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DISCUSSION PAPER SERIES

IZA DP No. 12359

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ABSTRACT

Monetary Policy Transmission to Consumer Financial Stress and Durable Consumption*

We examine the effects of monetary policy on household self-assessed financial stress and durable consumption using panel data from eighteen annual waves of the British Household Panel Survey. For identification, we exploit random variation in household exposure to interest rates generated by the random timing of household interview dates with respect to policy rate changes. After accounting for household and month-year-of-interview fixed effects, we uncover significant heterogeneities in the way monetary policy affects household groups that differ in housing and saving status. In particular, an increase in the interest rate induces financial stress among mortgagors and renters, while it lessens financial stress of savers. We find symmetric effects on durable consumption, mainly driven by mortgagors with high debt burden or limited access to liquidity and younger renters who are prospective home buyers.

JEL Classification: G21, E21

Keywords: monetary policy, mortgage debt, debt burden, financial stress, consumption

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1. Introduction

Households' perceptions of their financial situation are likely to have broader aggregate implications and may reveal hard information, that is not yet reflected in the data, about the economic conditions that households experience. While consumer sentiment indicators are closely monitored by policy makers, their link with certain policy interventions is not always clear. In particular, little is known about the effect of monetary policy on households' outlook of their financial situation, whether this effect extends to spending and the heterogeneous responses of population sub-groups. Uncovering these effects is important in order to better understand the monetary policy and financial stability nexus in the household sector. This paper examines the heterogeneous effects of monetary policy on household self-assessed financial stress and actual spending decisions.

Our starting premise is that households exhibit significant differences in multiple dimensions, such as their housing status and the mortgage debt burden, their savings capacity as well as the reasons for which they save. A more accommodative monetary policy, for example, is expected, in general, to stimulate borrowing, ease debt burden, compress interest income and incentivize spending. Nevertheless, such developments are unlikely to occur uniformly across population sub-groups. As a result, households, depending on their personal circumstances, should respond quite differently to a given interest rate change.[1]

Uncovering the heterogeneous transmission of monetary policy through housing, debt service burden and saving status onto consumer financial stress and spending is empirically

[1] The importance of such heterogeneity has been recently emphasized in the public debate about the repercussions of the low-for-long interest rate environment for savers. See, e.g., Cœuré (2016) "But people are not just savers – they are also employees, taxpayers and borrowers, as such benefiting from the low level of interest rates." (https://www.ecb.europa.eu/press/key/date/2016/html/sp160501.en.html)

challenging. Ideally, a dataset should measure both cross-sectional heterogeneity and track the same households over a long period of time. Moreover, it should provide information on household income, saving and borrowing choices as well as on their financial situation and consumption. From an econometrics point of view, one should uncover the exogenous variation in household interest rate exposure, while taking into account: a) fluctuations in various other macroeconomic factors; b) household-specific unobserved factors that induce self-selection into groups that are heterogeneously affected by monetary policy (e.g., mortgagors vs. outright owners and renters; savers vs. non-savers); and c) time-varying household characteristics that can account for other household-specific idiosyncratic shocks (e.g., in income and marital status).

Against this background, our paper provides the first empirical evidence on the heterogeneous effects of monetary policy on consumer self-reported financial stress, which represents a closely monitored indicator used to inform policy decisions. Moreover, we examine the extent to which these effects also translate into adjustments in durable spending.

The second contribution of our paper is the use of a novel approach to estimate the monetary policy transmission to household perceptions and behavior. We utilize data from the British Household Panel Survey (BHPS) that offers comprehensive information for a nationally representative panel of households over eighteen annual waves.[2] A key feature of the survey for our analysis is that households are interviewed in different days within months across consecutive years, which are determined independently of the policy rate set by the Bank of England. This generates exogenous variation in household interest rate *exposure* which we exploit for identification. This set up allows accounting for various time-varying macroeconomic factors by means of month-year-of-interview fixed effects. In addition, because of the survey's panel

[2] Similar questions on consumer sentiment and self-assessed financial situation are asked for a long time in large cross- sectional studies such as the Michigan Survey of Consumer Attitudes and Behavior and the European Commission Consumer survey.

dimension we control for time-invariant unobserved household heterogeneity by means of household fixed effects as well as for time-varying household characteristics. Compared to previous research, our approach takes into account macro effects at monthly frequency and self-selection into housing and saving status groups that are heterogeneously affected by monetary policy as well as other household idiosyncratic shocks.

Given that our measure of interest rate exposure is household-specific, our estimation approach is flexible enough to accommodate additional dimensions of heterogeneity that have not been explored by previous studies. Thus, the third contribution of our paper is to examine not only differences *across* mortgagors, renters and savers, but also differences in debt burden and hand-to-mouth status *within* mortgagors and in age *within* renters. As a result, we assess, for example, whether an increase in the interest rate is detrimental for all mortgagors or primarily for those who are considered 'risky borrowers' on the basis of their debt service ratio (i.e., a commonly used indicator to assess financial vulnerabilities in the household sector).

Focusing on the UK is relevant in this setting because mortgages account for most of the household indebtedness and they are quite prevalent (held by more than half of the general population). In addition, the vast majority of mortgages are adjustable rate, while the few fixed rate ones typically feature short fixation periods (e.g., two years), therefore changes in the policy rate pass on relatively fast to mortgagors. In addition, information about mortgage installments and household net income is known, thus one can calculate the household-specific debt-service-to-income ratio. Furthermore, the survey includes information about savers and those unable to save, which we use to distinguish between mortgagors who are hand-to-mouth and non-hand-to-mouth (see Kaplan and Violante, 2014 and Kaplan, Violante and Weidner, 2014).

