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Abstract

How do households respond when deposit rates drop below zero? Using administrative micro data and exploiting cross-bank variation in interest rate policies, we study a major episode of negative deposit rates in Denmark affecting two thirds of household deposits. We find that households strongly reduced deposit balances when exposed to negative deposit rates, allocating funds to stock portfolios and consumption. In a large-scale survey, we document important roles for loss aversion, perceived unfairness, intertemporal substitution and return considerations in driving these responses. Our findings suggest that monetary policy can have strong consumption effects in negative territory.

JEL-Codes: D14, D83, D84, D91, E21, E43, E52, E71.

Contact: Asger Lau Andersen, University of Copenhagen, asger.lau.andersen@econ.ku.dk. Niels Johannesen, Saïd Business School, Oxford University, niels.johannesen@sbs.ox.ac.uk. Jens Brøndum Petersen, University of Copenhagen, jbp@econ.ku.dk. Sonja Settele, University of Cologne, ECONtribute, Max Planck Institute for Behavioral Economics, settele@wiso.uni-koeln.de. Johannes Wohlfart, University of Cologne, ECONtribute, Max Planck Institute for Behavioral Economics, wohlfart@wiso.uni-koeln.de. **Acknowledgements**: We thank participants at various seminars and conferences as well as Felix Chopra, Robert Mahlstedt, Luca Michels, Oliver Pfäuti and Malte Rattenborg for helpful comments. Karim Khaled Baraqji, Julian Goedtel, Jacob Krueger, Georgios Louvaris, Max Christian Soerensen, Sofie Juul Harder, and Mathilde Vallat provided excellent research assistance. **Funding**: Financial support through the Economic Policy Research Network, the Center for Economic Behavior and Inequality (CEBI), the Independent Research Fund Denmark (DFF), and Germany's Excellence Strategy (EXC2126/1-390838866) is gratefully acknowledged. The activities of CEBI are funded by the Danish National Research Foundation (Grant DNRF134). Settele and Wohlfart: Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy – EXC 2126/2-390838866. **Ethics approval:** Ethics approval was received from the IRB of the economics department at the University of Copenhagen. **Pre-registration:** The survey was pre-registered at the AEA RCT Registry (AEARCTR-0015155).

1 Introduction

Economic textbooks generally assume that the nominal return households earn on their bank deposits is positive. This reflects the historical reality that deposit rates have been positive for as long as records exist (Zimmermann, 2019), but also the presumption that negative deposit rates would induce households to put their money under the mattress, where the nominal return is zero.

Two long-run developments, however, challenge the notion that deposit rates need to be positive. First, monetary policy rates have fallen steadily since the early 1980s and have recently been in negative territory for sustained periods in some of the world's largest economies. Second, the digitalization of the financial system has made it highly impractical for households to use bills and coins for wealth storage and payments. While negative monetary policy rates put pressure on banks to pass on the cost of holding liquidity to depositors, the digital economy removes an important practical barrier for charging negative deposit rates.

How should we expect households to behave in an environment with deposit rates below zero? In standard models of consumption and saving, households respond to real rather than nominal returns and there is nothing inherently special about zero: a change from 0% to -1% is conceptually the same as a change from 2% to 1% or from 1% to 0%. However, access to a zero-return asset in the form of cash and behavioral frictions such as nominal loss aversion and perceived unfairness of banks charging to hold deposits may lead households to respond differently to negative interest rates. While the question is central to monetary policy transmission, empirical evidence remains scarce as negative rates are a recent phenomenon and only few real-world settings lend themselves to investigation.

In this paper, we exploit a major episode of negative interest rates to study, first, how households respond when deposit rates turn negative and, next, what economic reasoning underlies their behavior. After a long period during which all banks in Denmark paid zero or slightly positive rates on personal deposits, the first bank introduced negative rates on personal deposits in 2019, applying -0.75% to balances exceeding DKK 750,000 (around $115,000). Negative deposit rates quickly spread across banks and balance thresholds declined. By the end of 2021, virtually all banks applied negative rates to balances exceeding DKK 100,000 (around $15,000) and to the entire balance of non-primary accounts, making it impossible to avoid the charges by splitting deposits across banks. Consequently, as much as one-third of all individuals and two-thirds of all personal deposits in the banking system were subject to negative rates by the end of 2021.

In the first part of the paper, we analyze how households adjusted their financial behavior when they became exposed to negative deposit rates. We use comprehensive administrative micro data on income, assets and liabilities, including account-level infor-

mation covering the universe of bank accounts in Danish banks, and exploit cross-bank variation in interest rate policies for empirical identification. While banks had converged to similar interest rate policies by 2021, differences in when they introduced negative rates and how quickly they lowered deposit thresholds generate substantial variation in exposure during 2019-2020 among households with identical deposit balances.

In the main analysis, we compare a treatment group that became exposed to negative rates in 2019 to a control group that became exposed in 2021. The two groups differ with respect to their main bank by construction, but are highly similar in terms of income, balance sheets, and demographics. We employ a dynamic difference-in-differences specification with a rich set of nonparametric controls that absorb the minor differences in observable characteristics.

The results indicate that responses were strong: on average, individuals in the main treatment group owned deposits of around DKK 1.1 million at the end of 2018 and reduced them by around DKK 90,000 during 2019-2020 relative to the control group. This estimate captures the reduction in the *total deposits* that exposed individuals held across all banks and not shifting across banks. The estimate implies a remarkably large semi-elasticity of total deposits with respect to deposit rates of above ten.

The high sensitivity to negative deposit rates is striking given that recent work on household choice over savings products often highlights a lack of sensitivity to interest rates (Argyle et al., 2026; Cirelli and Olafsson, 2025; Egan et al., 2025; Lu and Wu, 2026). Consistent with this work, we find no significant depositor responses when we analyze earlier rate cuts in positive territory, with confidence bounds ruling out semi-elasticities above one. Taken together, the results suggest that the introduction of negative rates triggers much stronger depositor responses than similar rate cuts above zero.

We also use the administrative data to investigate what happened to funds that flowed out of deposit accounts in response to negative rates. We find that around one third of the funds was reallocated to other asset classes: individuals in the treatment group differentially increased their stock market holdings and contributions to illiquid pension accounts during 2019-2020. We find no significant effects on other balance-sheet items such as debt and housing assets, nor on labor market earnings. While we have no micro data on cash holdings, we show that aggregate cash withdrawals were at, or slightly below, their long-run trend during the period with negative rates, suggesting that the liquidation of deposits to hold cash was not a quantitatively important response. This is consistent with non-trivial costs of holding cash in large amounts (Rogoff, 2017).

Most of the reduction in deposit balances appears to reflect increased consumption. Lacking direct information on consumption, we impute it from detailed administrative data on income and wealth (Browning and Leth-Petersen, 2003; Holm et al., 2021; Jensen and Johannesen, 2017). With the imputed measure, we show that individuals in the treatment group differentially increased annual consumption by around DKK

40,000 during 2019-2020. Aggregating these micro-estimates over all exposed households implies that the consumption responses may have contributed as much as 0.5-1% to aggregate private consumption in 2020. This suggest a sizable stimulating effect of negative monetary policy rates at the time they pass through to households—which could partially reflect an anticipation of planned purchases of durable consumption goods.

While the analysis of administrative data highlights that households respond strongly to negative rates, the responses are consistent with various underlying motives. The increase in consumption, for instance, may reflect standard intertemporal substitution—a lower deposit rate making current consumption more attractive relative to future consumption—or non-standard motives such as loss aversion or perceived unfairness of negative rates. Discriminating between different motives is important—not only to better understand the psychological foundations of consumption and financial behavior, but also to learn which forces can in principle matter for monetary policy transmission, with implications for how our findings might carry over to other settings.

In the second part of the paper, we therefore provide survey evidence on the motives underlying behavioral responses to negative interest rates. In January 2025, we invited a random sample of Danish residents aged 18 to 75 to participate in a survey via the official government electronic mailing system. Our main working sample consists of 6,231 complete responses.

To address the challenge that households may not remember how and why they adjusted their behavior when rates turned negative in 2019-20, we rely on hypothetical scenarios. In particular, we ask our respondents to imagine that the interest rate on their main bank account drops from 0% to -1% for all deposits exceeding DKK 100,000—mirroring the situation in Denmark in 2021 when all banks had adopted negative rates. We then ask respondents *whether* and *how* they would adjust different margins of behavior in this scenario and to explain, in open-ended responses, *why* they would or would not adjust their behavior in particular ways. The open-ended elicitation captures individuals' reasoning in a naturalistic manner, and does not prime or inform participants regarding any potential line of thought through the displayed response options (Haaland et al., 2025). A final feature of our survey is that subsets of respondents are randomized into scenarios where the rate cut is from 1% to 0% or from 2% to 1%, rather than from 0% to -1% as in the main treatment condition. This allows us to study systematic differences in responses and motives between rate cuts in negative vs. positive territory.

We begin by validating our approach by linking the survey responses to the administrative data. Respondents' self-reported intentions to reduce deposit holdings and to increase spending, stock investment, and pension contributions predict corresponding *actual* changes in the administrative data at the time the respondents became exposed to negative rates in the real world. These patterns underscore the validity of our survey approach and lend support to the use of hypothetical scenarios to study belief formation

and decision-making more generally.

