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Keywords: consumption, interest rates, household debt, liquidity constraints

JEL codes: E21, E52, G51

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1 Introduction

After more than a decade of slow inflation and low interest rates in the euro area, inflation picked up considerably in 2021 as a consequence of demand-supply imbalances caused by the Covid-19 pandemic and, subsequently, a strong increase in energy prices caused by the Russian war on Ukraine. In response, the European Central Bank began raising its interest rates rapidly, starting in July 2022.

In this paper, we explore whether aggregate private consumption in Finland has become more sensitive to changes in short-term interest rates as the Finnish household sector has become more indebted. The household sector's aggregate debt-to-income ratio has more than doubled from 60% in its trough in 1997 to 134% in 2021 (Figure 1). If this development entails more households having borrowed up to their credit limits, it suggests that aggregate private consumption will respond more strongly to a given change in interest rates today than 25 years ago.

Even though the debt-to-income ratio of the Finnish household sector has steadily increased over the past decades, we do not find a marked change in the interest rate elasticity of private consumption. Our empirical analysis is based on a rolling-window Bayesian vector autoregression and on various alternative strategies to identify the causal effect of an exogenous increase in interest rates on aggregate consumption. The approach is closely related to Stockhammar, Strid, and Tornese (2022) who conduct a similar analysis with Swedish aggregate data.

This result might indicate that despite growing debt burdens, the financial buffers of Finnish households – or at least of those households having accumulated debt – have remained sufficient. Accordingly, it is possible that the share of credit or liquidity constrained households has not increased with the overall indebtedness of the household sector. Some recent studies, such as Almgren, Gallegos, Kramer, and Lima (2022) and Cumming and Hubert (2021), find that these constrained households are important in driving the dynamics of private consumption in response to monetary policy or interest rate shocks.

We complement our aggregate analysis with descriptive observations from Finnish household-level data on wealth and income. We find that while the share of households having any type of debt (the extensive margin of increasing household indebtedness) has steadily grown since the mid-1990s, the estimated share of liquidity-

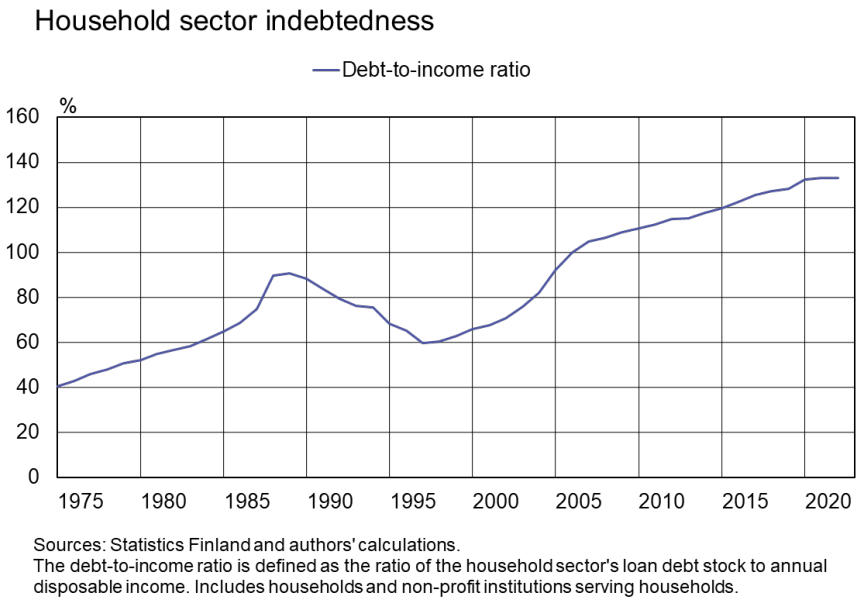


Figure 1

constrained households has declined or stayed roughly constant, depending on the measure used. Moreover, the share of hand-to-mouth households among the most indebted households seems to have slightly declined since 2009. While this analysis is purely descriptive and cannot be directly linked to the results of the aggregate analysis, the findings suggest a possible explanation for the observed aggregate dynamics of private consumption that is in line with mechanisms identified in the previous literature. Further research is needed to understand its empirical relevance.

An important factor contributing to the relaxation of liquidity constraints, among other things, may have been the marked decline in interest expenses during the low interest rate era of the 2010s. Figure 2 shows the evolution of the household sector's net interest rate expenses, defined as the difference between interest paid and interest received, as a ratio to the sector's disposable income. As market interest rates stayed low for years, so did the interest expenses of the household sector, despite a growing debt stock. In addition, the average maturity of new housing loans taken by Finnish households has also steadily increased in the past decades, contributing to a lighter debt service burden. According to Bank of Finland statistics on monetary financial institutions, the average maturity of new housing loan drawdowns was 18 years in 2010. At the end of 2022, it had increased to 22 years.

The current economic environment, characterised in the short-term both by in-

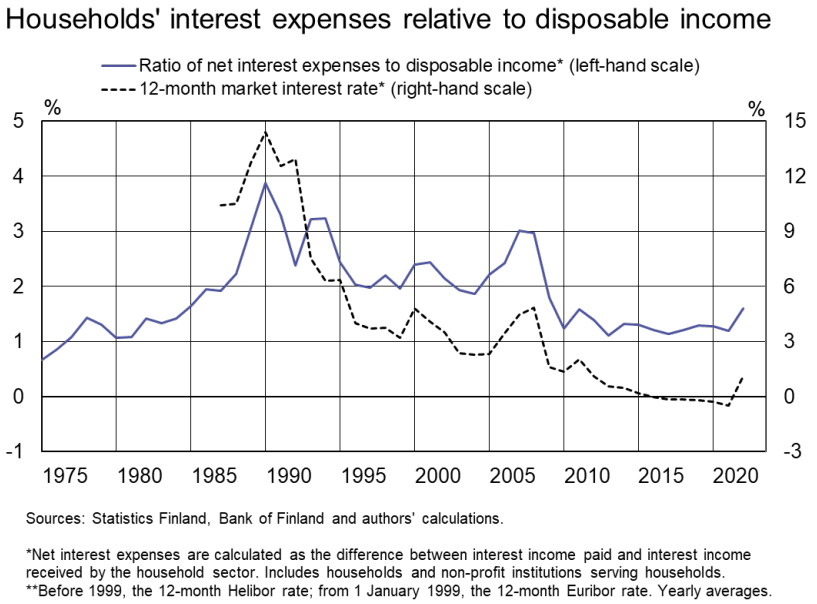


Figure 2

creasing costs of living and a rapid tightening of financial conditions, is challenging for many households. Different households are in a different position to face these challenges, depending for example on their financial net worth. Monetary policy tightening, in particular, affects household consumption through various channels. A large body of recent macroeconomic research has found that an individual household's consumption response to interest rate hikes crucially depends on its marginal propensity to consume (MPC) out of current income, which strongly correlates with the household's net asset position. Kaplan, Violante, and Weidner (2014) stress the importance of liquid assets that can easily be used to finance consumption expenditure.

Previous research has identified many transmission channels through which monetary policy, or more generally any exogenous increase in interest rates, affects private consumption. The traditional *intertemporal substitution channel* is most relevant for wealthy households that do not face liquidity or credit constraints and are able to smooth their consumption over time. A liquidity constraint refers to a situation in which a household has so few liquid assets that it has a very thin financial margin against unexpected shocks. A credit constraint, on the other hand, refers to a situation in which a household is unable to finance expenditures with credit when it wishes to do so. Both constraints prevent optimal consumption smoothing and lead

to high MPCs out of transitory income.