We find that an *increase* in the interest rate of 100 basis points *induces* financial stress among mortgagors and renters (by 4.4% and 7.2% respectively, compared to outright home

owners), while it *improves* savers' perceived financial situation by 5.7% in relation to non-savers (hand-to-mouth). Among mortgagors, we estimate more pronounced effects for those with a higher debt burden and for the hand-to-mouth. Congruently, we find that an increase in the interest rate also translates into a lower likelihood of purchasing durables for mortgagors by 1.7%. We show that this effect is driven by mortgagors with a high debt-service-to-income ratio and who are hand-to-mouth. Instead, mortgagors with low debt burden and access to liquid resources adjust spending only temporarily, as they are able to smooth the underlying shock, at least in the short-term. These findings highlight the importance and the heterogeneous role of the degree of liquidity constraints among borrowers when monetary policy tightens.

As regards renters, we do not find adjustments in their durable spending by hand-to-mouth status, consistent with the fact that an increase in the interest rate does not make tighter the (currently faced) liquidity constraints. Instead, we find evidence to suggest that younger renters reduce durable spending as an increase in the interest rate may signal additional difficulties for a prospective home buyer to take up a mortgage and service it.

Our paper relates to a growing literature examining households' perception about their financial situation and the likely implications for their behavior. For example, Cocco, Gomes and Lopes (2017) investigate the links between self-reported financial situation, psychological well-being and changes in expenditures. In a different context, Liberini et al. (2019), provide evidence that perceptions about own financial situation is a key predictor of voting in favor of 'Brexit'. We contribute to this literature by providing the first causal evidence of monetary policy transmission on household perceived financial situation through the 'cash-flow' effect, which we show that households react to by adjusting their spending.

Our paper also relates to a growing number of studies that use heterogeneous agent models and disaggregate data to gain insights on various effects of macro policies. For example, Mian,

Rao and Sufi (2013) and Mian and Sufi (2014) highlight the role of household borrowing for macroeconomic shocks. Recent work has studied the effects of interest rate changes on consumption through the implied reduced repayments for adjustable rate mortgages either by aggregating over groups of households by housing tenure (see, e.g., Cloyne, Ferreira and Surico, 2018 for the U.S. and the U.K.; and Koeniger and Ramelet, 2018 for Germany and Switzerland) or at the disaggregate level exploring household heterogeneity (see, e.g., Agarwal et al., 2019 for China; Di Maggio et al., 2017 for the U.S.; Flodén et al., 2016 for Sweden; and Jappelli and Scognamiglio, 2018 for Italy). We contribute to this literature by using a novel identification approach that allows deriving credible estimates on the effects of interest rate after taking into account unobserved macro effects at monthly frequency as well as regional conditions. Moreover, the panel nature of our dataset allows also accounting for both time invariant unobserved household heterogeneity (by means of household fixed effects) and time varying household-specific preferences and other idiosyncratic shocks (by, e.g., means of controls for income, occupation, education and marital status). As a result, we are able to deduce the effect of interest rate directly from the micro survey data without having to aggregate information (e.g., by pseudo-cohorts) or to (partly) ignore household unobserved heterogeneity and household idiosyncratic shocks. We also probe further into household heterogeneity by distinguishing mortgagors with different debt burden and access to liquidity and renters with different age (and home buying plans). We show that the relevant subgroups are sizeable in our data and that considering these differences turns out to be important.

Finally, a growing body of theoretical work has been exploring how heterogeneity in household balance sheets interrelates with the transmission of monetary policy (e.g., Iacoviello, 2005; Auclert, 2018; and Kaplan, Moll and Violante 2018). More generally, the paper relates to a number of empirical studies examining consumption adjustments in response to various actual

income shocks (e.g., Souleles, 1999; Agarwal, Liu and Souleles, 2007; Misra and Surico, 2014; and Sahm, Shapiro and Slemrod, 2010, 2015) or hypothetical income shock scenarios (e.g., Jappelli and Pistaferri, 2014; Christelis et al., 2018 and Fuster, Kaplan and Zafar, 2018).

The remainder of the paper is organized as follows. Section 2 provides information on the data. Section 3 provides details on the empirical strategy, while Section 4 discusses the baseline results and associated robustness checks. Section 5 probes further into heterogeneity within mortgagors and renters. Section 6 concludes.

2. Data

We use longitudinal data from all eighteen waves (1991-2008) of the BHPS, which is an annual, nationally representative survey of British households. The survey was completed in 2008 and was subsequently replaced by the UK Household Longitudinal Study. Thus, our sample period ends just before the global financial crisis and a period of unconventional monetary policy interventions. The BHPS in addition to standard demographic and labor market information, includes questions on self-assessed consumer financial situation, household durable consumption, saving status as well as information on housing and mortgage debt. Throughout the analysis we focus on household heads 21 to 70 years old using the entire unbalanced panel.[3] Table 1 provides summary statistics for the variables used in the estimation.

Information on household perceived financial situation is drawn from a question asking respondents whether they are, on the day of the interview, financially better off, worse off or about the same compared to one year ago. We construct a dummy variable representing (perceived) "financial stress", which equals one for household heads who report that are financially worse off, and zero otherwise. We also use information on household expected

[3] The vast majority of household heads older than 70 years of age do not have a mortgage outstanding. For the analysis we keep consecutive yearly observations for each household head.

financial situation, which is based on the question asking respondents whether they think that in one year's time they will be financially better off, worse off or in a similar financial situation. We construct a dummy variable denoting "expected financial stress", which equals one for household heads who expect to be financially worse off next year compared to their (perceived) financial situation on the day of the interview. Roughly one out of four households in the sample report financial stress and a similar share expects to be worse off one year ahead.[4]

Durable consumption is measured at the household level and draws from a series of questions asking about purchases out of a list of durable items during the time elapsed between the interview date and September 1st of last year.[5] We construct a dummy which equals one if the household has purchased any of the listed durables and zero otherwise (52% is the sample average). Because durable purchases are not high-frequency and there may be some delayed adjustments in spending due to an interest rate change, we also consider an alternative definition which takes into account any purchases in the current or in the subsequent year (with 73% of the sample reporting purchase of at least one item over a two-year period).

