# The Response of Debtors to Rate Changes*

Andreas Fuster† Virginia Gianinazzi‡ Andreas Hackethal§
Philip Schnorpfeil‡ Michael Weber¶

March 21, 2025

*Preliminary & incomplete*

**Abstract**

How borrowers respond to future changes in the interest rate on their debt is of crucial importance for the transmission of monetary policy and for financial stability. Combining administrative data from a large bank, a letter RCT, and an online survey, we study this question in the context of the German mortgage market, where rates surged in 2022 and borrowers face these rates as their rate fixation period ends. We find that borrowers take various actions to reduce the impact of higher rates on interest payments. Survey responses indicate high awareness of the evolution of interest rates and corroborate a strong propensity to prepare for the rate reset, which we show experimentally is sensitive to the size of the rate increase and to the distance from reset. Our letter intervention does not affect rate beliefs, consistent with high ex-ante knowledge, but increases awareness of available options and the desire to prepare. Ongoing tracking will reveal whether this awareness translates into actual behavior.

*We receive funding by the Swiss National Science Foundation. We have no other relationships and no conflicts of interests to disclose.

†EPFL, Swiss Finance Institute, and CEPR
‡Nova SBE
§Goethe University Frankfurt
¶University of Chicago, CEPR, and NBER

# 1 Introduction

Following the global resurgence of inflation that started in 2021, central banks across most developed economies increased interest rates substantially. One of the consequences of these rate movements is an increase in the cost of debt service for households. The largest share of household debt is made up of mortgages. There is substantial variation across countries in terms of how quickly changes in market interest rates affect the rates on outstanding mortgages. In some countries, most mortgages have adjustable rates that are directly indexed to prevailing short-term rates. However, in many other countries, including the US, Germany and France, a majority of households rely on mortgages that have fixed interest rates for five, ten or even more years.

With fixed-rate mortgages, an increase in market interest rates has more staggered effects on the debt service costs, as higher rates only apply once a household needs to roll over their loan (also known as remortgaging or refinancing). However, the extent and timing of the transmission to household spending and potentially financial distress depends crucially on whether households are aware of and prepare for future increases in their mortgage rate. If borrowers adjust their behavior ahead of having to roll over their loan, then monetary policy may transmit more quickly than simply looking at the interest rates on the loan stock would suggest. Conversely, a lack of preparation might lead to financial stability risks that materialize with a considerable delay.

Our goal in this paper is to provide novel evidence on how households think about, prepare for, and ultimately react to increases in their mortgage rate. To do so, we rely on a unique combination of administrative data from a large German bank, experimental interventions to exogenously change household awareness and understanding of potential rate increases, and surveys of households to understand their preparation and reaction.

We begin our analysis documenting patterns in the bank data over the last years, specifically examining borrowers who have a mortgage with a sizable balance that come to the expiration of their rate fixation period. Until early 2022, many borrowers saw substantial decreases in their interest rate upon refinancing, but this changed rapidly in 2022, and since then the refinancing rate has been one percentage point or more above the expiring rate (see Figure 1). We show that as market interest rates began to increase in 2022, many borrowers rushed to arrange a so-called "forward mortgage" that allows them to lock in an interest rate upon expiration of their old rate fixation. These forward mortgages can be arranged up to four years prior to expiration of the old rate fixation, but we find

that it is primarily borrowers closer to expiration (one to two years) that lock in their rate. Once market rates reached a new higher level—the 10-year covered bond rate, which provides a benchmark for mortgage rates, has hovered around 3% since late 2022, while it was close to 0% over most of 2020 and 2021—the demand for forward loans dried up quickly. Instead, a larger number of borrowers either pay off their mortgage completely or wait until close to expiration before refinancing.[1]

We also study changes in loan terms conditional on refinancing. We find that as market rates increase, borrowers become more likely to reduce the loan balance upon refinancing, and to choose shorter rate fixation periods on the new loan. Importantly, the combination of such borrower actions at the time of refinancing leads the average monthly payment increase to be only about half as large as would be the case if borrowers simply "rolled over" their loans passively.

A distinctive aspect of our bank data is the ability to track the timing and discussion topics of customers' meetings with bank advisors. We first document that most borrowers, even among those with a large outstanding loan amount, tend to wait until a few months before expiration to engage with the bank. Second, we find spikes in meeting activity after bank communication (e.g., via annual letters), indicating that people are responsive to reminders. In line with our finding that borrowers rushed to get a still attractive rate locked in as rates began to rise rapidly, we also find that during that period, the probability of originating a loan after a meeting increased from 40% to 55%. This "conversion rate" then dropped to 25% in 2023. Third, we show that concurrently with the increase in rates, meetings with the purpose of discussing mortgage-related topics decreased, while meetings discussing investments and savings increased.

Armed with the facts from the bank data, we design a letter RCT and an online survey to learn more about the drivers of borrower behavior, including their awareness of their contract, the rate environment, and their options. The goal of the letter, which the bank sent to over 35,000 borrowers in November 2024, is to exogenously increase recipients' awareness of the evolution of interest rates, of how changes in rates could affect monthly installments, and of potential actions they can take ahead of the fixation end.

[1] While German mortgages do not have the same "free" prepayment option as their US counterparts, they can be refinanced freely starting six months from expiration, or after 10 years or more from origination. Additionally, many contracts feature the option of making an annual curtailment ("Sondertilgung") of 5% (or, rarely, 10%) of the original loan amount. When we observe loans being paid off at expiration, some of these loans could be refinanced with another provider; while our data contain some information on external refinancing, the coverage is imperfect.

We use the online survey for three purposes. First, a subset of letter-treated and control-group borrowers participate, allowing us to study whether letter receipt affects beliefs, plans, and knowledge of potential actions.[2] Second, we elicit borrowers' current preparation and their reasoning behind it. Third, we embed a vignette experiment in which we ask respondents how they would prepare for a hypothetical rate change. We vary the size and timing of the rate increase across three possible scenarios to study the sensitivity of preparation choices to the size of the rate increase and distance to reset.

Most survey respondents are well-informed about high mortgage rates and take action to mitigate their impact. Specifically, respondents largely know about the evolution of interest rates, and they expect high rates to persist. A large majority of borrowers who will have to refinance their mortgage state that they either have already prepared for the reset, or plan to do so. Borrowers report two key actions in an open-text response: they partially or fully repay their mortgage or locked in interest rates before they reached their current high. Both actions mitigate the impact of high current rates on interest payments, and borrowers provide this channel as the key motivation for their actions.

The vignette provides causal effects on the sensitivity of preparing for the reset to both the size of the increase in interest rates and the distance to reset. A smaller hypothetical rate increase (of 0.5 instead of two percentage points) significantly reduces the stated propensity to meet with a bank advisor and to reduce the loan balance; it also raises the propensity to lock in the rate with a forward mortgage. These findings are in line with what we document in the bank data and with what borrowers explain they do in open text in the survey. We further find that a more distant hypothetical reset (three years instead of one year) decreases borrowers' information acquisition either via a meeting with an advisor or search of other providers. Interestingly, borrowers with a later hypothetical reset are significantly less likely to try to increase their household income.

We then turn to the study of letter effects. In a first step, we estimate that about 34% of recipients remember reading the letter around one month after it arrives in their letterbox.[3] We do not find significant effects of letter receipt on perceived past and current as well as expected mortgage rates, which is consistent with high ex-ante informedness about rates. However, we do find significant effects of the letter treatment on the stated propensity to prepare for the reset, and in particular on the likelihood of prepayments.

[2] We also use the survey to measure what share of letter recipients state that they actually read the letter. This is helpful to assess the magnitude of any letter-induced effects on beliefs and actions.

[3] This is an estimated treatment effect, since we similarly ask control-group respondents whether they have received a letter from the bank and whether they have read it.

Letter recipients are also more likely to indicate familiarity with the option to make partial prepayments and with forward loans. Over the coming months, we can study whether the differences in knowledge translate into actions—by tracking borrowers in the bank data over time, we will be able to assess how letter receipt affects the propensity to meet with an advisor, to make partial prepayments, and to take a forward loan.

Finally, we document selection into reading the letter, which could be an additional explanation for its limited effects, in particular on beliefs about mortgage rates. It is primarily borrowers with high self-reported financial literacy and high income that read the letter, along with those with a high original loan balance and those that have made partial prepayments in the past. The heterogeneity suggests that lender (or regulator) communication about mortgages disproportionately reaches borrowers that were better informed to begin with, while reaching the less aware is difficult.

**Related literature.** This paper is related to existing work that uses micro data to study how monetary policy affects borrowers' behavior through changes in debt servicing costs. Specifically, several papers have looked at how households adjust consumption in response to changes in mortgage payments.[4] Di Maggio et al. (2017) exploit variation in the timing of automatic interest rate resets of adjustable-rate mortgages in the US to estimate consumption responses to large declines in interest payments and find strong responses in car purchases as well as an increase in voluntary mortgage debt repayment. Using a more comprehensive measure of (imputed) consumption from administrative data on Swedish households, Flodén et al. (2021) similarly find large consumption responses to monetary policy changes among households with high levels of adjustable-rate debt. Cloyne et al. (2020) study how monetary policy transmission in the UK and the US differs between renters and owners with and without mortgages. Kartashova and Zhou (2023) use data on Canadian mortgages to study asymmetries between rate decreases and increases

Jørring (2020) studies the spending response to a predictable change in mortgage payments and finds that this response is larger for financially unsophisticated households. His results suggest that this is driven by both a savings channel (as unsophisticated households typically have smaller buffers) and an information channel (as even unsophis-

[4]Beyond the response of households to changes in debt servicing costs, a large literature has studied consumption responses to changes in disposable income, which can be either transitory or permanent, and either unpredictable or predictable. Relevant recent work in this area includes, for instance, Baker (2018), Baugh et al. (2021), Fagereng et al. (2021), Ganong and Noel (2020), Kueng (2018), and Parker (2017); Jappelli and Pistaferri (2010) provide a comprehensive overview of earlier work.

ticated households with substantial liquid assets decrease their spending after mortgage payments increase). Beyond consumption, households could also adjust labor supply when confronted with a change in debt servicing costs. Zator (2024) studies this question in the context of Polish adjustable-rate mortgages and finds strong adjustments in labor income to changes in mortgage payments, especially when payments increase.

While there is thus quite a bit of evidence on responses to realized changes in mortgage payments, the existing literature has focused much less on the actions that households may take *in anticipation of* these changes. One exception is work by Druedahl et al. (2022), which estimates marginal propensities to consume out of future expected changes in adjustable-rate mortgage payments. While we also study consumption/saving adjustments, we take a broader view at actions that borrowers can take with respect to mortgage contracts that need to be refinanced following the expiration of a fixed-rate period, a situation that is common in many countries. Furthermore, we measure directly how aware households are of likely future rate changes and how they plan for them.

A sizable literature has documented suboptimal mortgage refinancing behavior, primarily in response to decreases in rates that borrowers fail to take advantage of—see, for instance, Campbell (2006) and Keys et al. (2016) for evidence from the US. The literature has documented various behavioral frictions that contribute to this suboptimal behavior, including inattention (Andersen et al., 2020), low financial literacy (Bajo and Barbi, 2018), and distrust of lender motives (Johnson et al., 2019). Recent work by Byrne et al. (2023) conducts a randomized control trial (RCT) in Ireland, where subsets of borrowers with an incentive to refinance their mortgage received different types of letters, including subsequent reminder letters, that explain the possible savings from refinancing. The letters (and especially the reminders) lead to significant increases in refinancing rates, suggesting many borrowers are otherwise inattentive. To our knowledge, ours is the first large-scale information experiment targeted to mortgagors conducted in a period of rising rates.[5]

RCTs have also been used more broadly to study households' awareness of monetary policy and their response to being informed about it (e.g., Coibion et al., 2022, 2023).[6] Much of this work relies exclusively on surveys, and therefore cannot link survey re-

[5]Refinancing during rising-rate periods has received limited attention. One exception is recent work by Bracke et al. (2024) who study spending responses of UK borrowers that are confronted with higher market rates upon refinancing. Bhutta et al. (2021) show that as market rates increase, US borrowers obtain relatively better interest rates compared to lender offers, consistent with more intense mortgage shopping.

[6]Our use of survey vignettes, or "strategic surveys," follows Fuster et al. (2020) and Fuster and Zafar (2021), among others.

sponses to actual subsequently realized household choices measured in administrative data.[7] The unique combination of an information experiment, follow-up surveys and access to granular bank data available to us allows us to overcome this limitation.

# 2 Institutional setting and bank data

## 2.1 The German mortgage market

The German residential mortgage market is characterized by long fixed-rate periods, typically ranging from five to 15 years, with 10 years being the most common. Since the initial fixation period is usually shorter than needed for full loan amortization, at fixation end the residual loan amount must be refinanced at the prevailing market conditions (unless a borrower chooses to pay off the loan in full). Borrowers can either refinance with their current lender (prolongation) or seek a new loan from another bank. Borrowers can also secure a forward mortgage up to 3–5 years in advance to lock in rates ahead of expiration.

The timeline leading up to the fixation end at our partner bank is as follows. Forward mortgages are offered up to four years from expiration. If borrowers do not take such a forward, they can lock in a regular prolongation loan starting six months ahead of expiration. Around that time, borrowers also receive a letter from the bank reminding them that their fixed-rate period will soon end and providing information on current interest rates. Six weeks before expiration, borrowers who have not yet refinanced receive another letter containing two prolongation offers, which are valid for 10 days. To accept an offer, borrowers simply select one and return the signed letter to the bank. To negotiate different terms, borrowers can schedule a meeting with a bank advisor. In case no prolongation is agreed upon before expiration, the loan moves onto an expensive variable rate. This rate had been around 5% before 2022 and increased to above 9% in 2023. Borrowers who need refinancing also receive reminder letters 36, 24, and 12 months before the expiration.

Unlike the U.S., where 30-year fixed-rate mortgages with prepayment options dominate, German mortgages generally do not allow early repayment unless the borrower compensates the bank for the loss in interest income (i.e., a prepayment penalty). As a result, lower interest rates do not lead to an increase in mortgage refinancing. There are situations where prepayments without penalties are possible, however: first, loans can

[7] Instead, the primary behavioral outcomes studied usually consist of intentions or plans.

be prepaid in case the property is sold. Second, loans with an initial fixed-rate period of more than 10 years can be prepaid without penalty after 10 years, with six months' notice. Lastly, many mortgage contracts include an annual partial prepayment right (*Sondertilgung*), typically allowing 5% or 10% of the original loan amount to be repaid early.

Mortgage lending is predominantly provided by banks without government guarantees or securitization; instead, similar to some other European countries (Andersen et al., 2020), funding is often supported through a covered bond system (*Pfandbriefe*) that provides stability and liquidity to the mortgage market. Interest payments for mortgages are only tax deductible for buy-to-let properties, but not for owner-occupied real estate.

## 2.2 Bank data

Our first source of data is a proprietary dataset from the partner bank providing detailed information on all clients with mortgage debt outstanding at any point between December 2017 and October 2024.[8] The dataset covers 240,752 mortgagors and 396,426 distinct loans originated between 1997 and 2024. Roughly half of the loans are either paid-off or refinanced during the sample period.

For each loan, we observe its characteristics at origination, along with dynamically updated information on the loan's current balance, interest rate, and refinancing outcomes at an annual frequency. In the case of internal refinancing, we can link the old loan to the new one, allowing us to track changes in interest rates, installment amounts, loan balance, and fixation periods at expiration. As we observe the date of origination of the new loan, we can study refinancing behavior around monetary policy changes at high frequency. Note that we consider the old and new loan as two separate loans, which is the primary reason why the number of loans is much higher than the number of borrowers.

Customer demographic information includes age, gender, marital status, employment status, zip code, and the length of the relationship with the bank. We also observe annual financial balances of clients' deposit accounts, securities accounts, and other debt holdings, such as personal loans. Our partner bank operates nationwide, offering services across all regions of Germany, as illustrated in Appendix Figure A.1. We also know if, when, and for which reason(s) borrowers in our sample meet with a bank advisor. We observe a total of 681,254 meetings by 176,928 borrowers between January 2018 and Oc-

[8] We will obtain data updates to track the effects of our letter RCT, described below.

tober 2024. For each meeting, the data record the general purpose, such as mortgage financing, deposits, and investments.