Both types of constraints have implications for monetary policy transmission, and more generally on the impacts of an interest rate shock on aggregate consumption. Rising interest rates lower collateral values, which may constrain some households' ability to borrow to finance their consumption and investments (the *collateral channel*). Rising credit costs are also directly away from other consumption through a binding budget constraint (the *cash-flow channel*). This channel is particularly pronounced when loans tend to have variable interest rates, as in Finland.[1]

Our paper is related to two large and growing strands of macroeconomic research. First, recent research has emphasized the role of household heterogeneity and idiosyncratic risk in income and wealth as a driver of aggregate fluctuations in the macroeconomy. Prominent empirically-oriented contributions include Mian, Rao, and Sufi (2013), Mian and Sufi (2014), Kaplan et al. (2014) and Baker (2018). These papers identify important heterogeneities in the marginal propensity to consume out of wealth and income, and show that those have an important role in explaining fluctuations in aggregate consumption. Kaplan et al. (2014) develop a classification of households into wealthy hand-to-mouth, poor hand-to-mouth and non-hand-to-mouth households according to their liquid and illiquid asset positions relative to income, and show that a household's hand-to-mouth status has strong predictive power over their consumption response to a transitory income shock. The Kaplan et al. (2014) classification, which we also adopt in this paper, has subsequently become a prominent proxy for capturing heterogeneity in households' MPCs.

Following these empirical contributions, a growing theoretical literature has embedded incomplete markets and heterogeneity in MPCs in general equilibrium models of business cycle fluctuations. Earlier research featured a limited form of household heterogeneity, typically in the form of two-agent saver-borrower models instead of representative household models as in Iacoviello (2005), Bilbiie (2008) and Eggertsson and Krugman (2012); and more recently in Debortoli and Galí (2018) and Mian, Straub, and Sufi (2021). More recently, business cycle models with richer heterogeneity have been developed. Prominent examples include McKay and Reis (2016),

[1] See also Bech and Mikkelsen (2021) for an analysis of interest rate sensitivity of Danish households; the authors find that the cash flows of households with adjustable-rate or interest-only mortgages are particularly sensitive to interest rates.

Guerrieri and Lorenzoni (2017), Kaplan, Moll, and Violante (2018), Berger, Guerrieri, and Lorenzoni (2018) and Auclert (2019).

Second, a related strand of literature studies the role of household debt distributions and liquidity constraints in shaping aggregate consumption responses to interest rate shocks. Recent empirical contributions include DiMaggio, Kermani, Keys, Piskorski, Ramcharan, Seru, and Yao (2017), Cloyne, Ferreira, and Surico (2020), Flodén, Kilström, Sigurdsson, and Vestman (2021), Cumming and Hubert (2021) and Almgren et al. (2022). These papers find an important role for the cash-flow channel of monetary policy. While much of this literature has focused on monetary policy transmission, our focus is not on identifying impacts of monetary policy, specifically. Instead, we exploit popular monetary policy shock identification strategies to identify exogenous variation in nominal short-term interest rates, and study the responses of aggregate consumption to these shocks contingent on aggregate household indebtedness.

2 Interest rate elasticity of aggregate consumption in Finland: SVAR evidence

In this section, we examine whether the interest rate elasticity of private consumption in Finland has changed as the household sector has become more indebted. We do so by estimating and identifying structural vector autoregressive (SVAR) models on quarterly aggregate data. We first describe our baseline specification and results, and then discuss various robustness checks and alternative specifications.

2.1 Baseline results

In our baseline analysis, we utilise the following structural vector autoregressive (SVAR) model:

$$y_t = c + Ay_{t-1} + Be_t, \tag{1}$$

where y_t is the vector of endogenous variables, c is a vector of constant terms, A is a matrix containing the autoregressive coefficients of the model, and B is a matrix containing the impact coefficients. The vector e_t contains the structural shocks, assumed to be independent and normally distributed.

The following variables are contained in the vector of endogenous variables: the harmonised consumer price index, real private consumption, real GDP, the debt-to-income ratio of the household sector, the real national house price index, the 12-month Euribor rate, and the real effective exchange rate index.[2] The variables enter the model in log-levels, with the exception of the debt-to-income ratio and the interest rate, which are in levels.[3]

The model is estimated from quarterly Finnish data. The full sample covers the time period from 1996 Q1 until 2019 Q4.[4] The model is estimated with four lags.[5] As the estimated model is quite large and the number of observations rather limited, we use Bayesian methods in our estimation. We impose a Minnesota prior, as this choice of prior allows us to apply Bayesian shrinkage on the model parameters. The optimal choice of hyperparameters that govern the shrinkage is implemented using the methodology of Giannone, Lenza, and Primiceri (2015). In this approach, the hyperparameters are chosen so as to maximise the marginal likelihood of the model.

Given the previously mentioned ordering of endogenous variables, as our baseline approach, we use a recursive (Cholesky) approach to identify the interest rate shock. In other words, it is assumed that the 12-month Euribor rate can contemporaneously react to consumer prices, private consumption, GDP, the debt-to-income ratio, and real house prices, but not vice versa.

As an initial check regarding the validity of our recursive identification strategy, we estimate the model from the full sample and plot the impulse responses to a 25 basis point increase in 12-month Euribor, shown in Figure 3. The signs of the responses are as one would expect from a contractionary interest rate or monetary

[2]Original data sources are reported in Table 1 in the Appendix. We use the 12-month Euribor as the interest rate variable, because it is the most popular reference rate for mortgage loans in Finland. Mortgage loans, in turn, make up about two thirds of the household sector's total debt.

[3]In contrast to Stockhammar et al. (2022), we include the household debt-to-income ratio in our empirical model instead of the level of household debt. We also tried a model specification where we included the household sector's debt and disposable income separately, but this did not change the main conclusions.

[4]We drop observations from 2020 to 2022 from our estimation sample to leave out the extreme macroeconomic developments observed during the Covid-19 pandemic, especially in aggregate consumption, that could confound our results.

[5]Using four lags ($p = 4$) is a typical specification for models estimated on quarterly data using Bayesian methods. We have also estimated the baseline model with $p = 2$, which did not qualitatively change our results or conclusions.

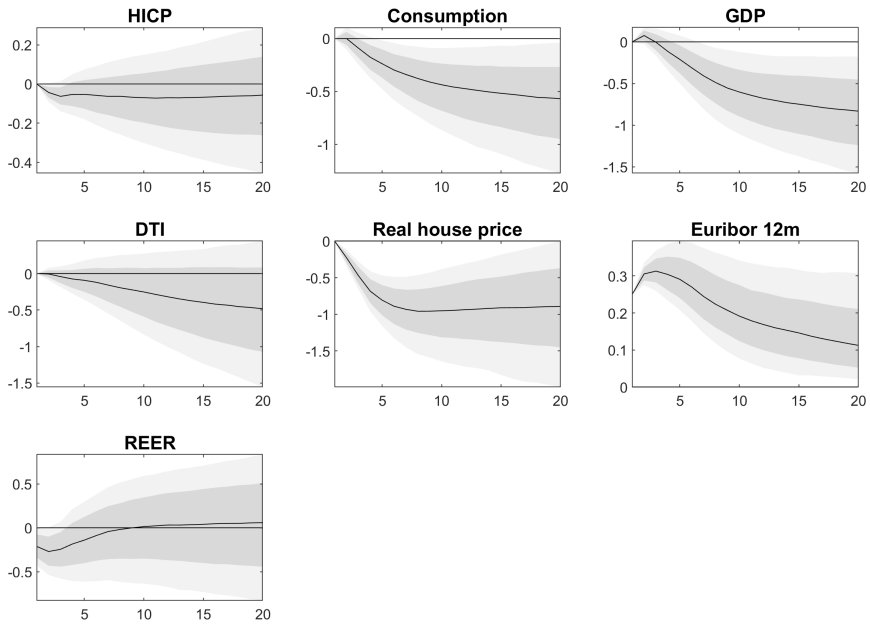


Figure 3: SVAR impulse responses to a positive one standard deviation interest rate shock. Estimation period is 1996 Q1–2019 Q4. Dark gray areas denote 68 % credible sets; light gray areas denote 90 % credible sets.

policy shock: consumption, GDP and prices all decline, while the 12-month Euribor rises. The sizes of the GDP and consumption responses are quantitatively similar to results previously reported by Kilponen, Orjasniemi, Ripatti, and Verona (2016), Silvo and Verona (2020) and Mäki-Fränti, Silvo, Gulan, and Kilponen (2022) for the Finnish economy.

