Debt repayment problems: what are the implications for consumption?

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Debt repayment problems: what are the implications for consumption?

Merike Kukk*

Abstract

The paper investigates the impact of debt repayment problems on consumption using quarterly panel data from 2004–2011 from Estonia, a euro area country. The results imply that arrears on debt lead to substantial short-term changes in consumption. Quarterly consumption is on average 30 per cent lower in the quarter when an individual faces debt repayment problems. The longer the problems last, the more severe the decline in consumption is. Although consumption recovers after the debt repayment problems are resolved, the increase is smaller than the original decline and consumption remains at a lower level than before the arrears emerged. The results suggest that the experience of debt repayment problems has severe consequences for consumption in the short term as well as in the longer term.

JEL Codes: E21, D14, E32, G21

Keywords: consumption volatility, indebtedness, debt repayment problems, duration of arrears

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The views expressed are those of the author and do not necessarily represent the official views of Eesti Pank, the Eurosystem or the IWH.

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Non-technical summary

Household debt has grown in most developed countries since the 1980s due to the deregulation of the banking sector. The debt-to-income ratio of household sector reached 140 per cent of disposable income in the UK by the mid-2000s while the euro area average debt-to-income ratio increased from 75 per cent in 2000 to 99 per cent in 2010. The rapid accumulation of household debt has induced the need to study the implications of indebtedness on the real economy as there are several channels through which household debt affects the real economy. Studies of the effect of household debt on consumption and the real economy started only after the 2008–2009 recession. This paper contributes to the literature by investigating the impact of debt repayment problems on consumption. Debt repayment problems not only affect financial stability but may also spill into the real economy if households adjust their consumption to cope with financial difficulties.

To examine the implications of debt repayment problems for consumption, several questions are answered. First, what is the spill-over of debt repayment problems into the consumption of individuals during the period of debt repayment problems? Second, how long does it take for consumption to recover from debt repayment problems after the problems have disappeared? And third, is the consumption adjustment different for temporary debt repayment problems and for long-lasting problems?

The paper uses a unique set of quarterly panel data from 2004–2011 to detect the quarterly consumption changes which are associated with arrears on debt. The estimations are run using a fixed effects model controlling for other determinants of consumption and controlling for time-invariant individual effects, aggregate shocks and seasonal fluctuations. The results are robust to different sets of control variables in the model.

The estimations show that debt repayment problems induce substantial consumption fluctuations. The problems are associated with a decline in quarterly consumption of 20 per cent on average. The results are similar in different socio-economic groups. When a possible positive effect from high spending to debt arrears is excluded, the repayment problems are associated with a decline of 30 per cent in consumption in the quarter when the problems are faced. The magnitude of the consumption decline depends on the duration of the debt repayment problems. A more substantial decline in quarterly consumption of 40–45 per cent is found when the problems last for several quarters.

Consumption increases only after individuals have overcome their debt repayment problems, and the main recovery occurs in the first quarter after the problems have been resolved. An important finding is that the recovery

after the arrears is smaller than the decline associated with the arrears and that the recovery of consumption is lower the longer the debt repayment problems last. Six quarters after the debt repayment problems with a duration of one or two quarters have been resolved, consumption is still approximately five per cent lower than it would have been without the experience of arrears. Consumption remains approximately 10–15 per cent lower for individuals who experienced arrears on debt for three or four quarters, while those who faced arrears for at least five consecutive quarters show 25–30 per cent lower consumption in the longer term.

Comparison of the consumption patterns of the five income groups shows that the initial decline in consumption is stronger for individuals in low income groups, while the recovery is similar across all income groups. It is only in the highest income quintile where consumption recovers fully after arrears which last one or two quarters. The upshot is that the consumption changes and the recovery after debt repayment problems do not spin down to the lowest income groups as has been hypothesised in the literature from the USA. An explanation is that individuals in higher income groups are more indebted than individuals in low income groups in Estonia, which is similar to the case in other European countries but different from the situation in the USA, where low income groups are the most indebted. This is an important finding for suggesting policy measures to alleviate the negative effect of debt repayment problems.

The result that consumption does not recover fully from the initial decline associated with debt repayment problems in the other four income groups implies that the repayment problems lead to both short-term and long-term negative effects on consumption. Even when the share of individuals in arrears in the total population is relatively small, the effect on aggregate consumption can be noticeable. If two percent of households fall into arrears and the average quarterly decline in consumption for them is 0.35 per cent, aggregate consumption would decrease by 0.7 per cent. The findings suggest that the mechanism that works through debt repayment problems on consumption is an important one for explaining movements in household consumption.

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1. Introduction

The main motivation for investigating debt repayment problems and defaults has typically been the consequences of such problems for financial stability. A rise in household defaults would lead to losses for financial institutions, and this could result in a financial crisis. There is a wide-ranging literature investigating financial vulnerability and the determinants of household default; see the recent studies by Gerardi et al. (2013) and Ghent and Kudlyak (2011). Another strand of literature investigates the consequences of household defaults for the banking sector; see among others Espinoza and Prasad (2010) and Friori et al. (2007). Klein (2013) and Nkusu (2011) emphasise that the feedback from debt defaults to the real economy is usually identified through the credit supply channel, but the feedback may also work through non-credit supply channels. This paper focuses on channel other than the credit supply channel by looking at how debt repayment problems affect consumption.

Although the spread of debt has increased among households in recent decades, there has only been limited research on the implications of debt repayment problems for consumption behaviour, and studies of the effect of household debt on consumption and the real economy started only after the 2008–2009 recession. Mian and Sufi (2009) suggest that household debt had an important role in the economic boom and subsequent bust in the 2000s. Mian and Sufi (2010) underline the importance of channels other than the banking sector in explaining the implications of household debt. The studies by Dynan (2012), Andersen et al. (2014) and Kukk (2015) show that household indebtedness does indeed hold back consumption. Dynan (2012) and Andersen et al. (2014) focus on the wealth channel as they investigate the relationship between the debt-to-asset ratio and consumption growth. Kukk (2015) focuses on the debt distress channel and finds a negative relationship between the debt service ratio and a change in consumption. However, these studies focus on overall household indebtedness while leaving the linkage between debt repayment problems and consumption aside.

There is another channel through which household debt may affect consumption and which has not previously been investigated. Debt repayment problems not only affect financial stability but may also spill into the real economy if households adjust their consumption to cope with financial difficulties. There are a few studies which suggest a linkage between arrears on debt and consumption but no study which explores the linkages comprehensively. May and Tudela (2005) mention that households in the British Household Panel Survey (BHPS) that report difficulties in making housing payments state that they have cut back on consumption. Duygan-Bump and Grant (2009) explore the relationship between arrears on debt and homeown-

ership, employment, self-employment and health. They use European Community Household Panel (ECHP) yearly data from 1994 to 2001 and estimate the relationship between lagged arrears and a set of variables. They find that arrears are negatively associated with future employment and homeownership and positively associated with bad health.

The study by Mian et al. (2011) is the only one to investigate the causal effect of foreclosures on economic outcomes in the US in the 2008-2009 recession. Using zip-code level data they show that foreclosures impacted house prices, residential investment and car sales negatively. While debt repayment problems are more common than foreclosures, which happen when there are severe repayment problems, there is no research exploring the effect of arrears on consumption using micro level data. This paper aims to fill this gap by using a unique set of quarterly individual level panel data that makes it possible to trace consumption and debt repayment problems over seven years.

The ability to study the real effects of arrears has been constrained by the availability of suitable databases. Studies of debt default have mainly used data from loan registers, which provide detailed data on the loan contract but only limited information on the borrower (Demyanyk and van Hemert (2011), Bajari et al. (2013)). Mocetti and Viviano (2014) point out that studies which use survey data are subject to several limitations. First, individuals are sensitive about revealing information on arrears and this leads to measurement error, and second, the spread of arrears on debt in the population is relatively small, so the result is a small sample and inefficient estimations. Consequently, the ability to investigate the implications of arrears of debt for consumption behaviour has been very limited.

This paper uses an anonymised dataset which contains quarterly information on the balance sheet and the inflows and outflows from the sight accounts of each individual. Proxies for income and spending can be derived from the flows, allowing investigation of the implications of arrears for spending behaviour. The paper takes a closer look at the quarterly consumption dynamics of those who fall into arrears on their debt. The dataset makes it possible to investigate not only short-term consumption changes but also the longer-term effect after the problems have been solved. It covers around 12% of the working age population in Estonia and is large enough to allow the incidents of debt repayment problems to be investigated in detail. Additionally, the panel dimension of the dataset makes it possible to compare the consumption dynamics after arrears of different duration.

The contribution of the paper is fourfold. First, to our knowledge it is the first paper to provide evidence on how debt repayment problems affect consumption. As the different channels through which debt repayment problems

affect the economy are little explored, the paper contributes in important ways to the literature on the linkages between financial markets and the real economy.

Second, as the database allows quarterly changes in spending behaviour to be tracked, it provides insights into the short-term spending changes induced by debt repayment problems. The use of proprietary data to investigate consumption has become more widespread recently; see among others Gelman et al. (2014), Agarwal and Qian (2014) and Baker (2014). However, none of these papers investigate the interaction between debt repayment problems and consumption.

Third, the paper provides additional insight into the consumption response to debt repayment problems, which has not been explored in previous studies. As it is possible to distinguish between arrears of different length, the results add to the knowledge about the implications of shorter and longer lasting debt repayment problems.

Fourth, as the results of the paper are not expected to be driven by country-specific factors, the lessons should be generally applicable. The accumulation of debt in Estonia, a euro area country from 2011, was among the fastest in Europe in the 2000s, but the presence of arrears is comparable to that in other European countries. According to the EU-SILC the share of the population which report arrears on a mortgage or rent is roughly at the EU average level, as the share in Estonia was 2.7 per cent in 2010 while the EU average was 4.0 per cent.[1] Statistics from the EU-SILC suggest that the evolution of arrears in Estonia has been quite similar to the developments in other European countries, implying that arrears have not been driven by features related to fast rates of debt growth. Therefore the lessons on the implications of debt repayment problems are not expected to be country-specific but to be widely applicable.