Table 1 provides summary statistics for the full sample of loans and borrowers. 50% of the loans have a fixation period of 10 years, 20% of 15 years and 8% of 5 years. The term of the loan is usually longer than the fixation period, with an average of approximately 20 years. The average mortgage has an initial loan amount of €125,000 and €80,000 left at expiration of the fixed rate. 27% of the loans are forward loans and 12% are loans initiated after a rate reset. 55% of loans do not permit borrowers to make annual partial prepayments (Sondertilgungen) during the fixation period; for the others, the vast majority allow annual partial prepayments up to 5% of the original balance. The average borrower in our sample is 51 years old and has been a client of the bank for 13 years. 34% of borrowers have at least 2,000 euros deposited at the bank on average. 9% also have a brokerage account. 70% have met with a bank advisor at least once since 2018.

In some of our analyses of the bank data, we will restrict the sample to loans with initial fixation length of up to 10 years, an expected residual balance at expiration of at least €10,000, and that have either already reached the end of their rate fixation period over our observation period 2018 to 2024 or that will reach it between 2025 and 2027. The loans by expiration year are described in Table 2, along with the outcomes.

# 3 Patterns from bank data

In this section, we study borrower activity over the period 2018–2024, with a particular interest in time variation in refinancing (and whether borrowers do so via regular prolongations or forwards) and actions borrowers take at the time of refinancing—in particular, balance reductions and choice of the new fixation period. Finally, we exploit a unique feature of our bank data, namely that we are able to observe the timing of meetings between customers and bank advisors to discuss mortgage-related questions or other topics.

## 3.1 Refinancing activity

Figure 2 shows that as market interest rates started rapidly increasing over the first half of 2022, there was a spike in forward-mortgage originations, primarily driven by borrowers with up to two years left before the expiration of their existing rate. Then, as rates further

increased over the second half of 2022, and stayed high from 2023 onward, forward originations dropped substantially. Borrowers do not appear to be interested in locking in a rate that is high compared to what they have been paying so far.

Panel A of Figure 3 instead displays the cumulative share of borrowers who refinance their loan internally (either via a forward mortgage, or a regular prolongation), by year of expiration of the rate fixation. We restrict the sample to loans with a projected residual balance at expiration of €10,000 or more. Several features stand out. First, less than half the borrowers do an internal refinancing; the others either pay down the loan at expiration, or refinance with another provider.[9] Second, a significant share of internal refinancing happens over the last few months prior to the expiration of the old loan, but there are also many borrowers that refinance their mortgage one year or more prior to expiration, via a forward contract. Third, in more recent expiration vintages, fewer borrowers refinance—consistent with them seeking out alternatives to the regular internal refinancing, such as prepaying their mortgage at reset. Fourth, looking at the expiration vintages 2023 and 2024, there is an unusual increase in refinancing activity around two years (2024) and one year (2023) prior to expiration. This increase can be ascribed to the rapid increase in market rates in early 2022—some borrowers with loans expiring later were able to still lock in a low rate via forwards, as already noted above.[10]

This increase in takeup in forward loans can be seen more clearly in panel B of Figure 3, which plots the cumulative share of refinancing borrowers by calendar month instead of months from expiration, and also add the average rate on 10-year mortgages originated in a given month to the picture. The picture again also shows that borrowers in later expiration vintages, who face higher rates upon expiration of their old fixation, are less likely to refinance internally and are thus more likely to take other actions. In sum, many borrowers rushed to lock in rates before they were "too high." Now that rates are high, borrowers actively seek alternatives to the standard internal prolongation.

We next turn to hazard models to statistically estimate how refinancing propensities are affected by (i) the gap between a borrower's existing rate and the current rate available in the market; (ii) recent changes in market rates; and (iii) other loan and borrower characteristics. Formally, we estimate Cox proportional hazard models, which posit that

[9] We do not rely on a flag for external refinancing, as it is not fully populated.

[10] The final column of Table 2 shows that the ratio of internal refinancing via forwards versus regular prolongations reached a record high for the 2023 expiration vintage.

the hazard rate of loan $i$ refinancing in month $t$ prior to expiration is given by

$$h(t|\mathbf{X}_{it}, R_{it}) = h_0(t) \cdot \exp(\beta_1(R_i - R_t^m) + \beta_2 \Delta R_t^m + \Gamma X_{i,t}). \quad (1)$$

Our main variables of interest are $(R_i - R_t^m)$, which is the gap (in percentage points) between the interest rate a borrower pays on their old loan and the market rate on a 10-year mortgage at time $t$, and $\Delta R_t^m$, which is the three-month change in the market rate. The coefficient $\beta_1$ indicates how sensitive borrowers' refinancing actions are to rate differences, and $\beta_2$ whether recent changes in market rates affect borrower behavior. Finally, $X_{i,t}$ covers borrower and loan characteristics, including the loan size, that could also influence refinancing decisions. The baseline hazard $h_0(t)$ is unrestricted, and we allow it to vary by origination year of the mortgage in some specifications to control for potential effects of unobservable variables that differ across origination vintages. We cluster standard errors by calendar month. Our estimation sample includes 75,422 loans with rate fixation ending between 2021 and 2027, of which 19,154 have refinanced internally (via forward or via regular prolongation). We include loans in the estimation sample from 36 months prior to the expiration of their fixation.

The results in Table 3 confirm the patterns seen in the charts, and show that they are robust to the inclusion of control variables. Column (1) indicates that borrowers who are paying a rate above the current market rate are more likely to refinance with the bank—per one-percentage-point increase in the gap, the hazard of refinancing increases by about 17%. Put differently, borrowers who would have to refinance into a rate higher than their current rate are less likely to do so. Column (2) shows that refinancing hazards are higher at times when market interest rates have been increasing (which was the case in particular during 2022), consistent with borrowers rushing to refinance (e.g., by entering a forward contract) in order to lock in a rate before market rates increase further. This finding suggests time-varying attention by borrowers. The first two findings may appear to contradict each other, because increases in market rates, which we find to increase internal refinancing, lead to smaller rate gaps, which in turn reduce refinancing. Column (3) shows that when we control for both of them jointly, both coefficients increase in magnitude, consistent with these countervailing effects. Finally, the remaining two columns show that these coefficients are stable when we add borrower- and loan-level controls, or we allow the baseline hazard to vary by origination vintage. The coefficients on the control variables indicate that borrowers with larger loans, longer residual terms, and younger

borrowers are more likely to refinance internally—consistent with them being less able to pay off the loan at expiration. Furthermore, borrowers that also hold a transaction or savings account at the bank are more likely to refinance with the bank, presumably reflecting that they are less willing to switch to another provider.

## 3.2 Actions conditional on refinancing internally

When borrowers refinance internally, we observe their old and new interest rate, fixation period, mortgage balance, and resulting monthly installment. This allows us to study choices—in addition to the timing of the refinancing—that borrowers can make to influence the impact of rate changes on their mortgage. In this section, we document effects of rate changes on the propensity to reduce the loan balance at refinancing, and on the fixation period of the new loan.

We first focus on reductions in the loan balance upon refinancing, and estimate the model

$$Y_i = \beta_0 + \beta_1(Rate_t^m - Rate_i^m) + \Gamma' X_i + \varepsilon_i \tag{2}$$

where $Y_i$ is a dummy variable equal to one if the loan balance is reduced by 5% or more upon refinancing internally.[11]

Our variable of interest is $(Rate_t^m - Rate_i^m)$, the change in the market rate on a 10-year mortgage in the month of refinancing versus the month in which the borrower had taken out their original loan. We use the market-level change in rates rather than the change in borrower $i$'s actual rate in order to reduce endogeneity concerns (although we note that results are very similar with the two approaches). The vector $X_i$ contains control variables, namely the log residual loan amount at expiration (assuming no prepayments), borrower age, a dummy for whether the borrower has an account at our partner bank, a dummy for fixation length of the old loan shorter than 10 years, the residual term of the loan, a dummy for whether the refinancing happened via a forward, and also a borrower's accumulated prepayments as a fraction of the original loan amount in the year before refinancing. Finally, in one specification we include fixed effects for the origination year of the old mortgage.

[11] The percent reduction in loan balance is calculated with respect to the expected oustanding balance at expiration, taking into account, if any, all the extra payments accumulated up to the year prior. Results are robust to using other thresholds, e.g. 10%.

Results shown in Table 4 indicate that borrowers that refinance when market rates have increased are more likely to reduce their loan balance upon refinancing—by about 1.1 to 2.2 percentage points per percentage point of rate increase, relative to a mean balance reduction propensity of 25%. Thus, the rapid increase in interest rates in 2022 led to more balance reductions for borrowers refinancing afterwards.

Table 5 implements a similar analysis as for the changes to the loan balance, but for the fixation length of the new loan (which averages 92.2 months, i.e. 7.7 years). The results show that after rates have increased, refinancing borrowers choose significantly shorter fixation lengths; in column (2), a one percentage point increase in the market rate between when the original loan and the refinancing loan were originated is associated with the borrower choosing a 4.3 month shorter fixation period on the new loan. Columns (3) to (5) show that borrowers who refinance via a forward mortgage tend to pick longer fixation periods; adding this (endogenous) control reduces the magnitude of the coefficient on rate change. The result of the increased propensity for balance reductions and the choice of shorter fixation periods when rates are higher, along with some borrowers locking in rates many months before expiration, implies that the changes in monthly installments are smaller than if borrowers just "passively" rolled over their mortgage when their old rate fixation expires.

Panel A of Figure 4 shows the distribution of installment changes in euros conditional on refinancing internally.[12] It is notable that, despite the substantial increase in interest rates in 2022 from very low levels over 2018 to 2021 (Figure 1), relatively few borrowers see large payment increases upon refinancing—e.g. only about a quarter of them see an increase in their monthly installment of 100 euros or more in 2023/2024. To some extent these rather modest increases reflect the actions of the borrowers, as shown in panel B of the same figure—the average installment increase in 2023/2024 would have been roughly twice as large if borrowers had just taken the standard prolongation offer by the bank.[13]

While not the focus of this paper, it is also notable that during the low-rate period 2018 to 2021, installments did not decrease nearly as much as they could have. This partly reflects that many borrowers, upon being able to refinance at a lower interest rate,

[12] Appendix Figure A.3 shows the same changes in percent of the old installment.

[13] The counterfactual installment is calculated using the residual loan balance and the residual term of the original loan at expiration, applying the observed mortgage rate of the new loan. This corresponds to the monthly installment the borrower would pay had she refinanced at current market rates without modifications to the loan term or amount. The counterfactual installment difference is computed as the difference between the installment on this counterfactual loan and the installment on the original (old) loan. This difference is compared to the actual change in installment observed upon internal refinancing.

choose to speed up the amortization of their loan while keeping the monthly payment approximately constant. This is evident e.g. in panel A, where the median and 75th percentile of installment changes are both very close to zero over the period 2018 to 2022. This pattern is consistent with "monthly payment targeting" (Argyle et al., 2020) and we are exploring the drivers behind it in separate work.

### 3.3 Meetings with bank advisors

In addition to allowing us to observe refinancing choices (for those borrowers that do so with our partnering bank) we are also able to access time-stamped information on meetings between clients and bank advisors. Along with the date of the meeting, the data indicate the general purpose(s) of the meeting, such as mortgage financing, deposits or investments.

Figure 5 shows that the propensity of customers to meet with an advisor to discuss mortgage financing spikes in the months around the expiration of the fixation of the old loan. In particular, there is a notable increase six months prior to expiration, which is when a regular prolongation becomes possible. However, the meeting frequency then further spikes within one month of expiration, suggesting that many borrowers do wait until the last moment to take care of their prolongation. Going back further in time, there appears to be a cyclical pattern, which may reflect annual communication by the bank to the borrowers.

Panel A of Figure 6 shows how the share of meetings that discuss different topics evolved over time.During the high-rate period since 2023, the share of meetings discussing mortgages is lower than in the years before, although it is difficult to know to what extent this decrease is driven by lower interest of borrowers in refinancing with our partnering bank versus lower interest in mortgages on a new property (e.g. for investment purposes). What is notable, however, is that the share of meetings discussing investments and savings increased over the last two years of our sample period.

Panel B of Figure 6 plots the time series of the "conversion rate" conditional on a meeting, i.e. how the probability of a loan being originated within a narrow window after a meeting evolved over 2018 to 2024. We see that during the period of rate increases, this conversion rate rises from 35-40% to 55%, before dropping to 25% in 2023. In line with our earlier refinancing analysis, this suggests that many borrowers rushed in early

2022 to get a still attractive rate locked in, while afterwards meetings were less likely to result in a loan origination, perhaps because borrowers were unhappy with the rate they were offered.

### 3.4 Summary

To summarize, the patterns in the bank data suggest that borrower choices with respect to the refinancing of their loan are quite sensitive to the evolution of market interest rates. When rates increased rapidly in 2022, many borrowers took actions to lock in a rate on their new loan that remained close to their old one. Furthermore, after rate increases, borrowers are more likely to reduce the loan balance or shorten the fixation period of their loan. The combination of these actions allows them to reduce the impact of higher market rates on their monthly installments.

At the same time, it is still the case that many borrowers do not appear to take any action until the expiration of their existing loans, although we are limited in our ability to observe external search and refinancing with other providers. Furthermore, based on the bank data, it is impossible to disentangle different factors leading to borrower action or inaction—e.g. (in)attention, financial sophistication, risk aversion, or variation in liquid savings that can be used to adjust the loan at refinancing or deal with higher installments. We next turn to an experimental intervention to potentially change borrowers' information set, as well as a survey of borrowers, to better understand these factors.

## 4 Letter RCT and borrower survey

### 4.1 Letter RCT

**Objective** We ran an RCT in November 2024 in which the partnering bank sent a letter to a random subset of mortgagors. We designed the letter, but it was sent by the bank, with official letterhead and signature. The letter features information about the recent increase in market interest rates, how these rates might feed into monthly mortgage payments once a mortgage's rate resets (upon refinancing), and how borrowers can cope with higher rates. We pursue two objectives with the letter intervention. First, in combination with the survey data (described below), we try to understand mortgagors' knowl-

edge about current mortgage rates and how these rates translate into monthly payments. Second, we aim to assess how treatment-induced awareness of the potential increase in mortgage rates and hence required payments affects mortgagors' beliefs and choices.

**Sample** Three criteria need to be met to enter the sample of possible letter recipients. First, the bank needs customers' approval to contact them via letter. Second, we require the customer to have a mortgage originated before June 2022. We thereby focus on borrowers not yet subject to higher mortgage rates. Third, the expected mortgage amount at the end of the interest-rate fixation period needs to be at least €10,000. This restriction excludes borrowers not subject to significant interest rate risk. Among the 150,000 active mortgagors, 48,000 mortgagors fulfill the criteria.

We randomly divide the sample of possible letter recipients into one of four equally-sized groups. Three groups receive different variants of the letter, as explained below, and one control group does not get any letter. We vary some of the letter contents across groups, similar to Byrne et al. (2023), in order to study whether specific letter features drive effects, if any, while still being able to pool together all letter recipients. Appendix Table A.1 reports a balancing table for all four groups. The sample is largely well-balanced for a wide array of loan and borrower characteristics.

**Content** The letter comprises four sections. Online Appendix B shows the letter translated to English. We strive for brevity and clarity throughout to keep the perceived costs of engaging with the letter content low (Stantcheva, 2023). In the first section, we state that market interest rates have increased substantially since early 2022. We then explain that the bank collaborates with Goethe University Frankfurt to understand how borrowers respond to the rate increase and that as part of this study, the bank would like to provide their customers with relevant information. We then add a figure that illustrates the recent surge in mortgage rates.

The second section states that the current interest rate on new mortgages in Germany is 4%. We explain prolongation interest rates might differ from this rate, depending on unpredictable market developments. We then cite a Bundesbank study that shows large heterogeneity in interest-rate expectations of German households. Our objective is to convey future interest rates are uncertain. This part on future rate uncertainty is not included in letter variant 2.

The third section sketches how higher interest rates can impact monthly installments. We explain that an increase in interest rates by two percentage points on a €100,000 loan

initially raises interest expenses by €2,000 per year or €167 per month. We embed the numbers in a small table that makes them more salient to the reader. This section is not included in letter variant 3.