The survey also asks respondents whether they manage to save any amount of income by putting something away now and then in a savings account other than to meet regular bills.[6] About 49% of households (i.e., both partners in case of couples) report that are unable to save. Furthermore, the survey provides information on housing tenure, distinguishing among outright home owners (22%), mortgagors (50%) and renters (28%). As discussed, mortgages account for the main bulk of household debt and most of the mortgages in the UK are variable rate.

[4] These questions in the BHPS are two of the five questions used to construct the so-called 'consumer confidence' index in the US. The latter is an average of answers to five questions (two about current financial conditions and three regarding future ones; for details see: https://www.bebr.ufl.edu/csi-data.

[5] The questions are about the following items: color TV, VCR, freezer, washing machine, tumble dryer, dish washer, microwave, home computer, CD player, satellite dish, cable TV, landline phone, mobile phone and car.

[6] Specifically, respondents are asked every year the following question: "Do you save any amount of your income for example by putting something away now and then in a bank, building society, or Post Office account other than to meet regular bills?"

Mortgagors represent a sizeable population sub-group that, importantly, is heterogeneous in terms of access to liquidity (roughly 40% are unable to save) as well as exposure to debt (about 8% have a debt-service-to-income ratio greater than 33%). The majority of renters are unable to save (69%), yet there is a non-trivial sub-group of savers among them. Further, there are other dimensions of heterogeneity, e.g. by age, that may be relevant, as younger renters are more likely to buy a house compared to their older counterparts. As discussed in the next section, our identification approach is flexible enough to allow estimating heterogeneous effects across these different groups (e.g., high vs. low debt-service ratio and hand-to-mouth vs. non-hand-to-mouth mortgagors; younger vs. older renters).

Last, the information on the interest rate is based on the official bank rate from the Bank of England (see Appendix Table A1), that is also the interest rate that households observe. This is consistent with our modeling approach that estimates the effect of exogenous household exposure to an observed macro variable on household perceptions (financial stress) and decisions (durable spending). For robustness, we also estimate instrumental variable regressions in which we exploit variation in monetary policy shocks (that typically are not observed by households).

3. Empirical strategy

The main goal of the paper is to examine the effect of changes in the interest rate on consumer financial stress and durable spending. We estimate a model that utilizes exogenous variation in household-specific exposure to interest rate fluctuations in the course of a year according to the day of the interview. The baseline model allows for the estimated effects to differ across three major population sub-groups that are differently affected by monetary policy (i.e., mortgagors and renters vs. outright home owners and savers vs. non-savers). More specifically, we estimate the following two-way fixed effects specification:

$$Y_{h,t,d} = \beta_1 \overline{IR}_{h,t,d} + \beta_2 (Mortgage * \overline{IR})_{h,t,d} + \beta_3 (Rent * \overline{IR})_{h,t,d} + \beta_4 (Save * \overline{IR})_{h,t,d} +$$

$$\beta_5 Mortgage_{h,t,d} + \beta_6 Rent_{h,t,d} + \beta_7 Save_{h,t,d} \; + \; + \beta_8 X_{h,t,d} + \; \alpha_h + \varphi_{t,m} + \omega_{h,t,d} \; . \quad (1)$$

Each household (*h*) is interviewed in year (*t*) on a specific day (*d*), where days-of-interview are scheduled by the survey agency and thus vary across months (*m*) in consecutive years. Starting with *financial stress* as the outcome of interest, the binary indicator $Y_{h,t,d}$ denotes respondents who report on the day of the interview a worse financial situation compared to one year ago. The variable ($\overline{IR}_{h,t,d}$) measures the *exposure* of each household to the Bank of England policy rate in the period between the interview date and 365 days ago, where the time window coincides with the time horizon of the outcome variable. More specifically, we measure household-specific interest rate exposure as:

$$\overline{IR}_{h,t,d} = \frac{1}{D} \sum_{j=d0,t-1}^{h,t,d} IR_j, \qquad (2)$$

where we average the prevailing interest on day j (IR_j) over the calendar period $[d0, d]$, where d denotes the interview date in year t , $d0$ denotes the calendar date 12 months before the interview date (in year $t-1$), and D denotes the number of days elapsed between the two dates. Because interview dates vary across households independently of policy rate changes, our measure of interest rate exposure varies exogenously across households at the daily level. Therefore, we are able to account for all unobserved aggregate factors which are common to all households at the month-year-of-interview level ($\varphi_{t,m}$), and which are likely to correlate both with the policy rate and the outcome of interest. In addition to controlling for month-year-of-interview fixed effects, we also account for household fixed effects (α_h) given that the survey is a panel tracking the same households over consecutive years. This is important as it allows us taking into account all the time-invariant idiosyncratic factors that determine selection into housing tenure and into saving status (i.e., the sub-groups that we allow to be differently affected by monetary policy). As

a result, the effects of owning a house with a mortgage *(Mortgage*) or being a renter (*Rent*) – relative to outright home ownership – on financial stress are identified through variation of housing tenure choice over time. Likewise, one can identify the effects of saving status *(Save)*. Later on, we augment specification (1) to probe further into cross-heterogeneities by housing and saving status.