During the sample period spanning from 1996 to 2019, the debt-to-income ratio of the Finnish household sector grew steadily. To study whether there is a connection between the interest rate elasticity of private consumption and household indebtedness, we use a rolling-window estimation technique: the same model is estimated from consecutive 10-year sub-samples, the first sub-sample beginning in 1996 Q1 and the last ending in 2019 Q4.[6] From each sub-sample, we estimate a VAR with four lags.

[6]The window size of 10 years was chosen on the basis of having enough observations in an individual sub-sample, while at the same time having enough sub-samples to conduct meaningful analysis regarding a potential change in consumption dynamics. The results do not change significantly when using for example a 12-year or a 14-year rolling window. With a 16-year rolling window, the regression line drawn in the scatterplot has a slightly negative slope, indicating a positive relationship between the indebtedness of the household sector and the interest rate sensitivity of private

For each sub-sample, we compute the impulse response of private consumption to a positive 25 basis point shock to the 12-month Euribor rate. In Figure 4, we report the estimated effect on private consumption in each sub-sample, three years (12 quarters) following the initial shock.[7] On the horizontal axis, we report the average debt-to-income ratio of the Finnish household sector in each respective sub-sample.

If there were a positive relationship between household indebtedness and the interest rate elasticity of private consumption, one would expect to see a negative slope on a regression line drawn in the household indebtedness–consumption response plane. Put differently, as the household sector becomes more indebted, the response of aggregate private consumption to an interest rate shock should become stronger. One reason behind this could be, for example, the cash-flow channel mentioned earlier: as the amount of debt held by the household sector gets larger, a rise in interest rates leads to a larger increase in debt servicing costs relative to income. If household incomes do not grow in tandem with debt servicing costs, households may be forced to cut their consumption in order to service their debt. Another possible reason is the so called collateral channel: rising interest rates typically reduce collateral values, which can hinder the consumption-smoothing possibilities of indebted households as their access to credit deteriorates.

Our estimation results obtained from aggregate Finnish data do not show a clear linear relationship between the interest rate elasticity of consumption and the household deb-to-income ratio, as can be seen from Figure 4. The least-squares regression line fitted in the scatterplot has a slightly positive slope, but the slope coefficient is not statistically significant. This indicates that despite the household sector having become more indebted, the overall sensitivity of consumption to interest rate shocks has not changed; or at least, the sensitivity has not increased since the household DTI ratio has hit around 100 %. If we only focus on sub-samples with a DTI ratio of 100 % or less, which coincide with the earlier sub-periods in our sample, there is a clear pattern that hints to an increasing sensitivity of consumption to interest rates as indebtedness grows.

An explanation for the weaker estimated responses of consumption to interest

consumption. However, the slope is not statistically significant: see Figure 10 in the Appendix.

[7] The 3-year mark was chosen for two reasons: first, for comparability of effects in different sub-samples; and second, because it can be seen as a relevant business cycle frequency, over which the effects of an interest rate shock have for the most part come into effect.

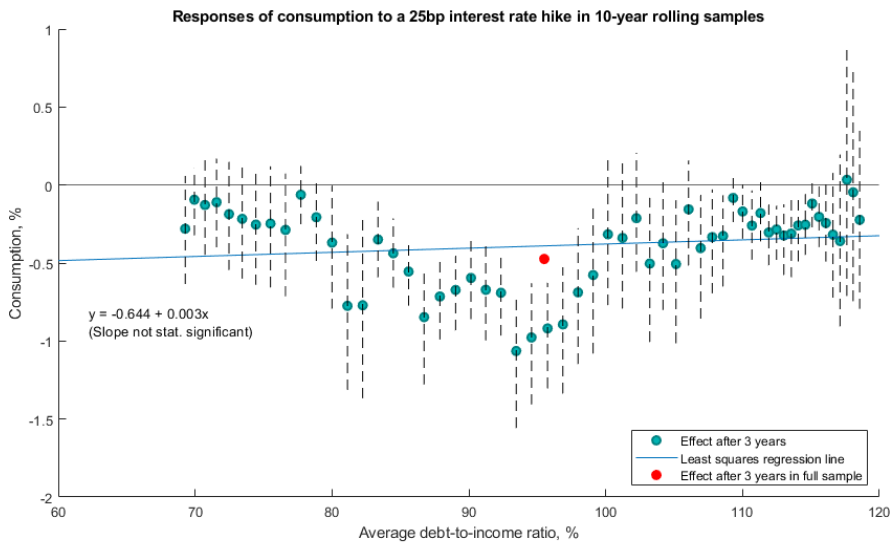


Figure 4: SVAR impulse responses to a positive one standard deviation interest rate shock in rolling 10-year sub-samples, recursive identification, impacts reported at 12 quarters after the initial shock. Dashed vertical lines denote 68% credible intervals.

rate shocks might be related to the period of very low and even negative interest rates that followed the financial crisis of 2007–2009. As the household sector's debt-to-income ratio has quite monotonically increased over time, the sub-samples in rolling-window estimation with relatively high debt-to-income ratios correspond to later sample start dates. Consequently, those sub-samples with high average debt-to-income ratios largely coincide the period of very accommodative monetary policy. [8] It is possible that in later sub-samples with high average debt-to-income ratios, the transmission of interest rate changes to households' consumption, through the cash-flow channel, has been rather weak.

The low interest rate era may also cause difficulties for statistical inference. As shown in Figure 2 in the introduction, the variability in the 12-month market interest rate has been quite minimal towards the end of our full sample ending in 2019. This may hamper the identification of the effects of a positive interest rate shock in later sub-samples, where the interest rate has been quite stagnant.

A further explanation may be related to asymmetric effects. From 2011 onwards,

[8] Figure 11 in the Appendix plots the estimated impacts of consumption in each sub-sample, with the end date of the sample on the horizontal axis. One can see that the scatter plot is virtually identical to that in Figure 4. This implies that the average debt-to-income ratio has steadily increased by each sub-sample.

the data only contain changes in the interest rate that are negative. Negative shocks to the interest rate may affect consumption differently, in terms of absolute value, than positive shocks – see for example Barnichon and Matthes (2018) and Angrist, Jordà, and Kuersteiner (2018). As our VAR model is linear, our estimated impulse responses to positive interest rate shocks might not reflect true effects, if they are asymmetric. To fully capture the potential differences between the effects of positive and negative shocks, one would need a non-linear modelling approach, which we do not pursue in this paper.