The fourth section lists options to cope with higher interest rates. We explain (i) annual partial repayments (Sondertilgungen), (ii) locking in interest rates using a forward loan or a home savings contract (Bausparen), and (iii) increasing savings to be able to afford higher future payments. The letter concludes by noting that the bank would be available to advise what actions might be best.

## 4.2 Survey design and data

### 4.2.1 Design

The survey consists of three sections: a pre-vignette section on beliefs about mortgage rates and preparing for the possibility of higher future rates; a vignette section in which respondents confront a hypothetical refinancing situation; and a post-vignette section on economic beliefs and preferences, household finances, and demographics.

**Pre-vignette section** We begin with a series of questions related to mortgage interest rates. The first asks qualitatively about how rates have changed over the past three years. Only respondents who perceive rates to have increased subsequently receive a question about the impact of higher rates on the current and future financial situation of their household. We then elicit point estimates of current and future rates as well as qualitatively the likelihood of the mortgage rate in two years being two percentage points above the point forecast. Starting the survey with questions about mortgage rates allows us to test for letter effects without the risk of priming respondents.

Respondents then answer questions about their preparation for a future rate change at the end of the rate-fixation period. We first ask about whether respondents prepare for the mortgage prolongation. Based on their response, they have to explain how and why they already have prepared or plan to do so. If they do not prepare, they also explain why. The response is in an open-text format, which avoids priming respondents on a specific set of response options (Haaland et al., 2024). We ask those who prepare about how far away from the fixation end they plan to prepare or have done so. The last two questions on the future rate change concern the expected monthly payment change.

The final question in this block is on whether respondents have received a letter on mortgage-rate increases from their bank over the past two months. We offer four response options: (i) no letter received, (ii) letter received but not read, (iii) letter received and read, (iv) do not remember. The question is important because we can test directly for lack of attention as one reason that could explain why the letter intervention might fail. We refer to rate increases in the question to be specific about which letter we have in mind, but avoid details on the letter content, which might confound subsequent responses.

**Vignette section** The second part of the survey contains the vignette. The respondents imagine they have a €100,000 mortgage that needs refinancing in one or three years, with the interest rate increasing to 3.5% (either from a level of 1.5%, or from 3%). We then ask them about whether they would consider the following options at their disposal to prepare for the rate reset: (i) meeting an advisor at their bank, (ii) compare loan offers from different provider, (iii) reduce the mortgage balance, (iv) lock in the future interest rate before the reset, (v) increase savings, and (vi) choose the next fixation period. Following (i) and (iii), we ask structured questions to get at respondents' underlying reasoning.

There are two main reasons for integrating the vignette into the survey. First, the hypothetical scenario is relevant to everyone, so we have all respondents provide hypothetical choices and their motivation behind them. In reality, instead, their mortgage setups are very heterogeneous. This heterogeneity makes it difficult to have enough respondents elaborate on each action. The second, related reason is that the hypothetical loan mitigates idiosyncratic factors that contribute to noise, such as the size of the loan. The structured questions about the hypothetical refinancing situation also serve complement our open-ended question about the preparation for borrowers' actual refinancing.

We construct three vignette variants. We randomly assign each respondent to one variant. All three cover the €100,000 mortgage that will reset to a 3.5% interest rate. In the baseline scenario, the current rate is 1.5% and the reset is one year away. We choose this scenario because respondents face a realistic rate increase of two percentage points. Moreover, the fixation period ends fairly soon, so respondents should care about the reset. In the second vignette, we increase the distance to the reset to three years. We choose the greater distance to reset because this is what we often see in the bank data and we want to gauge the sensitivity of preparation to the reset distance. In the third vignette, we reduce the rate increase by setting the current rate to 3%. This variant enables us to speak to the role of the size of the rate increase for hypothetical choices. We hold constant the future rate across scenarios to mitigate concerns about beliefs about general-equilibrium effects.

**Post-vignette section** The third part of the survey starts with a question on the extent of agreement with a number of statements. Specifically, we cover risk tolerance, which might determine the tolerance for interest-rate risk (Campbell and Cocco, 2003); debt aversion, which is an important dimension of heterogeneity; beliefs about the mortgage-originating bank (Johnson et al., 2019); recent consumption-savings decisions (Colarieti, Mei, and Stantcheva, 2024), which might be affected by the letter provision and can be measured only for a subset of customers in the bank data; and financial literacy, which matters for heterogeneity as well.

The last section of the survey elicits additional characteristics and beliefs of respondents. We ask for gross monthly household income and income net of major expenses, indicators for the ownership of various (financial) assets, educational attainment, and beliefs about the direct effect of an unexpected increase in interest rates. After completion, we ask respondents how interesting they found the survey and they can leave comments.

### 4.2.2 Data

**Survey administration** We run the survey in partnership with the same German bank, allowing us to combine bank data, letter RCT, and survey on the same set of customers. In November 2024, the bank sent a short email to around 41,000 customers, inviting them to participate in a survey on mortgages run by Goethe University Frankfurt. The bank sent a reminder email 1.5 weeks after the initial invitation. The survey remained open for 2.5 weeks. Overall, 2,004 customers complete the survey. The response rate is 4.9%, which is slightly above other surveys of the bank. The median response time is 14.2 minutes. Participants receive a €10 online-shopping voucher for survey completion.

**Sample selection** We set minimum restrictions for survey participation. All customers with a mortgage who consent to receiving emails from the bank get the survey invitation. Among those who complete the survey, we omit the respondents who take less than six minutes (around 1.5% of sample) and more than 120 minutes (around 0.5%). This step leaves 1,958 respondents in the baseline sample.

**Sample characteristics** The top panel of Table 6 reports summary statistics for the survey sample, which complement bank-data statistics (Table 1). Self-reported monthly household income net of main expenses, including mortgage payments, is €1,060 on average.[14]

[14] We elicit income net of expenses in buckets, such as income between €100 to €249, due to possible privacy concerns, and then take the average per bucket.

Only 10% of respondents state they have less than €250 monthly residual household income. 62% of the sample have completed college. The educational level is relatively high: in the most recent wave of the Bundesbank's Panel on Household Finances (PHF), a representative survey of German households, the college-educated share is 29%. 89% of respondents own the property they live in, and 47% have non-owner-occupied property.

## 4.3 Beliefs about interest rates and preparation for rate changes

**Interest rate perceptions and expectations** The bottom panel of Table 6 reports statistics for respondents' beliefs about interest rates.[15] We ask qualitatively on a five-point scale about how mortgage rates have changed relative to three years earlier (in 2021), with response options ranging from "today's rates are much lower" to "much higher." 83% of respondents believe mortgage rates are somewhat or much higher than they were three years ago. The average perceived current mortgage rate (for a 10-year fixed-rate mortgage) is 3.6%, below but close to the actual (average) market rate of 4%. Respondents expect interest rates to remain high on average, with a mean five-year forecast of 3.75%. Cross-sectional dispersion in estimates is higher for the forecast than for the rate today. We also ask the subset of respondents who perceive rates to be higher now than they were three years ago about whether the rate increase already has or will have an impact on household finances. Response options are on a five-point scale, from "very negative" to "very positive." 28% perceive a negative impact on their financial situation today (69% feel no effect); 50% expect a negative future impact (46% expect no effect). Overall, respondents on average have high income and are well-educated, have accurate perceptions of interest rates, and expect interest rates to remain high and affect their financial situation.

**Preparation for rate reset** We next study whether and how mortgagors prepare for the future interest-rate reset of their mortgage. Respondents first state whether they prepare: 29% have not prepared and do not plan to prepare for the rate reset, 32% plan to prepare, and 39% have prepared. We then ask respondents to describe in open-ended text how and why (or why not in case of no preparation) they prepare for the rate reset. The main advantage of this question style is that we do not prime respondents on a specific set of

[15] We include all survey participants and do not distinguish between letter recipients and non-recipients, because the letter treatment does not have significant effects on interest-rate beliefs on average, as discussed in Section 4.5.

response categories (Haaland et al., 2024). We develop a coding scheme that classifies the responses into eight categories and then combine a manual application of the scheme and a classification using a large language model (GPT-4o).

Figure 7 plots the categorized open-text explanations of whether and how mortgagors prepare for the rate reset. Among the 29% of borrowers who do not prepare (top left panel), most state that their mortgage will be naturally paid off at the end of the fixation period (63% of responses), whereas others write that the remaining balance will be small (8%) or they will actively pay it off (18%).[16] That is, most respondents who do not prepare for the rate reset expect no or only a small outstanding loan amount.

Among the 32% of borrowers who plan to prepare in the future (top right panel), the most common form of preparation is information acquisition (65% of responses), which for many borrowers entails searching for the best loan offers or consulting a mortgage advisor. Aside from that, some respondents consider fully or partially paying off the loan (10% respectively), increasing savings (19%), or locking in the future mortgage rate ahead of the rate reset using a forward loan or Bausparen (12%).

Among the 39% who have prepared already (bottom left panel), we observe more heterogeneity in the preparation. A significant fraction of borrowers has locked in their rate (36%), which is consistent with the surge in demand for forward loans once rates started to increase that we document in the bank data (Figure 2). Many borrowers have also fully (23%) or partially (10%) paid off their mortgage, which again aligns with actual behavior, such as the increased likelihood of loan-balance reductions (Table 4). Finally, we plot the frequency of categorized responses for borrowers pooled across types of preparation (bottom right panel), which illustrates the heterogeneity in how borrowers prepare, relying on (partial) repayments, increased savings, locking in interest rates ahead of the reset, and acquiring information. Overall, borrowers' open-text explanations of their preparation for higher future interest rates indicate most borrowers actively prepare, often taking steps to mitigate the interest-payment burden of higher rates.

For those that state they have prepared or will prepare, we also ask when the preparation has taken place or will take place. Appendix Figure A.4 documents large heterogeneity in the preparation timing. 69% of the borrowers who plan to prepare expect to do so fairly late, up to two years before the fixation end; 16% want to do so more than four

[16]The respondents who explain that they actively pay off their mortgage should arguably self-classify into preparing for the rate reset—presumably they do not because they will not face a rate reset.

years from the reset. Among the borrowers who have prepared, nearly 47% have done so early, more than four years from the reset.[17]

**Heterogeneity in preparation** Table 7 documents determinants of preparation for the interest-rate reset and its timing. In Columns 1–3, the dependent variable is one if a borrower has prepared for the reset already, and zero if there is no plan to prepare. We find rate beliefs matter: those who perceive a higher mortgage rate today or are more uncertain about their interest-rate forecast are more likely to prepare. Moreover, borrowers with high self-reported financial literacy, those who invest in nominal assets or stocks are also more likely to have prepared, whereas those farther away from the fixation end and (perhaps surprisingly) those with a larger loan at origination are less likely to have prepared. In Columns 4–6, the dependent variable captures how much ahead of the fixation end a borrower prepares for it. We include those who have prepared and those who plan to prepare in the estimation sample.[18] We again find that borrowers who perceive current mortgage rates to be higher are more likely to prepare early. Moreover, those who are averse to debt as well as younger borrowers tend to prepare further ahead of the reset.

## 4.4 Vignette analysis

Appendix Figure A.5 shows how likely respondents are to take action as part of the vignette. We focus on the baseline scenario of a hypothetical €100,000 mortgage with an interest rate of 1.5% that resets in one year at a rate of 3.5%. Most noticeably, 71% of respondents state they would "very likely" compare loan offers from multiple providers, and 16% respond they would "rather likely" compare offers. Relatedly, 78% would rather or very likely also consult the bank at which they have the current mortgage outstanding. Prepayments of any form are common as well (71% would likely prepay), consistent with its prominence in the bank data (Figure 4). We find similar likelihoods of reducing expenses, raising income, and taking out a forward loan, of around 47%.

We then turn to the between-respondent effects of varying the hypothetical refinancing situation. First, we study how increasing the distance to reset from one year (vignette 1) to three years (vignette 2) affects the likelihood of action over the next 12 months.

[17] Note that the evidence is so far merely suggestive. Borrowers who have prepared already and are still more than four years from the reset have prepared very early by construction. Future versions of the paper will refine this analysis.

[18] We control for distance to reset, which mechanically correlates positively with how early borrowers prepare, as borrowers who have prepared already and are still far away from reset could only have prepared early.

Table 8 shows the results. Reset in three years reduces the likelihood of consulting the mortgage-originating bank by 16 percentage points (or 20%) and searching for loan offers by five percentage points (6%). Respondents are also seven percentage points (14%) less likely to try to raise income. The likelihood of prepayments—for which we do not reduce the choice horizon to 12 months in vignette 2—and taking out a forward does not differ. The results indicate respondents become more active as they approach the rate reset.

Varying the hypothetical change in interest rates at reset matters for choices as well. Specifically, vignette-3 respondents confront a smaller rate increase, from 3% to 3.5%. This smaller increase lowers significantly the likelihood of reaching out to the mortgage-originating bank by five percentage points (5%), prepaying by five percentage points (7%), and raising income by five percentage points (11%). Instead, vignette-3 respondents are 10 percentage points (21%) more likely to lock in the 3.5% already using a forward loan. The results corroborate borrowers are sensitive to increases in interest rates, in particular in the context of locking in the post-reset interest rate.

## 4.5 Letter effects and selection

**Letter effects** Table 9 documents the extent to which the letter reaches respondents and affects interest-rate beliefs. We exclude respondents not eligible to receive the letter, which reduces the sample size to 900. In Columns 1–2, the dependent variable captures whether respondents state they have received and read a letter from their bank over the past two months concerning mortgage-rate increases. Letter provision increases the probability of reporting to have received a letter, which includes those who state they have not read it, by 32–39 percentage points, depending on the letter variant. The effect on receiving and reading a letter is 30–38 percentage points.[19] As the bank regularly sends out marketing and contract material, 12% report to have received and 7% to have received and read a letter. In sum, many letter recipients state they read our letter.

Columns 3–6 report letter effects on beliefs about mortgage rates. We find no significant effects on any of our measures: the qualitative perception of mortgage-rate changes over the past three years, quantitative estimates of the current mortgage rate and the difference between the current rate and the rate in two years, as well as the perceived likelihood of the mortgage rate in two years being significantly above the point estimate

[19]The sample is too small to reject the null of differential treatment effects across letter variants.

provided. The results suggest high ex-ante awareness of mortgage rates.[20] Indeed, 87% of respondents in the letter control group perceive interest rates to have increased over the past three years. Moreover, the middle 80% of them perceive the current mortgage rate to be between 3–4.5%. We explore in this section further below whether selection into who reads the letter implies even less scope for learning about mortgage rates.

Table 10 reports letter effects on prolongation beliefs and choices. We find significantly positive effects on the propensity to prepare for the prolongation and the likelihood to reduce the mortgage balance. Letter recipients are also significantly more likely to report they know about prepayment options, such as annual curtailments, and locking in interest rates using forward loans. The results indicate that, whereas respondents are well-informed about interest rates ex-ante, there is some scope to shift beliefs about whether and how to prepare for the mortgage prolongation.

**Selection into reading the letter** We explore selection into reading the letter, and whether this could possibly explain the limited letter effects on beliefs about mortgage rates. Table 11 reports heterogeneity in the propensity to read the letter by loan (Columns 1–4) and borrower characteristics (Columns 5–6). The dependent variable is one if the respondent states to have read a letter and zero for all other responses (no letter received, letter received but not read, does not remember). We regress the variable on an indicator for receiving any of our letters, which we interact with one of the characteristics.

We observe large heterogeneity in which borrowers read the letter. Borrowers with above-median original loan balances are seven percentage points (21%) and borrowers who have engaged in past curtailments (Sondertilgungen) are 16 percentage points (62%) more likely to read the letter. The propensity to read does not significantly differ by distance to reset and the existing mortgage rate. Borrowers whose self-reported financial literacy is above the median and those with above-median household income net of general expenses are 18 percentage points (76%) and 15 percentage points (57%) more likely to read the letter, respectively. Overall, the characteristics that positively predict the likelihood to read the letter likely also positively determine ex-ante awareness.

[20] We follow the existing literature that uses the extent of learning from exogenously provided information as a measure of attention and knowledge (see, e.g., Weber et al., 2023).