We next compare self-reported behavioral adjustments between respondents in the main survey condition where rates turn negative and respondents in the alternative conditions where rates remain non-negative. We find that rate cuts below zero are up to three times more likely to trigger adjustments in deposit holdings, spending, stock holdings, and pension contributions. This finding is consistent with our analysis of administrative data and suggests that households think fundamentally differently about nominal rate cuts in negative territory.

As a next step, we analyze respondents' behavioral motives as expressed in the open-ended responses, focusing on consumption and stock investment. Respondents most frequently explain increases in consumption by referring to a distaste for losses—suggesting a role for nominal loss aversion (Barberis and Huang, 2001; Gneezy and Potters, 1997)—, anger about perceived greed or unfair behavior by banks, or more standard intertemporal substitution arguments. Respondents who do not plan to change their consumption often cite a general insensitivity to interest rates, for example due to adjustment frictions or because they are satisfied with their current level of consumption. Participants reporting increases in stock investment tend to cite loss aversion or return differentials. Households reporting no adjustment in stock holdings often emphasize a general reluctance to participate in the stock market, for example due to participation costs, lack of knowledge, or the perceived riskiness of stocks—reflecting the well-known non-participation of many households in the stock market (Haliassos and Bertaut, 1995). Importantly, we also find that two non-standard motives behind adjustments to negative rates—loss aversion and perceived unfairness—are almost absent in the conditions featuring rate cuts within non-negative territory. Lastly, the considerations revealed in the open-ended responses predict the respondents' behavioral adjustments following the actual introduction of negative interest rates in 2019–20 in the expected directions.

Our survey elicits full-attention responses to negative rates and therefore does not capture potential changes in the attention environment triggered by negative interest rates. We show that news coverage and Google searches regarding deposit rates strongly increased during the 2019-21 episode of negative rates, suggesting that heightened attention may have further contributed to the strong responses to negative rates.

Taken together, our analysis suggests that households—driven in part by non-standard behavioral motives such as loss aversion and perceived unfairness—respond strongly when deposit rates turn negative. They reduce deposit balances, not to hold cash as is often assumed in theory, but rather to invest more in risky assets and to increase consumption. The reduction in deposit balances is much larger than for rate cuts in positive territory—where the non-standard motives are absent.

These findings have important implications for monetary policy transmission in low-rate environments. Recent theory contributions assume that negative policy rates do

not pass through to deposit rates, since households would switch to cash if they did. According to these models, the consumption effects of rate cuts in negative territory are therefore muted (e.g., McLeay et al. 2025; Ulate 2021) or possibly even reversed (Abadi et al., 2023; Eggertsson et al., 2024). Our results only partly agree with this view. On the one hand, we find support for the notion that zero is a critical bound, below which depositors respond more strongly to rate changes, potentially disciplining banks' decisions about pass-through. On the other hand, the nature of depositor responses is to consume more rather than to hold more cash, suggesting that, conditional on pass-through, policy rate cuts in negative territory may have particularly strong consumption effects.

Related literature We contribute to the literature on monetary policy transmission in negative territory. As discussed above, most previous papers study bank behavior in theoretical and empirical settings where the zero lower bound is binding for banks (Abadi et al., 2023; Eggertsson et al., 2024; McLeay et al., 2025; Ulate, 2021). A smaller set of studies consider real-world settings where banks pass on negative rates and study responses by firms (Altavilla et al., 2022) and households (Floccari et al., 2023) or conduct laboratory experiments to study individual behavior under negative interest rates (Bracha, 2020; Corneille et al., 2021). Our paper provides the first comprehensive analysis of household balance sheet and consumption responses to negative deposit rates and the first evidence on the distinctive economic reasoning underlying these responses.

We also contribute to the broad literature that uses micro data to study how monetary policy shapes household consumption through its impact on market interest rates. Most of this work studies monetary policy-induced changes in mortgage payments and estimates consumption responses using transaction data (Andersen et al., 2026; Di Maggio et al., 2017) or an imputed measure similar to ours (Flodén et al., 2021; Holm et al., 2021). A smaller literature identifies a deposit channel of monetary policy: when the policy rate increases, the deposit spread widens because of incomplete pass-through, which in turn erodes bank funding (Drechsler et al., 2017) and lowers household consumption (Agarwal et al., 2021). Our study highlights alternative mechanisms through which changes in the policy rate below zero can affect household portfolio allocation and consumption.

Finally, we contribute to the literature using survey approaches to study economic belief formation and decision-making. Part of this literature has used hypothetical approaches (Coibion and Gorodnichenko, 2025), among others to understand households' consumption responses to income shocks (Fuster et al., 2021; Jappelli and Pistaferri, 2014), expected inflation or home price growth (Chopra et al., 2025; Jiang et al., 2024), macroeconomic uncertainty (Coibion et al., 2024; Kumar et al., 2023), or belief formation and decision-making following macroeconomic shocks (Andre et al., 2022; Kuang et al., 2025; Roth et al., 2023). An emerging strand of this literature has used open-ended

approaches to study the motives and reasoning underlying beliefs and decisions (Andre et al., 2026; Colarieti et al., 2024; Haaland et al., 2025; Link et al., 2025). Our study highlights how one can use hypothetical survey approaches to understand the motives behind observed real-world behavior—which is particularly useful when the episode of interest lies in the past. An additional contribution of our study is to validate both reported behavioral responses to hypothetical survey scenarios and open-ended measures of reasoning by showing that they strongly predict decisions as measured in administrative register data during an actual comparable real-world episode.

2 Evidence from administrative data

2.1 Background: Negative deposit rates in Denmark

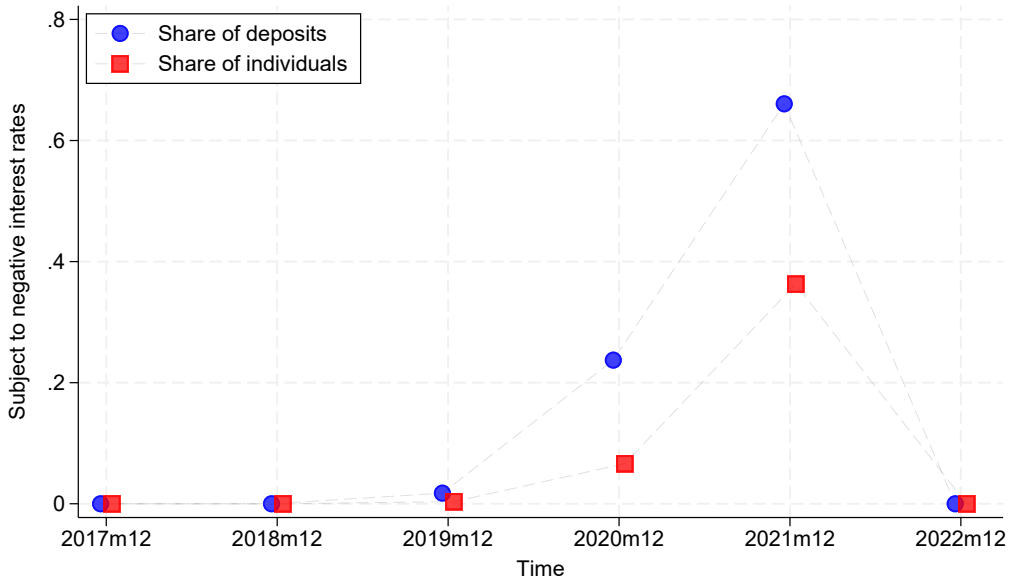
In the aftermath of the global financial crisis in 2008/9, central banks adopted a range of unconventional monetary policy tools, including negative interest rates, which effectively made commercial banks pay a charge to deposit excess reserves at the central bank. Denmark emerged as a forerunner of this practice when its central bank reduced the policy rate below zero in 2012. A number of other central banks, including the European Central Bank, entered negative territory in 2014.

In Denmark, negative interest rates gradually permeated the broader financial system, with commercial banks passing on the cost of the deposit facility at the central bank to their own depositors. In 2014, commercial banks began charging negative rates to businesses and institutional customers with large deposit balances. From 2019, banks gradually extended this practice to household customers and, by 2021, negative rates applied to virtually all household deposit balances, including term deposits, over DKK 100,000. Moreover, banks generally applied negative rates to the *entire* deposit balance of customers who did not hold their primary bank account at the bank, making it impossible to escape negative rates by splitting deposits across multiple banks.[1] When banks applied negative rates to deposit balances, they almost universally opted for -0.75%, mirroring the policy rate of the Danish central bank. Negative deposit rates quickly disappeared when monetary policy rates started climbing in the beginning of 2022.

Figure 1 illustrates the dynamics in household exposure to negative interest rates. Over the period 2019-2021, the share of deposits (blue markers) subject to negative rates increased gradually from 0% to around 65%. Over the same period, the share of depositors paying negative rates on their marginal deposit balance increased from 0% to around 30% (red markers). The gradual increase in exposure reflects, on the one hand, that banks adopted negative rates at different points in time and, on the other hand, that

[1] Banks in Denmark typically consider the primary bank account to be the unique account selected for transactions with the government, i.e., the account to which, for instance, child benefits, pensions and tax rebates are disbursed.