Finally, even though the overall amount of debt held by the Finnish household sector has grown, it might have accumulated to those households that are relatively well-off in terms of their income, financial assets, and access to liquidity. When facing sudden increases in their debt servicing expenses, these households may be able to tap into their liquid assets (such as cash, savings accounts, shares in mutual funds, or stocks) in order to maintain a desired level of consumption. In contrast, households that are liquidity or credit constrained may not have this option. Instead, they may be forced to cut their consumption when their debt servicing costs increase. Thus, from the perspective of aggregate consumption dynamics, the amount of these constrained households can be crucial. We turn to this question later in this study when we examine Finnish household-level data to see how the share of liquidity and credit constrained households has evolved over time.

Our benchmark results stand in contrast to Stockhammar et al. (2022), who find that the interest rate sensitivity of consumption has roughly doubled in Sweden over the past 15 years as the aggregate debt-to-income ratio has increased by 50 percentage points. This may reflect institutional and regulatory differences in the housing market and in macroprudential policies, as well as differences in the developments of income and wealth distributions and liquidity constraints of households, among others reasons. On the other hand, our results are consistent with evidence in e.g. Cumming and Hubert (2021), who analyse UK data and find that the overall indebtedness of the household sector does not seem to drive the consumption response to monetary policy shocks. They find an important role for the distribution of household debt in driving the aggregate consumption response instead.

While the focus of this paper is on the interest rate sensitivity of consumption and its evolution, the VAR approach does provide us with the estimates of other

variables' sensitivities as well. While exploring those sensitivities in greater detail is beyond the scope of this paper, it should be mentioned that the interest rate sensitivities of GDP and inflation seem to exhibit somewhat similar patterns as the sensitivity of consumption. A more careful analysis and presentation of these results is beyond the scope of this paper and is left for future research.

2.2 Sensitivity of results to different identification schemes

To explore the robustness of our VAR results, we estimate the impulse responses to an interest rate shock using alternative identification strategies. Specifically, we focus on two alternative identification schemes that have gained popularity in the empirical literature. First, we employ the sign restrictions approach, where we require that in response to a positive interest rate shock, the 12-month Euribor increases on impact, while consumer prices and real house prices decline.[9] The signs of the responses of other model variables are left unrestricted.

As a second alternative identification scheme, we use high-frequency information, extraneous to our VAR model, in order to uncover the effects of a structural monetary policy shock. More specifically, we use changes in the euro area 1-week overnight indexed swap (OIS) rate within a tight window around monetary policy announcements of the ECB, obtained from the Euro Area Monetary Policy Event-Study Database (EA-MPD) of Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019). This variable serves as a proxy for the structural monetary policy shock, whose impact we may recover using the proxy variable identification approach popularised by Stock and Watson (2012) and Mertens and Ravn (2013), among others.

Figures 13 and 14 in the Appendix depict scatterplots from the rolling-window estimation as in the case of our baseline VAR. Neither sign nor proxy-identified SVAR models display evidence that would support the view that private consumption in Finland would have become more sensitive to changes in interest rates as the household sector's debt-to-income ratio has increased. As a word of caution, it should be noted that for some sub-samples in the rolling-window estimation of the proxy-identified SVAR, the effects of contractionary interest rate shocks on consumption are positive. From a theoretical perspective this is hard to justify and might suggest

[9] The sign restrictions approach is implemented using the algorithm of Rubio-Ramirez, Waggoner, and Zha (2010).

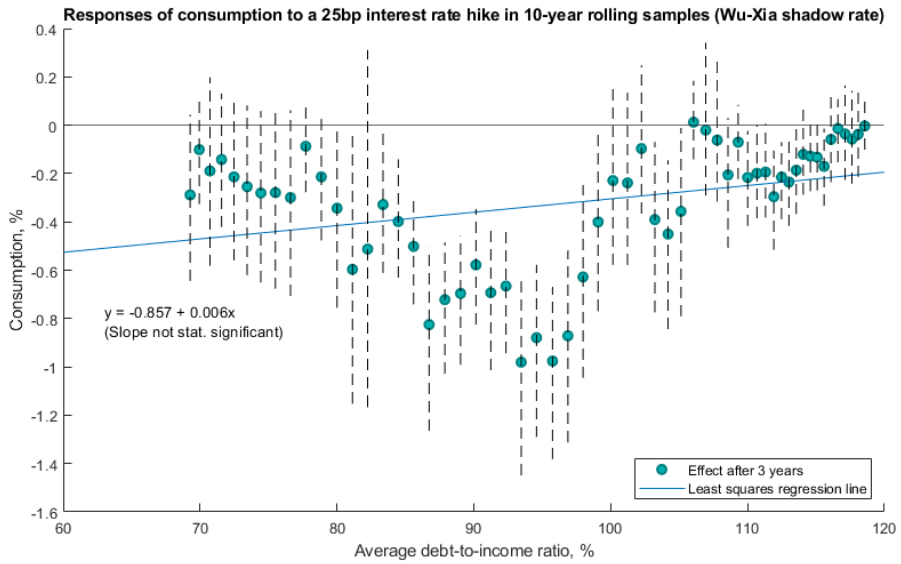


Figure 5: SVAR impulse responses to a positive one standard deviation interest rate shock in rolling 10-year sub-samples, recursive identification, impacts reported at 12 quarters after the initial shock. Dashed vertical lines denote 68% credible intervals. The 12-month Euribor has been replaced with the Wu-Xia shadow rate for the euro area in the model specification.

that the shock is poorly identified in certain sub-samples. Furthermore, as can be seen from the 68% credible intervals associated with the estimated impacts, the uncertainty surrounding the size of the effects can be very large.

2.3 Handling the period of zero or negative interest rates

To address the issue arising from the period of low interest rates, as a robustness check, we again employ a rolling-window estimation, but this time using the shadow rate of Wu and Xia (2016) as the interest rate variable in the model. In this case, we use the recursive identification as with our baseline model. The shadow rate can be used to capture the stance of monetary policy even when the short-term nominal rate is at its effective lower bound. To be precise, as the euro area shadow rate series of Wu and Xia (2016) is available from 2004 Q2 onwards, we form a composite series for the interest rate variable whose values before that date are those of the 12-month Euribor rate.

The rolling-window estimation results using the shadow rate are shown in Figure 5. Similar to our baseline result, the slope of the regression line fitted in the scatterplot is not statistically significant, indicating no linear relationship between

indebtedness of the household sector and the sensitivity of private consumption to interest rate changes. However, perhaps even more strikingly than in our baseline rolling-window estimation, a pattern seems to emerge where the sensitivity of consumption to interest rate increases until the indebtedness of the household sector reaches approximately 90–100%. In sub-samples with higher average debt-to-income ratios, the interest rate sensitivity of consumption seems to decrease.

2.4 The role of net interest expenses

Although the total amount of debt held by the household sector in Finland has increased over our full sample period, net interest expenses have steadily declined, as clearly seen in Figure 2. While at the end of 2019 the Finnish household sector's debt-to-income ratio was around twice as high as in the mid-1990s, the ratio of net interest expenses to disposable income was almost one percentage point lower, half the level in the mid-1990s.

One could argue that it is the cost of servicing debt that matters more for the level of consumption than the overall amount of debt: even with high levels of debt, a household may keep its consumption at a desired level as long as debt servicing costs are low. When debt servicing costs increase, households may be forced to cut their consumption especially if the amount of debt they hold is high, holding constant the level of disposable income.

Next, we examine the relationship between the sensitivity of private consumption to interest rate changes and the household sector's net interest rate expenses. We do so by replacing the debt-to-income ratio in our baseline recursive SVAR specification with the ratio of household net interest expenses to disposable income. Again, we employ a rolling-window estimation. For this VAR specification, our estimation starts from 1997 Q2 due to the availability of data on net interest expenses.