The paper proceeds as follows: Section 2 presents the dataset and compares it with other data sources. Section 3 introduces the hypothesis to be tested and the empirical model. Section 4 delivers the estimation results and provides the robustness tests. Finally, Section 5 summarises the findings.

2. The dataset and the properties

The paper uses anonymised quarterly panel data from a financial institution in Estonia. The dataset contains financial information about individuals

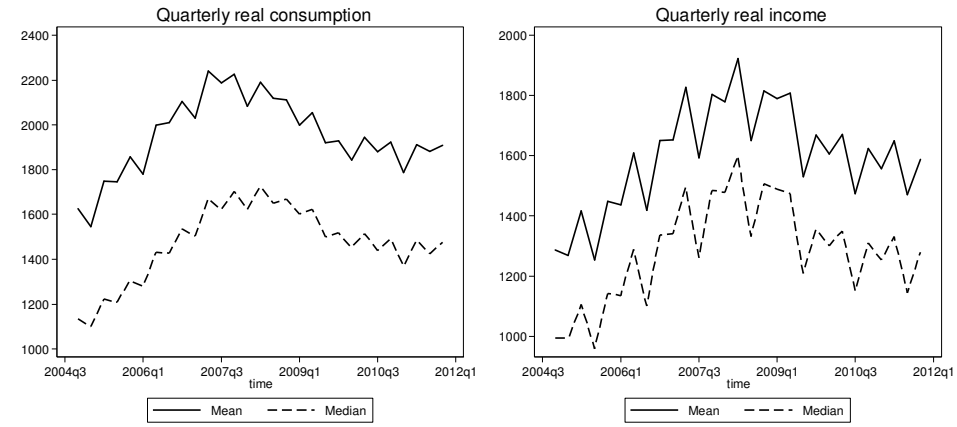
[1] The statistics are available in Eurostat http://ec.europa.eu/eurostat/data/database (ilc_mdes).

from the end of 2004 up to the end of 2011 and panel information about regular clients of the financial institution, covering 12% of the working age population in Estonia. The wide coverage of the database minimises the problem of using information from one financial institution rather than the total market. A detailed description of the dataset is provided by Kukk (2015).

The feature of key relevance for this study is that the dataset contains not only financial information but also quarterly outflows from and quarterly inflows to the sight accounts. The outflows exclude payments to savings or other accounts held by an individual and payments to the financial institution, which mainly consist of debt servicing payments. The outflows from the sight accounts consist of payments, transactions and cash withdrawals, so they can be taken as a proxy for consumption. It is not possible to distinguish between durable and non-durable consumption, and so total consumption is the subject of investigation. As the outflows also contain real estate purchases, which should not be considered as consumption, information about new or additional housing loans makes it possible to control these outflows in the empirical model.

Moreover, the database includes data about the quarterly inflows from legal entities (companies or other institutions) to the sight accounts of the individual. In Estonia the coverage of the financial sector is very high as over 90 per cent of individuals have a bank account and income is mainly paid to the sight account (Demirguc-Kunt and Klapper (2012)). Therefore payments from legal entities, which contain payments of salaries, social benefits, dividends and self-employment income, are taken as a proxy for the total income of an individual.

The nominal variables of consumption and income are deflated by the HICP consumer price index and the real variables are expressed in 2005 prices. The quarterly dynamics of the mean and median values of the two variables are provided in Figure 1. The dynamics of consumption and income follow the development of the aggregate variables, showing an increase in 2004-2008 and a decline in 2009. In the model the variables are expressed in logarithms; the main statistics are given in Table A.1 in Appendix A.



Notes: The variables are expressed in EUR in 2005 prices

Figure 1: The dynamics of quarterly consumption and income from 2004:Q4 to 2011:Q4

This study is able to use a unique piece of information about debt repayment problems. The debt servicing payments, which contain principal payments and interest rate payments, are deducted automatically from the sight account by the financial institution. If an individual does not have sufficient funds on their sight account to cover their regular debt repayments, the problem is flagged until the full payment is covered. The dataset contains a flag or dummy denoting debt repayment problems at the end of each quarter. The dummy is one if there are any arrears at the end of the quarter and is zero otherwise. No information is available on debt repayment problems which occur within a quarter and are solved by the end of the quarter, so some short-term problems are not included. This is not considered to be a concern since very short-term arrears are mainly a consequence of cash management problems rather than actual repayment problems. Short-term or temporary arrears which appear at the end of the quarter are still tracked in the dataset.

Figure 2 provides information on the dynamics of arrears on debt. Both the number of individuals in arrears (left-hand graph) and the share of arrears (right-hand graph) were at a lower level in 2005–2007 than in 2009–2011, showing a sharp increase in 2008. The share of individuals with any arrears on debt at the end of quarter rose from 0.9 per cent to 2.6 per cent among individuals with debt.

Figure 2: The dynamics of quarterly arrears from 2004:Q4 to 2011:Q4 in the dataset

As there is no information about the prevalence of arrears on debt from public statistics, the dataset has to be compared with the data from the annual EU Survey on Income and Living Conditions (EU-SILC), which gives some information on households' arrears. Figure A.1 in Appendix A compares the prevalence of arrears on mortgages and rents reported in the EU-SILC and the quarterly prevalence of arrears on any type of debt in the dataset. The prevalence of arrears on debt in the dataset is around half of the prevalence of arrears found from the survey data, which can be explained by the different features of the arrears in the two datasets.[2] The dynamics of the prevalence of arrears in both datasets are quite similar, with the lowest values in 2006 and the highest values in 2010, while the prevalence of arrears increased within that time by a factor of 2.5. The dynamics are also consistent with the statistics on non-performing loans from Eesti Pank, the national central bank.

The left-hand graph in Figure 2 shows a widening gap between the number of arrears in each quarter and new arrears, which are defined as arrears that appear at the end of the quarter where no arrears were detected at the end

[2] The differences between the dataset and the EU-SILC emerge from several sources. First, the EU-SILC provides data for a household, while individual level data are available in the dataset, and the prevalence of arrears among individuals is lower than it is among households. Second, in the EU-SILC households report arrears which occurred in the last 12 months, while in the dataset the current status of debt is recorded, suggesting that the prevalence of arrears is higher in the EU-SILC than in the dataset. Finally, it is not possible to distinguish between arrears on mortgages and those on other types of loans in the dataset, while the EU-SILC reports arrears on mortgages or rent, meaning the content of the arrears is different and is not comparable one-to-one.

of the previous quarter. The graph suggests that the duration of debt repayment problems has increased since 2008.

The dynamics of debt repayment problems by gender and age are given in Figure 3. The prevalence of arrears is slightly higher among males and young age groups but the increase in debt repayment problems is similar across a range of socio-demographic groups.

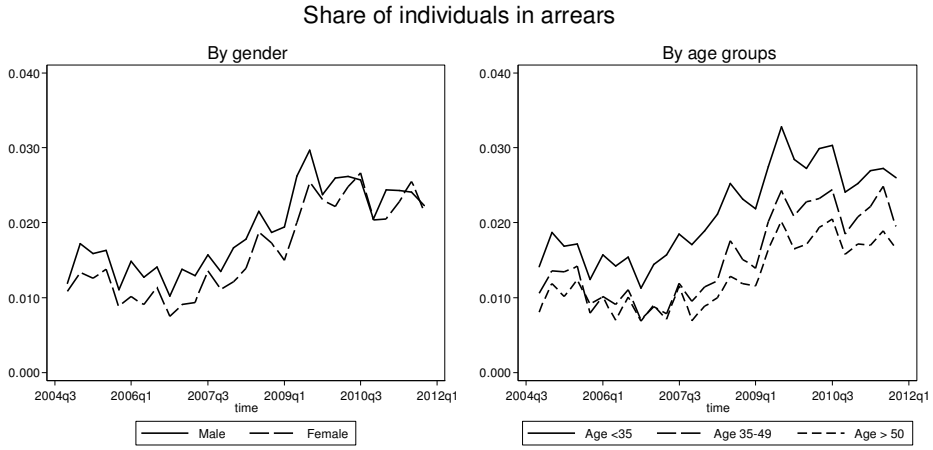


Figure 3: The share of individuals with arrears on debt by gender (left graph) and age group (right graph) from 2005:Q3 to 2011:Q4, conditional on debt ownership

The panel structure of the database makes it possible to identify the duration of debt repayment problems. The number of consecutive quarters in which an individual is in arrears can be counted to estimate the duration of arrears. It has to be noted that when an individual faces arrears on a debt for several consecutive quarters, it is not possible to identify whether it is the same incidence of arrears over the quarters or whether these are different incidences. It is assumed that arrears on debt for several quarters in a row indicate that there is a continuous debt repayment problem. In the dataset individuals experienced arrears for an average of 2.5 quarters. Around 76 per cent of the arrears lasted only one quarter, about 13 per cent of the arrears lasted for two quarters, and about five per cent of all arrears had a duration of more than three quarters.

Figure 4 shows the distribution of the duration of debt repayment problems at two different times, the end of 2006 and the end of 2009. The total duration of debt repayment problems which occur in these particular quarters is calculated by counting all the consecutive quarters with debt repayment

problems before 2006:Q4 and after 2009:Q4. Figure 4 confirms that the share of long-term debt repayment problems was higher during the recession in 2009 than it was during the boom in 2006.

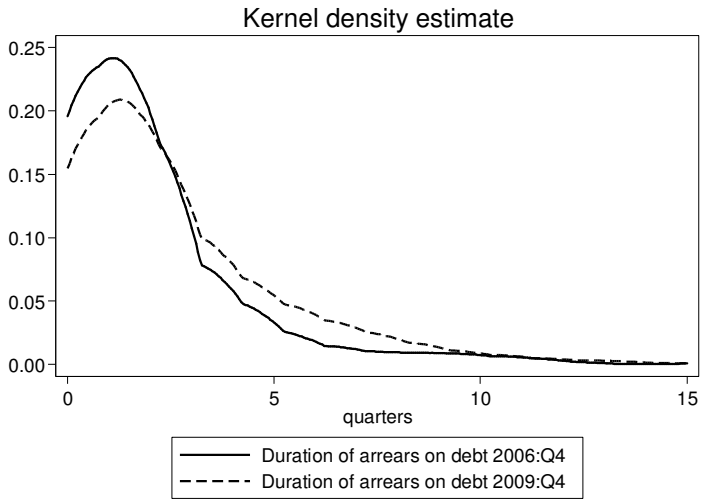


Figure 4: The distribution of the duration of arrears on debt in 2006:Q4 and 2009:Q4

The dataset contains information about debt servicing payments, liabilities and financial assets at the end of each quarter, and these can be used as control variables. The study by Kukk (2015) shows that these variables along with debt repayment problems affect consumption growth. The full list of the variables used in the estimations and their notation are given in Table A.1 in Appendix A.