Moreover, we control for various time-varying socio-economic household characteristics that can account for preferences and idiosyncratic shocks. More specifically, $X_{h,t,d}$, comprises controls for marital and employment status, education, net household income and region of residence. Having taken the above broad set of factors and a rich set of fixed effects into account, there is still variation left in our specification to estimate the main effects of interest through the interaction terms of the interest rate exposure with the sub-groups of mortgagors, renters and savers (provided by estimates of β_2, β_3 and β_4, respectively). Estimated standard errors are double clustered at the household and month-year-of-interview level to allow for possible cross-sectional and serial correlation dependence in the error term $\omega_{h,t,d}$.

Furthermore, we also explore whether these groups adjust their spending behaviour in a consistent way to their reported changes in financial stress. In the case of *durable spending*, the dependent variable in equation (1) is a dummy denoting whether households have purchased any durable goods between their interview date and September 1st of the previous interview year.[7] Similarly to the case of financial stress, interest rate exposure varies exogenously across households because interview dates vary across households independently of policy rate changes. We measure interest rate exposure as in equation (2) where D denotes the number of days elapsed between the current interview date (d) in year t and $d0$, which is September 1st of the previous

[7] For example, according to the survey design, a household that is interviewed on October 1st 2000 and another one that is interviewed on December 1st 2000 have to report durable purchases that took place during the last thirteen and fifteen months, respectively (i.e., since September 1st 1999).

year. The length of the time window over which we measure exposure is consistent with the time window in which households are asked to report their durable spending. The remaining specification is similar to equation (1), thus it allows for heterogeneity of interest rate exposure across sub-groups, while it takes into account individual household fixed effects and month-year-of-interview fixed effects and various household characteristics. As before, standard errors are double clustered at the household and month-year-of-interview level.[8]

4. Baseline Results

4.1. Financial stress

Table 2 shows estimated results for financial stress. The first two columns show results from specifications that allow the interest rate effect to differ by housing status only (column 1) and by saving status only (column 2). Results in column (3) are from a more flexible specification allowing for changes in monetary policy to influence differently households according to both their housing and saving status (similar to equation (1) in Section 3). In column (4), we show estimates from the latter specification using expected financial stress (referring to one year ahead) as the dependent variable. We find that a change in the interest rate affects significantly the financial stress in the current period and the expected financial stress reported by each of these groups.

In particular, an assumed increase in interest rate induces financial stress among mortgagors (compared to outright home owners) as it is indicated by the positive estimated coefficient of the relevant interaction term (p value < .05). Mortgage debt represents the main bulk of household debt and, as discussed, the majority of mortgages are variable rates. Thus, an increase in interest rate implies a higher debt burden to service and a relatively immediate increase in loan

[8] In the robustness section, we also consider (for both outcomes) a weighted average interest rate exposure that attaches higher weight to values of the interest rate closer to the date of the interview.

repayments. According to column (3), an assumed exposure to a 1 p.p. (or 100 basis points) higher interest rate contributes to about 1.1 p.p. higher financial stress among mortgagors. Given that one-fourth of the sample reports financial stress, this estimate implies an (unconditional) increase of financial stress of about 4.4%.

As regards renters, we find that an assumed 1 p.p. increase in interest rate exposure implies a 7.2% higher likelihood of reporting financial stress compared to outright home owners. Below we attempt to shed some light into possible mechanisms that may drive this result.

Savers represent a group that is likely to be immediately affected by monetary policy. Results are in line with economic intuition suggesting that an interest rate increase (of 100 basis points) lowers financial stress of savers compared to their hand-to-mouth counterparts (by about 5.7%).

Results in column (4) suggest that an increase in the interest rate increases expected financial stress for mortgagors and renters and lowers expected financial stress for savers. Yet, the underlying magnitudes are relatively lower compared to those estimated for current financial stress. We also repeat the analysis using as dependent variable the self-assessed financial situation on the day of the interview, without a reference to the financial situation one year ago (i.e., the outcome variable used in our baseline specifications). Our findings (available from the authors upon request) remain unaffected.

4.2. Durable spending

We use the same modelling approach to examine whether a change in the interest rate affects differently the spending behavior of households with different housing and saving status. Table 3 shows results for having purchased durable goods, where the specifications are comparable to those used to study financial stress. In column (1) we find that an assumed 1 p.p. increase in

interest rate exposure, reduces the likelihood of purchasing durable goods for mortgagors by about 0.9 p.p. (or an unconditional decline of 1.7%). We find similar results when we control for saving status, as shown in columns (2) and (3), as well as when we allow for the dependent variable to include purchases both in the current, or in the next year, as shown in column (4). On the other hand, we do not find a change in interest rate to influence significantly the spending behaviour of renters (in relation to outright home owners) or savers (in relation to non-savers).

Taken together, the baseline results imply that monetary policy has heterogeneous and significant effects on the perceived financial situation of household groups that differ in housing and saving status. However, the adjustments in durable spending that these groups make (at least in the short-term) do not fully reflect their reported financial stress. In particular, we find that changes in monetary policy induce financial stress and adjustment of spending only among mortgagors.

4.3. Robustness checks

In what follows we discuss results from a number of checks that we have undertaken in order to ensure robustness of the baseline results shown above. First, one potential concern is that the interest rate may be set in response to the general economic situation, which may influence household perceived financial situation. In our setting this is less of a concern because we already account for all macroeconomics factors at the month-year level through the month-year-of-interview fixed effects. However, we also check the robustness of our findings by instrumenting the interest rate that households observe with monetary policy shocks, estimated for the UK by Cloyne and Hürtgen (2016).