# 5 Ongoing analyses

So far, we have analyzed letter effects using survey data. We have recently obtained the updated bank data, which allow us to observe borrowers until March 2025 and thus measure treament effects on refinancing probabilities (including forwards), curtailments, and meetings with advisors. We will receive periodic updates of the bank data so will be able to measure treatment effects at different horizons.

In future versions of the paper, we will also exploit categorized account-transaction data provided by the bank for a subset of around 40,000 mortgagors to study consumption-saving behavior around refinancing and in response to our letter treatment.

# References


ANDERSEN, S., J. Y. CAMPBELL, K. M. NIELSEN, AND T. RAMADORAI (2020): "Sources of inaction in household finance: Evidence from the Danish mortgage market," *American Economic Review*, 110, 3184–3230.

ARGYLE, B. S., T. D. NADAULD, AND C. J. PALMER (2020): "Monthly payment targeting and the demand for maturity," *Review of Financial Studies*, 33, 5416–5462.

BAJO, E. AND M. BARBI (2018): "Financial illiteracy and mortgage refinancing decisions," *Journal of Banking & Finance*, 94, 279–296.

BAKER, S. R. (2018): "Debt and the Response to Household Income Shocks: Validation and Application of Linked Financial Account Data," *Journal of Political Economy*, 126, 1504–1557.

BAUGH, B., I. BEN-DAVID, H. PARK, AND J. A. PARKER (2021): "Asymmetric consumption smoothing," *American Economic Review*, 111, 192–230.

BHUTTA, N., A. FUSTER, AND A. HIZMO (2021): "Paying Too Much? Borrower Sophistication and Overpayment in the US Mortgage Market," Discussion Paper 14924, CEPR.

BRACKE, P., M. EVERITT, M. FAZIO, AND A. VARADI (2024): "When refinancing meets monetary tightening: heterogeneous impacts on spending and debt via mortgage modifications," *Bank of England Financial Stability Paper*.

BYRNE, S., K. DEVINE, M. KING, Y. MCCARTHY, AND C. PALMER (2023): "The Last Mile of Monetary Policy: Inattention, Reminders, and the Refinancing Channel," Working Paper 31043, National Bureau of Economic Research.

CAMPBELL, J. Y. (2006): "Household Finance," *Journal of Finance*, 61, 1553–1604.

CAMPBELL, J. Y. AND J. F. COCCO (2003): "Household Risk Management and Optimal Mortgage Choice," *The Quarterly Journal of Economics*, 118, 1449–1494.

CLOYNE, J., C. FERREIRA, AND P. SURICO (2020): "Monetary policy when households have debt: new evidence on the transmission mechanism," *Review of Economic Studies*, 87, 102–129.

COIBION, O., Y. GORODNICHENKO, E. S. KNOTEK, AND R. SCHOENLE (2023): "Average Inflation Targeting and Household Expectations," *Journal of Political Economy Macroeconomics*, 1, 403–446.

COIBION, O., Y. GORODNICHENKO, AND M. WEBER (2022): "Monetary Policy Communications and Their Effects on Household Inflation Expectations," *Journal of Political Economy*, 130, 1537–1584.

COLARIETI, R., P. MEI, AND S. STANTCHEVA (2024): *The How and Why of Household Reactions to Income Shocks*.

DI MAGGIO, M., A. KERMANI, B. J. KEYS, T. PISKORSKI, R. RAMCHARAN, A. SERU, AND V. YAO (2017): "Interest rate pass-through: Mortgage rates, household consumption, and voluntary deleveraging," *American Economic Review*, 107, 3550–3588.

DRUEDAHL, J., E. B. JENSEN, AND S. LETH-PETERSEN (2022): "The intertemporal marginal propensity to consume out of future persistent cash-flows: Evidence from transaction data," Tech. rep., CEBI Working Paper Series.

FAGERENG, A., M. B. HOLM, AND G. J. NATVIK (2021): "MPC Heterogeneity and Household Balance Sheets," *American Economic Journal: Macroeconomics*, 13, 1–54.

FLODÉN, M., M. KILSTRÖM, J. SIGURDSSON, AND R. VESTMAN (2021): "Household debt and monetary policy: revealing the cash-flow channel," *Economic Journal*, 131, 1742–1771.

FUSTER, A., G. KAPLAN, AND B. ZAFAR (2020): "What Would You Do with $500? Spending Responses to Gains, Losses, News, and Loans," *Review of Economic Studies*, 88, 1760–1795.

FUSTER, A. AND B. ZAFAR (2021): "The Sensitivity of Housing Demand to Financing Conditions: Evidence from a Survey," *American Economic Journal: Economic Policy*, 13, 231–65.

GANONG, P. AND P. NOEL (2020): "Liquidity vs. Wealth in Household Debt Obligations: Evidence from Housing Policy in the Great Recession," *American Economic Review*, 110, 3100–3138.

HAALAND, I. K., C. ROTH, S. STANTCHEVA, AND J. WOHLFART (2024): "Understanding Economic Behavior Using Open-ended Survey Data," Working Paper 32421, National Bureau of Economic Research.

JAPPELLI, T. AND L. PISTAFERRI (2010): "The Consumption Response to Income Changes," *Annual Review of Economics*, 2, 479–506.

JOHNSON, E. J., S. MEIER, AND O. TOUBIA (2019): "What's the catch? Suspicion of bank motives and sluggish refinancing," *Review of Financial Studies*, 32, 467–495.

JØRRING, A. (2020): "Financial sophistication and consumer spending," *Journal of Finance*, forthcoming.

KARTASHOVA, K. AND X. ZHOU (2023): "How do mortgage rate resets affect consumer spending and debt repayment? Evidence from Canadian consumers," *Journal of Money, Credit and Banking*, forthcoming.

KEYS, B. J., D. G. POPE, AND J. C. POPE (2016): "Failure to refinance," *Journal of Financial Economics*, 122, 482–499.

KUENG, L. (2018): "Excess Sensitivity of High-Income Consumers," *Quarterly Journal of Economics*, 133, 1693–1751.

PARKER, J. A. (2017): "Why Don't Households Smooth Consumption? Evidence from a $25 Million Experiment," *American Economic Journal: Macroeconomics*, 9, 153–183.

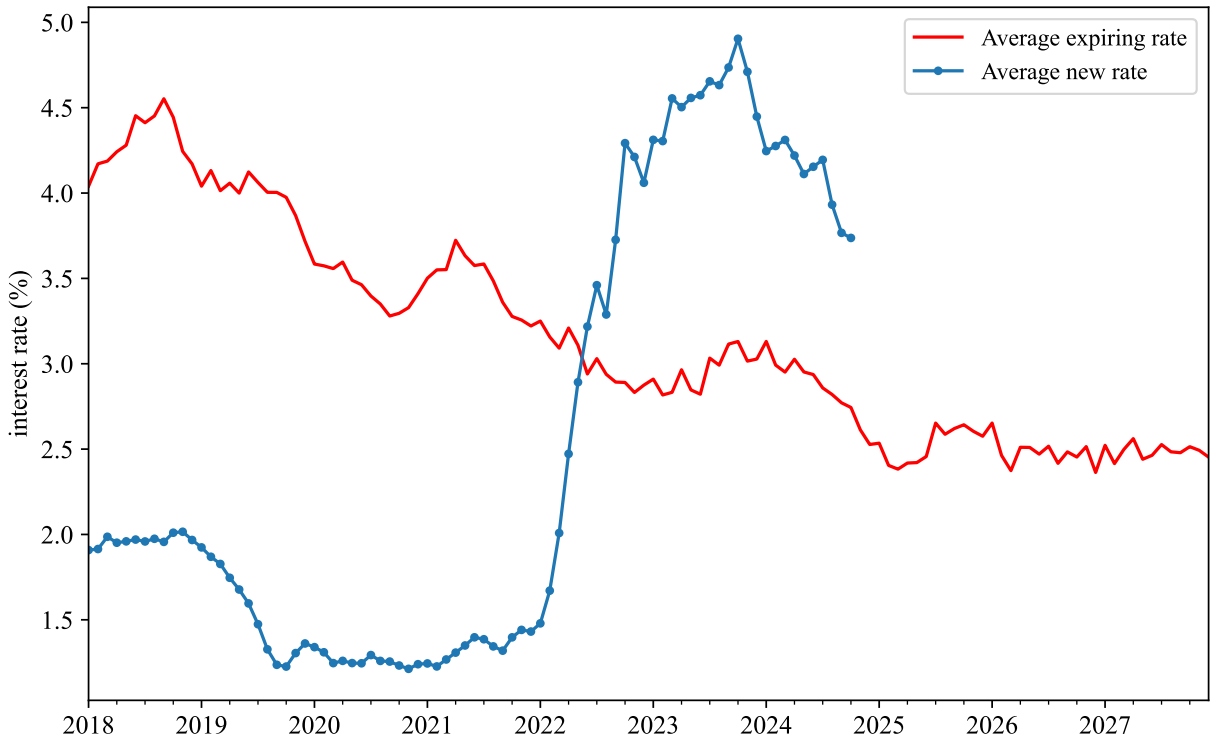
STANTCHEVA, S. (2023): "How to Run Surveys: A Guide to Creating Your Own Identifying Variation and Revealing the Invisible," *Annual Review of Economics*, 15.

WEBER, M., B. CANDIA, T. ROPELE, R. LLUBERAS, S. FRACHE, B. H. MEYER, S. KUMAR, Y. GORODNICHENKO, D. GEORGARAKOS, O. COIBION, ET AL. (2023): "Tell Me Something I Don't Already Know: Learning in Low and High-Inflation Settings," Working Paper 31485, National Bureau of Economic Research.

ZATOR, M. (2024): "Working More to Pay the Mortgage: Household Debt, Interest Rates, and Family Labor Supply," *The Journal of Finance*, forthcoming.

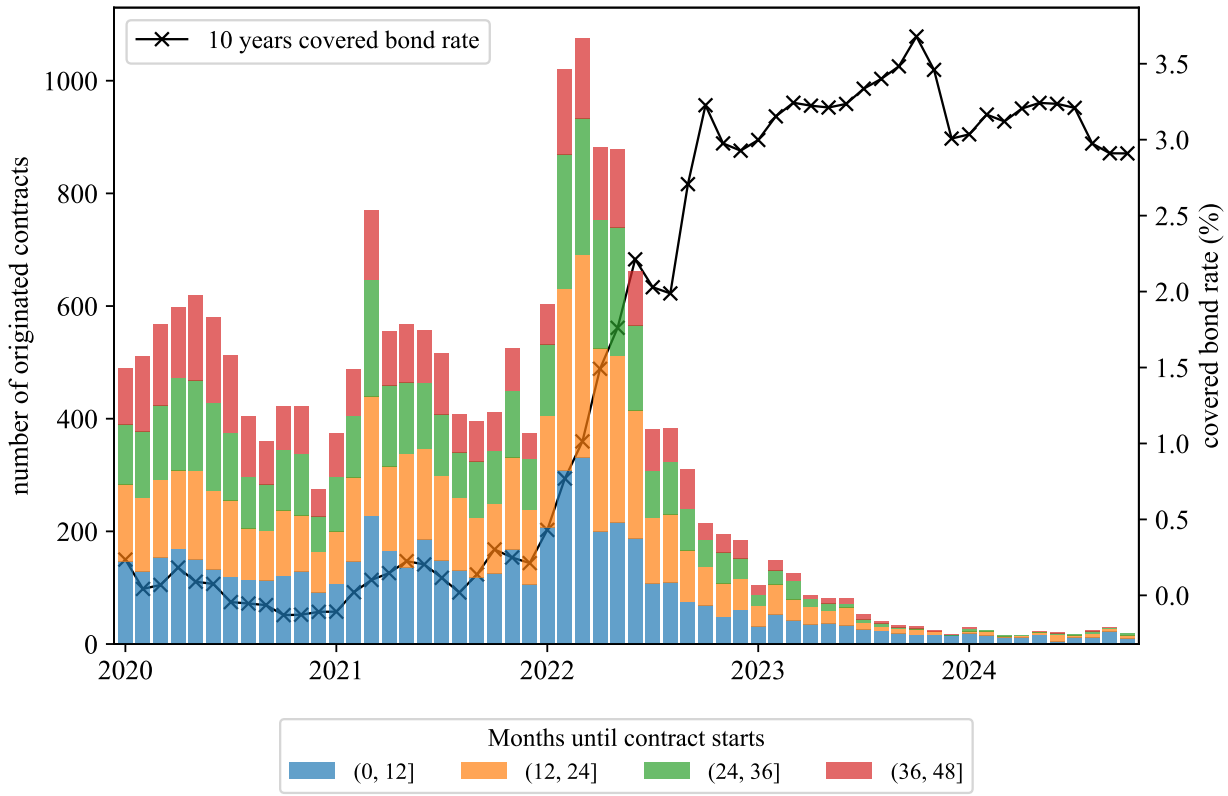
# Figures and Tables

Figure 1: New and expiring rates




*Notes:* The blue dotted line shows on the y-axis the average interest rate across the mortgages originated by the bank in a given month (x-axis). The red solid line plots on the y-axis the average interest rate across all mortgages originated by the bank with fixed-rate periods expiring in a given month (x-axis).

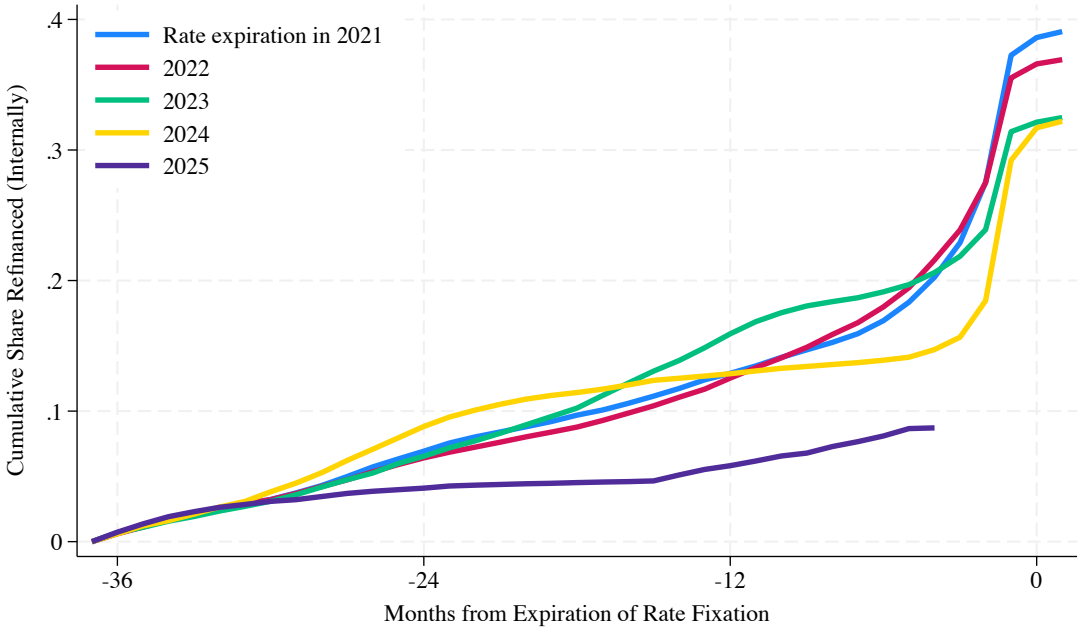
Figure 2: Origination of forward mortgages




*Notes:* This figure plots the number of forward contracts by month of origination (x-axis) and number of months between origination and start of the interest rate (stacked columns). It also shows the evolution of the 10-year covered bond rate in Germany, which serves as a benchmark for 10-year mortgage rates.