The pooled dataset contains 2,597,000 observations across 29 quarters from 2004:Q4 to 2011:Q4; the number of individuals in the dataset is 108,000. The dataset contains only individuals who were over the age of 20 in 2004:Q4 and below the age of 70 in 2011:Q4, and it contains only those individuals for whom the financial institution is identified as the main bank for the whole period of 2004–2011, as this restriction is needed to identify individuals all or most of whose financial transactions are included in the dataset.[3]

[3] The dataset contains individuals who are considered to be *regular bank clients*, which means they have income transferred to their sight account regularly. The definition of a regular bank client has been provided by the financial institution.

Some additional omission of outliers has been applied. First, all individuals who could be identified as farmers, self-employed, entrepreneurs or family doctors were excluded as it is not possible to distinguish for them between accounts used for personal and business purposes. Second, individuals with extraordinary values for financial variables are excluded. More specifically, individuals for whom any of the quarterly inflows or outflows of the sight account fall in the upper 99^{th} or 100^{th} percentile, individuals with a debt-to-income ratio or debt service ratio in the 99^{th} or 100^{th} percentile, and individuals with transactions of securities (funds, bonds and shares) in the 1^{st}, 2^{nd}, 99^{th} or 100^{th} percentile have been excluded. Observations with other abnormalities such as negative values for any variable were likewise excluded.

3. The empirical model

The standard consumption model assumes that households smooth their consumption so that consumption depends on their lifetime wealth, which again implies that consumption is a random walk process. However, most empirical studies suggest that consumption is affected by current income and preference shifters; see the overviews by Jappelli and Pistaferri (2010) or Attanasio and Weber (2010). Furthermore, Dynan and Edelberg (2013) argue that household indebtedness enters the consumption model beyond the standard wealth effect and the mechanism works through different channels, such as a rise in the borrowing constraints or an impediment to refinancing, a higher probability of future credit constraints or a need to deleverage because of an uncomfortably high level of leverage. Dynan (2012) introduces the debt-to-asset ratio into the consumption model when investigating the effect of liabilities on consumption during the 2007–2008 recession in the USA and she finds that households cut back their consumption because of their indebtedness. Andersen et al. (2014) use Danish register data to investigate the hypothesis that highly leveraged households lowered their consumption during the recession to normalise their spending patterns. They use the debt-to-income ratio to measure the indebtedness in their model. Kukk (2015) incorporates a lagged debt-to-income ratio and a lagged debt-service ratio into the model in order to investigate the different mechanisms which are at work. She finds that the debt distress effect captured by the debt service ratio is explicitly strong during the recession. The overview of the studies suggests that indebtedness affects consumption through different channels and in order to investigate the channels the debt-related variables should be incorporated into a consumption model.

To examine the implications of debt repayment problems for consumption, several questions should be answered. First, what is the spill-over of debt re-

payment problems into the consumption of individuals during the period of debt repayment problems? Second, how long does it take for consumption to recover from debt repayment problems after the problems have disappeared? And third, is the consumption adjustment different for temporary debt repayment problems and for long-lasting problems?

In the light of this discussion, a consumption model will be used in which log consumption is a dependant variable, and lagged log consumption, log income, the debt-to-income (DTI), the debt service ratio (DSR) and a dummy for arrears on debt (DA) are explanatory variables.

The previous studies on indebtedness have focused on biannual or yearly consumption while the current paper investigates quarterly consumption over 29 quarters. A dynamic model can therefore be used that includes several lags to capture a possibly delayed quarterly response of consumption to a set of explanatory variables. Four lags are included for all the explanatory variables to avoid the lags of arrears on debt picking up any effect from the lags of the other explanatory variables.

$$\begin{aligned}\log c_{it} = u_i + \sum_{k=1}^{4} \rho_k \log c_{it-k} + \sum_{k=0}^{4} \beta_k \log y_{it-k} + \sum_{k=0}^{4} \gamma_k DA_{it-k} + \\ + \sum_{k=0}^{4} \phi_k DTI_{it-k} + \sum_{k=0}^{4} \psi_k DSR_{it-k} + \sum_{k=0}^{4} Z'_{it-k}\alpha_k + \tau_t + \upsilon_s + \varepsilon_{it}\end{aligned} \tag{1}$$

The index i denotes an individual person, t indexes time, and k stands for the number of lagged quarters. As $\log c_{it-k}$ is the log of real consumption the coefficient ρ_k gives the AR(k) parameter. The variable $\log y_{it-k}$ stands for the log real income of individual i in quarter $t - k$ and the coefficient β_0 depicts the response of consumption to income within the quarter. The estimated parameters β_1, …, β_4 depict the consumption response to the lagged income, as consumption may respond sluggishly to income. The inclusion of income in the model addresses additionally the issue that the dummy for arrears on debt is correlated with income as the main sources for arrears on debt are income shocks.

The variable DA_{it-k} denotes a dummy of arrears on debt and the coefficient γ_0 shows the relationship between the debt repayment problem and consumption in the same quarter. The coefficient γ_1 gives the relationship between consumption and a debt repayment problem which occurred in the previous quarter, while γ_2 gives the association between current consumption and a debt repayment problem that occurred two quarters earlier. The inclusion of four lags provides the effect of arrears which occurred in the last four quarters.

The variable DTI_{it-k} denotes the debt-to-income ratio and the variable DSR_{it-k} stands for the debt service ratio in the period $t - k$. These variables are included to avoid the dummy for the debt repayment problem picking up other mechanisms beyond debt repayment problems as detected by Dynan (2012), Andersen et al. (2014) and Kukk (2015). The vector Z_{it-k} contains other control variables which may affect consumption. As the consumption variable is a proxy for outflows from sight accounts, additional controls have been added to the model such as dummies for new or additional mortgages, which are used for home purchase and are recorded in the outflows from the sight accounts. Additionally, the financial asset-to-yearly income ratio is included, as consumption depends on both human and non-human wealth.

The individual fixed effects u_i are included to control for time-invariant unobserved individual characteristics that may affect consumption while correlating with the dummy for arrears. The time fixed effects τ_t are included to control for the time-varying heterogeneity that may stem from omitted common variables or global shocks. Seasonal dummies υ_s are also added to capture possible seasonal fluctuation of consumption. Finally, ε_{it} is an error term.

The estimations are interpreted as the consumption response to debt repayment problems. It is hypothesised that the incidence of arrears makes individuals limit their consumption so they can still meet their obligations, implying a negative relationship between contemporaneous consumption and debt repayment problems. As the model controls for income changes, the estimated coefficient γ_k does not pick up the effect of negative income shocks, which is one of the main causes of arrears on debt; see McCarthy (2014) or Mocetty and Viviano (2014).

A possible causal effect from consumption to arrears must also be considered. High spending which cannot be financed by income and accumulated assets would lead to problems with compulsory expenditures, including debt repayments, implying a positive relationship between contemporaneous consumption and arrears on debt. As the lagged consumption is included in eq. (1), the model controls for extraordinary consumption in the previous periods, but it does not capture extraordinary high consumption in the same quarter. This type of reverse causality would affect the estimated coefficient of the dummy for debt repayment problems in the same quarter, $\gamma_{0,}$ but would not affect the estimated coefficients of the lagged dummy for debt repayment problems. Although no studies have detected consumption as a driver for arrears on debt, such reverse causality cannot be neglected and it will be addressed in the robustness tests.

Given the source of the database, consumption may decline not only because of an individual's consumption decisions but equally because of bank

procedures. Debt repayment problems appear when the financial institution cannot debit the required sum from the sight account of the individual, which occurs when the balance of the account is zero or the limit of the overdraft is met. The obligation to pay remains until the payment has been completed, implying that the financial institution debits the sight account as soon as any funds are transferred to the account. Hence the decline in consumption identified from outflows from the sight account may occur because the individual cannot make any payments from the sight account until the debt repayment problem is solved, which would indicate liquidity problems and the estimations may not reveal the active choices of individuals, but rather the outcome of liquidity problems. To provide an understanding of the active adjustment and liquidity problems, different sub-samples are investigated for which different mechanisms are expected to prevail.

4. Estimation results

4.1. Baseline estimations

The estimated coefficients γ_k in eq. (1) are given in column (1) in Table 1, while the estimated coefficients for the other explanatory variables in eq. (1) are given in Table B.1 in Appendix B. First, the lagged dependent variable is estimated to be 0.14, suggesting that consumption exhibits very low quarterly persistence. Although Nickell (1981) finds that the fixed effects estimations are biased when a dynamic model is used, Monte Carlo simulations show that the bias of the estimated AR coefficient is marginal and the bias of the estimated coefficients for other explanatory variables is almost non-existent when the autoregressive coefficient is below 0.2 (Judson and Owen 1999). Therefore the use of the fixed effects model is not considered to be a concern.

The estimated coefficient for current income, 0.34, is consistent with the estimations by Kukk et al. (2015). They use the Estonian Household Budget Survey to investigate the consumption response to income shocks of different persistence and find that total consumption reacts to income shocks by 0.3–0.4 depending on the persistence of the income shock.