Figure 1 Household exposure to negative interest rates



Notes: This figure illustrates how exposure to negative interest rates evolved over the period 2017-2022. At the end of each year, it shows the share of all personal deposits in Danish banks (blue line) and the share of all individual depositors in Danish banks (red line) that are exposed to negative interest rates.

they gradually lowered the deposit threshold at which negative rates kicked in.

2.2 Cash withdrawals

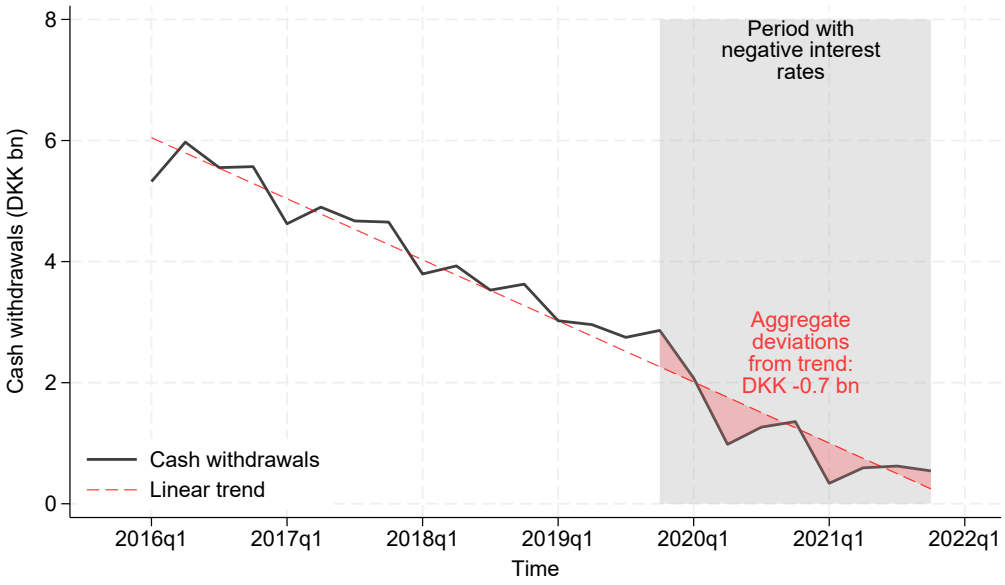
A key assumption in standard models of monetary policy is the zero lower bound: households respond to negative rates by withdrawing money from their bank accounts to hold it in cash. However, the inconvenience of using cash for payments and wealth storage in modern economies with digitalized financial systems casts doubt on the empirical relevance of this assumption in the Danish setting.

Before turning to the analysis of micro data, we use aggregate data to investigate whether the introduction of negative interest rates was associated with a significant increase in cash withdrawals. We focus on cash withdrawals made at the bank counter, which is the only way to make large one-time withdrawals given the low limit on daily withdrawals in ATMs. Figure 2 shows that such cash withdrawals are on a secular downward trend, consistent with increasing digitalization of consumer finances. Moreover, there is no evidence of a trend break in the period with negative interest rates on retail deposits, 2019q4-2021q4. If anything, cash withdrawals are somewhat below the long-run trend in this period.[2]

The absence of abnormally large cash withdrawals during the period of negative deposit rates suggests that converting deposits to cash was not an important response margin. In addition, the fact that aggregate cash withdrawals in 2020–2021 amounted to only about 2% of the aggregate deposits exposed to negative interest rates bounds the

[2]We find similar results for a time series that also includes ATM withdrawals (Appendix Figure A.1)

Figure 2 Aggregate cash withdrawals at the counter



Notes: This figure shows a seasonally adjusted time series of aggregate cash withdrawals from banks (black solid line) and the linear trend in this series (red dashed line). The series only includes withdrawals at the counter and not withdrawals from automatic teller machines. The red areas represent deviations from the linear trend during the period with negative interest rates. To construct the seasonally adjusted series, we obtain the error terms from a regression of the raw quarterly outcomes on indicators for first, second, third and fourth quarter, and add back the mean of the raw quarterly observations taken over the same period. The raw data is from official statistics published by the Danish Central Bank (Table DNBSHI).

possible error due to confounding factors. Even under the extreme assumption that depositors for some reason stopped making cash withdrawals for any other purpose in 2020-2021—i.e., all observed withdrawals were to reduce balances subject to negative rates—the implied rate of withdrawal from exposed deposits would still be negligible, around 2%.

2.3 Empirical design

We study a range of response margins using administrative micro data and exploiting the staggered adoption of negative interest rates across banks. The basic idea is to compare households who are similar with respect to their ex-ante characteristics, particularly their deposit holdings, but differ in their ex-post exposure to negative rates because banks adopted negative rates at different times.

Our preferred empirical design compares customers at two major Danish banks with a particularly stark difference in their interest rate policies. One of them was the first bank in Denmark to introduce negative rates in December 2019. The negative rates initially applied to deposit balances above DKK 750,000 (about USD 110,000 at 2019 exchange rate), but the threshold was quickly lowered to DKK 250,000 in May 2020 and to DKK 100,000 in April 2021. We refer to this early adopter as Bank $\mathcal{E}$. The other one was consistently the last mover among the major banks. It introduced negative

rates on deposit balances above DKK 1.5 million in June 2020—while maintaining a 0.0% rate for customers below this threshold—and subsequently lowered the threshold to DKK 250,000 in January 2021, and to DKK 100,000 in July 2021. We refer to this later adopter as Bank $\mathcal{L}$.[3]

As illustrated in Figure 3, this creates a useful natural experiment for customers in the two banks with ex-ante deposits between DKK 750,000 and 1.5 million (USD 110,000—220,000): Between December 2019 and January 2021, customers in Bank $\mathcal{E}$ were subject to negative interest rates while otherwise similar customers in Bank $\mathcal{L}$ were not. We can therefore identify the effect of exposure to negative interest rates with a difference-in-difference estimator, assuming that customers in Bank $\mathcal{E}$ ("exposed group") would have followed the same trajectory as customers in Bank $\mathcal{L}$ ("non-exposed group") through this period in a counterfactual scenario without negative rates (conditional on observable characteristics).

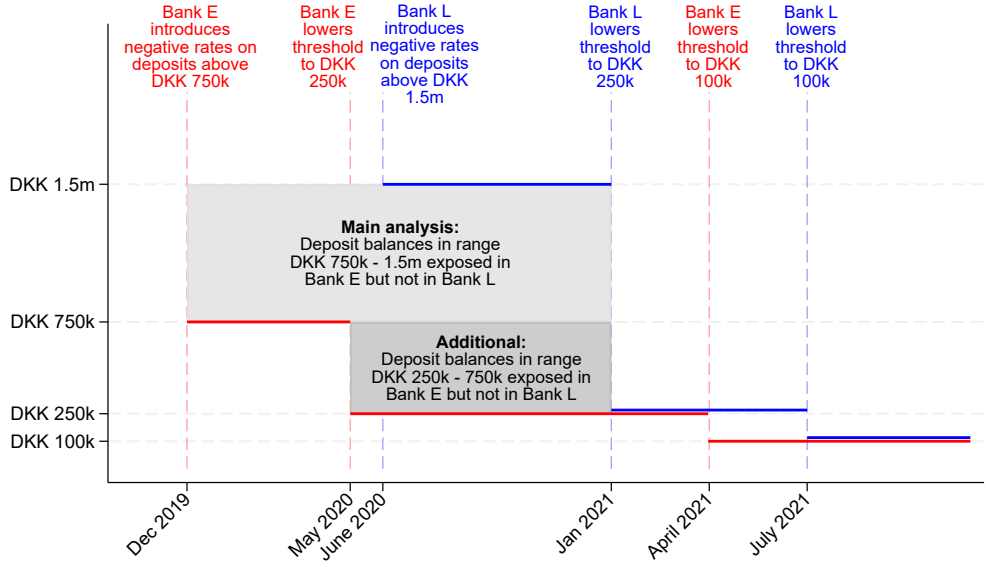
This empirical design has several desirable features. Importantly, the exposure is most likely unanticipated, as no personal accounts in Denmark had been subject to negative interest rates before. Moreover, the design maximizes the time period with differential exposure as it compares customers in the first and the last adopter among the main banks and thus allows the maximum possible time for lagged behavioral responses.

However, the design also has limitations. First, we consider a set of individuals with relatively large stocks of deposits. While these individuals are important for the transmission of monetary policy to aggregate consumption, they are far from representative of the overall population. Second, we are not able to estimate effects over long time horizons, as the banks converged to similar interest rate policies in 2021. It is possible that the responses we estimate are temporary, reflecting for instance re-timing of durable goods purchases. Third, the introduction of negative rates may have led non-exposed individuals to adjust their behavior, anticipating that they would eventually be exposed as well. We expect such anticipation effects to bias our results toward zero.