Figure 3: Cumulative hazards of internal refinancing

A. Cumulative refinancing hazard by distance from expiration, across rate expiration vintages




B. Cumulative refinancing hazard by calendar time, across rate expiration vintages

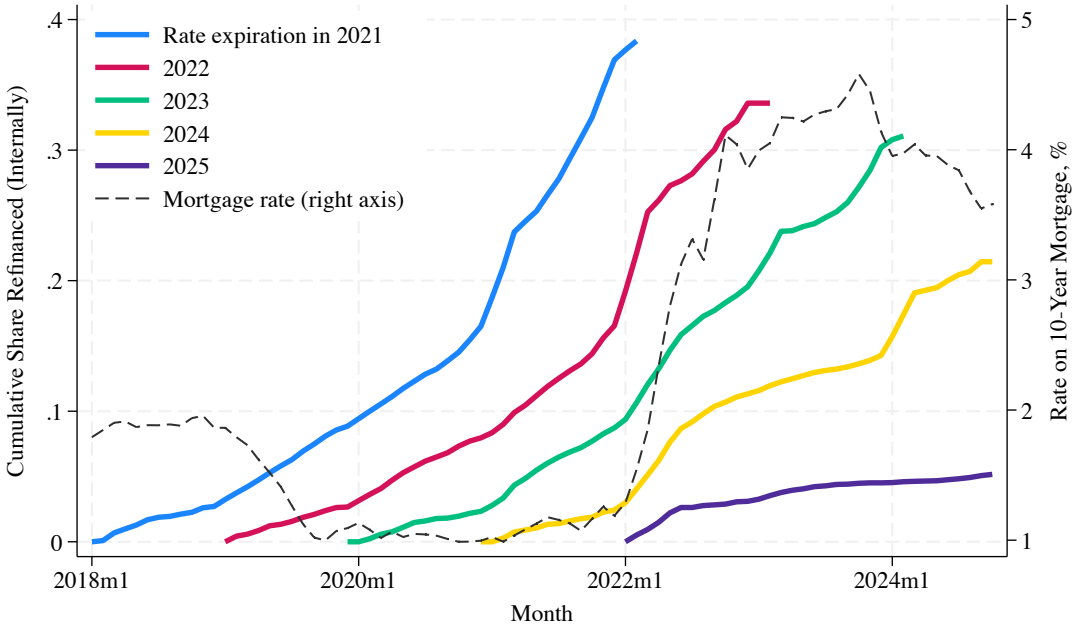
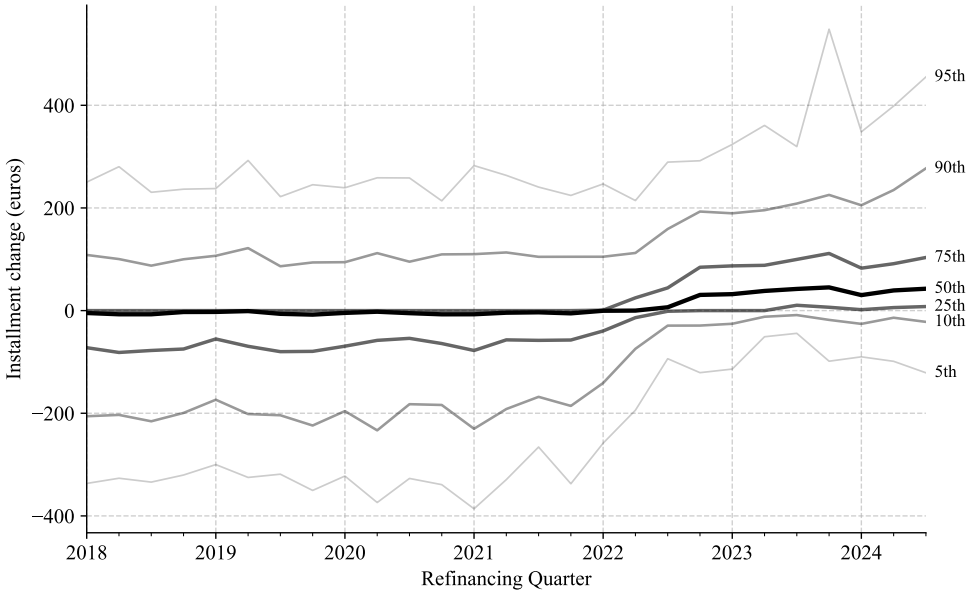
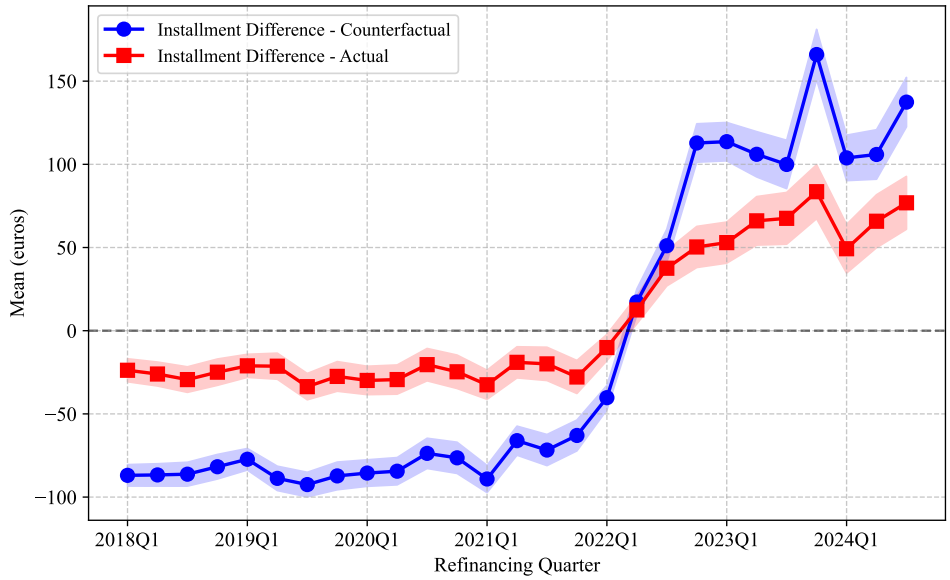


Figure 4: Changes in monthly installments

A. Distribution of changes in monthly installments

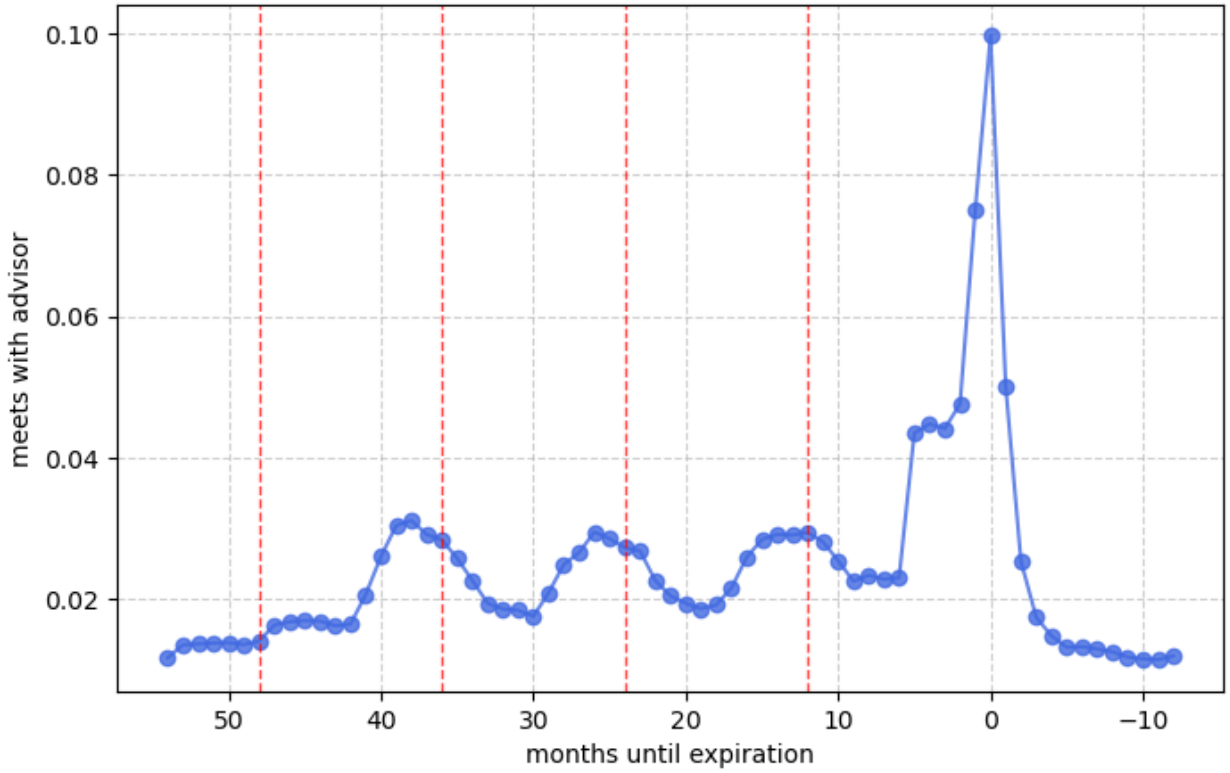



B. Average actual vs. counterfactual changes




*Notes:* Panel A shows the actual changes in monthly installments for loans that refinance internally. Panel B shows the average actual change vs. the average change that would have taken place if a borrower had picked the standard prolongation offer by the bank.

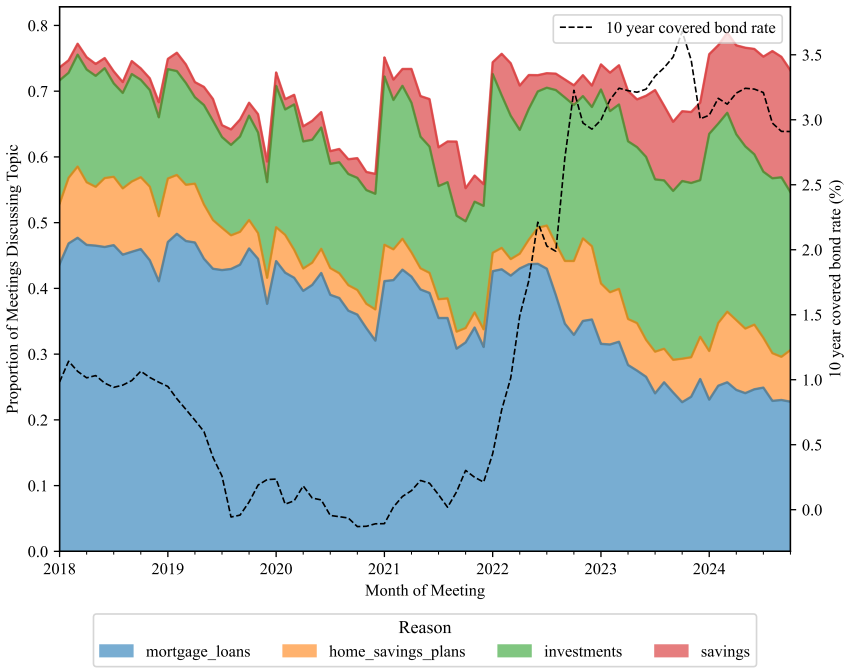
Figure 5: Advisor meetings as a function of time to rate expiration



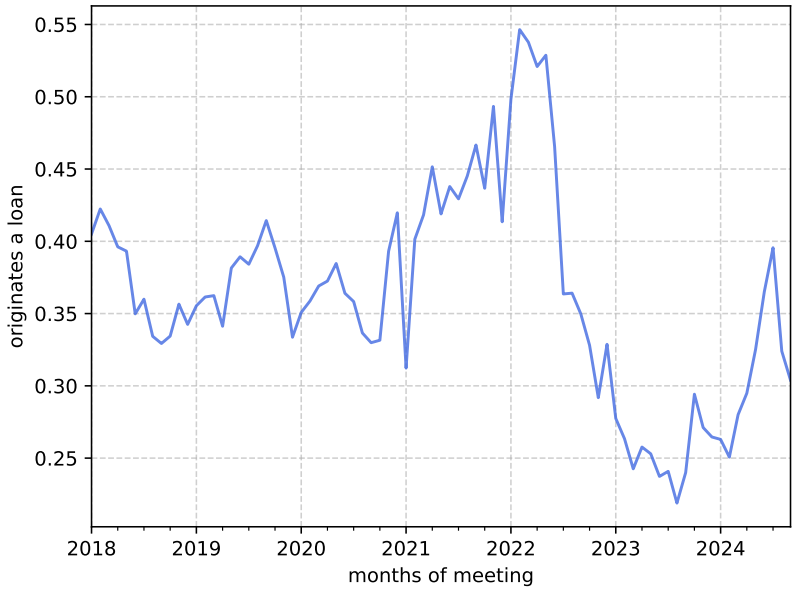

*Notes:* The figure shows the fraction of borrowers meeting with an advisor each month as a function of time remaining until the fixed interest rate expires. We restrict to advisor meetings in which mortgages (*Baufinanzierung)* are reported as a topic of discussion. The vertical red dashed lines mark round years, specifically 1, 2, 3, and 4 years before expiration. The sample is restricted to borrowers with a residual loan amount at expiration of at least 10,000 euros.

Figure 6: Advisor meetings and actions taken over time

A. Topics discussed over time




B. Evolution of propensity to originate mortgage after meeting




*Notes:* Panel A shows the proportion of advisor meetings in which each topic is discussed (multiple topics can be discussed in a single meeting) and the evolution of the 10-year covered bond rate. Panel B plots the probability of observing a loan origination within 30 days since a meeting in which mortgages (*Baufinanzierung)* were discussed. From the sample of meetings taking place in month $t$, we restrict to those by borrowers with a fixed rate loan (i) expiring between $t$ and $t + 48$ and (ii) with a residual loan amount of at least 10,000 euros.

Figure 7: Frequency of preparation types for prolongation, from open-text responses.

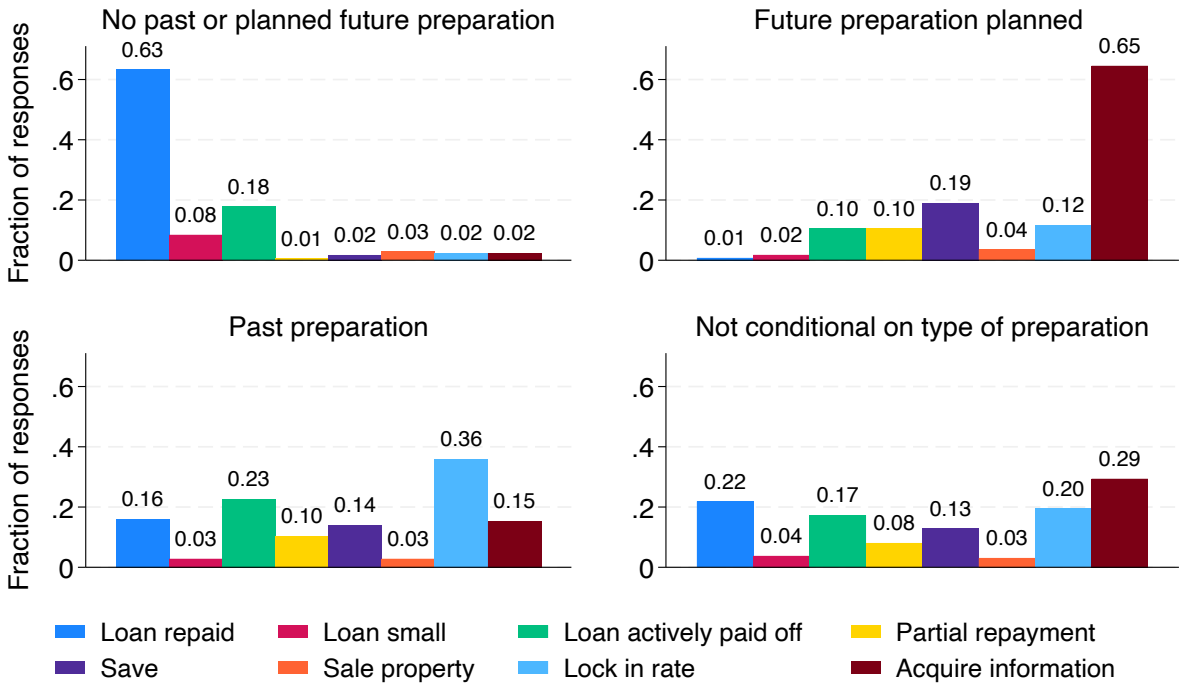


Table 1: **Summary Statistics**

**Panel A: Sample**

| Unique borrowers | Unique loans | —— Loan Fixation —— | | | | | | | Loan ends |
|---|---|---|---|---|---|---|---|---|---|
| | | <5 year | 5 year | (5-10) year | 10 year | (10-15) year | 15 year | >15 year | in sample |
| 240,752 | 396,426 | 21,678 | 31,789 | 32,152 | 198,007 | 1,789 | 78,434 | 32,577 | 210,679 |
| | | (5.47%) | (8.02%) | (8.11%) | (49.95%) | (0.45%) | (19.79%) | (8.22%) | (53.14%) |