The results are shown in Figure 6. The scatterplot suggests that as average ratio of net interest expenses to income increases, the sensitivity of consumption to interest rate shocks increases. The regression line fitted into the scatterplot has a statistically significant negative slope.[10] Looking at the scatter, it seems that in sub-samples with

[10] Throughout this paper, when estimating the least squares regression lines from the scatterplots, heteoscedasticity and autocorrelation robust standard errors (Newey–West) have been used. As a word of caution, it should be kept in mind that as the observations in the scatterplots are estimates

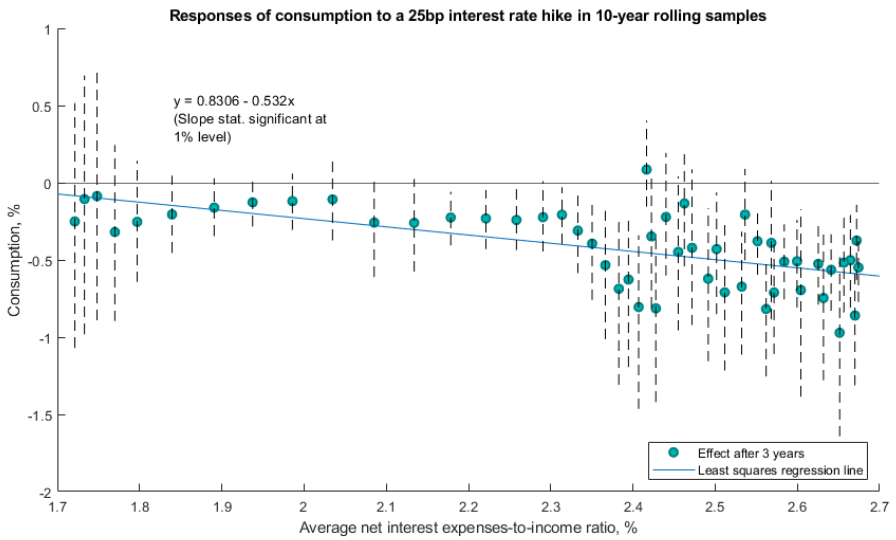


Figure 6: SVAR impulse responses to a positive one standard deviation interest rate shock in rolling 10-year sub-samples, recursive identification, impacts reported at 12 quarters after the initial shock. Dashed vertical lines denote 68% credible intervals. The debt-to-income ratio has been replaced with net interest expenses-to-income ratio in the model specification.

a particularly high average net interest expenses-to-income ratio (over 2.3 % or so), the responses of consumption are greater in magnitude compared to the sub-samples where the ratio is lower. However, the variability between responses in different sub-samples is large.

Furthermore, Figure 12 in the Appendix plots the estimated responses of consumption in each sub-sample, with the end date of the sub-sample on the horizontal axis. There is a pattern indicating that in earlier sub-samples, the responses of consumption to increases in interest rates have generally been stronger. In the latter sub-samples, where the average net interest expenses have been rather low, the responses of consumption are clearly more subdued and less dispersed. This seems to reinforce the idea that net interest rate expenses relative to income might be the driving factor for the interest rate sensitivity of private consumption.

All in all, these results suggest that while there is no clear connection between the debt-to-income ratio of the household sector and the interest rate sensitivity of consumption, there might be a more pronounced relation between the latter and net interest rate expenses relative to income. This observation lends support to the household cash-flow channel as a potentially important monetary policy transmission

themselves and have a probability distribution, the statistical significance may be overestimated.

channel.

3 Liquidity and credit constrained households in Finland: observations from household-level data

We now turn from an aggregate perspective to a household-level analysis. As discussed in the previous section, the distribution of debt across households, who may differ in their income and wealth, may affect the aggregate response of private consumption to interest rate shocks. Recent macroeconomic literature stresses the role of liquidity and credit constraints at the household level in shaping aggregate business cycle dynamics. In this section, we provide a descriptive analysis of liquidity constraints among Finnish households by using data from the national Wealth Survey 1987–2019, a repeated cross-sectional survey collected at irregular intervals (mostly every three or four years). The last four waves of the survey (2009, 2013, 2016 and 2019) are part of the euro area Household Finance and Consumption Survey (HFCS).

The Finnish Wealth Survey is a repeated cross-sectional survey with a representative sample of the Finnish population of households of approximately $N = 10,000$ in the last four waves. In earlier waves, the sample size was smaller. The data collection methods have changed over the years and especially since the national survey was harmonised with the HFCS.

In the four most recent waves, most of the data were collected from administrative registries, supplemented by surveying households on some items on which registry data were not available. Prior to 2009, the national Wealth Survey was conducted through in-person inteviews. This complicates the comparison of data over time, especially prior to the 2009 wave; the results below need to be interpreted with this caveat in mind.[11]

We compute the share of hand-to-mouth households in each survey wave by adopting the definition of Kaplan et al. (2014) and complement this measure with various survey-based proxies for the prevalence of liquidity constraints. Adopting the approach of Kaplan et al. (2014), we define a household to be liquidity-constrained,

[11] The methodology has remained comparable across the last four waves (the HFCS waves). In our calculations below, we aim to use variables whose definitions have remained reasonably comparable also prior to 2009, but the estimated hand-to-mouth shares cannot be interpreted as constituting a time series.

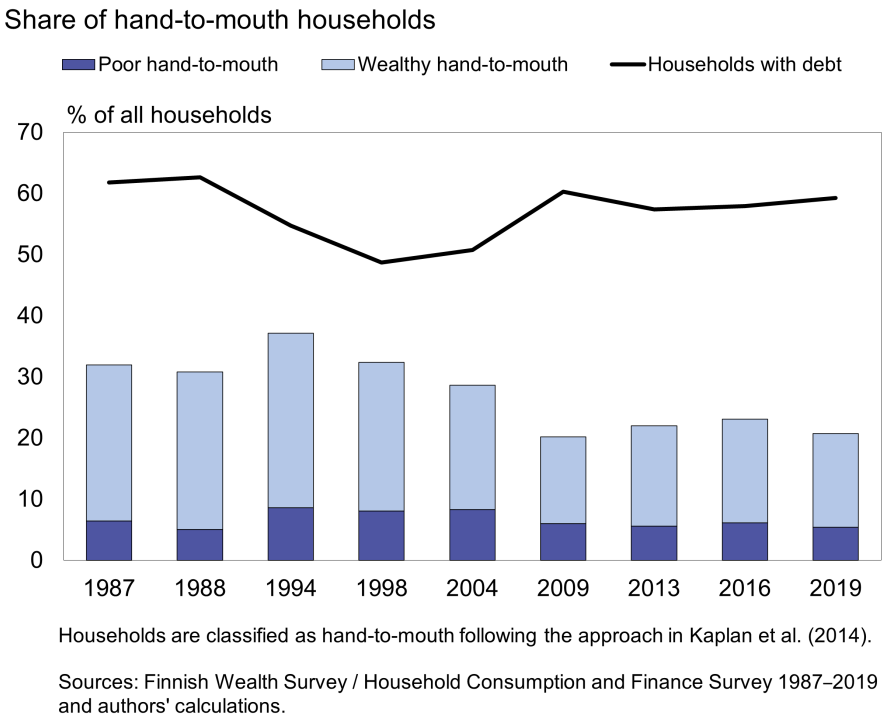
or hand-to-mouth, if its liquid assets are less than half of its average monthly income in a given survey year. Moreover, a household is classified as poor hand-to-mouth if its net illiquid wealth is non-positive, and wealthy hand-to-mouth if its net illiquid wealth is positive.[12]

We complement this measure, which is based on the household's financial position, by computing the shares of household reporting various subjective financial hurdles that may also proxy for liquidity constraints. This information has been collected yearly since 2004 as part of the EU-SILC survey. The survey-based proxies include the shares of households that report being unable to save, in general, out of their income; having difficulties in making ends meet; being unable to face unexpected financial expenses; and having payments in arrears.