Table 1: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of debt repayment problems

Arrears on debt	**(1) Baseline**	**(2) Males**	**(3) Females**	**(4) Indebted**
Quarter t	–0.208***	–0.197***	–0.215***	–0.206***
	(0.005)	(0.008)	(0.006)	(0.006)
Quarter $t-1$	–0.131***	–0.123***	–0.136***	–0.129***
	(0.005)	(0.008)	(0.007)	(0.007)
Quarter $t-2$	–0.041***	–0.045***	–0.038***	–0.032***
	(0.004)	(0.007)	(0.006)	(0.006)
Quarter $t-3$	–0.024***	–0.022***	–0.025***	–0.020***
	(0.004)	(0.007)	(0.006)	(0.006)
Quarter $t-4$	–0.030***	–0.020***	–0.039***	–0.029***
	(0.005)	(0.007)	(0.006)	(0.006)
R^2	0.244	0.251	0.246	0.307
No. of groups	106 381	41 397	64 984	44 856
No. of obs.	1 973 996	740 312	1 233 684	826 326

Notes: FE estimation of eq. (1). The subsample of indebted contains individuals who are debt owners in at least one quarter in the sample period. All explanatory variables and time dummies are included in the estimations but are not reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

The focus of the current paper is on the estimated coefficients for arrears on debt, which are given in Table 1. The estimated coefficient of 0.208 implies that consumption is on average 21 per cent lower in the quarter when an individual faces a debt repayment problem.[4] Consumption recovers to some extent in the next quarter, and the estimated coefficient 0.131 indicates that the recovery is slight but consumption is still substantially lower in the quarter following the debt repayment problem. Consumption has recovered further two quarters after the arrears arise, as it is on average only 4 per cent lower. There does not seem to be any additional recovery in consumption in

[4] The approximation of log consumption to the percentage change in consumption holds only when the change in consumption is small. Otherwise the exact formula is needed to calculate the effect of different explanatory variables on consumption. The precise effect of the debt repayment problem on consumption is $e^{\gamma_k} - 1$, implying that the estimated coefficient of 0.208 indicates a drop in consumption of 23 per cent. However, the rough approximate percentage changes in consumption are discussed, rather than the exact estimations, to make tracing the estimated coefficients in the text and tables straightforward.

the following quarters, and it is 2–3 per cent lower in the following five quarters.

To find the sensitivity of the results to the set of variables in the model, estimations were run using only one explanatory variable with lags, the dummies for debt repayment problems, and starting to include other explanatory variables into the model one by one. The estimations are provided in Table B.2 in Appendix B. The estimated coefficients for debt repayment problems are somewhat lower when the dummies are the only explanatory variable in the model, apparently picking up the correlation with income. When the income variable is included in the model, the estimated coefficients are very stable over the different sets of explanatory variables. The exercise suggests that the results in Table 1 do not pick up any effect other than the relationship between debt repayment problems and consumption.

The results given in Section 3 provide the consumption response to arrears on debt at the individual level as the dataset contains information on individuals. However, the standard approach is to analyse the consumption behaviour of households. If debt is held by one household member, say the household head, while expenses are divided between all the adult household members, the estimations might be different for males and females. Therefore additional robustness tests are carried out for sub-samples of males and females.

Figure 3 in Section 2 shows that the share of individuals with debt repayment problems is slightly higher among males than among females but the dynamics over the sample period are very similar. Columns (2) and (3) in Table 1 give the results of eq. (1) for males and females separately. The estimation results are comparable, indicating that consumption declines by 20–21 per cent in the quarter when individuals face arrears on debt and adjusts in the same way for both males and females. Similar results in the two subsamples suggest that the results are not affected by the use of individual level data rather than household level data.

The prevalence of arrears is relatively low at 1–2.5 per cent in the total sample, and the results may be affected by the huge number of zeros for the dummy of debt repayment problems. Additional estimations have been carried out for the sub-sample that contains only individuals who are indebted in at least one quarter in the sample from 2004:Q4 to 2011:Q4. The results are given in column (4) in Table 1, and the estimated coefficients and standard errors are virtually identical to those for full sample, suggesting that the use of the full sample is not a concern.

Another set of estimations has been done for individuals who resided in the capital region at the beginning of the sample period, in 2004:Q4, and for

individuals who lived in other regions. As indebtedness is also affected by the credit supply and there is stiffer competition among credit institutions in the capital region, the differences in the estimations between the capital and other regions may indicate that the estimations are affected by a selection due to supply-side factors. The average spread of debt was 45 per cent in the capital region and 42 per cent in other regions in the sample while the spread of arrears among the indebted is 1.5 per cent in the capital region and 1.9 per cent in other regions. The estimations are provided in Columns (1)–(2) in Table B.3 in Appendix B and show that there are no regional differences in the consumption adjustment to debt repayment problems. In consequence the estimation results are very stable across different sub-samples, suggesting that the estimated coefficients of the debt repayment problems do not pick up any sample-specific effect but reflect the consumption response to arrears on debt.

Additional estimations are carried out for three different age groups of individuals younger than 35, individuals aged 35–50 and individuals aged over 50 at the beginning of the sample period 2004:Q4. Figure 3 in Section 2 shows that there is a slightly higher share of individuals in arrears in the youngest age group than in the other two age groups. The estimations of eq. (1) for each age group are given in Columns (3)–(5) in Table B.3 in Appendix B. The decline in consumption related to a debt repayment problem is 22 per cent among individuals aged below 35, while there is a 15 per cent decline among those over 50. Consumption by individuals over 50 is less affected by arrears in the previous quarter than is consumption among other age groups, and the arrears among over-50s are associated with eight per cent lower consumption. For comparison, debt repayment problems in the previous quarter in the two younger age groups are related to 13 per cent lower consumption. The results suggest that there is some heterogeneity in the adjustment of consumption to arrears on debt as the spill-over of arrears into consumption is stronger for individuals aged below 50.

4.2. Estimations for different consumption patterns and liquidity conditions

It was noted in Section 3 that the estimated coefficient for the dummy for contemporaneous arrears on debt, γ_0, may additionally capture reverse positive causality. The estimated coefficient of 0.21 in Table 1 gives the net result of the positive effect from contemporaneous consumption on debt repayment problems and the negative effect on consumption from the arrears on debt. To distinguish between the two effects, the sample is split along the lines of spending level. Figure 1 in Section 2 shows that the volatility of spending

over quarters is quite noticeable, and so the cases in which debt repayment problems occur concurrently with high spending are distinguished from the cases in which spending is relatively steady. Consumption is considered to be high when quarterly expenditures exceed the average expenditures of the previous four quarters by 10 per cent, and it is considered to be stable in other cases.[5] Extraordinary declines in expenditures are included as stable spending as the main goal of the separation is to remove the possible positive causality from high spending to the appearance of arrears. There are 4715 cases of arrears when spending is high under the given definition and 17213 cases of arrears when spending is considered to be stable.

The estimations for arrears in the two consumption patterns are carried out in the same regression; more precisely, in eq. (1) dummies for arrears on debt are interacted with a dummy denoting high spending. Columns (2)–(3) in Table 2 provide the estimated coefficient of the dummy for debt repayment problems, confirming that the two cases do indeed differ. Debt repayment problems are associated with approximately 26 per cent higher consumption in the first case when high spending might be one cause of debt repayment problems. There is a drop in consumption related to debt repayment problems in the previous quarter but there are no constraints on consumption from arrears on debt which have occurred three or more quarters earlier.

The other case, in which individuals face debt repayment problems when following a more stable spending path, is a more interesting one. The estimations suggest that the quarterly drop in consumption associated with arrears on debt is substantial at approximately 32 per cent. Moreover, lower consumption is related to arrears on debt in previous quarters as the estimated coefficients for the lagged debt repayment problems are negative. The results suggest that quarterly spending is substantially lower for individuals when they face debt repayment problems. Arrears in previous quarters are associated with consumption that is approximately four per cent lower, suggesting that debt repayment problems have long-lasting negative effects on spending.

[5] One standard deviation of the mean quarterly consumption is 8.9 per cent while the average yearly consumption growth reached 15 per cent in 2007 together with income growth of similar magnitude, and the threshold value of 10 per cent for high spending originates from these statistics. The estimations for threshold values of zero, five, 15 and 20 per cent are provided in Table B.4 in Appendix B and the results are very similar across the threshold values, suggesting that the choice of threshold value does not affect the results. Additional estimations were implemented where the consumption-to-income ratio was used instead of quarterly consumption to distinguish between high and stable consumption and similar results have been obtained, again confirming that the estimations are robust to different splits.

Table 2: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of the debt repayment problems

Arrears on debt	**(1) Baseline**	**(2) High spending**	**(3) Stable spending**	**(4) Deposit > 0 & stable spending**	**(5) Deposit = 0 & stable spending**
Quarter t	–0.208***	0.263***	–0.321***	–0.280***	–0.329***
	(0.005)	(0.007)	(0.005)	(0.012)	(0.006)
Quarter t-1	–0.131***	–0.099***	–0.132***	–0.090***	–0.140***
	(0.005)	(0.008)	(0.005)	(0.013)	(0.006)
Quarter t-2	–0.041***	0.011	–0.060***	–0.049***	–0.062***
	(0.004)	(0.008)	(0.005)	(0.012)	(0.005)
Quarter t-3	–0.024***	0.032***	–0.049***	–0.044***	–0.050***
	(0.004)	(0.008)	(0.005)	(0.012)	(0.005)
Quarter t-4	–0.030***	0.018**	–0.057***	–0.040***	–0.060***
	(0.005)	(0.008)	(0.005)	(0.012)	(0.005)
R^2	0.244	0.246		0.246	
No. of groups	106 381	106 381		106 381	
No. of obs.	1 973 996	1 973 996		1 973 996	

Notes: FE estimation of eq. (1). Stable spending is when the quarterly spending does not exceed the average spending of the previous four quarters by more than ten per cent. Deposit contains the total balance of all the sight accounts of an individual. All explanatory variables and time dummies are included in the estimations but not reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

As explained in Section 3, the consumption decline due to arrears on debt may be the result of individual choices or liquidity constraints. It is possible to investigate the role of liquidity constraints in the consumption decline by distinguishing between individuals using their balance of deposits. The obligation to make regular debt repayments is linked to one sight account of an individual and if the balance of this particular sight account is zero at the time of repayment, the financial institution cannot debit the payments but instead creates a flag for the problem. The other accounts of the individual are neither debited nor flagged, so individuals who have a positive balance on their other sight accounts do not face liquidity constraints as they can use the other sight accounts for consumption purposes. There are 3896 cases of arrears when the balance of sight accounts is positive and 18032 cases where the balance is zero.