**Panel B: Loan Characteristics**

| | count | mean | std | min | 5% | 25% | 50% | 75% | 95% | max |
|---|---|---|---|---|---|---|---|---|---|---|
| Original Loan Amount (1,000 euros) | 396,426 | 125.53 | 167.12 | 1.01 | 19.86 | 45.60 | 80.50 | 149.00 | 370.00 | 14,050.00 |
| Interest Rate (%) | 396,426 | 2.86 | 1.38 | 0.01 | 0.99 | 1.70 | 2.60 | 3.97 | 5.35 | 12.49 |
| Fixation Period (months) | 396,426 | 131.47 | 54.65 | 0.00 | 50.00 | 120.00 | 121.00 | 180.00 | 240.00 | 361.00 |
| Loan Term (months) | 396,426 | 233.19 | 115.65 | 1.00 | 62.00 | 131.00 | 222.00 | 321.00 | 438.00 | 714.00 |
| Monthly Installment (euros) | 396,426 | 683.93 | 907.88 | 10.09 | 133.44 | 300.00 | 497.97 | 800.00 | 1,768.62 | 95,479.98 |
| Residual amount (1,000 euros) | 396,426 | 79.52 | 127.92 | 0.00 | 0.00 | 14.34 | 45.29 | 99.78 | 267.82 | 11,086.65 |
| Residual term (months) | 396,426 | 125.32 | 107.05 | 0.00 | 0.00 | 27.00 | 112.00 | 207.00 | 322.00 | 594.00 |
| Origination Year | 396,426 | 2015.00 | 4.58 | 1997.00 | 2008.00 | 2011.00 | 2015.00 | 2019.00 | 2022.00 | 2025.00 |
| Forward loan | 396,426 | 0.27 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Prolongation loan | 396,426 | 0.12 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Allowed prepayments (%) | 396,426 | 2.49 | 2.71 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 5.00 | 10.00 |

**Panel C: Borrower Characteristics**

| | count | mean | std | min | 5% | 25% | 50% | 75% | 95% | max |
|---|---|---|---|---|---|---|---|---|---|---|
| Borrower age | 240,321 | 51.06 | 11.70 | 19.00 | 33.00 | 42.44 | 51.00 | 58.50 | 72.00 | 95.57 |
| Years at bank | 199,754 | 12.53 | 9.68 | -5.00 | 1.50 | 4.50 | 10.50 | 18.00 | 30.50 | 82.58 |
| Single Male | 240,510 | 0.25 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Couple | 240,510 | 0.62 | 0.49 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank deposits (1,000 euros) | 240,752 | 12.23 | 74.64 | 0.00 | 0.00 | 0.00 | 0.01 | 5.26 | 51.16 | 7,866.71 |
| Total debt amount (1,000 euros) | 240,752 | 133.85 | 225.51 | 0.00 | 6.79 | 33.09 | 76.59 | 158.13 | 431.75 | 27,044.58 |
| Brokerage account (1,000 euros) | 240,752 | 13.97 | 206.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 17.74 | 35,358.56 |
| Advisor meetings (number, annual) | 240,752 | 0.45 | 0.75 | 0.00 | 0.00 | 0.00 | 0.25 | 0.57 | 1.53 | 44.25 |
| Simultanously active loans | 240,752 | 1.29 | 0.62 | 1.00 | 1.00 | 1.00 | 1.00 | 1.25 | 2.50 | 11.00 |

*Notes:* This table presents summary statistics for the full sample of mortgages in the bank data. The dataset covers all mortgagors with outstanding mortgage debt between December 2017 and October 2024. In total we observe 240,752 mortgagors and 396,426 distinct loans. 53% of these loans are either paid-off or refinanced during the sample period. Panel B reports summary statistics at loan level. *Residual amount* and *residual term* are, respectively, the residual outstanding loan amount and residual time until loan maturity at the end of the fixed rate period calculated assuming no deviation from regular payment schedule. For loans with fixation period longer than ten years we report the residual amount and residual term after ten years since origination. *Forward loan* is an indicator for whether the loan is a forward loan and *Prolongation loan* indicates whether the loan is a prolongation loan. Both forward loans and prolongation loans are used to refinance previously existing loans. *Allowed prepayments (%)* is the maximum amount of prepayments allowed by the mortgage contract as a fraction of the initial loan amount. Panel C reports summary statistics at borrower level. For time-varying characteristics we first compute the average value for each borrower during the sample. *Bank deposits* is the aggregate amount of money deposited on current or savings accounts at the bank. *Total debt amount* is outstanding debt including mortgage debt and personal loans. *Brokerage account* is the amount of money on their brokerage account. *Advisor meetings* is the average number of times a borrower meets with a bank advisor during a year.

Table 2: **Loan Outcomes.** This table reports the number of loans in our sample by year of fixed rate expiration and by outcome. *Small* $< 10k$ refers to loans with residual balance at expiration lower than 10,000 euros. *Large* refers to loans with residual balance at expiration equal or larger than 10,000 euros. We restrict to loans with a fixation length up to 10 years and we impose that loans survive until 2 years before expiration.

| Expiration Year | Total | Small (<10k) | Large (≥10k) | Large & internal refi | | | ongoing | Ratio forward/ prolongation |
|---|---|---|---|---|---|---|---|---|
| | | | | total | *prolongation* | *forward* | | |
| 2018 | 25683 | 5370 | 20313 | 9551 | 5276 | 4275 | 318 | 0.81 |
| | | (20.9%) | (79.1%) | (47.0%) | (26.0%) | (21.0%) | (1.6%) | |
| 2019 | 31491 | 6058 | 25433 | 11780 | 5816 | 5964 | 302 | 1.03 |
| | | (19.2%) | (80.8%) | (46.3%) | (22.9%) | (23.4%) | (1.2%) | |
| 2020 | 21955 | 6153 | 15802 | 7262 | 3896 | 3366 | 180 | 0.86 |
| | | (28.0%) | (72.0%) | (46.0%) | (24.7%) | (21.3%) | (1.1%) | |
| 2021 | 21400 | 6257 | 15143 | 6628 | 3428 | 3200 | 233 | 0.93 |
| | | (29.2%) | (70.8%) | (43.8%) | (22.6%) | (21.1%) | (1.5%) | |
| 2022 | 22035 | 6488 | 15547 | 6517 | 2981 | 3536 | 226 | 1.19 |
| | | (29.4%) | (70.6%) | (41.9%) | (19.2%) | (22.7%) | (1.5%) | |
| 2023 | 21798 | 6473 | 15325 | 5802 | 2245 | 3557 | 361 | 1.58 |
| | | (29.7%) | (70.3%) | (37.9%) | (14.6%) | (23.2%) | (2.4%) | |
| 2024 | 18193 | 5841 | 12352 | 4025 | 1809 | 2216 | 2417 | 1.22 |
| | | (32.1%) | (67.9%) | (32.6%) | (14.6%) | (17.9%) | (19.6%) | |
| 2025 | 15307 | 5408 | 9899 | 1087 | 3 | 1084 | 7947 | |
| | | (35.3%) | (64.7%) | (11.0%) | (0.0%) | (11.0%) | (80.3%) | |
| 2026 | 11956 | 4685 | 7271 | 304 | 5 | 299 | 6686 | |
| | | (39.2%) | (60.8%) | (4.2%) | (0.1%) | (4.1%) | (92.0%) | |
| 2027 | 10267 | 4052 | 6215 | 30 | 2 | 28 | 6166 | |
| | | (39.5%) | (60.5%) | (0.5%) | (0.0%) | (0.5%) | (99.2%) | |
| Total | 200085 | 56785 | 143300 | 52986 | 25461 | 27525 | 24836 | 1.08 |
| | | (28.4%) | (71.6%) | (37.0%) | (17.8%) | (19.2%) | (17.3%) | |

Table 3: **Proportional hazard model of internal refinancing**. $(R_i - R_t^m)$, which is the gap (in percentage points) between the interest rate a borrower is paying on their old loan and the market rate on a 10-year mortgage at time $t$, and $\Delta R_t^m$, which is the 3-month change in the market rate. Sample includes 75,422 loans with rate fixation ending between 2021 and 2027, of which 19,154 have refinanced internally. "Vintage BH" means that the baseline hazard is allowed to vary across origination vintages. Table shows exponentiated coefficients; $> 1$ means increased hazard while $<1$ means decreased hazard. Standard errors (clustered at calendar month level) in parentheses.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $R_i - R_t^m$ | 1.175*** | | 1.200*** | 1.199*** | 1.276*** |
| | (0.018) | | (0.013) | (0.015) | (0.026) |
| $\Delta R_t^m$ | | 1.484*** | 1.742*** | 1.765*** | 1.800*** |
| | | (0.196) | (0.165) | (0.170) | (0.156) |
| Outstanding balance (log) | | | | 1.127*** | 1.134*** |
| | | | | (0.018) | (0.018) |
| Residual term | | | | 1.003*** | 1.003*** |
| | | | | (0.000) | (0.000) |
| <10y Fixation (0/1) | | | | 0.983 | 0.673*** |
| | | | | (0.032) | (0.032) |
| Borrower age | | | | 0.997*** | 0.998** |
| | | | | (0.001) | (0.001) |
| Has bank account | | | | 1.118*** | 1.122*** |
| | | | | (0.024) | (0.024) |
| Vintage BH | No | No | No | No | Yes |
| Observations | 2009733 | 2009733 | 2009733 | 2008292 | 2008292 |
| Log Likelihood | -203431 | -204160 | -202990 | -201809 | -162563 |

Table 4: **Reduction of loan balance**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Dep. Variable | I(Reduces Balance by 5% or more) | | | | |
| Rate change (average) | 0.011*** | 0.013*** | 0.013*** | 0.014*** | 0.022*** |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) |
| Residual loan amount (log) | | 0.100*** | 0.101*** | 0.082*** | 0.082*** |
| | | (0.004) | (0.004) | (0.004) | (0.004) |
| Borrower age | | -0.001*** | -0.001*** | -0.000 | -0.000 |
| | | (0.000) | (0.000) | (0.000) | (0.000) |
| <10y Fixation (0/1) | | 0.011 | 0.010 | 0.024*** | 0.078*** |
| | | (0.009) | (0.009) | (0.009) | (0.018) |
| Residual term (years) | | -0.000 | -0.000 | -0.001 | -0.001 |
| | | (0.000) | (0.000) | (0.000) | (0.000) |
| Has bank account | | 0.008 | 0.008 | 0.003 | 0.004 |
| | | (0.007) | (0.007) | (0.007) | (0.007) |
| Forward | | | -0.008 | -0.006 | 0.001 |
| | | | (0.007) | (0.007) | (0.007) |
| Lag total extra payments (%) | | | | 0.848*** | 0.848*** |
| | | | | (0.039) | (0.039) |
| Vintage Year FE | No | No | No | No | Yes |
| Observations | 18346 | 18346 | 18346 | 18346 | 18346 |
| Adjusted $r^2$ | 0.00 | 0.04 | 0.04 | 0.08 | 0.08 |
| Mean Y Var | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |

*Notes:* This table reports OLS estimates of model Equation 2. Robust standard errors are clustered at the borrower level and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: **Fixation Choice**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Dep. Variable | ——— New Fixation Length (Months) ——— | | | | |
| Rate change (average) | -6.280*** | -4.302*** | -2.575*** | -2.648*** | -3.743*** |
| | (0.186) | (0.182) | (0.174) | (0.171) | (0.269) |
| Residual loan amount (log) | | 3.000*** | -0.145 | 1.237*** | 1.034** |
| | | (0.431) | (0.416) | (0.420) | (0.420) |
| Borrower age | | -0.474*** | -0.436*** | -0.474*** | -0.454*** |
| | | (0.032) | (0.030) | (0.030) | (0.030) |
| <10y Fixation (0/1) | | -14.263*** | -11.875*** | -12.927*** | -10.847*** |
| | | (0.843) | (0.795) | (0.798) | (1.633) |
| Residual term (years) | | 2.195*** | 2.007*** | 2.035*** | 2.007*** |
| | | (0.051) | (0.048) | (0.048) | (0.049) |
| Has bank account | | -0.963 | -1.466** | -1.135* | -1.260** |
| | | (0.687) | (0.644) | (0.637) | (0.637) |
| Forward | | | 28.183*** | 28.028*** | 27.094*** |
| | | | (0.659) | (0.651) | (0.669) |
| Lag total extra payments (%) | | | | -61.806*** | -62.824*** |
| | | | | (3.123) | (3.138) |
| Vintage Year FE | No | No | No | No | Yes |
| Observations | 18346 | 18346 | 18346 | 18346 | 18346 |
| Adjusted $r^2$ | 0.06 | 0.27 | 0.35 | 0.36 | 0.37 |
| Mean Y Var | 92.19 | 92.19 | 92.19 | 92.19 | 92.19 |

*Notes:* This table reports OLS estimates of model Equation 2. Robust standard errors are clustered at the borrower level and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Descriptive statistics based on the survey

| *Statistics:* | Mean | SD | P25 | P50 | P75 |
|---|---|---|---|---|---|
| **Demographics** | | | | | |
| Monthly income net of all expenses (€) | 1060.19 | 592.29 | 625.00 | 1125.00 | 1750.00 |
| University completed (0/1) | 0.62 | 0.48 | 0.00 | 1.00 | 1.00 |
| Owner-occupied property (0/1) | 0.89 | 0.31 | 1.00 | 1.00 | 1.00 |
| Non-owner-occupied property (0/1) | 0.47 | 0.50 | 0.00 | 0.00 | 1.00 |
| **Perceptions and expectations** | | | | | |
| Mortgage rate today relative to three years ago (0–4) | 3.19 | 0.99 | 3.00 | 3.00 | 4.00 |
| Mortgage rate today (%) | 3.60 | 0.98 | 3.00 | 3.50 | 4.00 |
| Mortgage rate in five years (%) | 3.75 | 1.77 | 2.50 | 3.30 | 4.50 |
| Impact of rate increase on current finances (0–4) | 1.69 | 0.67 | 1.00 | 2.00 | 2.00 |
| Impact of rate increase on future finances (0–4) | 1.47 | 0.77 | 1.00 | 2.00 | 2.00 |

*Notes:* This table presents summary statistics for respondents' characteristics (survey data) and perceptions and expectations (survey data). We present the variables' mean, standard deviation (SD), 25th percentile (P25), median (P50), and 75th percentile (P75).