Table A.2 shows the instrumental variable estimates where for financial stress we find very robust estimates for the effect of interest rate across all groups. For durable spending, we find that our estimates are robust when the dependent variable includes current and next year's spending.[9]

Second, we check whether the baseline results shown in Tables 2 and 3 are resilient to the inclusion of additional interaction terms of the groups of mortgagors, renters and savers with contemporaneous values of macro variables at the time of the interview, such as the exposure to inflation (using CPI), oil prices and the stock market index (FTSE 100). By including these interaction terms we take into account other macro indicators that may affect heterogeneously each group. Results, shown in Table A.3, suggest that the estimates of interest remain unaffected for both financial stress and durable spending.

Third, we calculate household interest rate exposure by using the same time frame as in our baseline analysis but by attaching progressively lower weights (assuming a linear decline) to the days being more distant from the day of the interview. Our findings (available from the authors upon request) suggest that assigning a higher weight to the interest rates closer to the interview date results into similar conclusions with only slightly stronger effects of interest rate exposure on financial stress compared to our baseline results.

5. Across and within-group heterogeneity

5.1 Heterogeneity by debt burden and age

Evidence shown in the previous section suggests that mortgagors react differently to interest rate changes compared to renters and savers. However, there is significant heterogeneity within mortgagors and renters. For example, mortgagors differ in their debt service burden and thereby their 'sensitivity' to interest rate fluctuations. To this end, we utilize household information on

[9] This finding is consistent with the evidence provided in Cloyne, Ferreira and Surico (2018) who rely on a different estimation approach and find that monetary policy shocks affect consumption of mortgagors with a lag effect.

the debt-service-to-income ratio (i.e., the fraction of household disposable income used to pay mortgage installments) that represents a commonly used indicator for borrowers' vulnerability. The average (median) debt-service-to-income ratio among mortgagors is 16% (12%). Financial practitioners typically classify households as "risky" borrowers with possible difficulties in servicing debt those who should pay more than one-third of their net income in debt installments.[10] As discussed, about 8% of mortgagors in our sample have a debt-service-to-income ratio in excess of 33%. On the other hand, renters may respond differently, based on their plans to buy a house, which are likely to vary by age. In what follows, we probe further into cross- and within-group heterogeneity to assess their importance for our baseline results.

In Table 4, we show estimates for the effect of interest rate on financial stress from an extended version of equation (1). On the left panel, instead of interacting IR with a mortgage dummy, we interact IR with dummies denoting low, medium and high debt-service-to-income ratios (i.e., below 10%, between 10% and 32% and above 33%, respectively). We find that a change in interest rate does not influence the responses of mortgagors with low debt-service-to-income ratio compared to outright home owners. On the other hand, the response of mortgagors with high debt-service ratio is considerably stronger compared to their counterparts with medium range debt-service ratio. More specifically, based on the estimates in column (1), an assumed 1 p.p. increase in the interest rate implies an increase in financial stress by 4.7% for the medium and by 7.5% for the high debt-service-to-income group. We obtain similar results when we examine expected financial stress in column (2).[11]

On the right panel of Table 4, we extend the baseline specification by considering heterogeneity of renters by age. Generally, prospective homebuyers are more prevalent among

[10] See, e.g., DeVaney and Lytton (1995).
[11] These findings are robust to using the lagged value of debt-service-to-income levels to define the three groups and are available from the authors upon request.

younger than older renters.[12] Although younger renters are not immediately exposed to a shock following an interest rate increase, they are likely to face harder financing conditions when searching to buy a home. Thus, we would expect younger renters to be more responsive to interest rate changes compared to their older counterparts. In columns (3) and (4) of Table 4 we find that an interest rate increase induces higher financial stress to younger renters.

In Table 5, we re-estimate the above specifications for durable spending. The effects are, in general, symmetric to those reported for financial stress. On the left panel, we show that an interest rate increase implies a progressively larger reduction in the likelihood of purchasing durable goods. That is, an assumed 1 p.p. increase in interest rate exposure reduces the likelihood of purchasing durable goods by 1.4% and 2.7% for the medium and high debt-service-to-income groups, respectively. For the group with low debt burden we find a negative effect on durable spending only in the current period, while for the other two groups the effect persists when spending in the follow-up period is also considered. On the right panel, we show that an interest rate increase reduces the likelihood of purchasing durables only among younger renters (i.e., the group most likely to report financial stress in response to an interest rate increase).

5.2 Heterogeneity by saving status

Further, we shed more light on heterogeneity within mortgagors and renters by distinguishing between those who have put some money aside (after paying regular bills) versus those who have not. As mentioned, about 60% of mortgagors are non-hand-to-mouth and may use their savings to buffer against an unexpected interest rate increase. In view of this, we estimate a modified version of our baseline model in which we introduce two additional triple interaction terms allowing for differential effects among mortgagors and renters according to their saving status.

[12] We consider a cut-off age of 30 years old as this is the median age of first-time buyers in the UK (see Report on UK and Irish housing markets: a first-time buyer perspective; p.19, UK Finance (2017)).

Results, shown in Table 6, column (1), suggest that an interest rate increase induces financial stress mainly to hand-to-mouth mortgagors. In other words, a tightening in monetary policy implies an increase in mortgage repayments and the implied shock is harder to buffer for the group of mortgagors facing liquidity constraints (i.e., non-savers). Instead, the effect of an interest rate increase on financial stress is largely offset for mortgagors with access to liquidity through saving (non-hand-to-mouth). On the other hand, unlike mortgagors, an increase in interest rate should not imply an immediate increase in large committed expenditures carried by renters. Consistent with this, we find that access to liquidity does not differentiate the financial stress reported by renters due to an interest rate change.

Mortgagors with access to liquidity do not report financial stress in the current period, as they can buffer the immediate underlying shock from an interest rate increase. Instead, the estimates from column (2) suggest that a tightening in monetary policy increases expected financial stress for all households holding mortgages, even those with access to savings. This suggests that access to liquidity, following an increase in loan repayments, can lessen concerns about financial situation in the current period, but it may not be sufficient to eliminate concerns about the expected financial situation one period ahead. On the other hand, we find that a tightening in monetary policy induces financial stress only among liquidity constrained renters. Renters with access to liquidity, although they report higher current financial stress due to an interest rate increase, they do not expect their financial situation to worsen any further.