It is worth comparing the consumption decline in these two cases, excluding the cases with high consumption and investigating further the estimations in Column (3) in Table 1. Eq. (1) is estimated by distinguishing between four different cases that have been identified: arrears on debt associated with 1) high spending where the balance of the sight accounts is positive; 2) high spending where the balance of the sight accounts is zero; 3) stable spending where the balance of the sight accounts is positive and 4) stable spending where the balance of the sight accounts is zero. All cases are included in the model to control for heterogeneity by interacting dummies for arrears on debt with dummies denoting different cases. As the first two cases are beyond the focus here, the results are not reported.

The comparison of the last two cases, stable spending with or without a positive balance, sheds more light on the role in the consumption decline of the liquidity problems induced by the procedures of the financial institution. Consumption in the fourth case is driven mainly by liquidity constraints, as individuals do not have any other liquid assets to use, while consumption in the third case is less constrained. A much stronger consumption decline in the fourth case than in the third case would suggest that liquidity problems caused by the procedures of the financial institutions have a major role in driving the decline.

Columns (4) and (5) in Table 2 provide the estimations for the two cases. The quarterly consumption decline is somewhat smaller when individuals have a positive balance on their sight accounts, as the estimated decline in consumption is 28 per cent, rather than the 33 per cent decline in consumption when individuals do not have any money on sight accounts. Debt repayment problems which occurred four quarters ago are associated with four per cent lower consumption for individuals with zero balance, while consumption is six per cent lower for individuals with a positive balance. However, the difference between the two cases is marginal in economic terms and indicates that individuals who are less liquidity constrained cut their spending in a similar way to individuals who are constrained.

4.3. Estimations for arrears on debt of different duration

It is not clear from eq. (2) whether the consumption decline is temporary and consumption recovers after arrears, as arrears may last several quarters in a row. It was shown in Section 2 that the majority of arrears on debt last for one quarter but in some cases the duration of the arrears can be substantially longer. Consumption might respond differently to arrears of a different duration as long-term debt repayment problems are more pressing than short-term problems. There is no micro-level research comparing the effect of debt re-

payment problems on consumption for arrears of different duration as the data about the duration of arrears are not available. This is the first paper to identify the effect on consumption of the duration of arrears.

In order to investigate the differences in the adjustment to the arrears and in the recovery of consumption after the problems have been solved, the cases of debt repayment problems of different duration are categorised. The arrears on debt are divided into five groups based on the duration of the arrears. The first group contains arrears which last for only one quarter, the second group contains arrears which last for two consecutive quarters, and so on so that the fifth group contains debt repayment problems which last five or more consecutive quarters. Figure 4 in Section 2 gives the distribution of the duration of arrears in two time periods (2006:Q4 and 2009:Q4) and Table 3 shows the share of all arrears over the sample period which last for the specified number of quarters. Arrears which last for several consecutive quarters are counted as one case rather than the quarters with arrears being counted separately.

Table 3 shows that the majority of debt repayment problems, 75.5 per cent, are temporary, lasting only one quarter, while the share of arrears which last five or more quarters is 4.5 per cent.

Table 3: The distribution of the duration of arrears

Number of quarters in arrears on debt	**Number of cases of arrears**	**Share of cases of arrears**
1	8367	75.5%
2	1421	12.8%
3	554	5.0%
4	243	2.2%
≥ 5	498	4.5%
Total	11083	100.0%

It is important to detect when individuals fall into arrears that last longer than one quarter. To do this, the dummy for debt repayment problems in eq. (1) is replaced by a dummy for *falling* into arrears in the given quarter. This specification helps to show how consumption responds to the individual falling into arrears and how consumption moves after the problems have disappeared. The dummy is 1 when the quarter is the first quarter when the arrears on debt appear, meaning that there were no arrears in the previous quarter. The dummy takes the value zero if there are arrears on debt in this particular quarter but the problems started in an earlier quarter. The dummy for falling

into arrears is interacted by a categorical variable which denotes the duration of arrears.

As some arrears last five or more quarters, more lags of arrears are included in the model to capture the consumption adjustment even after long-lasting arrears have been resolved. Additionally, it is possible to examine the consumption dynamics from before the debt repayment problems appear by including leads of arrears in the model. Individuals may postpone the fall into arrears by constraining their consumption, which would be reflected in a consumption decline before the actual debt repayment problems. Unfortunately it is not possible to detect a consumption adjustment which results in the full avoidance of debt repayment problems, only consumption before the realisation of debt repayments can be detected.

The following extended model of eq. (1) is estimated:

$$\begin{aligned}\log c_{it} = u_i + \sum_{k=1}^{8}\rho_k \log c_{it-k} + \sum_{k=-3}^{8}\beta_k \log y_{it-k} + \sum_{l=1}^{5}\sum_{k=-3}^{8}\gamma_{lk}\left(N_l^{dur} \times DA_{it-k}\right) + \\ + \sum_{k=1}^{8}\phi_k DTI_{it-k} + \sum_{k=0}^{8}\psi_k DSR_{it-k} + \sum_{k=0}^{8} Z'_{it-k}\alpha_k + \tau_t + \upsilon_s + \varepsilon_{it}\end{aligned} \tag{2}$$

In eq. (2) the additional categorical variable N_l is interacted with three leads and eight lags of the dummy for falling into arrears. The index l indicates the duration of arrears, from one quarter to five or more quarters. Theory suggests that consumption adjusts to expected income changes and therefore the three leads of the income variable are also included, otherwise the dummy for arrears may pick up this effect.

As eight lags are included in eq. (2), the estimated coefficient γ_{lk} gives the effect on consumption of repayment problems which last l quarters. The effect is cumulative, starting from three quarters before the arrears ($k = -3$), identifying the quarter when the arrears *start* ($k = 0$) and tracing the effect in the following eight quarters. Table C.1 in Appendix C gives the estimated coefficients γ_{lk} and standard errors from the estimation of eq. (2).

Moreover, individuals with high spending in the quarter that they fall into arrears are distinguished from those with a stable spending pattern, as discussed in Subsection 4.2 and presented in columns (2) and (3) in Table 2.[6] The focus is on the case of stable spending when quarterly spending does not exceed the average quarterly spending in the previous four quarters by 10 per cent or more.

[6] Separating the cases of falling into arrears with zero or positive balance of the sight accounts was considered but discarded as there would not be a sufficient number of observations in each group to give reliable estimates. Columns (4) and (5) in Table 2 suggest that the consumption in these two cases is rather similar and the two cases can be pooled.

To give a straightforward picture of the estimations, the results for arrears with stable spending are presented graphically. The estimated coefficients and standard errors are provided in Table C.1 in Appendix C. Figure 5 provides the point estimates of the coefficients for the dummies of debt repayment problems which last a different number of quarters, showing the cumulative effects on consumption of the fall into arrears. The quarters from the quarter the arrears start are counted on the x-axis, where zero indicates the quarter when an individual falls into arrears, negative numbers refer to the quarters before the fall into arrears and positive numbers refer to the quarters after the fall into arrears.

As expected, the consumption response is different for arrears of different duration. When the problems last only one quarter (the solid line in Figure 5), consumption declines in that quarter by 25 per cent on average and half of the recovery occurs in the following quarter. Six quarters after the debt repayment problems appear, consumption is still approximately five per cent lower than it would have been without the experience of arrears. Consumption remains at this level in subsequent quarters.

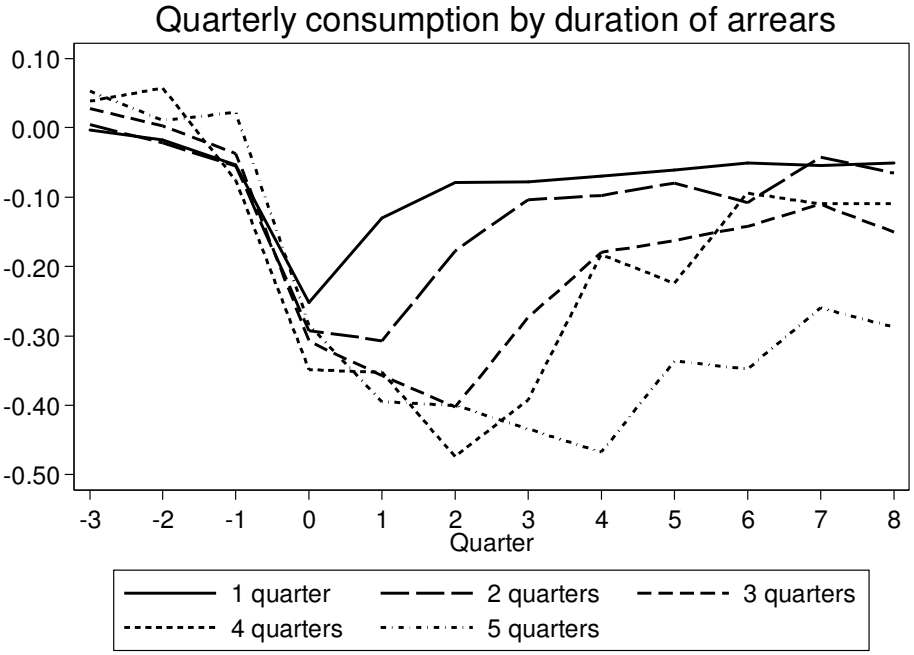


Figure 5: Estimated coefficients in eq. (2) for arrears on debt of different duration

When the problems last two quarters (the long dashed line in Figure 5), consumption declines by around 30 per cent in the first quarter and remains at the same level in the following quarter. The major recovery in consumption takes place in the first quarter after the repayment problems have been resolved, which is the third quarter after the fall into arrears. Consumption remains approximately five per cent lower even six quarters after the debt repayment problems have disappeared, suggesting that it remains subdued for a relatively long time because of the debt payment problems.