Table 7: Determinants of preparation for prolongation and its timing

| *Dependent variable:* | Preparation for prolongation | | | Timing of preparation (reset distance) | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Mortgage rate today (%) | 0.040*** | | 0.049*** | 0.071* | | 0.105** |
| | (0.015) | | (0.015) | (0.037) | | (0.041) |
| Mortgage rate in 2y relative to today (%) | 0.009 | | 0.023 | 0.047 | | 0.032 |
| | (0.015) | | (0.018) | (0.043) | | (0.046) |
| Uncertainty about 2y-rate forecast (0–4) | 0.034** | | 0.033* | 0.003 | | 0.002 |
| | (0.016) | | (0.018) | (0.043) | | (0.045) |
| Risk tolerance (0–4) | −0.034** | | −0.026 | −0.040 | | −0.031 |
| | (0.015) | | (0.016) | (0.040) | | (0.043) |
| Debt aversion (0–4) | 0.007 | | 0.003 | 0.085** | | 0.101*** |
| | (0.013) | | (0.015) | (0.036) | | (0.038) |
| Financial literacy (0–4) | 0.062*** | | 0.061*** | 0.044 | | 0.075 |
| | (0.018) | | (0.020) | (0.047) | | (0.051) |
| Income net of all expenses (0–8) | 0.000 | | −0.002 | 0.041** | | 0.031 |
| | (0.008) | | (0.008) | (0.020) | | (0.021) |
| University completed (0/1) | 0.007 | | 0.014 | 0.000 | | −0.005 |
| | (0.032) | | (0.035) | (0.087) | | (0.094) |
| Own savings product (0/1) | 0.114*** | | 0.117*** | 0.197** | | 0.104 |
| | (0.038) | | (0.042) | (0.097) | | (0.101) |
| Own stocks (0/1) | 0.097*** | | 0.106*** | −0.006 | | 0.040 |
| | (0.035) | | (0.038) | (0.093) | | (0.100) |
| Own cryptocurrency (0/1) | −0.057 | | −0.092* | 0.253** | | 0.178 |
| | (0.048) | | (0.052) | (0.117) | | (0.125) |
| Initial amortization of mortgage (%) | | −0.674 | −0.545 | | 1.694 | 1.964 |
| | | (0.696) | (0.700) | | (1.988) | (1.957) |
| Log respondent age | | −0.047 | −0.060 | | −0.607*** | −0.548** |
| | | (0.089) | (0.090) | | (0.214) | (0.218) |
| Distance to fixation end (yrs) | | −0.011*** | −0.010*** | | 0.034*** | 0.037*** |
| | | (0.004) | (0.004) | | (0.010) | (0.010) |
| Log total initial loan amount | | −0.043** | −0.044** | | 0.008 | 0.011 |
| | | (0.021) | (0.021) | | (0.053) | (0.056) |
| Mortgage rate (%) | | −0.004 | −0.002 | | −0.070* | −0.066 |
| | | (0.017) | (0.017) | | (0.041) | (0.042) |
| Avg. Y | 0.66 | 0.66 | 0.66 | 2.40 | 2.40 | 2.40 |
| Observations | 1,024 | 828 | 828 | 1,226 | 1,029 | 1,029 |
| R-squared | 0.05 | 0.02 | 0.07 | 0.02 | 0.04 | 0.06 |

*Notes:* Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Effects of changes in hypothetical vignettes

| *Dependent variable:* | Advisor | Prepay | Forward | Cut costs | Raise income | Search |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| V2: 1.5% to 3.5% in 3y | −0.159*** | −0.006 | −0.037 | −0.041 | −0.069*** | −0.052*** |
| | (0.025) | (0.024) | (0.027) | (0.027) | (0.026) | (0.019) |
| V3: 3% to 3.5% in 1y | −0.050** | −0.048* | 0.100*** | −0.003 | −0.054** | −0.015 |
| | (0.024) | (0.025) | (0.027) | (0.027) | (0.027) | (0.018) |
| Avg. Y V1 | 0.78 | 0.71 | 0.47 | 0.46 | 0.48 | 0.88 |
| Observations | 1,958 | 1,958 | 1,958 | 1,958 | 1,958 | 1,958 |
| R-squared | 0.05 | 0.09 | 0.07 | 0.06 | 0.10 | 0.05 |

*Notes:* This table reports estimates of regressions of choices on variants of hypothetical refinancing situations. The dependent variables are likelihoods of action measured on a four-point scale, covering "very unlikely," "rather unlikely," "rather likely," and "very likely." We construct an indicator for each action, which is equal to one if the action is likely, and zero if it is unlikely. *Advisor* refers to meeting an advisor from the bank, *Prepay* is reducing the loan balance, *Forward* means locking in rates using a forward loan, *Cut costs* is lowering spending, *Raise income* is increasing income, and *Search* refers to comparing offers by different loan providers. *V2: 1.5% to 3.5% in 3y* indicates the effect of vignette 2. *V3: 3% to 3.5% in 1y* indicates the effect of vignette 3. The effects are relative to vignette 1. We describe the vignettes in Section 4.2.1. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Letter effects on propensity to read letter and beliefs about mortgage rate

| *DV:* | Letter received | Letter read | Past rate change | Current rate | Future rate | Rate uncertainty |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel A. Indicator for each letter** | | | | | | |
| Letter 1 | 0.323*** | 0.300*** | −0.095 | 0.094 | 0.079 | −0.033 |
| | (0.040) | (0.036) | (0.085) | (0.105) | (0.086) | (0.090) |
| Letter 2 | 0.362*** | 0.329*** | −0.064 | −0.041 | 0.108 | −0.033 |
| | (0.042) | (0.039) | (0.088) | (0.077) | (0.084) | (0.095) |
| Letter 3 | 0.391*** | 0.381*** | −0.085 | 0.016 | 0.111 | −0.089 |
| | (0.040) | (0.038) | (0.087) | (0.084) | (0.087) | (0.091) |
| **Panel B. Indicator for any letter** | | | | | | |
| Any letter | 0.358*** | 0.337*** | −0.082 | 0.025 | 0.099 | −0.052 |
| | (0.030) | (0.027) | (0.070) | (0.069) | (0.069) | (0.078) |
| Controls | Y | Y | Y | Y | Y | Y |
| Avg. Y | 0.12 | 0.07 | 3.36 | 3.57 | -0.12 | 1.28 |
| N | 900 | 900 | 900 | 900 | 900 | 900 |
| R2 | 0.13 | 0.13 | 0.08 | 0.03 | 0.09 | 0.11 |

*Notes:* This table reports estimates from regressions of the propensity to read the letter and beliefs about mortgage rates. The dependent variables come from the survey: *Letter received* and *Letter read* are indicators that the respondent has recently received / read a letter from the bank on the topic of increases in mortgage rates. *Past rate change* is a qualitative estimate on the level of the mortgage rate today relative to three years ago, measured on a five-point scale ranging from "much lower" to "much higher." *Current rate* is the point estimate of the current mortgage rate. *Future rate* subtracts from the point forecast of the mortgage rate in two years the perceived current rate. *Rate uncertainty* is the perceived likelihood, measured on a five-point scale, of the mortgage rate in two years being two percentage points above the point forecast. Panel A shows the effect of each letter relative to the control group. Panel B shows the effect of an indicator that pools all letter groups. We explain the letter RCT in Section 4.1. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Letter effects on prolongation beliefs and choices

| *DV:* | Prolong prep | Pay change | Prepay | Forward | Prepay know | Forward know |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel A. Indicator for each letter** | | | | | | |
| Letter 1 | 0.067 | 0.143* | 0.219** | −0.071 | 0.125* | 0.185* |
| | (0.070) | (0.078) | (0.086) | (0.092) | (0.067) | (0.102) |
| Letter 2 | 0.134* | 0.034 | 0.196** | −0.118 | 0.100 | 0.219** |
| | (0.071) | (0.081) | (0.091) | (0.099) | (0.070) | (0.103) |
| Letter 3 | 0.107 | 0.061 | 0.154* | −0.016 | 0.118* | 0.172* |
| | (0.070) | (0.080) | (0.089) | (0.092) | (0.064) | (0.102) |
| **Panel B. Indicator for any letter** | | | | | | |
| Any letter | 0.101* | 0.080 | 0.189*** | −0.066 | 0.115** | 0.191** |
| | (0.058) | (0.065) | (0.073) | (0.077) | (0.056) | (0.085) |
| Controls | Y | Y | Y | Y | Y | Y |
| Avg. Y | 1.1 | 1.2 | 1.7 | 1.4 | 2.5 | 1.7 |
| N | 900 | 670 | 900 | 900 | 900 | 900 |
| R2 | 0.05 | 0.06 | 0.09 | 0.04 | 0.16 | 0.19 |

*Notes:* This table reports estimates from regressions of prolongation beliefs and choices. The dependent variables come from the survey: *Prolong prep* captures whether a borrower prepares for the prolongation, with zero being no preparation, one being planned preparation, and two being past preparation. *Pay change* is the expected monthly payment change for borrowers who state they need a prolongation. The variable takes zero for lower payments, one for similar payments, and two for higher payments. *Prepay* is reducing the loan balance and *Forward* means locking in rates using a forward loan, both measured as likelihoods of action on a four-point scale. *Prepay know* and *Forward know* measure self-reported awareness of prepayment options / forward loans on a four-point scale. Panel A shows the effect of each letter relative to the control group. Panel B shows the effect of an indicator that pools all letter groups. We explain the letter RCT in Section 4.1. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Heterogeneity in propensity to read letter

| *Trait:* | Loan reset | Loan size | Loan rate | Loan repay | Literacy | Savings |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Letter | 0.336*** | 0.318*** | 0.328*** | 0.264*** | 0.240*** | 0.257*** |
| | (0.026) | (0.027) | (0.027) | (0.037) | (0.037) | (0.040) |
| Trait | −0.020 | −0.010 | 0.002 | −0.058* | −0.003 | −0.041 |
| | (0.018) | (0.017) | (0.022) | (0.034) | (0.036) | (0.036) |
| Letter x trait | 0.006 | 0.066** | −0.041 | 0.163*** | 0.182*** | 0.147*** |
| | (0.027) | (0.027) | (0.032) | (0.051) | (0.052) | (0.052) |
| Observations | 899 | 900 | 899 | 900 | 900 | 900 |
| R-squared | 0.09 | 0.10 | 0.10 | 0.10 | 0.12 | 0.10 |

*Notes:* This table reports estimates from regressions of the propensity to read the bank letter. Specifically, the dependent variable equals one if the respondent states they have read a letter from the bank over the past two months on the topic of mortgage-rate increases, and zero otherwise (no letter received, letter received but not read, does not remember). *Letter* is one if the respondent has received any of the three letters, and zero if not. We explain the letter RCT in Section 4.1. *Trait* is a loan or borrower characteristic we interact with *Letter*: *Loan reset* is one for an above-median distance to the end of the fixation period. *Loan size* equals one for an above-median original loan balance. *Loan rate* is one if the current mortgage rate is above the median rate we observe in the data. *Loan repay* equals one if the borrower has reduced the loan balance in the past using an annual partial repayment option (Sondertilgung). *Literacy* is one for self-reported financial literacy that is above the median. *Savings* is one for above-median household income net of general expenses. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

# A Appendix figures and tables

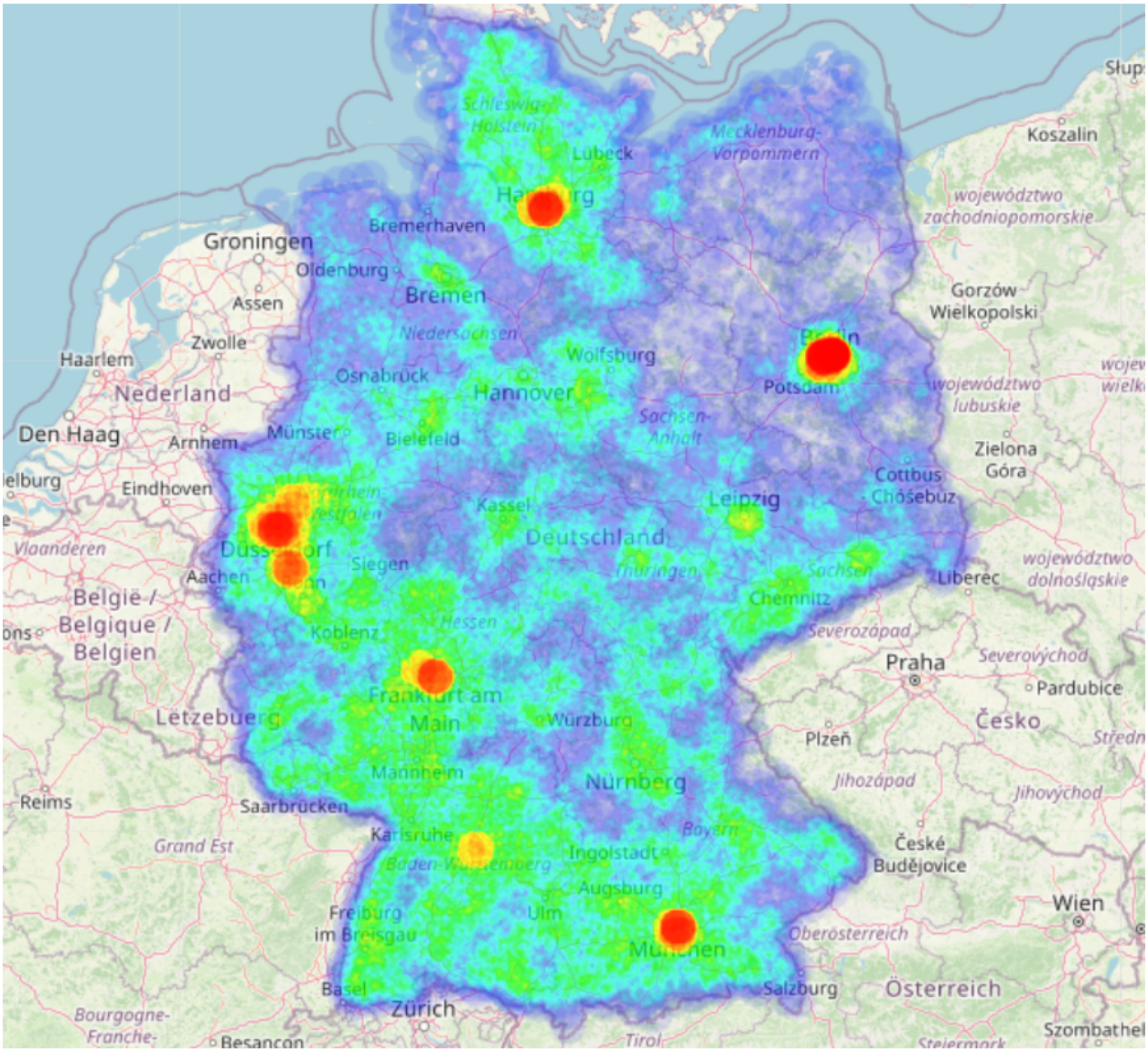



Figure A.1: **Outstanding Loan Amounts**. The map visualizes the geographic distribution of outstanding credit volume as of October 2024.

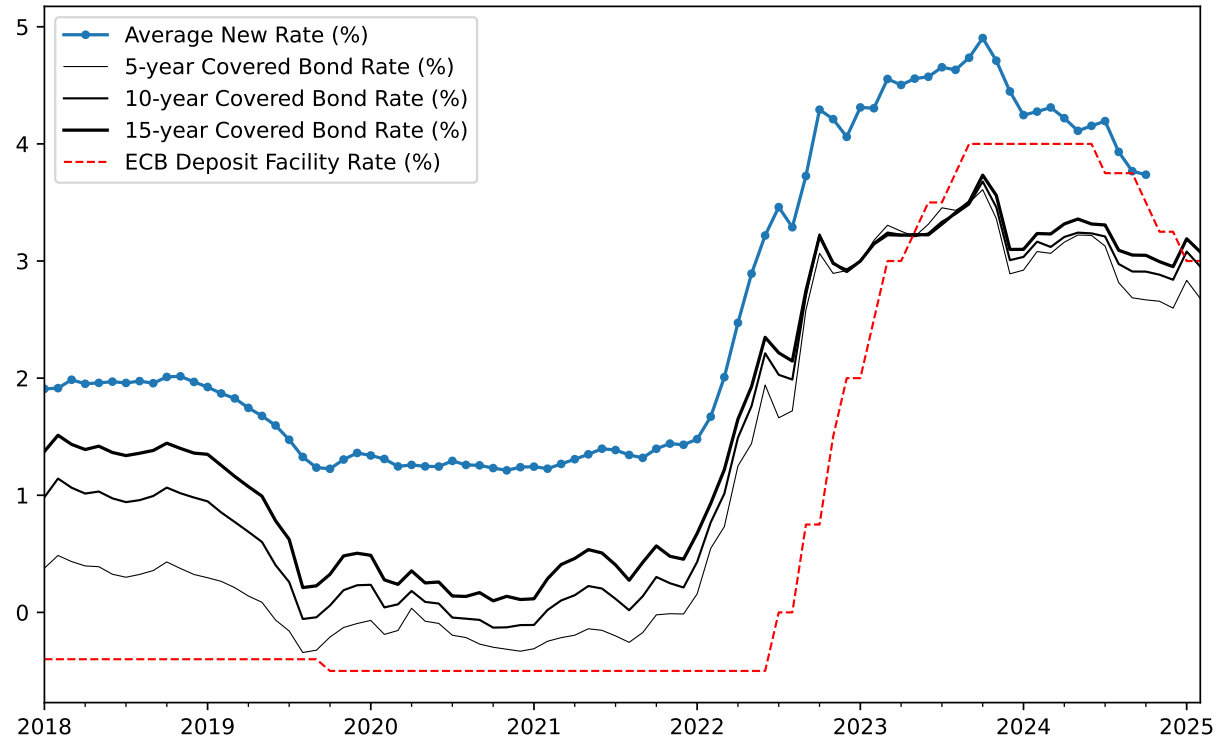



Figure A.2: **Mortgage Rates and Policy Rates**. This figure plots the average interest rate on newly originated mortgages by our bank (blue dotted line) by month, the monthly 5, 10 and 15 year covered bond rate (black solid lines), and the ECB Deposit Facility Rate (red dashed line).