The share of households having any debt decreased in the early 1990s during the banking crisis accompanied by a deep recession in Finland, as the household sector went through a strong deleveraging episode. From the mid-1990s, households started to accumulate debt both through the extensive margin (the share of households with debt grew) and through the intensive margin (the sector's aggregate debt-to-income ratio increased). In 1998, the share of households with debt was 49%, but in 2019 it was 59% (Figure 7).

As households have become more indebted, however, the share of liquidity constrained households has not grown. The share of hand-to-mouth households was at its highest in 1994 (37%), during the trough of the Finnish Depression of the 1990s, but it seems to have subsequently declined. In the four most recent survey waves harmonised with the HFCS, across which the survey methodology has been comparable, the estimated share of hand-to-mouth households has been rather constant between 20% and 23%. Across all survey waves, the wealthy hand-to-mouth have consistently accounted for around 3/4 of all hand-to-mouth households, consistent

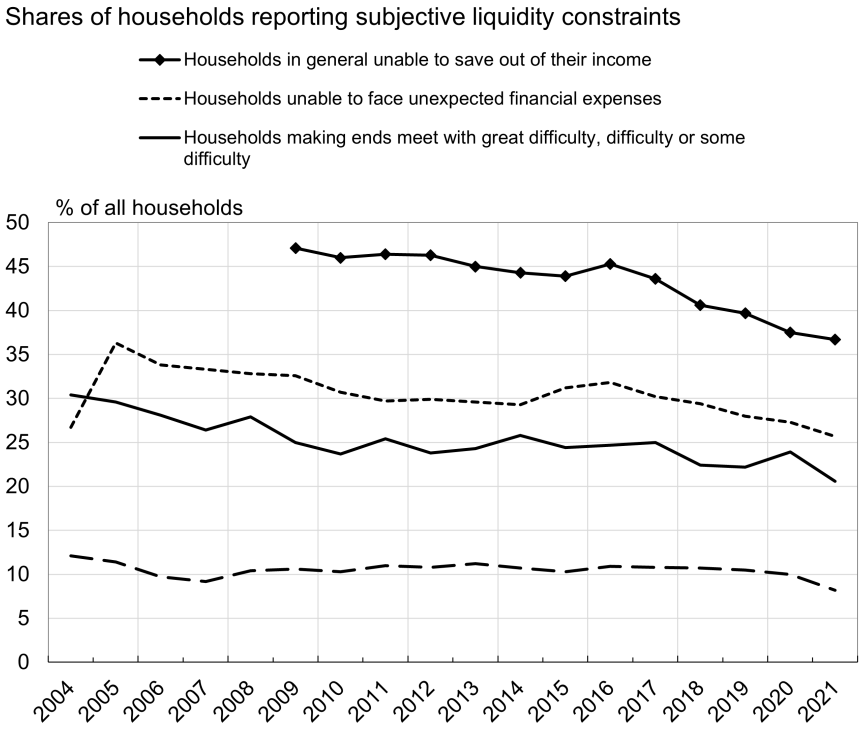
[12] Kaplan et al. (2014) use a concept of *net* liquid wealth, i.e. the difference between liquid assets and liquid (short-term) debt, such as credit card debt and credit lines. However, such a granular breakdown of debts is not available in the survey waves conducted prior to 2009. To calculate comparable estimates across waves, we define (gross) liquid wealth as the sum of deposits, listed shares, investment shares and bonds. Data on cash holdings has not been collected since 2009, so we exclude it from our definition of liquid wealth. Following Kaplan et al. (2014) who define net illiquid wealth as the difference between illiquid assets and illiquid debt, the household's net illiquid wealth is calculated as (total assets – liquid wealth – mortgage debt).



Households are classified as hand-to-mouth following the approach in Kaplan et al. (2014).

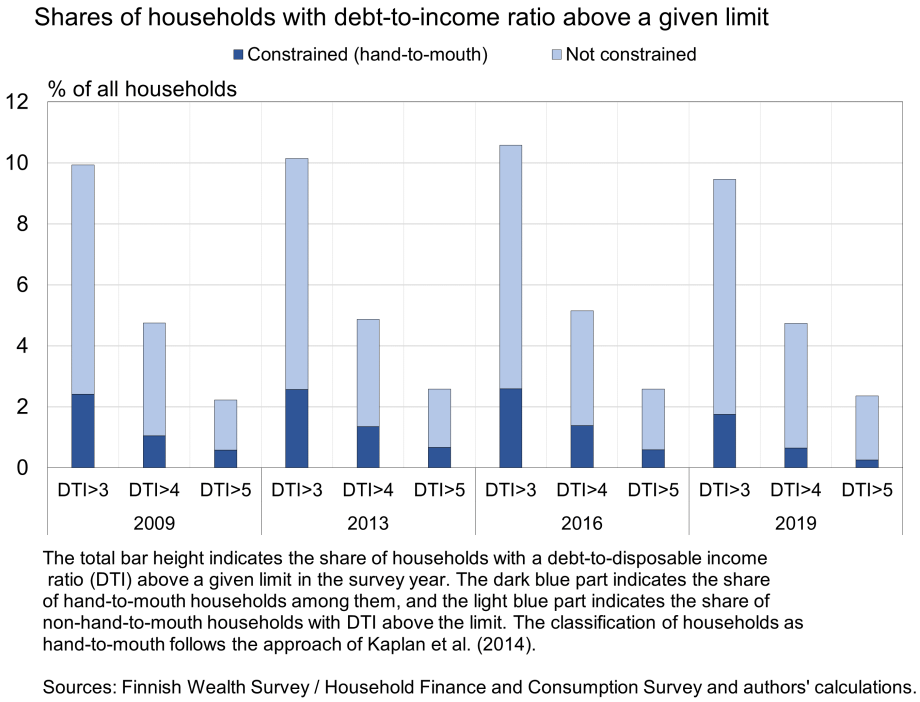
Sources: Finnish Wealth Survey / Household Consumption and Finance Survey 1987–2019 and authors' calculations.

Figure 7



Sources: Statistics Finland, EU-SILC.

Figure 8



The total bar height indicates the share of households with a debt-to-disposable income ratio (DTI) above a given limit in the survey year. The dark blue part indicates the share of hand-to-mouth households among them, and the light blue part indicates the share of non-hand-to-mouth households with DTI above the limit. The classification of households as hand-to-mouth follows the approach of Kaplan et al. (2014).

Sources: Finnish Wealth Survey / Household Finance and Consumption Survey and authors' calculations.

Figure 9

with observations from other countries (e.g. Kaplan et al. (2014), Cumming and Hubert (2021)).

When measured by the various subjective assessments of the households' financial margin, the shares of households facing liquidity constraints have also declined since the start of the survey collection in 2004, in most cases by about 10 percentage points from their respective peak values (Figure 8). The only proxy measure for liquidity constraints not showing a clear decline is the share of households reporting as being in arrears, which has hovered around 10% over the whole span of the survey collection. These subjective proxies for liquidity constraints give a consistent picture of the developments over time as the hand-to-mouth measure in Figure 7.