In the robustness analysis, we take two alternative empirical approaches. First, we consider another sample: individuals who are also customers in Banks $\mathcal{E}$ and $\mathcal{L}$, but with ex-ante deposits between DKK 250,000 and 750,000. Deposits in this interval were subject to negative interest rates between May 2020 and January 2021 in Bank $\mathcal{E}$ but not in Bank $\mathcal{L}$. Second, we employ a stacked regression design that includes all individuals with ex-ante deposits between DKK 750,000 and 1.5 million regardless of their bank. We consider these alternative designs less compelling than the main one because anticipation is more likely to confound the estimates and because the time spans with variation in exposure are significantly shorter.

[3]Before 2019, deposit rates were generally zero or near-zero on normal savings products while slightly higher rates were available for special products like custodial saving accounts for children or for shareholders' savings accounts. For instance, the best rates offered by Bank $\mathcal{E}$ and Bank $\mathcal{L}$ on any normal savings product, including terms deposits, were 0.05% and 0.01%, respectively, in 2017.

Figure 3 Household exposure to negative interest rates



Notes: This figure illustrates how our empirical design levers the variation in interest rate policies. It shows how the threshold balance for applying negative deposit rates evolved over time in Banks $\mathcal{E}$ and $\mathcal{L}$. The main analysis compares customers in the two banks with deposits between DKK 750,000 and 1.5 million who were differentially exposed to negative rates between December 2019 and January 2021 (light gray area). An additional analysis compares customers in the two banks with deposits between DKK 250,000 and 750,000 who were differentially exposed to negative rates between May 2020 and January 2021 (dark gray area).

2.4 Data

Sources We use administrative micro data at the annual frequency from a range of government registers. Most important is the deposit register (IRTEPERS), which contains account-level, end-of-year information about deposit balances for all personal accounts in Danish banks.[4] As the dataset includes unique identifiers for the individuals owning the accounts as well as for the banks in which the accounts are held, we can enrich it with information from other sources. For individuals, we add annual information about earnings and balance sheet positions from the income register (IND), about basic demographics such as age, gender and municipality from the population register (BEF), about transfers to and from tax-favored pension accounts from the pension registers (INPI and INHP), and about property transactions by combining the registers of properties (EJSA) and property owners (EJER). For banks, we add information, hand-collected from bank websites and press releases, about the introduction of negative interest rates and subsequent changes in rates and thresholds.

Variables In this dataset, we measure the exposure of each individual to negative interest rates based on the ex-ante deposit balances and the time-varying thresholds applied by Danish banks. Specifically, we define an individual's main bank as the bank in which

[4]This information is comprehensive and accurate as it is collected by the tax authorities for the purposes of tax enforcement (Alstadsæter et al., 2019).

they hold more than 50% of their total deposits at the end of 2018 and consider them to be exposed from the time the main bank's balance threshold for applying negative rates is below the individual's end-of-2018 balance. For instance, we consider an individual holding DKK 1 million in Bank $\mathcal{E}$ in 2018 to be exposed from December 2019 when Bank $\mathcal{E}$ introduced negative interest rates for balances above DKK 750,000, whereas an individual holding the same amount in Bank $\mathcal{L}$ became exposed in January 2021 when Bank $\mathcal{L}$ reduced the balance threshold from DKK 1.5 million to 250,000. Importantly, our measure does not capture actual ex-post exposure to negative interest rates, which is endogenous to behavioral responses, but rather isolates an exogenous component of exposure that derives from ex-ante deposit balances and bank relations. This feature gives our results a flavor of intention-to-treat estimates.

To measure how financial behavior changes in response to exposure to negative interest rates, we track a number of individual-level outcomes over time. First, we measure each individual's *total deposits* across all banks in each year. This choice reflects that we are mainly interested in substitution across asset classes and changes in consumption, rather than deposit shifting across banks. Next, we measure the value of an individual's total *stock portfolio* and the value of their voluntary contributions to tax-favored *pension accounts* in each year. This allows us to directly test for substitution to other asset classes that were not subject to negative interest rates. Finally, we impute individual *consumption* from the administrative data on income, assets and liabilities (Browning and Leth-Petersen, 2003; Holm et al., 2021; Jensen and Johannesen, 2017):

$$\text{consumption}_{i,t} = \text{income}_{i,t} - \text{tax}_{i,t} + \Delta\text{debt}_{i,t} - \Delta\text{assets}_{i,t} \tag{1}$$

where i refers to an individual and t to a year. Intuitively, the imputation procedure backs out consumption from the accounting identity stating that any discrepancy between consumption and after-tax income will emerge as a change in net assets. We provide more details on the imputation in Appendix C.

We emphasize that the imputed consumption measure comes with a number of caveats. First, if depositors responded to negative rates by shifting funds to family members, such transfers would add to the estimated consumption responses (as transfers reduce observed assets). To address this concern, we conduct robustness tests that collapse outcomes at the household- and family-level. Likewise, cash withdrawals also enter the estimated consumption responses (as cash withdrawals reduce observed assets). While the analysis in Section 2.2 suggests that substitution toward cash is not an important behavioral margin, we discuss below to what extent it may bias our estimated consumption responses. Finally, if the stock portfolios of exposed and non-exposed individuals performed differently around the introduction of negative rates, the estimated consumption responses may be biased (as abnormal gains increase observed assets). While our data does not allow us to compute total returns, it is reassuring that cash returns—i.e. divi-

dends plus realized net gains as a fraction of portfolio value—remain on parallel trends through the sample period (Appendix Figure A.2).

In addition to these four main outcomes—bank deposits, stock holdings, pension contributions and consumption—we consider a number of secondary outcomes. They capture additional adjustment margins, such as debt, income, and property holdings as well as efforts to reduce exposure to negative rates by shifting deposits across banks during the time period where some banks still offered zero rates.

Sample Appendix Table B.1 reports descriptive statistics for the roughly 100,000 individuals in Denmark with ex-ante deposit balances in their main bank between DKK 750,000 and 1.5 million in 2018. The main analysis focuses on individuals whose main bank is either Bank $\mathcal{E}$ (Column 1) or Bank $\mathcal{L}$ (Column 2) whereas the robustness analysis also includes individuals with ex-ante deposit balances in the same range at other banks (Column 3). The three samples are highly similar in dimensions such as age, gender, income, consumption, housing assets and debt. However, there are material differences in other dimensions, with customers at Bank $\mathcal{L}$ holding more stocks and being more likely to live in the capital, Copenhagen, than customers at other banks, including Bank $\mathcal{E}$. Our regression models absorb differences in demographics, geography, income and balance sheets with a set of highly granular non-parametric controls.

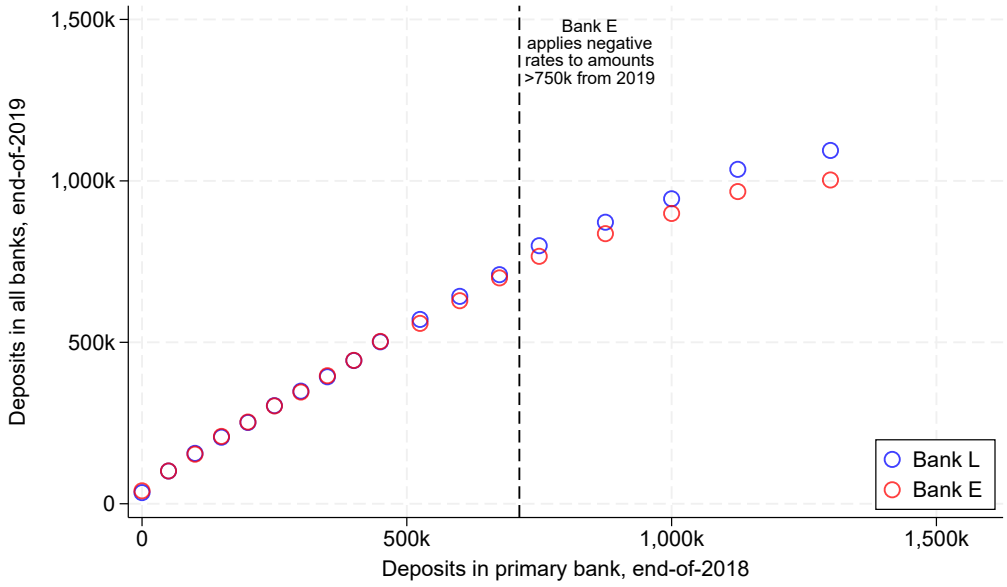
2.5 Graphical analysis of deposits

We first provide a simple graphical analysis of depositor responses to negative rates in Figure 4. The horizontal axis indicates deposit balances in the main bank at the end of 2018, i.e. *before* any of the two banks had introduced negative interest rates. The vertical axis shows average deposit balances, including not only accounts at the main bank but also at other banks, at the end of 2019, i.e. *after* Bank $\mathscr{E}$ had introduced negative interest rates on deposit balances in excess of DKK 750,000.