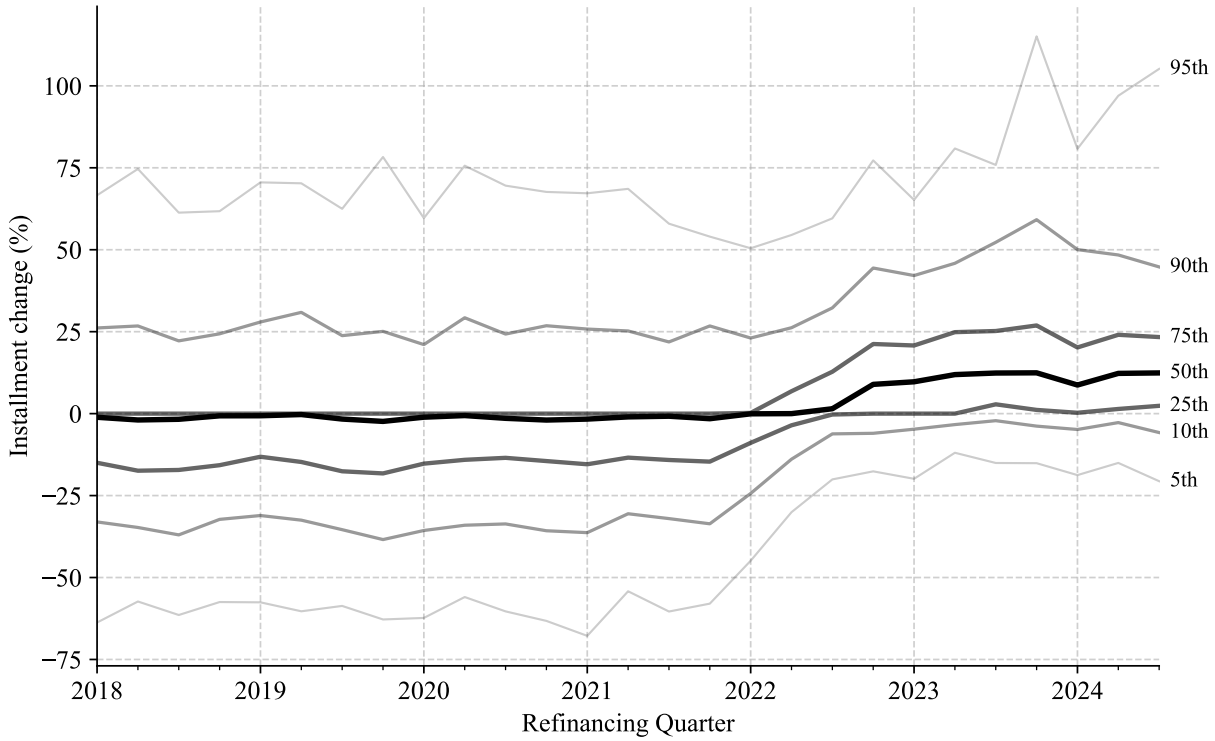



Figure A.3: **Change in installment.** The figure displays the distribution of installment changes for loans refinanced internally. On the x-axis is the quarter in which refinancing occurs. On the y-axis is the installment change as a percentage of the old installment. The sample is restricted to loans with an expected residual amount at refinancing of at least 10,000 euros and a fixation length of up to ten years on the refinanced loan.

Figure A.4: Timing of preparation for prolongation

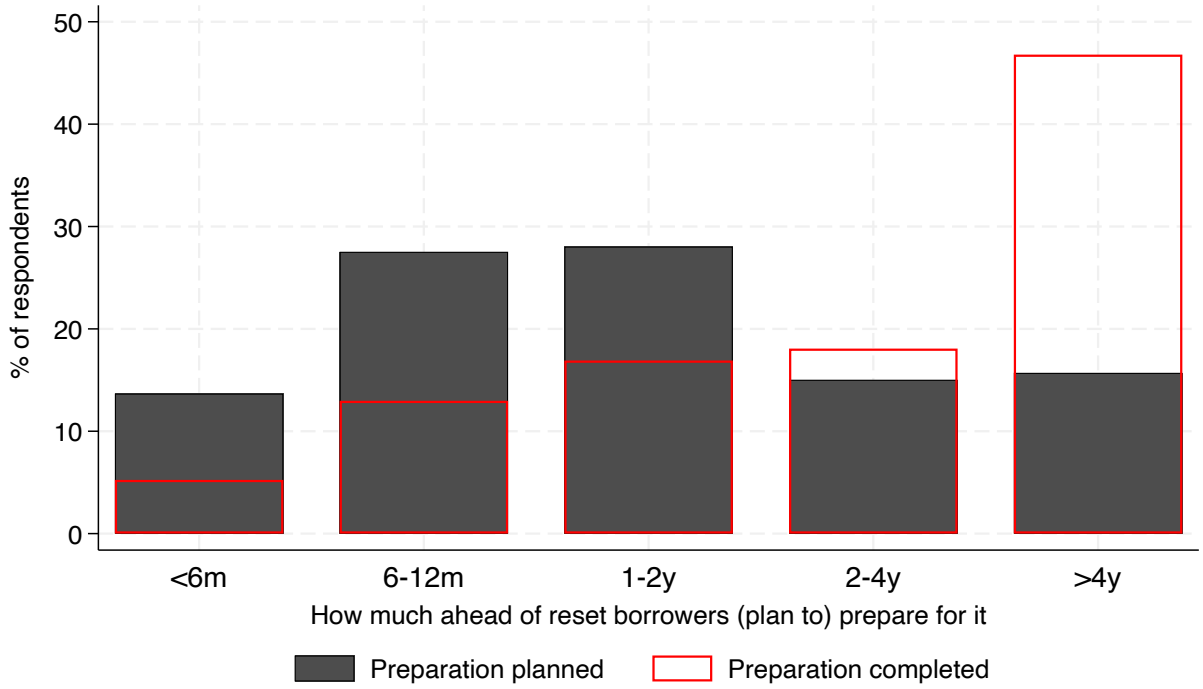


Figure A.5: Actions as part of hypothetical refinancing

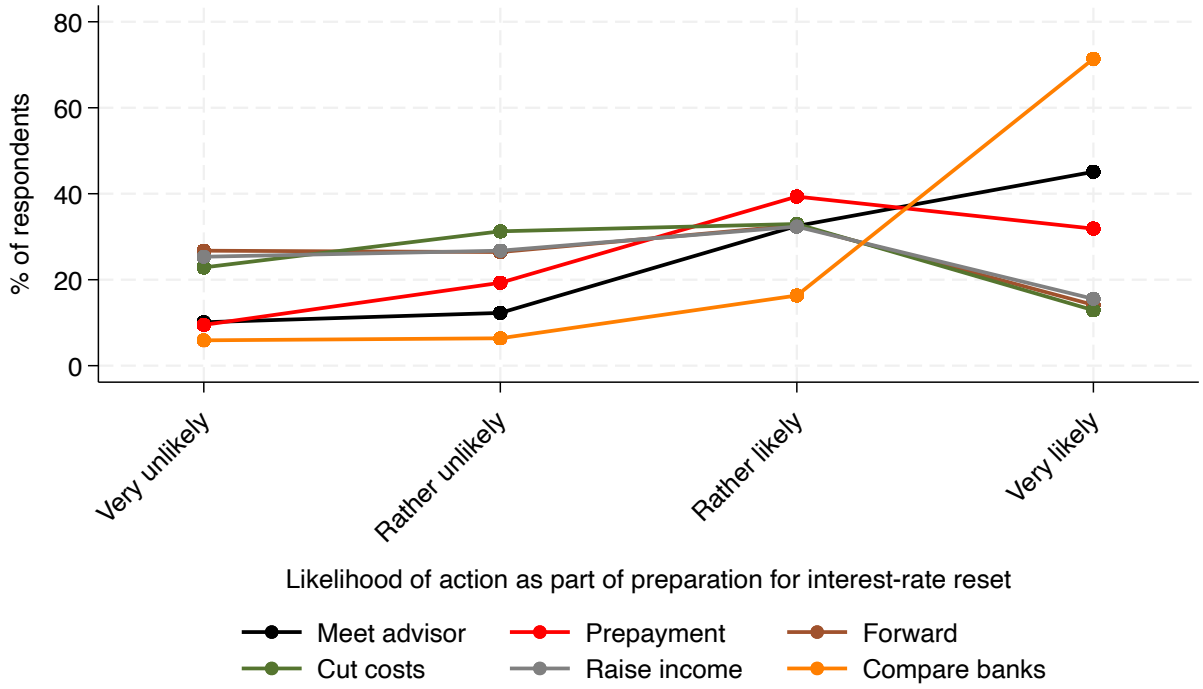


Table A.1: **Letter sample**

| | Control group (1) | Treat: group 1 (2) | Treat: group 2 (3) | Treat: group 3 (4) | p-value (1)=(2) (5) | p-value (1)=(3) (6) | p-value (1)=(4) (7) |
|---|---|---|---|---|---|---|---|
| Original loan amount (1,000 euros) | 171.25 | 166.45 | 168.67 | 168.72 | 0.03** | 0.25 | 0.27 |
| | (218.41) | (209.69) | (205.23) | (216.75) | | | |
| Current balance (1,000 euros) | 131.17 | 126.76 | 129.13 | 129.37 | 0.03** | 0.30 | 0.38 |
| | (192.59) | (182.99) | (179.99) | (192.48) | | | |
| Residual loan amount (1,000 euros) | 89.91 | 85.79 | 88.29 | 88.25 | 0.01*** | 0.29 | 0.29 |
| | (154.45) | (138.16) | (137.35) | (142.56) | | | |
| Fixation period (months) | 150.94 | 151.48 | 150.84 | 150.70 | 0.33 | 0.85 | 0.66 |
| | (51.86) | (52.43) | (51.47) | (51.61) | | | |
| Loan term (months) | 273.54 | 273.35 | 273.24 | 273.48 | 0.86 | 0.79 | 0.95 |
| | (104.56) | (103.48) | (104.05) | (104.86) | | | |
| Monthly installment (euros) | 757.86 | 747.50 | 751.48 | 751.95 | 0.29 | 0.50 | 0.55 |
| | (900.45) | (943.77) | (879.54) | (971.55) | | | |
| Interest Rate (%) | 2.00 | 2.01 | 2.01 | 2.00 | 0.67 | 0.22 | 0.56 |
| | (0.96) | (0.95) | (0.96) | (0.95) | | | |
| Origination Year | 2017.95 | 2017.92 | 2017.92 | 2017.96 | 0.28 | 0.29 | 0.91 |
| | (3.12) | (3.11) | (3.13) | (3.09) | | | |
| Borrower Age | 50.14 | 50.30 | 50.15 | 50.12 | 0.17 | 0.89 | 0.88 |
| | (10.94) | (10.94) | (10.79) | (10.81) | | | |
| Has bank account | 0.41 | 0.41 | 0.41 | 0.40 | 0.36 | 0.95 | 0.01*** |
| | (0.49) | (0.49) | (0.49) | (0.49) | | | |
| Meets advisor | 0.88 | 0.88 | 0.88 | 0.88 | 0.40 | 0.83 | 0.99 |
| | (0.33) | (0.33) | (0.33) | (0.33) | | | |
| Has brokerage account | 0.11 | 0.11 | 0.12 | 0.11 | 0.62 | 0.02** | 0.72 |
| | (0.31) | (0.31) | (0.32) | (0.31) | | | |
| Received survey | 0.47 | 0.46 | 0.46 | 0.46 | 0.36 | 0.08* | 0.04** |
| | (0.50) | (0.50) | (0.50) | (0.50) | | | |
| Unique borrowers | 11,889 | 11,887 | 11,892 | 11,892 | | | |
| Observations | 17,853 | 17,919 | 17,991 | 17,927 | | | |

*Notes:* This table reports means and standard deviations in parentheses of loan characteristics and demographics of borrowers in the control group (Column 1) and the three letter treatment arms (Columns 2, 3, and 4). Columns 5, 6 and 7 report the p-value of the t-test of equal means across groups. *Original loan amount* is the loan amount at loan origination. *Current balance* is the loan balance at the time of the experiment. *Residual loan amount* is the expected outstanding loan amount at expiration of the fixed rate, assuming no deviation from the amortization schedule. *Fixation period* is the length of the fixed rate period, in months. *Loan term* is the total term of the loan, in months. *Has bank account* is an indicator for whether borrowers have at least €2,000 deposited at the bank. *Meets advisor* is an indicator for whether borrowers meet with a bank advisor at least once over the sample period. *Has brokerage account* is an indicator for whether borrowers have a brokerage account at the bank. *Received survey* indicates whether the borrower was invited to participate in our survey. *Unique borrowers* reports the number of borrowers in each group. The last row reports the number of observations used to compute the descriptive statistics. This corresponds to the number of loans by the borrowers in each group that are outstanding at the time of the experiment.

# B Letter

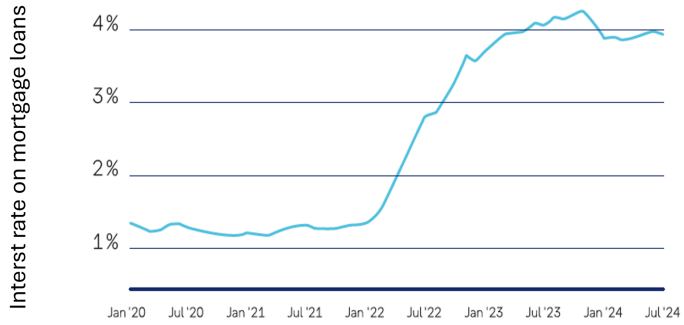
This appendix reports the text of the three letter variants translated from German to English. We use grey text to highlight the different sections of the survey.

**How do you deal with higher mortgage rates?**

Dear XXXX,

—— Section 1: included in variants 1,2, and 3 ——

Since the beginning of 2022, market interest rates have risen significantly. Together with Goethe University Frankfurt, we are investigating how borrowers deal with this increase in interest rates. As part of this study, we would like to provide you with relevant information some time before the fixed interest rate on your mortgage comes to an end.




Quelle: Deutsche Bundesbank SUD 131

According to the Bundesbank, the average fixed interest rate on newly originated mortgages in Germany is currently 4%. The fixed interest rate at which we can continue your contract may be higher or lower than this value. This is because the final value depends primarily on market developments

—— Section 2: included in variants 1 and 3 ——

that cannot be predicted. For example, a current study by the Bundesbank (Survey on Consumer Expectations, as of August 2024) shows that 40% of Germans expect an increase in lending rates. 20% of respondents believe that lending rates will fall.

[page 1]

—— Section 3: included in variants 1 and 2 ——

An increase in interest rates can lead to significantly higher monthly payments after the end of your fixed interest period. This example illustrates the possible impact:

| | Initial effect on interst payments | |
|---|---|---|
| | Annual | Monthly |
| Increase of mortgage rate from 2% to 4% for a 100,000 euros loan amount | + 2.000 Euro | + 167 Euro |

—— Section 4: included in variants 1, 2, and 3 ——

In principle, there are different options to deal with increased mortgage rates. These include:

- You reduce the loan amount by making extra payments during the fixation period and/or a (partial) early prepayment. Extra payments are possible once a year, provided that the contract allows for it; early prepayments can be made after ten years from origination for loans with a fixed interest period of more than ten years and at expiration of the fixed interest period.
- You take out a forward loan or a home savings plan. This gives you planning security as future fixed interest rates and payments are predetermined.
- You build up savings to be able to make higher payments in the future.

The option that is best suited for your situation depends on various factors. We are available for consultation at any time.

[Signature]

As part of the joint study with Goethe University Frankfurt, in the coming weeks, you may receive via email an invitation to an online survey from Goethe University Frankfurt. We appreciate your participation and thank you in advance.

[page 2]