Finally, we compute the share of households with large debts relative to their income in the latest survey waves. Figure 9 shows the shares of households with debt-to-income (DTI) ratios above 3, 4 and 5 in each of the four waves. These households are heavily indebted relative to their disposable income, and could be regarded as particularly vulnerable to shocks that adversely affect their income and debt servicing capability. However, even among these heavily indebted households, only a small fraction are classified as liquidity-constrained, i.e. have thin margins of liquid assets relative to their income that can be used as a financial buffer.

Moreover, the share of liquidity-constrained households among the heavily indebted has declined (Figure 9). In 2009, one quarter of households with DTI>3 and of those with DTI>5 were classified as hand-to-mouth. In 2019, 19% of households with DTI>3 and 11% of households with DTI>5 were classified as hand-to-mouth.

This cross-tabulation of the subset of households with large debts *and* few liquid assets relative to income shows that liquidity constraints are, if anything, less prevalent among the most heavily indebted households than among all households. This would suggest that the households that have acquired large debts are also, on average, ones with a relatively strong financial position. In other words, credit and liquidity constraints may be positively correlated, and liquidity-constrained households are not likely to receive large debts relative to their income in the first place.

It must be noted that the share of hand-to-mouth households, as measured using the Kaplan et al. (2014) definition, is endogenous to interest rates in the economy. The household-level balance sheet and income items are recorded in nominal terms and valued to market prices at the end of each survey year. Changes in interest rates affects asset valuations directly and may affect incomes and debt stocks of households through general equilibrium effects. The period of low interest rates after the financial crisis thus likely eased liquidity constraints by increasing asset valuations. Similarly, in an environment of rising interest rates, liquidity constraints may tighten and a larger share of households may become constrained.

The shares of households reporting subjective financial difficulties, which we interpret as proxies for liquidity constraints, are also surely endogenous to the state of the aggregate economy and the business cycle. Regardless, we observe a downward trend over the past two decades in these subjective assessments. This suggests a longer-run positive development in the financial margin of Finnish households that started already before the period of low interest rates. Consequently, this may at least partly explain why consumption responses to interest rate shocks may not have become stronger over time.[13]

[13] In a cross-country comparison of European countries, Almgren et al. (2022) find that monetary policy shocks have larger effects on output and consumption in countries with larger shares of hand-to-mouth households, and consistent with the analysis in Kaplan et al. (2014), the result may be driven by wealthy hand-to-mouth households.

4 Conclusions

As a consequence of high inflation and the ensuing rapid increase in ECB's key interest rates, Finnish households are faced with rising debt servicing costs. From a macroeconomic perspective, this has widely been identified as a key vulnerability: over time, the Finnish household sector has grown more indebted, and in order to service their loans, households may be forced to cut their consumption, which may then further depress aggregate demand and exacerbate the economic contraction. In this paper, we look at Finnish data, both at the macro and micro level, to study whether private consumption have become more sensitive to changes in the level of interest rates as the indebtedness of the household sector has grown.

Based on our results from aggregate data, the relationship between household indebtedness and the interest rate elasticity of consumption is not clear-cut. Our baseline rolling-window SVAR estimates suggest that in sub-samples with a relatively low average debt-to-income ratio (100% or less), private consumption might have become more sensitive to changes in the interest rate as household indebtedness increased. However, this relationship seems to have dampened in the later sub-samples with relatively high indebtedness.

As the debt-to-income ratio of the Finnish household sector has grown steadily over time, the sub-samples with high average debt-to-income ratios largely correspond to periods of very low – or negative – and stagnant nominal short-term interest rates. Consequently, during these periods, there has been little variation in the aggregate net interest expenses of the household sector. This might explain why, at the aggregate level, the estimated effects of interest rate shocks on consumption have seemingly diminished in the sub-samples with high average indebtedness. This would also be consistent with a weakening of the cash-flow channel of monetary policy transmission to private consumption.

Another possible explanation has to do with the evolution of the *net* financial position of Finnish households. Our examination of household-level survey data reveals that, despite the stock of household debt growing at the aggregate level, the share of households facing liquidity constraints has not increased. In fact, the share of liquidity-constrained households seems to have declined compared to early 2000s. This observation holds true when using either subjective survey indicators or prox-

ies established in earlier literature to approximate the share of liquidity-constrained households. An improvement in the financial margins and liquid asset positions of households would further dampen the cash-flow channel, as households have more liquid buffers to counter adverse shocks.

In line with recent literature, our findings stress the potential key role played by the distribution of households' income and wealth in driving aggregate fluctuations and in interacting with monetary policy transmission. However, our present analysis does not establish a causal relationship between the share of liquidity-constrained households and the sensitivity of aggregate private consumption to interest rates. Indeed, a further empirical exploration of this link would provide an interesting area for future research.

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A Data used in VAR estimation

Variable	Transformation	Original source	Macrobond identifier
Harmonised index of consumer prices	Logarithmic	Eurostat	i15cp00fidx
Real private consumption	Logarithmic	Statistics Finland	finaac0188
Real GDP	Logarithmic	Statistics Finland	finaac0178
Household debt-to-income ratio	None	Bank of Finland	fibank5079
Real house price index	Logarithmic	OECD	oecd_eo_hpi _00463338
12-month Euribor	None	European Money Markets Institute	fi12mibr
Real effective exchange rate index	Logarithmic	European Commission	fiecexri0008
1-week OIS rate change within ECB monetary event window	Quarterly sum	Altavilla et al. (2019)	-
Household sector's net interest expenses to income	None	Bank of Finland and Statistics Finland	-

Table 1: All the data used in VAR estimation, except for the 1-week OIS rate change and the household sector's net interest expenses to income, are retrieved from Macrobond. For the series that are from Macrobond, the original sources and Macrobond series identifiers are reported in the two last columns of the table.

B Additional SVAR results

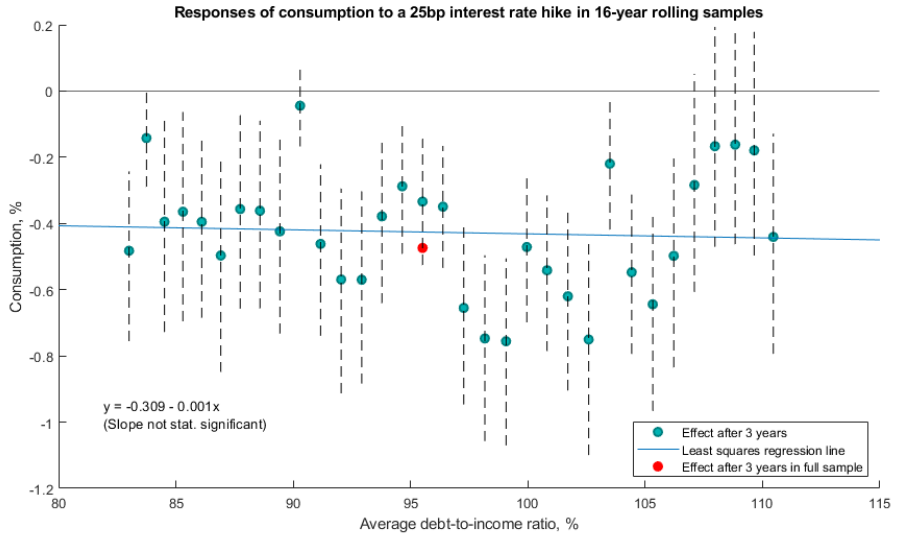

Figure 10: Results from a rolling-window estimation of a SVAR model, recursive identification. The length of the rolling window is 16 years. Dashed vertical lines denote 68% credible intervals.