For 2018-balances below DKK 750,000, i.e., to the left of the dashed vertical line, average end-of-2019-balances are similar across customers at the two banks. This suggests that the two customer groups behave similarly in terms of deposit dynamics when they face the same interest rate policies. By contrast, for 2018-balances above the threshold, i.e., to the right of the dashed vertical line, average 2019-balances are systematically lower for customers in Bank $\mathscr{E}$, suggesting that these customers lowered their deposit balances after becoming exposed to negative interest rates.

The behavioral responses implied by the figure are sizable. For instance, the vertical difference between the two lines suggests that customers at Bank $\mathscr{E}$ with ex-ante balances around DKK 1 million reduced deposits by around DKK 50,000 during 2019 relative to customers at Bank $\mathscr{L}$. Importantly, as the vertical axis measures an individual's deposits at all banks, this does not simply reflect deposit shifting across banks.

Figure 4 Deposit responses to negative interest rates



Notes: This figure illustrates how individuals exposed to negative interest rates in 2019 changed their deposit holdings. The binned scatterplot shows individuals' deposits in their main bank at the end of 2018 on the horizontal axis and their deposits in all banks at the end of 2019 on the vertical axis. The dashed vertical line indicates the threshold level of deposits at which Bank $\mathscr{E}$ started applying negative interest rates in 2019. The sample includes all individuals whose main bank at the end of 2018 was Bank $\mathscr{E}$ (red line) or Bank $\mathscr{L}$ (blue line).

Interpreting the divergence above the threshold as the response to the introduction of negative interest rates is consistent with two additional results. First, when we conduct the same exercise in the prior year, we do not find a similar divergence around DKK 750,000: ex-post deposit balances are generally aligned across customers at the two banks throughout the whole deposit distribution (Appendix Figure A.3). Second, when we conduct the same exercise but analyze the change in total deposits over two years, by plotting end-of-year deposit balances for 2020 on the vertical axis, the divergence appears around DKK 250,000, coinciding with the threshold employed by Bank $\mathscr{E}$ from May 2020 (Appendix Figure A.4).

While the graphical analysis produces evidence on household responses to negative interest rates in a highly transparent way, it has several limitations: it provides no formal test for underlying differential trends and it compares customer groups who are materially different in some dimensions (as shown in Appendix Table B.1) and who are therefore potentially exposed to other differential shocks than negative interest rates. We address these limitations in the main analysis.

2.6 Main analysis

In this section, we develop and implement an empirical framework that exploits the same variation in exposure to negative deposit rates as the graphical analysis, but broadens the scope by including more outcomes and improves identification by modeling dynamics

and adding controls.

Specification We restrict the estimation sample to individuals whose main bank at the end of 2018 was Bank $\mathscr{E}$ ("exposed group") or Bank $\mathscr{L}$ ("non-exposed group") and whose deposit balance was between DKK 750,000 and 1.5 million. Letting i and t index individuals and years, respectively, we estimate the following model for the period 2014-2020:

$$y_{i,t} = \alpha + \gamma \text{Exposed}_i + \sum_{\tau \neq 2018} \beta_\tau 1(t = \tau) \text{Exposed}_i + \delta_t + \boldsymbol{X}_i \boldsymbol{\mu}_t + \epsilon_{i,t} \tag{2}$$

where $y_{i,t}$ is the outcome of interest, Exposed_i is an indicator for having Bank $\mathscr{E}$ as the main bank at the end of 2018, δ_t is a year fixed effect, and $\boldsymbol{X}_i$ is a vector of non-parametric controls, measured in 2018. It includes binary indicators for age (80 indicators), municipality (98 indicators), civil status (1 indicator), total liabilities (100 indicators), stock portfolio (100 indicators), bank deposits (100 indicators), foreign assets (100 indicators) and property assets (100 indicators). We allow for time-varying coefficients on all these indicators by interacting each of them with a full set of year dummies.

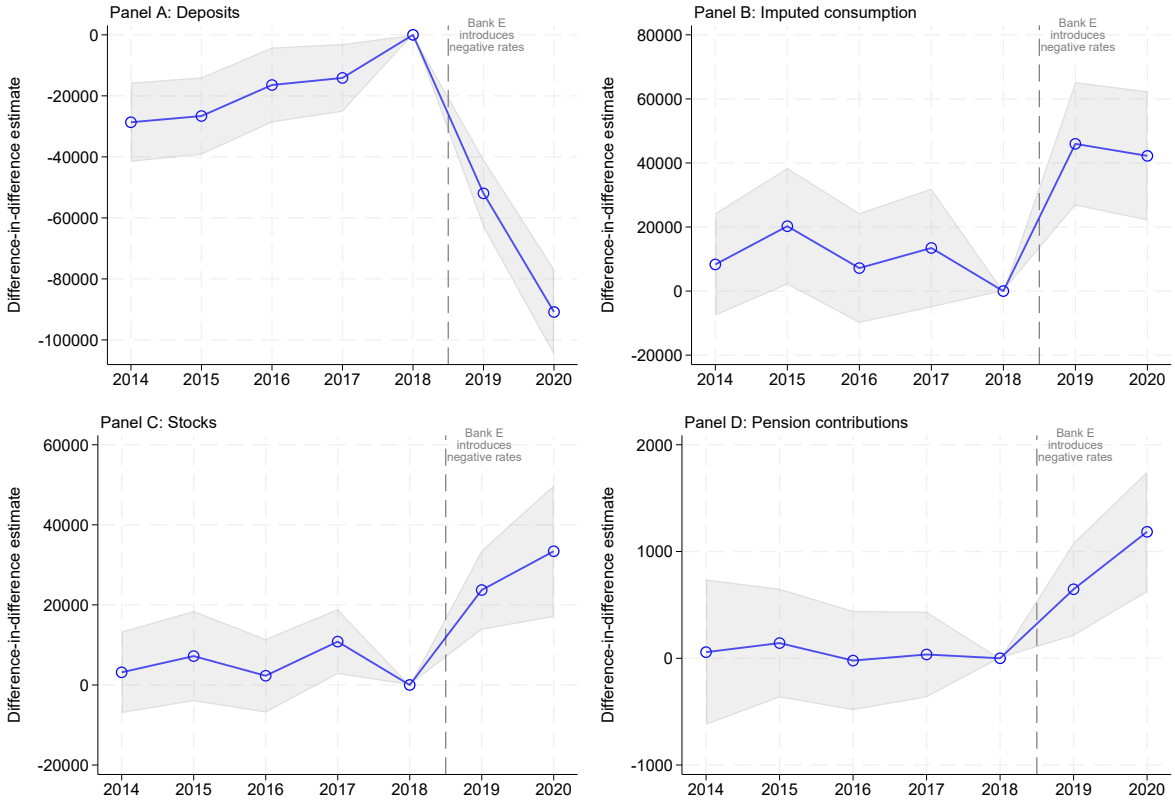
The main parameters of interest are the elements of β for years with differential exposure to negative interest rates. These parameters indicate the average change in the outcome since 2018 for individuals in the exposed group relative to individuals in the non-exposed group with similar ex-ante characteristics. Hence, these elements of β are difference-in-difference estimates of the effect of exposure to negative interest rates. The identifying assumption is that the two groups would have been on parallel trajectories absent the introduction of negative interest rates.

Results We illustrate the results for the main outcomes in Figure 5: total deposits (Panel A), consumption (Panel B), stock portfolios (Panel C) and pension contributions (Panel D). The blue dots indicate the difference-in-difference estimates (the elements of β) and the shaded areas indicate the 95% confidence interval of these estimates (with standard errors clustered at the individual level).

Panel A suggests that treated individuals responded to the introduction of negative interest rates by reducing total deposits by more than DKK 50,000 in 2019 and by an additional DKK 40,000 in 2020. The cumulative response of around DKK 90,000 is large, almost 10% of the baseline deposit balances (see Table B.1), and similar to the results from the graphical analysis. The large decrease in 2019 is particularly striking given that negative rates took effect late in the year.

While the main result concerns behavioral responses in terms of total deposits at all banks, we provide complementary evidence on deposit shifting across banks in the Online Appendix. In 2019–2020, it remained possible to avoid negative deposit rates by switching to a bank that still applied a zero rate; however, doing so typically required transferring one's entire banking relationship, suggesting significant switching costs. We find that customers at Bank $\mathscr{E}$ differentially decreased their deposit balances in the main

Figure 5 Behavioral responses to the onset of negative interest rates



Notes: This figure shows dynamic difference-in-difference estimates of behavioral responses to the onset of negative interest rates on four margins: deposits in all banks (Panel A), consumption (Panel B), stocks (Panel C) and pension contributions (Panel D). The sample is individuals holding deposits between DKK 750,000 and 1.5 million in Bank $\mathscr{E}$ ("exposed") or Bank $\mathscr{L}$ ("non-exposed") at the end of 2018.

bank by around DKK 150,000, but at the same time increased their balances at other banks by around DKK 60,000, with a net effect on total deposits of around DKK 90,000 (Appendix Figure A.5).