In columns (3) and (4) of Table 6 we report the estimates for durable spending. We find that an increase in interest rate reduces significantly spending of hand-to-mouth mortgagors in the current period (column 3), while savings help to counter this effect for the non-hand-to-mouth mortgagors. Yet, we no longer find significant differences by hand-to-mouth status with reference to next year's spending, as current savings may not suffice to fully absorb the

underlying shock for two consecutive periods. This is consistent with our earlier findings for financial stress underlying the role of liquidity constraints for spending adjustments. While an increase in the policy rate does not alter durable spending of mortgagors with access to liquidity in the current period, it may still reduce spending of all mortgagors in the follow-up period.

Finally, a change in interest rate does not influence renters' spending behaviour, irrespective of their saving status. This is consistent with the notion that an increase in the interest rate does not imply an immediate negative income shock for renters, thus differential access to liquidity should not matter for their current or future spending.

In sum, results in this section highlight the importance of the degree of liquidity constraints (either in the form of a high debt service burden or hand-to-mouth status) in household reported financial stress and spending in response to interest rate changes. The relevant effects are more pronounced for mortgagors who have a high debt burden or limited access to liquid resources, as well as for young renters who are prospective home buyers.

6. Conclusions

We use household survey data from eighteen consecutive waves of the BHPS in order to examine the heterogeneous effect of changes in the interest rate on perceived financial stress and durable consumption across population sub-groups that differ by housing and saving status. Our estimation strategy exploits random variation of household interview dates with respect to the timing of policy rate changes to identify the effects of monetary policy on household perceptions and behavior. As exposure to interest rate changes is household-specific, this approach is flexible enough to accommodate additional dimensions of household heterogeneity, e.g., on the degree of indebtedness within mortgagors.

While changes in household reported financial situation over population subgroups and time are likely to have broader aggregate implications, there is no related evidence on the heterogeneous effects of monetary policy transmission. It is often presumed that savers are punished when interest rates decline; nevertheless, households differ in a number of dimensions, as they can be also borrowers, renters and/ or savers with different saving plans. We offer some new insights by uncovering significant heterogeneities in the financial stress of mortgagors, renters and savers in response to interest rate changes as well as in the way these heterogeneous responses translate into spending.

A tightening in monetary policy is broadly viewed as detrimental for households with debt and raises concerns about vulnerabilities in the household sector and financial stability more general. Our results highlight the importance of liquidity constraints in inducing financial stress and reducing spending of mortgagors, but also uncover significant heterogeneities among them. In fact, an increase in the interest rate does not affect the consumption of the non-trivial fraction of mortgagors with a low debt service burden or access to liquidity. Likewise, it does not affect the consumption of renters, irrespective of their saving status, as well as older renters who are less likely to buy a house.

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Table 1

Summary statistics

	Mean	Std. Dev.	Min	Max
Financial stress	0.25		0	1
Expected financial stress	0.22		0	1
Durables purchased (current year)	0.52		0	1
Durables purchased (current or next year)	0.73		0	1
Outright home owners	0.22		0	1
Mortgagors	0.50		0	1
Renters	0.28		0	1
Savers	0.51		0	1
Female head	0.40		0	1
Age	46.04	13.26	21	70
Education				
No qualifications	0.23		0	1
Other qualifications	0.09		0	1
O-level	0.17		0	1
A-level	0.10		0	1
Other higher education	0.27		0	1
University degree	0.14		0	1
Living with a partner	0.64		0	1
Unemployed	0.04		0	1
Self-employed	0.10		0	1
Retired	0.15		0	1
Net household income	21,678	13,139	1,820	87,586
Number of dependent children	0.69	1.04	0	9
Observations		73,016		

Source: UK BHPS 1991-2008

Table 2

Financial stress: the effect of interest rate exposure

	(1) Financial stress	(2) Financial stress	(3) Financial stress	(4) Expected financial stress
IR	-0.0411	-0.0254	-0.0324	-0.131
	(0.129)	(0.126)	(0.126)	(0.0952)
Mortgage * IR	0.0120***		0.0113***	0.00839**
	(0.00352)		(0.00343)	(0.00414)
Rent * IR	0.0234***		0.0181***	0.0117***
	(0.00323)		(0.00310)	(0.00395)
Save * IR		-0.0158***	-0.0143***	-0.0120***
		(0.00200)	(0.00208)	(0.00166)
Observations	73,016	73,016	73,016	69,927
Household controls	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes

Notes: The table shows the effect of interest rate exposure on financial stress distinguishing among mortgagors, renters and savers. The sample includes household heads aged 21-70. The dependent variable in Columns (1)-(3) is a dummy taking the value of one if reported financial situation is worse compared to last year and zero otherwise. The dependent variable in Column (4) is a dummy taking the value of one if financial situation next year is expected to be worse than now. Interest Rate (IR) is the average Bank of England base rate the household has been exposed to between the interview date and one year ago. Mortgage: home owners with mortgage; Rent: renters (including renters from local authority, housing associations, employers, private furnished and private unfurnished); Save: manage to save out of income excluding income used to meet regular bills. All specifications also include household, month-year-of-interview, regional fixed effects and the following household head characteristics: age and its square; education in levels; a dummy for having a spouse; dummies for being unemployed, self-employed, retired and the log of net household income (in 2005 prices). Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3