When arrears on debt last longer, for three, four or five quarters, the main adjustment in consumption takes place in the first quarter after the fall into arrears, and the recovery is seen in the quarter after the problems have disappeared. Again, the recovery in consumption is lower the longer the debt repayment problems last. Consumption is approximately 10–15 per cent lower for individuals who experienced arrears on debt for three or four quarters, while those who faced arrears for at least five consecutive quarters show 25–30 per cent lower consumption in the long run.

It is worth noting that consumption already starts to decline one quarter before the arrears occur. Consumption is approximately five per cent lower in the quarter before the fall into arrears. The pattern is clearer for arrears which last one or two quarters while for arrears of longer duration the estimated negative coefficient is not statistically significant. However, the pattern is clear, suggesting that when financial difficulties arise individuals react by cutting their consumption to avoid or postpone debt repayment problems. The decline is quite small compared to the consumption decline in the quarter of the fall into arrears, suggesting that the adjustment ex ante is modest and the main effect on consumption occurs after the realisation of debt repayment problems.

The estimations reveal that debt repayment problems contribute to short-term changes in the economy. The quarterly declines in the consumption of individuals in arrears are substantial at 30–40 per cent, and the longer the debt repayment problems last, the stronger the decline in consumption is, and hence the greater the negative effect on the real economy. The share of individuals in arrears in the total population is relatively small, suggesting that the effect on aggregate consumption is less pronounced. If two per cent of the population faces arrears leading to a decline in their consumption of 35 per cent, aggregate consumption would fall by 0.7 per cent.

The longer-term effect is that consumption remains at a lower level after the repayment problems have disappeared, as all the estimated coefficients are negative several quarters after consumption recovers from the problems. The results suggest that the experience of arrears leads to a longer-term depression of consumption. The sluggishness of the recovery may be induced

by precautionary motives as individuals are more concerned about their future ability to repay debt once they have experienced arrears on debt, and this makes them restrain their consumption.

The specific features of the dataset could be interpreted as showing that individuals may shift their finances from financial institutions to cash, or to other financial institutions when they face debt repayment problems, not returning to the services of the particular financial institution after the problems have been solved. It is not easy to detect the actual cause of the estimated decline in long-term consumption. Additional estimations were run to test how debt repayment problems affect the volume of liquid financial assets, which include demand deposits, term deposits and securities. It is hypothesised that a lower volume of financial assets after the problems have been resolved could be an indication that individuals have moved to another financial institution. The initial estimations show that after controlling for other variables affecting financial assets, the volume of financial assets declines when individuals face repayment problems, increases in the quarter after the problems have been resolved and returns to the same level as it was before the arrears on debt, conditioning on other explanatory variables.[7] This means that no evidence was detected for customer relationships being shifted away from the financial institution. As the dataset contains regular customers of the financial institution, the estimations apparently show that the consumption of the individuals is still constrained after the problems have been solved.

4.4. Distribution of the debt repayment problems

The large dataset containing many observations with debt repayment problems makes it possible to compare the recovery from debt repayment problems in different income groups. Mian et al. (2013) suggest that low-income groups are more affected by reverse shocks and therefore need to adjust their consumption more than high-income groups do. This is backed up by Kumhof et al. (2015), who present a model explaining why the indebtedness of low-income groups increased in the USA in 1984–2008, leading to higher financial vulnerability for these groups. On the other hand, Devlin-Foltz and Sabellaus (2015) provide evidence from the Survey of Consumer Finances (SCF) that changes in spending and indebtedness are present in all income groups in the USA. There is only one study from Europe which investigates the relationship between indebtedness and consumption across income distribution. Kukk (2015) finds that similar consumption patterns are present in all

[7] The results are not reported but are available upon request.

income groups, suggesting that the reverse effects of indebtedness on consumption are not concentrated in any particular income group.

Figure 6 presents the share of individuals with arrears within each income quintile, showing that the strongest increase in the prevalence of arrears was for individuals in the lowest income quintile, from 1.8 per cent in 2006:Q4 to four per cent in 2009:Q3. For comparison, the share of individuals with arrears on debt in the highest income quintile rose from 0.6 per cent to two per cent in the same period. Although high income groups are more indebted (Kukk (2015), ECB (2013)), Figure 6 suggests that they experience the fewest arrears on debt.

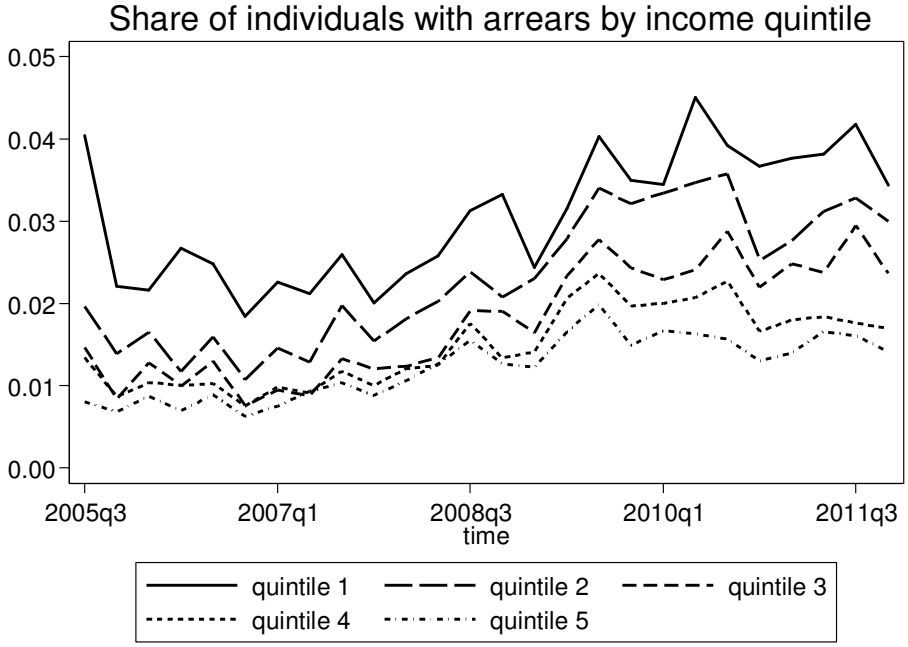


Figure 6: The share of individuals with arrears on debt by income quantile from 2005:Q3 to 2011:Q4, conditional on debt ownership

It was found in Subsection 4.3 that the effect of arrears on consumption varies with the length of the arrears. To investigate further whether the effect varies across different income groups, individuals are divided into five income quintiles based on their income of the previous quarter. The incidence of falling into arrears is specified for each income quintile and for arrears of different duration, which can be expressed as an interaction term between the dummy for falling into arrears, a categorical variable denoting the number of

quarters in arrears, and a categorical variable indicating income quintiles. The extension of eq. (2) is given as:

$$\log c_{it} = u_i + \sum_{k=1}^{8} \rho_k \log c_{it-k} + \sum_{k=-3}^{8} \beta_k \log y_{it-k} + \sum_{m=1}^{5} \sum_{l=1}^{5} \sum_{k=-3}^{8} \gamma_{mlk} \left(Q_m^{inc} \times N_l^{dur} \times DA_{it-k} \right) + \\ + \sum_{k=0}^{8} \phi_k DTI_{it-k} + \sum_{k=0}^{8} \psi_k DSR_{it-k} + \sum_{k=0}^{8} Z_{it-k}^{'} \alpha_k + \tau_t + \upsilon_s + \varepsilon_{it} \tag{3}$$

where the categorical variable denoting income quintiles Q_m is added. The index *m* refers to the m'th income quintile ranging from 1 to 5. In this specification, cases with a different consumption pattern are separated but no different deposit balance is distinguished, like in the estimations in Subsection 4.3. The focus is on the estimations when consumption has been stable, meaning that consumption in quarter *t* is not more than 10 per cent higher than the average consumption in the previous four quarters.

Figure 7 provides point estimates for the coefficients of the debt repayment problems for one quarter (left-hand graph) and two quarters (right-hand graph) in different income quintiles. The estimated coefficients with standard errors are provided in Tables C.2 and C.3 in Appendix C. The number of observations in each income group for arrears which last longer than two quarters is small, resulting in estimates with large standard errors so that no solid conclusions can be drawn about the differences. The dummies for arrears lasting three, four and five or more quarters are included in the model but the estimated coefficients are not reported here.

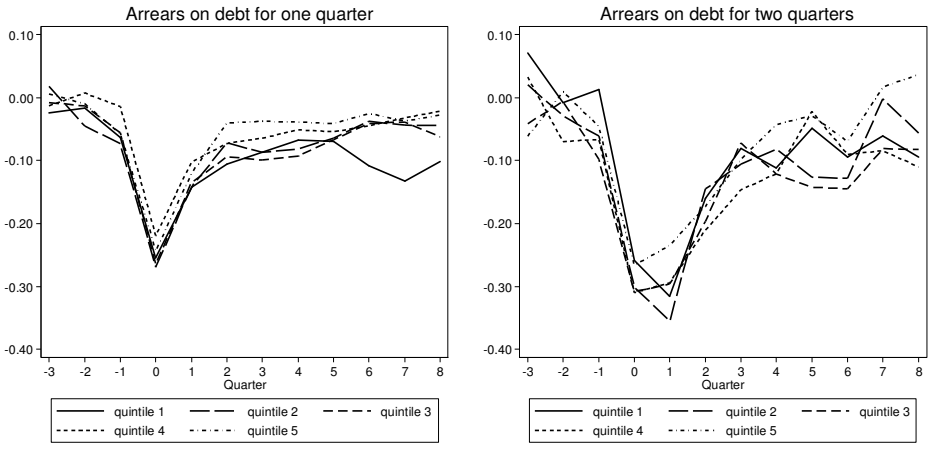


Figure 7: Estimated coefficients in eq. (3) for arrears on debt of different duration by income quintile

The left-hand graph in Figure 7 shows that consumption by individuals in the highest income quintile recovers fastest from debt repayment problems and consumption is around four per cent lower in the second quarter following the quarter in arrears, while individuals in other income quintiles face up to ten per cent lower consumption after two quarters. Consumption for individuals in the lowest income quintile remains around 5–10 per cent lower while the estimated coefficient for the eighth lag is statistically not significant for individuals in the fourth and fifth income group, suggesting that their consumption returns to the same level as before the debt repayment problems emerged (point estimates with standard errors are provided in Table C.1. in Appendix C).