Panel B suggests that most of the decrease in deposits reflects an increase in consumption. The estimates show a differential increase in imputed consumption of around DKK 40,000 in both 2019 and 2020 for the exposed group. This may reflect increased purchases of durable goods (e.g., cars and electronics), non-durable goods (e.g., food and clothing) or services (e.g., travel or eating out), whereas purchases of real estate are excluded by construction.[5] The consumption effects are unlikely to be confounded by substitution toward cash given the patterns in aggregate cash withdrawals (Figure 2).[6]

Panel C points to stock market investment as another major margin of behavioral adjustment. Specifically, the estimates suggest that the exposed group increased their stock

[5]Conceptually, the purchase of real estate should not affect an individual's net assets and should therefore have no bearing on our measure of imputed consumption. In practice, this is often not true, reflecting, for instance, that real estate is not measured exactly at market value in the administrative data. We address this challenge by excluding from the sample all individual-year observations where the individual is buying or selling real estate (less than 10% of all observations) when the outcome is imputed consumption.

[6]We discuss the uncertainty created by cash responses in more detail in Section 2.9.

portfolios by more than DKK 20,000 in 2019 and by an additional DKK 10,000 in 2020 in response to the introduction of negative interest rates. The cumulative response of around 30,000 suggests that roughly one third of the decrease in deposits reflected a portfolio reshuffling with additional funds flowing into risky stock market investments.[7] The reallocation of funds towards stocks was fully driven by changes on the intensive margin, suggesting that deposit rates turning negative was not sufficient to entice non-participants to enter the stock market (Appendix Figure A.6).

Panel D shows that individuals exposed to negative interest rates also increased the annual flow into pension accounts. While the effect is relatively small—around DKK 1,000 on average across the two years—it shows that some individuals were willing to shift funds into much less liquid assets to reduce exposure to negative interest rates.

We summarize the baseline results in Table 1 (Column 1). To make comparisons across outcomes economically meaningful, we report the estimate for 2020 when the outcome is a stock (deposits and stock holdings) and the sum of the 2019-2020 coefficients when the outcome is a flow (consumption and pension contributions). The estimated decrease in deposits is somewhat smaller than the combined estimated increase in stock holdings, consumption and pension contributions. The discrepancy partly reflects a range of secondary response margins that we discuss briefly in Section 2.8.

2.7 Robustness

Next, we probe the robustness of our baseline estimates in a range of additional tests.

Varying the set of controls As shown in Table 1, we generally find results similar to the baseline when we omit controls entirely (Column 2), use a smaller set of controls (Column 3), or augment the baseline set of controls with individual fixed effects (Column 4). In many cases, a larger set of controls reduces standard errors by absorbing residual variation, but the point estimates are generally robust to varying the set of controls.

Intra-family transfers Our results are robust to defining outcomes at the household-level (Column 5) and the broader family-level (Column 6), which addresses the concern that money transfers to family members may potentially bias the estimates of deposit and consumption responses away from zero.[8] For both outcomes, the estimates become numerically *larger* when we move to the household- or family-level.

Including customers of other banks Our results are also qualitatively robust to using a stacked difference-in-difference regression design that exploits all the variation in the data by extending the sample to include customers at other banks.[9] The reported

[7] The DKK 10,000 response in 2020 may partly reflect the return on the DKK 20,000 response in 2019.

[8] While aggregating outcomes to the household- or family-level, the unit of analysis remains the individual and we continue to define exposure to negative rates at the individual level.

[9] We start from the full sample of individuals with deposits between DKK 750,000 and 1.5 million in their main bank at the end of 2018 and split it into three treatment cohorts based on whether they were

Table 1 Baseline and robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Controls			Level of analysis		Design	Sample
	Baseline	No controls	Few controls	Fixed effects	Household	Family	Stacked	250k - 750k
Total deposits	−90,840***	−103,775***	−107,023***	−91,299***	−92,199***	−95,613***	−36,921***	−45,116***
	(7,217)	(8,736)	(7,328)	(7,165)	(11,791)	(13,774)	(1,729)	(2,962)
Consumption	88,182***	50,467***	63,710***	86,404***	103,082***	97,506***	17,872***	18,537***
	(17,202)	(17,262)	(18,621)	(16,951)	(25,764)	(31,255)	(2,455)	(4,735)
Stock holdings	33,406***	24,026	38,903***	33,453***	45,023***	49,429***	7,740***	19,940***
	(8,393)	(21,121)	(10,446)	(8,361)	(12,512)	(15,005)	(1,965)	(2,820)
Pension	1,831***	2,264***	1,887***	1,826***	1,213*	718	479***	409***
	(448)	(767)	(436)	(441)	(665)	(823)	(68)	(103)

Notes: The table summarizes the baseline results and probes the robustness to alternative specifications. Columns (1)-(4) report two-year effects analogous to the 2020-coefficient in the dynamic regression when the outcome is a stock (deposits and stock holdings) and the sum of the 2019- and 2020-coefficients when the outcome is a flow (consumption and pension contributions). Column (1) reports results from the baseline specification; Column (2) from the most parsimonious specification without controls; Column (3) from a specification with a small set of controls; Column (4) from a specification with individual fixed effects in addition to the baseline controls. Column (5) reports results from the baseline specification where outcomes are aggregated across spouses and Column (6) where they are aggregated across spouses and adult children. Column (7) reports one-year effects (for year t) derived from the stacked regression design and a sample that includes all bank customers in Denmark with deposits between DKK 750,000 and 1.5 million in their main bank. Column (8) reports one-year effects (for 2020) derived from the main specification and a sample that includes customers in Bank $\mathscr{E}$ and Bank $\mathscr{L}$ with deposits between DKK 250,000 and 750,000.

estimates are one-year effects, reflecting comparisons in year t across individuals who became exposed to negative rates in year t and those who were not yet exposed in year t, and therefore not directly comparable to the two-year effects in the baseline. While smaller, the estimates are qualitatively similar, with a drop in deposits of around DKK 45,000 in the exposure year, reflecting similar-sized increases in stock holdings and consumption, and a smaller increase in pension contributions.

Different deposit range Finally, we also find qualitatively similar results when we apply the baseline model to individuals holding deposits between DKK 250,000 and 750,000 (Column 8). Again, the reported estimates are one-year effects, reflecting comparisons in 2020 between individuals who became exposed to negative rates in 2020 (customers in Bank $\mathscr{E}$) and those who were not yet exposed in 2020 (customers in Bank $\mathscr{L}$). The estimates are generally similar to the one-year effects derived from the stacked design (Column 7), except that the increase in stock holdings is larger.

2.8 Additional results

Additional response margins We provide analogous results for a number of additional response margins in Appendix Table B.2 based on the same empirical framework. Consistent with the exposure to negative deposit rates, we find that treated individuals exhibit a

exposed to negative interest rates in 2019, 2020 or 2021 (given the deposit balance and main bank in 2018). Following Baker et al. (2022), we then create two separate datasets, one for each of the two first treatment cohorts (indexed by d) augmented with a control group that includes all not-yet-treated individual-year observations. We stack the two datasets and produce difference-in-difference estimates in the combined datasets using the same vector of control variables as in the baseline, X_i, interacted with calendar time t like in the baseline, and further interacted with an indicator for the dataset d.

statistically significant differential increase in interest payments. We find relatively small and statistically insignificant differential changes in debt, housing assets, and earnings, suggesting that debt repayment, home purchases and labor supply adjustments were not quantitatively important responses to negative deposit rates. While the adding-up properties of the estimates improve when we consider all response margins, they remain imperfect, which we attribute to sampling variation.[10]

Rate cuts in positive territory We also provide evidence on responses to deposit rate cuts in positive territory, exploiting the sharp decline in interest rates associated with the monetary policy expansion after the financial crisis. We exploit that the decrease in deposit rates between 2008 and 2010 was highly heterogeneous across banks (Appendix Figure A.7, Panel A). Analogous to the main analysis, we consider individuals with deposits between DKK 750,000 and 1.5 million in their main bank and, in the same difference-in-difference framework, show that individuals subject to larger rate cuts did not reduce their total deposits more. Specifically, individuals subject to a differential decrease in deposits rates of around 0.8 pp during 2008-2010 *increased* deposits differentially by around DKK 12,000 over the same period ($p = 0.29$, Appendix Figure A.7, Panel B).[11]

2.9 Aggregate consumption

We use the micro-based estimates to gauge how much negative interest rates on deposits increased household consumption in 2020. We illustrate the results in Figure 6.

For the deposit ranges where our empirical design delivers well-identified per-person estimates of the causal effect on imputed consumption, i.e., DKK 250,000-750,000 and DKK 750,000-1.5 million, we simply multiply these estimates with the population-wide number of individuals exposed in 2020 according to their ex-ante deposit balances (at the end of 2018). The estimates sum to around DKK 5 billion or, analogously, just below 0.5% of aggregate private consumption (dark red bars).