Durable spending: the effect of interest rate exposure

	(1) Durables purchased (current year)	(2) Durables purchased (current year)	(3) Durables purchased (current year)	(4) Durables purchased (current or next year)
IR	-0.0340	-0.0377	-0.0346	0.0807
	(0.117)	(0.117)	(0.117)	(0.0914)
Mortgage * IR	-0.00907***		-0.00877***	-0.00881**
	(0.00257)		(0.00256)	(0.00341)
Rent * IR	-0.00408		-0.00313	-0.00369
	(0.00381)		(0.00362)	(0.00366)
Save * IR		0.000975	0.00181	0.000490
		(0.00264)	(0.00249)	(0.00247)
Observations	73,016	73,016	73,016	60,666
Household controls	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes

Notes: The table shows the effect of interest rate exposure on durable spending distinguishing among mortgagors, renters and savers. The sample includes household heads aged 21-70. The dependent variable in Columns (1)-(3) is a dummy taking the value of one if households have purchased durable goods (at least one item out of a list of eight) since September 1st of the previous interview year. In Column (4) the dependent variable is a dummy taking the value of one if households have purchased durable goods either in current or in the follow-up year. Interest Rate (IR) is the average Bank of England base rate the household has been exposed to between the interview date and September 1st of the previous interview year. The remaining specification is similar to Table 2 (see also notes in Table 2). Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.

Table 4

Financial stress: heterogeneous effects of interest rate exposure by debt burden and age

	(1) Financial stress	(2) Expected financial stress	(3) Financial stress	(4) Expected financial stress
IR	-0.0319	-0.130	-0.0266	-0.130
	(0.128)	(0.0956)	(0.125)	(0.0948)
Debt-service ratio (≥ 33%) * IR	0.0188***	0.0151**		
	(0.00448)	(0.00597)		
Debt-service ratio (10-32%) * IR	0.0118***	0.00891*		
	(0.00380)	(0.00453)		
Debt-service ratio (1-9%) * IR	0.00353	0.00338		
	(0.00376)	(0.00379)		
Rent * IR	0.0187***	0.0121***		
	(0.00308)	(0.00402)		
Mortgage* IR			0.0115***	0.00843**
			(0.00340)	(0.00418)
Rent (≤ age 30) * IR			0.0305***	0.0141**
			(0.00501)	(0.00566)
Rent (> age 30) * IR			0.0152***	0.0111***
			(0.00309)	(0.00393)
Save * IR	-0.0133***	-0.0114***	-0.0143***	-0.0120***
	(0.00218)	(0.00164)	(0.00208)	(0.00166)
Observations	73,011	69,922	73,016	69,927
Household controls	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes

Notes: The table shows the effect of interest rate exposure on financial stress by distinguishing among mortgagors with different debt-service ratio (left panel), renters with different age (right panel) and savers. The sample, the dependent variables and the interest rate (IR) are defined similarly to Table 2. Debt-to-income ratio is the fraction of net household income used to pay for mortgage installments. Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.

Table 5

Durable spending: heterogeneous effects of interest rate exposure by debt burden and age

	(1) Durables purchased (current year)	(2) Durables purchased (current or next year)	(3) Durables purchased (current year)	(4) Durables purchased (current or next year)
IR	-0.0342	0.0804	-0.0411	0.0765
	(0.116)	(0.0904)	(0.115)	(0.0917)
Debt-service ratio (≥ 33%) * IR	-0.0138***	-0.0150***		
	(0.00443)	(0.00452)		
Debt-service ratio (10-32%) * IR	-0.00743***	-0.00786**		
	(0.00265)	(0.00321)		
Debt-service ratio (1-9%) * IR	-0.00886***	-0.00598		
	(0.00336)	(0.00528)		
Rent * IR	-0.00329	-0.00407		
	(0.00367)	(0.00370)		
Mortgage* IR			-0.00932***	-0.00914***
			(0.00258)	(0.00340)
Rent (≤ age 30) * IR			-0.0169***	-0.0154**
			(0.00606)	(0.00656)
Rent (> age 30) * IR			0.000351	-0.00112
			(0.00385)	(0.00390)
Save * IR	0.00150	-0.000181	0.00175	0.000441
	(0.00247)	(0.00246)	(0.00251)	(0.00246)
Observations	73,011	60,661	73,016	60,666
Household controls	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes

Notes: The table shows the effect of interest rate exposure on durable spending by distinguishing among mortgagors with different debt-service ratio (left panel), renters with different age (right panel), and savers. The sample, the dependent variables and the interest rate (IR) are defined similarly to Table 3. Debt-to-income ratio is the fraction of net household income used to pay for mortgage installments. Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.

Table 6

Financial stress and durable spending: heterogeneous effects of interest rate exposure by saving status

	(1) Financial stress	(2) Expected financial stress	(3) Durables purchased (current year)	(4) Durables purchased (current or next year)
IR	-0.0384	-0.132	-0.0276	0.0849
	(0.126)	(0.0966)	(0.116)	(0.0922)
Mortgage * IR	0.0176***	0.0112*	-0.0155***	-0.0134**
	(0.00478)	(0.00582)	(0.00418)	(0.00517)
Mortgage * Save * IR	-0.0104**	-0.00476	0.0112**	0.00749
	(0.00457)	(0.00446)	(0.00562)	(0.00624)
Rent * IR	0.0232***	0.0178***	-0.00547	-0.00579
	(0.00442)	(0.00467)	(0.00556)	(0.00526)
Rent * Save * IR	-0.00866	-0.0143**	0.00134	0.00235
	(0.00611)	(0.00566)	(0.00685)	(0.00852)
Save * IR	-0.00615	-0.00613	-0.00507	-0.00439
	(0.00389)	(0.00397)	(0.00544)	(0.00632)
Observations	73,016	69,927	73,016	60,666
Household controls	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes

Notes: The table shows the effect of interest rate exposure on financial stress and durable spending by distinguishing among hand-to-mouth and non-hand-to-mouth mortgagors and renters. The samples, the dependent variables and the interest rate (IR) are defined as in Tables 2 and 3. Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1
Bank of England policy rate: 1991-2008

1991	13	Feb	13.3750	**1997**	6	May	6.2500	**2003**	6	Feb	3.7500
	27	Feb	12.8750		6	Jun	6.5000				
	22	Mar	12.3750		10	Jul	6.7500	**2003**	10	Jul	3.5000
	12	Apr	11.8750		7	Aug	7.0000		6	Nov	3.7500
	24	May	11.3750		6	Nov	7.2500				
	12	Jul	10.8750					**2004**	5	Feb	4.0000
	4	Sep	10.3750	**1998**	4	Jun	7.5000		6	May	4.2500
					8	Oct	7.2500		10	Jun	4.5000
1992	5	May	9.8750		5	Nov	6.7500		5	Aug	4.7500
	22	Sep	8.8750		10	Dec	6.2500				
	16	Oct	7.8750					**2005**	4	Aug	4.5000
	13	Nov	6.8750	**1999**	7	Jan	6.0000	**2006**	3	Aug	4.7500
					4	Feb	5.5000		9	Nov	5.0000
1993	26	Jan	5.8750		8	Apr	5.2500				
	23	Nov	5.3750		10	Jun	5.0000	**2007**	11	Jan	5.2500
					8	Sep	5.2500		10	May	5.5000
1994	8	Feb	5.1250		4	Nov	5.5000		5	July	5.7500
	12	Sep	5.6250						6	Dec	5.5000
	7	Dec	6.1250	**2000**	13	Jan	5.7500				
					10	Feb	6.0000	**2008**	7	Feb	5.2500
1995	2	Feb	6.6250						10	April	5.0000
	13	Dec	6.3750	**2001**	8	Feb	5.7500		8	Oct	4.5000
					5	Apr	5.5000		6	Nov	3.0000
1996	18	Jan	6.1250		10	May	5.2500		4	Dec	2.0000
	8	Mar	5.9375		2	Aug	5.0000				
	6	Jun	5.6875		18	Sep	4.7500				
	30	Oct	5.9375		4	Oct	4.5000				
					8	Nov	4.0000				

Source: Bank of England

Table A.2

Financial stress and durable spending: baseline estimates using monetary policy shock as instrumental variable

	(1) Financial stress	(2) Expected financial stress	(3) Durables purchased (current year)	(4) Durables purchased (current or next year)
IR	-0.564**	-0.447**	-0.0966	0.145
	(0.243)	(0.193)	(0.272)	(0.263)
Mortgage * IR	0.0137**	0.0148**	-0.00366	-0.0121**
	(0.00559)	(0.00599)	(0.00550)	(0.00577)
Rent * IR	0.0207***	0.0175***	-0.00452	-0.00553
	(0.00586)	(0.00665)	(0.00691)	(0.00683)
Save * IR	-0.0122***	-0.00919***	0.00438	-0.000103
	(0.00385)	(0.00320)	(0.00479)	(0.00388)
First stage F statistics				
IR	31.36	30.48	27.81	25.11
Mortgage * IR	41.27	42.62	41.13	41.82
Rent * IR	33.62	36.91	35.09	31.64
Save * IR	26.38	25.57	26.37	26.51
Observations	73,016	69,927	73,016	60,666
Household controls	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes

Notes: The table shows the effect of interest rate exposure on financial stress distinguishing among mortgagors, renters and savers with IR being instrumented using the monetary policy shocks from Cloyne and Hürtgen (2016). The samples, the dependent variables and the interest rate (IR) are defined as in Tables 2 and 3. Sanderson and Windmeijer F-tests for multiple endogenous variables are reported. Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3

Financial stress and durable spending: baseline estimates controlling for additional interactions with various macro factors

	(1) Financial stress	(2) Financial stress	(3) Financial stress	(4) Durables purchased (current year)	(5) Durables purchased (current year)	(6) Durables purchased (current year)
IR	-0.0378	-0.0329	-0.0398	-0.0392	-0.0352	-0.0410
	(0.125)	(0.126)	(0.127)	(0.116)	(0.117)	(0.117)
Mortgage * IR	0.0169***	0.0113***	0.0125***	-0.00727**	-0.00830***	-0.00788***
	(0.00414)	(0.00346)	(0.00324)	(0.00357)	(0.00263)	(0.00276)
Rent * IR	0.0236***	0.0185***	0.0191***	-0.00974**	-0.00318	-0.00364
	(0.00401)	(0.00322)	(0.00295)	(0.00397)	(0.00373)	(0.00373)
Save * IR	-0.0131***	-0.0148***	-0.0132***	0.00206	0.00160	0.00340
	(0.00307)	(0.00200)	(0.00221)	(0.00309)	(0.00250)	(0.00278)
Observations	73,016	73,016	73,016	60,666	60,666	60,666
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Month-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Interactions of Mortgage, Rent, Save with:						
CPI	Yes	No	No	Yes	No	No
Oil price	No	Yes	No	No	Yes	No
FTSE	No	No	Yes	No	No	Yes

Notes: The table shows estimates of an augmented version of the baseline specification which includes as additional controls interactions of the mortgage, rent and save dummies with: the monthly CPI (columns 1 and 4); the monthly oil price change (columns 2 and 5); and the daily closing value of the FTSE 100 (columns 3 and 6). The samples, the dependent variables and the interest rate (IR) are defined as in Tables 2 and 3. Standard errors (in parentheses) are two-way clustered at the household-month-year-of-interview level. *** p<0.01, ** p<0.05, * p<0.1.