Similar results emerge for consumption when individuals experience arrears for two consecutive quarters. Consumption declines the least for individuals in the fifth income quintile while it declines the most for individuals in the lowest two income groups. Within the following quarters after the debt repayment problems disappear, consumption recovers fully for individuals in the highest income group but remains 5–10 per cent lower for individuals in other income groups.

It has to be emphasised that the differences in the consumption adjustment by individuals in different income quintiles are modest, except for individuals in the highest income quintile. The estimations suggest that the consumption changes and recovery after debt repayment problems do not spin down to the lowest income groups as was hypothesised. The results are similar to the finding by Kukk (2015) who finds a similar linkage between the debt-to-income ratio, the debt service ratio and consumption in all income groups. Kukk (2015) argues that the findings reflect the fact that individuals in higher income groups are more indebted in Europe than individuals in low income groups, which is different from the situation in the USA where low income groups are the most indebted.

5. Conclusions

This paper investigates the consequences of debt repayment problems for consumption. The paper uses a unique set of quarterly panel data from 2004–2011 to detect the quarterly consumption changes which are associated with arrears on debt. The estimations are run using a fixed effects model controlling for other determinants of consumption and controlling for time-invariant individual effects, aggregate shocks and seasonal fluctuations. The results are robust to different sets of control variables in the model.

The estimations show that debt repayment problems induce substantial consumption fluctuations. The problems are associated with a decline in quarterly consumption of 20 per cent on average. The results are similar in different socio-economic groups. When a possible positive effect from high spending to debt arrears is excluded, the repayment problems are associated with a decline of 30 per cent in consumption. The magnitude of the consumption decline depends on the duration of the debt repayment problems. A more substantial decline in quarterly consumption of 40–45 per cent is found when the problems last for several quarters.

Consumption increases only after individuals have overcome their debt repayment problems, and the main recovery occurs in the first quarter after the problems have been resolved. An important finding is that in most cases the recovery after the arrears is smaller than the decline associated with the arrears and the longer the arrears last, the smaller the subsequent recovery is. Although the initial decline in consumption is stronger for individuals in low income groups, the recovery is similar across all income groups. It is only in the highest income group where consumption recovers fully after arrears which last one or two quarters.

The result that consumption does not recover fully from the initial decline associated with debt repayment problems in the other four income groups implies that the repayment problems lead to longer negative effects on consumption. Individuals who have experienced arrears on debt lower their spending to a lower level than in the period before they faced the problems. As the long-term negative effect of debt repayment problems on consumption is present in almost all income groups rather than being a concern only in the lowest income group, policy measures which target all income groups to alleviate the negative effect of debt repayment problems would be more effective than those targeting only the lowest income group.

The results help in understanding the role of household debt in consumption changes. Recent studies have sought to assess how indebtedness hampers consumption through various channels, while this paper highlights how debt repayment problems affect the real economy through consumption. Although the penetration of arrears on debt is relatively low and therefore the effect on aggregate consumption might be modest, the sharp adjustment in spending at the individual level affects the welfare of indebted population groups markedly.

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Appendix A. Summary statistics

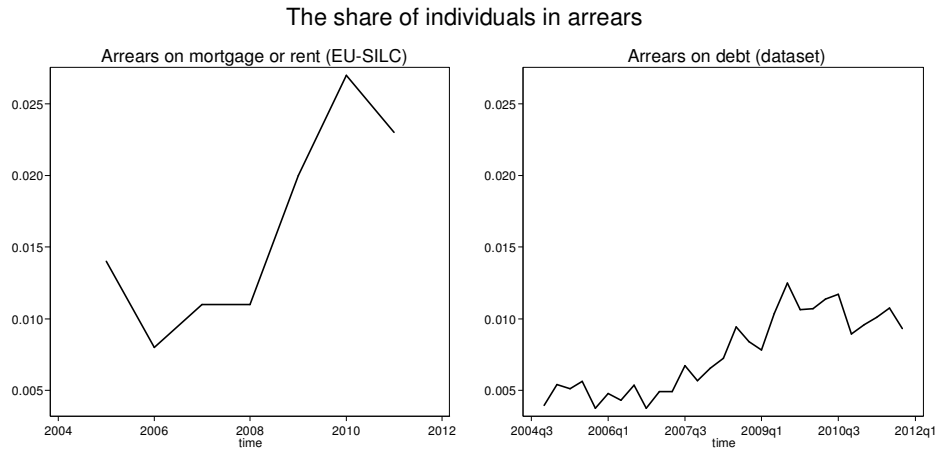

Figure A.1: The prevalence of arrears in the total population in the EU-SILC and the dataset from 2004 to 2011

Table A.1: Definitions of all the variables used in the empirical model with summary statistics

Variable	Definition	Mean	St. dev.
$\log y_{it}$	Logarithm of real yearly inflow from legal entities to sight accounts of individual *i* in quarter *t*, in EUR in 2005 prices	7.073	0.862
$\log c_{it}$	Logarithm of real yearly outflows from the sight account of individual *i* in quarter *t*, excluding transactions between saving and investment accounts, in EUR in 2005 prices	7.270	0.801
DA_{it}	Dummy = 1 if the individual has a flag for an arrear on debt at the end of quarter *t*, otherwise = 0	0.008	0.087
DTI_{it}	Debt-to-yearly income ratio; debt stock is measured at the end of quarter t and income is the sum of the income of the four previous quarters	0.574	1.647
DSR_{it}	Ratio of annual debt service payments to annual income in quarter *t*	0.138	0.265
FA_{it}	Ratio of financial assets to yearly income from legal entities at the end of quarter *t*. Financial assets include deposits, investment funds, stocks, bonds and pension funds	0.660	51.923
$newH_{it}$	Dummy = 1 if the individual owns a housing loan in quarter t while not having any housing loan in quarter *t*-1, otherwise = 0	0.002	0.047
$addH_{it}$	Dummy = 1 if the size of the individual's housing loan in quarter t exceeds the housing loan in quarter *t*-1 and the individual owns the housing loan in quarter *t*-1, otherwise = 0	0.005	0.072

Appendix B. Consumption estimations for all arrears

Table B.1: Estimations for all the explanatory variables in the baseline consumption model in Column (1) in Table 4

Coefficients:	**(1)** $\log c_{it}$	**(1)** $\log y_{it}$	**(2)** DA_{it}	**(3)** DTI_{it}	**(4)** DSR_{it}	**(5)** FA_{it}
Quarter t	..	0.336***	–0.208***	0.034***	0.025***	–0.015*
		(0.002)	(0.005)	(0.003)	(0.006)	(0.009)
Quarter t–1	0.137***	0.065***	–0.131***	–0.031***	–0.191***	0.029**
	(0.002)	(0.001)	(0.005)	(0.003)	(0.007)	(0.013)
Quarter t–2	0.049***	0.008***	–0.041***	–0.008***	0.037***	–0.002
	(0.001)	(0.001)	(0.004)	(0.002)	(0.006)	(0.002)
Quarter t–3	0.024***	0.007***	–0.024***	–0.003	0.014**	0.001**
	(0.001)	(0.001)	(0.004)	(0.002)	(0.006)	(0.000)
Quarter t–4	0.059***	–0.032***	–0.030***	–0.005***	–0.045***	–0.000
	(0.001)	(0.002)	(0.005)	(0.001)	(0.005)	(0.000)
R^2		0.244				
No. of groups		106 381				
No. of obs.		1 973 996				

Notes: FE estimation of eq. (1). Time dummies are included in the estimations but not all are reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

Table B.2: Robustness test of the estimated coefficient of arrears in the baseline consumption model in Column (1) in Table 4. Dependent variable: $\log c_{it}$

Da_{it}	(1)	(2)	(3)	(4)	(5)	(6)
Quarter t	–0.313***	–0.236***	–0.225***	–0.226***	–0.219***	–0.219***
	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Quarter t–1	–0.208***	–0.172***	–0.136***	–0.132***	–0.126***	–0.126***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Quarter t–2	–0.105***	–0.085***	–0.048***	–0.044***	–0.039***	–0.039***
	(0.006)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)
Quarter t–3	–0.074***	–0.063***	–0.033***	–0.030***	–0.025***	–0.025***
	(0.006)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Quarter t–4	–0.094***	–0.072***	–0.038***	–0.032***	–0.028***	–0.028***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
$\log c_{it}$	NO	NO	YES	YES	YES	YES
$\log y_{it}$	NO	YES	YES	YES	YES	YES
DTI_{it}	NO	NO	NO	YES	YES	YES
DSR_{it}	NO	NO	NO	NO	YES	YES
FA_{it}	NO	NO	NO	NO	NO	YES
newH_{it}	NO	NO	NO	NO	NO	NO
R^2	0.021	0.187	0.214	0.219	0.220	0.223
No. of groups	106 381	106 381	106 381	106 381	106 381	106 381
No. of obs.	1 973 996	1 973 996	1 973 996	1 973 996	1 973 996	1 973 996

Notes: FE estimation of eq. (1). All explanatory variables and time dummies are included in the estimations but not all are reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

Table B.3: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of debt repayment problems

Arrears on debt	**(1)** **The capital region**	**(2)** **Other regions**	**(3)** **Age < 35**	**(4)** **Age 35 – 50**	**(5)** **Age > 50**
Quarter t	–0.197***	–0.211***	–0.221***	–0.207***	–0.153***
	(0.009)	(0.006)	(0.007)	(0.008)	(0.011)
Quarter t–1	–0.102***	–0.142***	–0.131***	–0.134***	–0.076***
	(0.009)	(0.006)	(0.007)	(0.008)	(0.012)
Quarter t–2	–0.030***	–0.045***	–0.027***	–0.053***	–0.025**
	(0.008)	(0.005)	(0.006)	(0.007)	(0.010)
Quarter t–3	–0.020**	–0.025***	–0.015**	–0.020***	–0.040***
	(0.008)	(0.005)	(0.006)	(0.007)	(0.010)
Quarter t–4	–0.019**	–0.034***	–0.025***	–0.031***	–0.035***
	(0.008)	(0.005)	(0.007)	(0.007)	(0.011)
R^2	0.226	0.258	0.310	0.268	0.208
No. of groups	36 430	69 951	35 798	38 450	32 133
No. of obs.	650 606	1 323 390	613 113	715 571	645 312