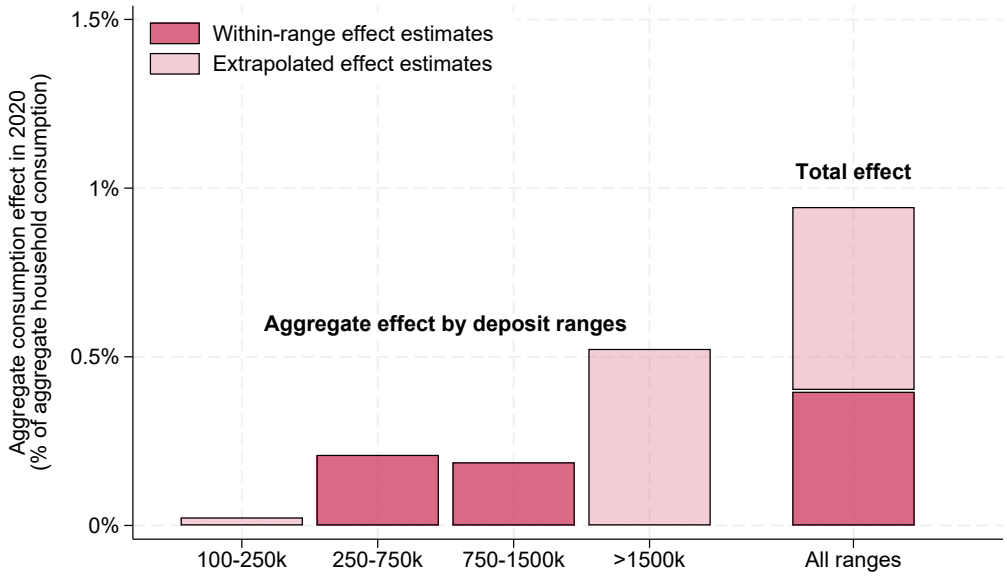
Assuming that behavioral responses were proportional to deposit balances, we can construct similar aggregate figures for exposed individuals with deposit balances in the range DKK 100,000-250,000 and above DKK 1.5 million (light red bars).[12] Including these estimates, the effect on aggregate consumption increases to around DKK 11 billion

[10] As shown in Appendix Table B.2, the estimated effect on net flows (consumption, earnings, etc) mirrors the estimated effect on net assets (deposits, stocks, etc) almost perfectly. As we break down these composites and estimate the effect on the elements separately, adding up becomes imperfect. This may reflect that the controls load differently across outcomes or that the identity that links the outcomes at the individual level does not hold after winsorizing.

[11] These results are consistent with earlier work on deposit allocation in the aftermath of the financial crisis (Iyer et al., 2019).

[12] Within the interval DKK 250,000-1.5 million, we find that decreases in deposit balances are roughly proportional to deposit levels whereas increases in consumption become smaller (and noisier) relative to deposit levels at the very top of the interval (Appendix Figure A.8).

Figure 6 Aggregate consumption



Notes: This figure illustrates the effect on aggregate consumption implied by our micro-estimates. For the deposit ranges DKK 250,000 - 750,000 and DKK 750,000 - 1,500,000, we simply multiply the estimated consumption effects for 2020 by the number of individuals in the respective ranges exposed to negative rates in 2020 (dark red). For the deposit ranges DKK 100,000 - 250,000 and above DKK 750,000, we extrapolate the estimated effect sizes, assuming that consumption effects are proportional to ex ante deposit balances, and multiply by the number of individuals in the respective ranges exposed to negative rates in 2020 (light red).

or, analogously, just below 1% of aggregate private consumption.

The aggregate consumption effects are associated with some uncertainty. First, it is unclear how well effect sizes extrapolate beyond the range of deposits where they are estimated. In particular, it is not obvious that consumption responses scale with deposit balances at the top of the deposit distribution. Second, our difference-in-differences framework captures partial equilibrium effects from households' direct responses when interest rates on their bank deposits turn negative. General equilibrium forces, such as multiplier effects from the increased spending of exposed households, are likely to amplify these effects. Third, even if cash withdrawals were below the long-run trend in the period with negative rates, we cannot exclude that the estimated consumption responses reflect some substitution toward cash. To bound this confounder, we note that aggregate withdrawals in 2020 were just above DKK 5 billion. Under the extreme assumption that *all* cash withdrawals in 2020 were in response to negative rates, i.e., assuming *no* aggregate cash withdrawals in the counterfactual with zero rates, substitution to cash can account for around half of the aggregate consumption effect of DKK 11 billion.

Absent an empirical design that allows us to identify responses of all deposit ranges, estimate general equilibrium effects and measure cash withdrawals at the individual level, we conclude that the overall impact on aggregate consumption likely lies in the range of 0.5–1%.

3 Survey evidence

Our analysis of administrative data in the previous section suggests that households respond strongly to negative deposit rates: they reduce deposit balances, chiefly by increasing consumption, but also by allocating more funds to stock portfolios and pension accounts. While these findings on real-world responses offer advantages in terms of credibility and external validity, they are silent on the underlying mechanisms. In this section, we present survey evidence on the reasoning behind behavioral adjustments to negative rates. First, we study whether households think differently about rate cuts below zero than about rate changes within the positive domain. Second, we draw on open-ended questions to directly elicit motives behind adjustments to rate changes.

3.1 Setting and sample

In January 2025, we invited a random sample of 94,000 Danish residents aged 18 to 75 to participate in an online survey. Invitations were sent via Denmark's official digital government mailing system, with a reminder issued two weeks later to non-respondents. The survey remained open for approximately 15 weeks. To incentivize participation, we raffled 30 gift cards, each worth DKK 1,000 (≈USD 140). Our setting offers three key advantages: high response rates due to the use of the official communication channel, access to a population that extends beyond habitual survey participants from online platforms, and the possibility to link survey responses to administrative register data.

A total of 9,371 individuals completed our survey. Appendix Table B.3 reports summary statistics for both the contact population and the survey participants, using register data on respondent characteristics. Relative to the contact population, respondents are on average slightly older, are more often male, have higher levels of income and wealth, and are more likely to hold stocks. Our sample somewhat over-represents individuals with higher education—a common feature in online surveys (Haaland et al., 2023).

We restrict our main working sample to the 6,231 respondents who report holding total bank deposits of at least DKK 50,000. We do so because our hypothetical scenarios presented below specify that negative rates only kick in after a threshold of DKK 100,000 to mimic the actual setting in Denmark in 2019-2021, and we aim to focus on a sample of individuals for whom the rate cuts are likely to matter. We demonstrate the robustness of our main findings to using the full sample. While the restriction raises average income and wealth somewhat further, it does not materially affect other characteristics.

Appendix Table B.4 shows that the main working sample is well balanced across the three treatment conditions described below.

3.2 Design

Next, we describe the main parts of our survey. Appendix G provides the full instructions.

We aim to understand the reasoning behind households' responses to negative interest rates. A key challenge is that respondents may not accurately recall how and why they adjusted their behavior in response to the 2019-21 rate cuts. To circumvent this issue, we present respondents with a hypothetical scenario involving a rate cut implemented today that closely mirrors the ones in 2019-21. Respondents are then asked whether and how they would adjust their behavior along several margins, and to explain the reasoning behind their choices. Specifically, respondents are given the following instructions:

> *In 2019 and 2020, many Danish banks introduced negative interest rates on bank deposits. For every krone above a certain threshold, customers would need to pay interest to the bank for keeping money at the bank.*
>
> *Please imagine a hypothetical scenario where the interest rate in all Danish banks is initially 0% on all deposits. All Danish banks – including the bank where you have your NemKonto – then lower the interest rate on amounts in excess of 100,000 kroner from 0 to –1%.*
>
> *This means that for every krone up to 100,000 kroner, the interest rate remains at 0%. For every krone above 100,000 kroner, you now have to pay an interest rate of 1% to the bank.*
>
> *For deposits at other banks than the one where your NemKonto is, the interest will be –1% starting from the first krone.*[13]

The interest rate schedule pre- and post-change is illustrated to the respondents in a figure (see the instructions in Appendix G). Respondents are then asked whether and how they would adjust their deposit balances in response to the rate cut:

> *Imagine you are aware of this change in the interest rates on bank deposits, and that your economic and financial situation is otherwise identical to your actual current situation.*
>
> *Would you do something to change the amount of money you have on your bank accounts because of the change in interest rates?*
>
> - *I would reduce the total amount on my bank accounts.*
> - *I would not change the total amount on my bank accounts.*
> - *I would increase the total amount on my bank accounts.*

The design of the scenario and the elicitation of decisions reflect a trade-off between comparability to the situation in 2019-21 and the need to keep length and complexity low to minimize survey fatigue and cognitive load. Four features are worth highlighting. First, we elicit directional rather than quantitative adjustments to decisions. Second, unlike in 2019-21, the introduction of negative rates is not staggered but uniform across banks in our scenarios. Third, by asking respondents to assume that they are aware of the interest rate change, we focus on *full-attention* responses. Since many respondents would likely assume that they are being asked about full-attention responses in any case,

[13] "NemKonto" is the Danish term for the primary bank account.

we opted for fixing this feature. This design choice, however, implies that we do not capture inattention—an important driver of real-world behavior. Fourth, our wording ("do something") makes it clear that we are asking about active adjustments to decisions, shutting down mechanical changes from paying interest to the bank.

