)	(0.123)
	Unemployed	0.031	-0.113	0.141	0.602	-0.057
		(0.034)	(0.098)	(0.138)	(0.643)	(0.135)
	Retired	0.024	0.079	-0.001	-0.127	0.059
		(0.026)	(0.099)	(0.054)	(0.515)	(0.105)
	Other	0.155**	0.100	0.200	1.079	0.093
		(0.074)	(0.157)	(0.140)	(0.771)	(0.162)
	Female head	0.001	-0.038	0.012	0.094	-0.028
		(0.015)	(0.068)	(0.032)	(0.253)	(0.068)
	Head age	-0.001	-0.002	0.001	0.003	-0.001
		(0.001)	(0.004)	(0.002)	(0.017)	(0.004)
	Constant	0.212***	0.061	0.072	-1.657	-0.069
		(0.077)	(0.332)	(0.230)	(1.274)	(0.280)
	N	469	469	469	469	469

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; The head is the reference person in the household; OC stands for Omitted Category; The dependent variable in the 1st stage is the DSTI variable (in level for the linear analysis and as a binary variable for the non-linear analysis); The dependent variable for the in the 2nd stage is the growth of the equalized consumption of food at home.

Table A.10: Purpose of the loans using collaterals: proportions

	Loans using as collateral:			
	Main residence		Other property	
Purpose of the loan	First loan	Second loan	First loan	Second loan
To purchase the main residence	0.901***	0.267***	0.365***	0.196
	(0.0179)	(0.0498)	(0.0934)	(0.176)
To purchase another real estate asset	0.0157***	0.118***	0.547***	0.804
	(0.00533)	(0.0407)	(0.102)	(0.248)
To refurbish or renovate the residence	0.0776***	0.468***	0.0492	
	(0.0165)	(0.0816)	(0.0737)	
To buy a vehicle or other means of transport		0.113*		
		(0.0653)		
To finance a business or professional activity			0.0389*	
			(0.0207)	
To cover living expenses or other purchases	0.00383			
	(0.00295)			
Other	0.00224	0.0341*		
	(0.00153)	(0.0182)		
N	318	54	32	5

Notes: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; The presence of non-integers, variability, and hence standard errors is due to the multiply imputed nature of the data.

Table A.11: Correlation between the instrument and the dependent variable

	m=0	m=1	m=2	m=3	m=4	m=5
Correlation	-0.0404	-0.0439	-0.0439	-0.0410	-0.0389	-0.0428
	(0.2264)	(0.1678)	(0.1672)	(0.1975)	(0.2218)	(0.1783)
N	897	990				

Note: p-values are in parentheses; The table shows the correlation between the number of collateralised loans held by a household in 2010 and that household's growth of food consumption at home between 2010 and 2014.

Table A.12: Threshold analysis for mortgage debt only - Full sample

Dependent variable:	Growth of the (equalized) consumption of food at home						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Threshold:	20%	25%	30%	35%	40%	45%	50%
DTA in 2010	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Indebted in 2010	-0.009	-0.008	-0.001	-0.007	-0.007	-0.008	-0.010
(DSTI < threshold)	(0.075)	(0.071)	(0.070)	(0.068)	(0.068)	(0.068)	(0.068)
DSTI ≥ threshold	-0.046	-0.075	-0.202*	-0.263**	-0.278**	-0.292**	-0.262*
in 2010	(0.082)	(0.099)	(0.112)	(0.102)	(0.108)	(0.121)	(0.132)
Δ Net wealth	0.004	0.004	0.004	0.004	0.004	0.004	0.004
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Δ Income	0.019	0.020	0.023	0.023	0.023	0.023	0.023
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Constant	0.106	0.110	0.112	0.092	0.091	0.092	0.092
	(0.198)	(0.198)	(0.199)	(0.200)	(0.200)	(0.200)	(0.200)
N	948	948	948	948	948	948	948

Notes:* p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; The omitted category for the indebtedness variable is "no mortgage debt in 2010"; All regressions presented here include the level of education, marital status, work status, sex, and age of the reference person as control variables.

Table A.13: Threshold analysis for mortgage debt only - Conditional on mortgage debt

Dependent variable:	Growth of the (equalized) consumption of food at home						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Threshold:	20%	25%	30%	35%	40%	45%	50%
DTA in 2010	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DSTI ≥ threshold	-0.019	-0.068	-0.215**	-0.345***	-0.367***	-0.384***	-0.360***
in 2010	(0.077)	(0.089)	(0.091)	(0.087)	(0.089)	(0.098)	(0.103)
Δ Net wealth	0.013	0.013	0.012	0.012	0.012	0.012	0.012
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Δ Income	0.068*	0.072*	0.080**	0.089**	0.086**	0.085**	0.084**
	(0.038)	(0.038)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Constant	-0.191	-0.174	-0.157	-0.195	-0.184	-0.182	-0.183
	(0.244)	(0.238)	(0.243)	(0.241)	(0.243)	(0.243)	(0.243)
N	469	469	469	469	469	469	469

Notes: p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; All monetary variables are expressed in 2010 prices; Only households with mortgage debt in 2010 were considered in this table; All regressions presented here include the level of education, marital status, sex, and age of the reference person as control variables.

Table A.14: Frequencies of the categories of DSTI for the panel countries

Categories of DSTI	Full sample	Conditional on debt
No Debt	0.517***	
	(0.008)	
0%-10%	0.212***	0.437***
	(0.008)	(0.013)
10%-20%	0.132***	0.275***
	(0.006)	(0.011)
20%-30%	0.068***	0.142***
	(0.005)	(0.009)
30%+	0.070***	0.146***
	(0.005)	(0.009)
N	11623	4910

Note: * p<0.10, ** p<0.05, *** p<0.01; Standard errors are reported in parentheses and were computed using a set of 1000 replicated weights constructed by bootstrap replication; The presence of variability and hence standard errors is due to the multiply imputed nature of the data; The samples used include households for which panel information was available in the HFCS and with a DSTI≤100%.

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