Notes: FE estimation of eq. (1). All explanatory variables and time dummies are included in the estimations but not all are reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

Table B.4: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of debt repayment problems for cases when consumption is defined to be stable

Arrears on debt	**(1)** $c_{it} \leq \overline{c}_{it}$	**(2)** $c_{it} \leq 1.05 \times \overline{c}_{it}$	**(3)** $c_{it} \leq 1.1 \times \overline{c}_{it}$	**(4)** $c_{it} \leq 1.15 \times \overline{c}_{it}$	**(5)** $c_{it} \leq 1.2 \times \overline{c}_{it}$
Quarter t	–0.356***	–0.338***	–0.321***	–0.308***	–0.296***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Quarter t–1	–0.134***	–0.134***	–0.132***	–0.132***	–0.130***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Quarter t–2	–0.065***	–0.063***	–0.060***	–0.058***	–0.056***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Quarter t–3	–0.054***	–0.051***	–0.049***	–0.047***	–0.044***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Quarter t–4	–0.063***	–0.060***	–0.057***	–0.054***	–0.050***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
R^2	0.246	0.246	0.246	0.246	0.246
No. of groups	106 381	106 381	106 381	106 381	106 381
No. of obs.	1 973 996	1 973 996	1 973 996	1 973 996	1 973 996

Notes: FE estimation of eq. (1). Stable spending in column (1) is when the quarterly spending does not exceed the average spending of the previous four quarters, in column (2) the quarterly spending is no more than five per cent higher than the average spending of the previous four quarters while the threshold value for the quarterly spending is 10 per cent, 15 per cent and 20 per cent in Columns (3), (4) and (5) respectively. All explanatory variables, dummies for arrears when high spending and time dummies are included in the estimations but not all are reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

Appendix C. Consumption estimations for arrears of different duration

Table C.1: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of falling into arrears on debt when spending is stable (quarterly spending is no more than 10 per cent higher than the average quarterly spending of the previous four quarters)

Falls into arrears	**(1)** **Arrears for one quarter**	**(2)** **Arrears for two quarters**	**(3)** **Arrears for three quarters**	**(4)** **Arrears for four quarters**	**(5)** **Arrears for five quarters**
Quarter t+3	–0.003	0.004	0.028	0.038	0.053
	(0.007)	(0.017)	(0.027)	(0.038)	(0.034)
Quarter t+2	–0.018**	–0.022	0.003	0.057	0.011
	(0.007)	(0.018)	(0.030)	(0.048)	(0.031)
Quarter t+1	–0.054***	–0.055***	–0.037	–0.076*	0.022
	(0.008)	(0.017)	(0.029)	(0.043)	(0.034)
Quarter t	–0.252***	–0.293***	–0.308***	–0.349***	–0.284***
	(0.007)	(0.017)	(0.026)	(0.044)	(0.030)
Quarter t–1	–0.130***	–0.307***	–0.357***	–0.353***	–0.395***
	(0.009)	(0.022)	(0.035)	(0.047)	(0.038)
Quarter t–2	–0.079***	–0.177***	–0.403***	–0.474***	–0.400***
	(0.008)	(0.020)	(0.037)	(0.051)	(0.036)
Quarter t–3	–0.078***	–0.104***	–0.273***	–0.392***	–0.435***
	(0.008)	(0.017)	(0.044)	(0.044)	(0.035)
Quarter t–4	–0.070***	–0.098***	–0.180***	–0.183***	–0.468***
	(0.009)	(0.018)	(0.037)	(0.052)	(0.040)
Quarter t–5	–0.061***	–0.080***	–0.162***	–0.224***	–0.336***
	(0.008)	(0.019)	(0.036)	(0.050)	(0.038)
Quarter t–6	–0.051***	–0.107***	–0.142***	–0.094**	–0.348***
	(0.008)	(0.019)	(0.040)	(0.048)	(0.034)
Quarter t–7	–0.054***	–0.042**	–0.110***	–0.110**	–0.260***
	(0.009)	(0.018)	(0.034)	(0.047)	(0.039)
Quarter t–8	–0.050***	–0.065***	–0.150***	–0.109**	–0.287***
	(0.008)	(0.018)	(0.031)	(0.043)	(0.049)
R^2			0.230		
No. of groups			95 237		
No. of obs.			1 159 924		

Notes: FE estimation of eq. (2). Dummies for arrears on debt when consumption is higher than usual, all other explanatory variables and time dummies are included in the estimations but not reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

Table C.2: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of falling into arrears on debt for one quarter when spending is stable (quarterly spending is no more than 10 per cent higher than the average quarterly spending of the previous four quarters), by income quintile

Arrears for one quarter	**(1) Quintile 1**	**(2) Quintile 2**	**(3) Quintile 3**	**(4) Quintile 4**	**(5) Quintile 5**
Quarter t+3	–0.025	0.018	–0.008	–0.013	0.006
	(0.019)	(0.014)	(0.015)	(0.016)	(0.018)
Quarter t+2	–0.016	–0.045***	–0.013	0.007	–0.010
	(0.018)	(0.014)	(0.016)	(0.016)	(0.019)
Quarter t+1	–0.064***	–0.073***	–0.056***	–0.014	–0.057***
	(0.021)	(0.014)	(0.016)	(0.017)	(0.019)
Quarter t	–0.254***	–0.269***	–0.265***	–0.219***	–0.243***
	(0.020)	(0.014)	(0.016)	(0.014)	(0.017)
Quarter t–1	–0.142***	–0.142***	–0.136***	–0.103***	–0.121***
	(0.024)	(0.019)	(0.018)	(0.019)	(0.023)
Quarter t–2	–0.106***	–0.072***	–0.094***	–0.073***	–0.040**
	(0.019)	(0.016)	(0.015)	(0.017)	(0.019)
Quarter t–3	–0.087***	–0.087***	–0.099***	–0.065***	–0.037**
	(0.020)	(0.017)	(0.017)	(0.017)	(0.018)
Quarter t–4	–0.068***	–0.082***	–0.093***	–0.051***	–0.039*
	(0.024)	(0.017)	(0.019)	(0.018)	(0.021)
Quarter t–5	–0.069***	–0.064***	–0.067***	–0.054***	–0.041*
	(0.021)	(0.017)	(0.016)	(0.017)	(0.022)
Quarter t–6	–0.108***	–0.037**	–0.041**	–0.045***	–0.025
	(0.024)	(0.018)	(0.017)	(0.017)	(0.019)
Quarter t–7	–0.132***	–0.044**	–0.039**	–0.032*	–0.037*
	(0.025)	(0.019)	(0.019)	(0.018)	(0.021)
Quarter t–8	–0.102***	–0.044***	–0.063***	–0.022	–0.028
	(0.024)	(0.017)	(0.018)	(0.016)	(0.020)
R^2			0.230		
No. of groups			95 237		
No. of obs.			1 159 924		

Notes: FE estimation of eq. (2). All other explanatory variables, interaction terms of arrears with income quintiles and time dummies are included in the estimations but not reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

Table C.3: Consumption model with dependent variable $\log c_{it}$. Parameter estimates for the dummy of falling into arrears on debt when spending is stable (quarterly spending is no more than 10 per cent higher than the average quarterly spending of the previous four quarters), by income quintile

Arrears for two quarters	**(1) Quintile 1**	**(2) Quintile 2**	**(3) Quintile 3**	**(4) Quintile 4**	**(5) Quintile 5**
Quarter t+3	0.070	0.020	–0.041	0.033	–0.062
	(0.050)	(0.032)	(0.027)	(0.039)	(0.038)
Quarter t+2	–0.008	–0.029	–0.006	–0.070**	0.009
	(0.054)	(0.033)	(0.040)	(0.036)	(0.038)
Quarter t+1	0.013	–0.061*	–0.098***	–0.066	–0.046
	(0.045)	(0.032)	(0.035)	(0.044)	(0.035)
Quarter t	–0.259***	–0.301***	–0.308***	–0.310***	–0.266***
	(0.038)	(0.031)	(0.032)	(0.048)	(0.034)
Quarter t–1	–0.316***	–0.355***	–0.296***	–0.294***	–0.235***
	(0.062)	(0.038)	(0.038)	(0.058)	(0.053)
Quarter t–2	–0.161***	–0.145***	–0.197***	–0.211***	–0.173***
	(0.052)	(0.038)	(0.037)	(0.047)	(0.054)
Quarter t–3	–0.081*	–0.106***	–0.072**	–0.147***	–0.098***
	(0.046)	(0.034)	(0.036)	(0.039)	(0.036)
Quarter t–4	–0.112***	–0.081**	–0.122***	–0.121***	–0.043
	(0.042)	(0.037)	(0.039)	(0.037)	(0.039)
Quarter t–5	–0.049	–0.127***	–0.143***	–0.022	–0.029
	(0.053)	(0.035)	(0.036)	(0.041)	(0.041)
Quarter t–6	–0.094*	–0.128***	–0.145***	–0.090**	–0.070
	(0.051)	(0.039)	(0.041)	(0.036)	(0.047)
Quarter t–7	–0.061	–0.002	–0.081**	–0.085***	0.017
	(0.054)	(0.036)	(0.040)	(0.031)	(0.038)
Quarter t–8	–0.095**	–0.057	–0.083**	–0.110***	0.037
	(0.039)	(0.035)	(0.042)	(0.041)	(0.043)
R^2			0.230		
No. of groups			95 237		
No. of obs.			1 159 924		

Notes: FE estimation of eq. (2). All other explanatory variables, interaction terms of arrears with income quintiles and time dummies are included in the estimations but not reported. Standard errors are reported in parentheses below the coefficient estimates, SE estimates are robust to disturbances that are heteroskedastic and autocorrelated. Superscripts ***, ** and * indicate that the coefficient is statistically different from 0 at the 1%, 5% and 10% level respectively.

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