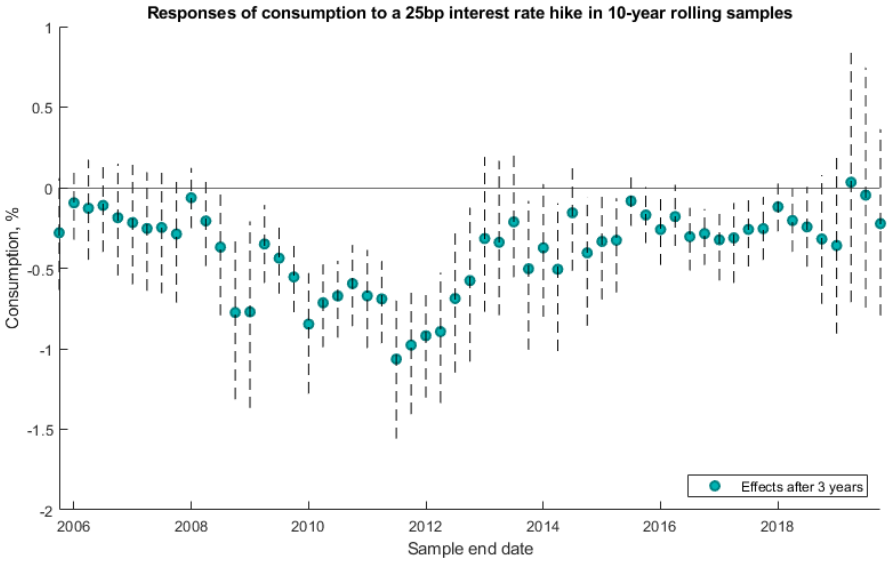

Figure 11: Results from a rolling-window estimation of a SVAR model, recursive identification, with sample end dates plotted on the horizontal axis. The length of the rolling window is 10 years. Dashed vertical lines denote 68% credible intervals.

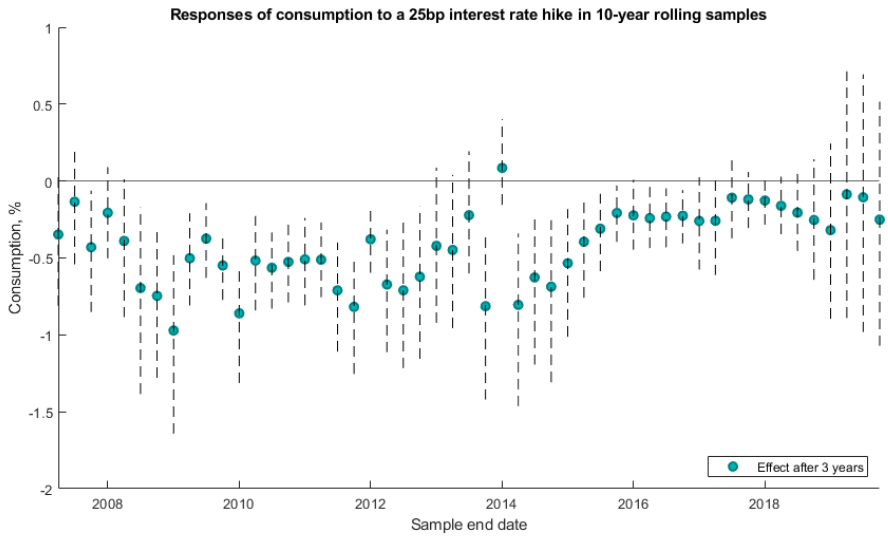

Figure 12: Results from a rolling-window estimation of a SVAR model, recursive identification, with sample end dates plotted on the horizontal axis. In the model specification, the household debt-to-income ratio has been replaced with the net interest expenses-to-income ratio. The length of the rolling window is 10 years. Dashed vertical lines denote 68% credible intervals.

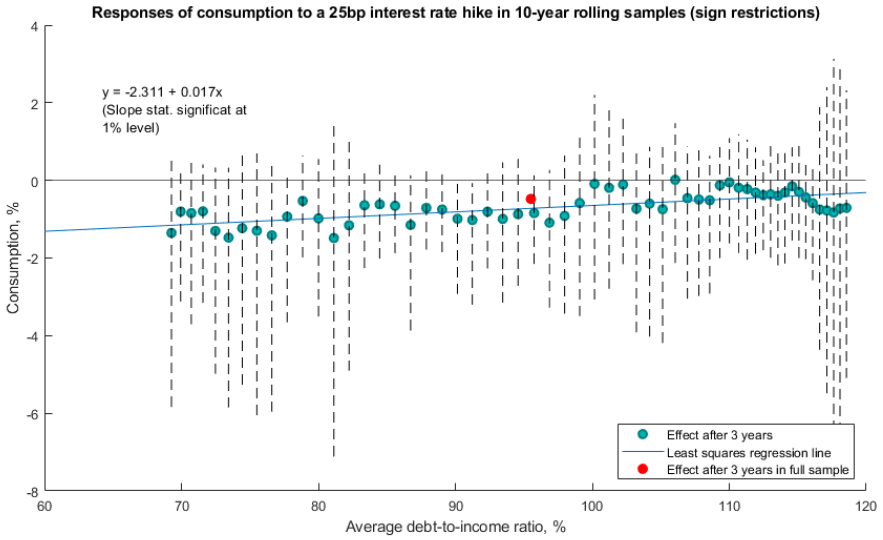

Figure 13: Results from a rolling-window estimation of a SVAR model identified via sign restrictions. See the main text in section 2.2 for further details. Dashed vertical lines denote 68% credible intervals.

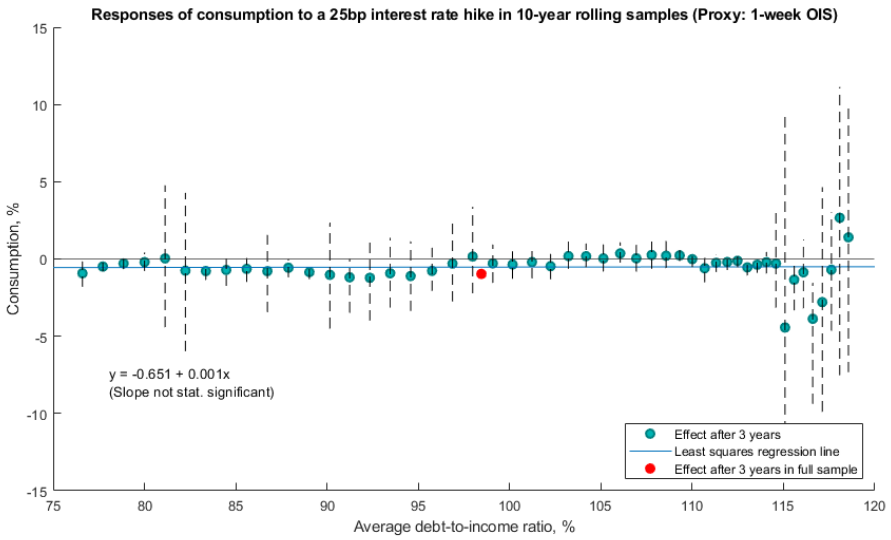

Figure 14: Results from a rolling-window estimation of a SVAR model identified using an external proxy (changes in the 1-week OIS rate around ECB monetary policy events). See the main text in section 2.2 for further details. Dashed vertical lines denote 68% credible intervals.

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