The respondents are then asked about behavioral adjustments in four domains, in random order: consumption spending, stock investment, cash holdings, and holdings in pension accounts.[14] The question format is parallel to the one for adjustments in deposit balances. The respondents are also asked to explain the reasoning underlying a random two of these margins: consumption and stock holdings (80% probability), consumption and cash (5%), stock holdings and cash (5%), consumption and pension accounts (5%), or stock holdings and pension accounts (5%). For each margin, they are asked:

> *We would like to learn about the reasons behind your decision.*
>
> *Please explain why you would respond to the change in rates in this way.*
>
> *Please respond in two to three full sentences.*

We focus on adjustments to consumption, stock holdings and pension account holdings, for which we can match motives elicited in the survey with actual adjustments measured in register data. Appendix E.1 analyzes reported adjustments to cash holdings.

Open-ended elicitations have recently become more common as a tool for understanding the mechanisms behind economic behavior. Compared to more traditional closed-ended formats, they have the key advantages (i) that they capture people's reasoning in a very naturalistic manner and (ii) that they do not prime or inform the respondents regarding any potential argument through the displayed response options, reducing the scope for ex-post rationalization (Haaland et al., 2025). A potential disadvantage is that the responses may be noisy due to respondents being unable or unwilling to articulate their thoughts. Moreover, researchers have many degrees of freedom in the analysis of such data. In Section 3.5, we explain how we analyze the open-ended responses.

Our hypothetical approach allows us to freely vary the conditions described in the scenarios. We leverage this flexibility to explore whether households think fundamentally differently about rate cuts when rates fall below zero. Specifically, we cross-randomize respondents into the *Negative rate condition* (80% of the sample), the *Zero lower bound condition* (10% of the sample) and the *Positive rate condition* (10% of the sample). Respondents in the Negative rate condition receive the scenario described above, featuring a cut into negative territory. Those in the Zero lower bound condition are instead asked about adjustments to a drop of rates from 1% to 0% on deposits exceeding DKK 100,000, while deposits below this threshold earn 0% interest throughout. Those in the Positive rate condition respond to a scenario with a comparable cut from 2% to 1%.

[14] We observe no strong order effects in reported behavioral adjustments.

At the end of the survey, we elicit several background characteristics. For example, we ask about current bank deposit holdings to assess the extent to which respondents think they would be financially affected by the rate cuts in our scenarios. We also collect measures of loss aversion, risk aversion and patience, which we analyze in Appendix E.2.

3.3 Validation

Our hypothetical approach addresses that people may not recall their motives underlying adjustments to the 2019-21 rate changes and offers full flexibility about the scenario features. However, one potential drawback is that households' stated adjustments to rate cuts may diverge from how they would respond to rate cuts in the real world. For example, such intention-behavior gaps could arise if respondents (i) do not find the scenario meaningful, (ii) engage only superficially with it, (iii) report normative judgments about what one *ought* to do, or (iv) neglect constraints that would matter in the real world.[15] To assess the validity of our approach, we link our survey with administrative data and compare the respondents' stated behavioral responses to the hypothetical rate cut to how they changed their behavior following the actual 2019-21 rate cuts.

Empirical approach We focus on 2,567 respondents from our main working sample who were (i) assigned to the Negative rate condition and (ii) actually exposed to negative deposit rates in their main bank in 2019-21. For each respondent, we focus on the calendar year t in which the interest rate on their main bank account first turned negative.[16] We estimate specifications of the following form:

$$y_{i,t} = \alpha + \beta \mathbf{1}(\text{Reports adjustment})_i + \gamma y_{i,t-1} + \epsilon_{i,t}, \tag{3}$$

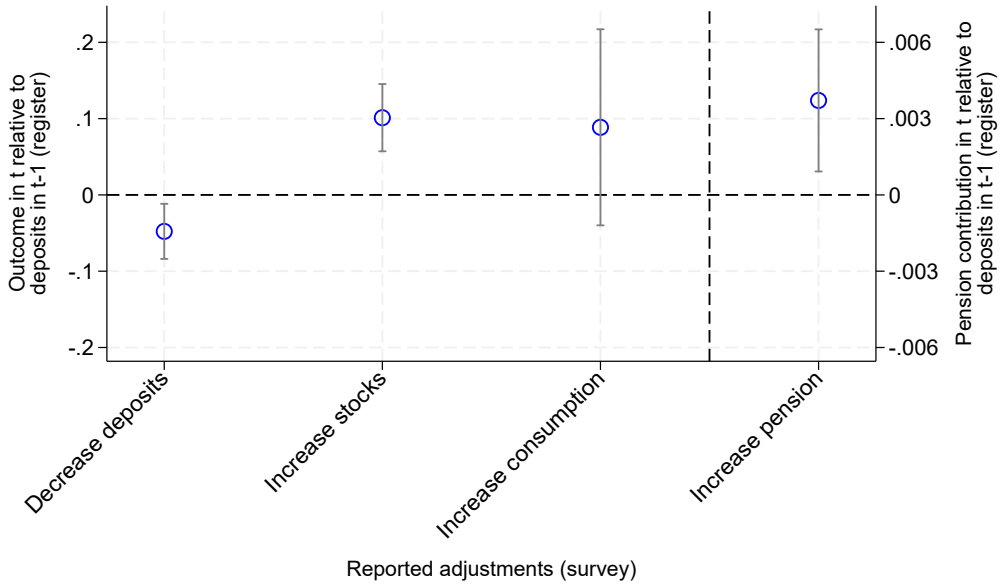
where $y_{i,t}$ is the register-based outcome of interest at the end of year t for stock variables (deposit balances, stock holdings) or over year t for flow variables (consumption, pension contributions). Similarly, $y_{i,t-1}$ denotes the value of the outcome at the beginning of that year or over the previous year. We scale both $y_{i,t}$ and $y_{i,t-1}$ by the respondent's overall deposits at the beginning of year t.[17] We let $\mathbf{1}(\text{Reports adjustment})_i$ denote a dummy that equals one if a respondent reports a particular adjustment in the respective domain in our survey (e.g., increasing consumption), and zero otherwise (e.g., decreasing or not changing consumption). The coefficient β therefore captures the extent to which the register-based outcome of interest differs following exposure to negative rates for

[15] Existing literature suggests that conclusions drawn from hypothetical scenarios—e.g., on consumption responses to income shocks (Colarieti et al., 2024; Jappelli and Pistaferri, 2014) or changes in home price expectations (Chopra et al., 2025)—tend to be qualitatively aligned with conclusions drawn from data on actual real-world behavior.

[16] A respondent counts as getting exposed to negative rates in year t if their deposits in their main bank at the end of year $t-1$ exceed the threshold at which the bank introduces negative rates during year t.

[17] For all analyses with these outcomes, we winsorize the scaled outcomes at the 95th percentile and exclude negative values of consumption. In analyses with deposit holdings as the outcome, the scaling implies that the lagged dependent variable always takes the value one, and we therefore exclude it.

Figure 7 Validating stated behavioral responses



Notes: This figure validates reported behavioral responses to a hypothetical rate cut below zero as measured in our survey by examining their predictive power for how households actually adjusted different margins of behavior as measured in the register data when their main bank first introduced negative interest rates in 2019-21. It displays estimates of the coefficient β in equation (3), which captures the predictive power of dummy variables indicating particular (directional) behavioral adjustment as reported in the survey for the register-based outcome of interest at the end of the year when a respondent was first exposed to negative rates, conditional on a lagged dependent variable. The figure displays confidence bands based on robust standard errors.

individuals reporting a given adjustment, conditional on the pre-rate cut value of the outcome. We report robust standard errors throughout the analysis of the survey data.

Results Figure 7 shows that the adjustments reported by respondents for the hypothetical rate cut below zero are strongly predictive of their responses to negative rates in 2019-21. Reporting a reduction in deposits is associated with deposits balances that are lower by about 5% of initial holdings ($p < 0.01$). Respondents who state that they would increase their stock holdings exhibit actual stock holdings that are higher by about 10% of baseline deposit balances ($p < 0.01$), conditional on initial stock holdings. Reporting an increase in consumption is associated with actual consumption being higher by about 10% of initial deposits, although this estimate is imprecise ($p = 0.14$). Finally, respondents who state that they would increase their pension account holdings exhibit pension contributions that are higher by about 0.4% of pre-rate cut deposits ($p < 0.01$).

Summary Taken together, we view these results as strongly encouraging for our survey-based approach to studying the motives underlying adjustments to negative interest rates. More generally, the findings lend support to approaches that rely on hypothetical scenarios to study belief formation and decision-making.

3.4 Results: Responses to rate cuts in negative vs. positive territory

We start by examining whether households approach rate cuts below zero differently than rate cuts within non-negative territory.

Specification To compare self-reported adjustments across the Negative rate, the Zero-lower bound and the Positive rate conditions, we estimate the following specification:

$$y_i = \beta_0 + \beta_1 \times \text{Negative rate condition}_i + \beta_2 \times \text{Zero lower bound condition}_i + \varepsilon_i, \quad (4)$$

where Negative rate condition$_i$ and Zero lower bound condition$_i$ are dummy variables for being assigned to the respective treatment conditions, and being in the Positive rate condition is the omitted base category. y_i is the outcome of interest. The coefficients β_1 and β_2 identify how individuals adjust their behavior differentially when rates fall below zero or to zero, respectively, compared to a rate cut strictly within the positive domain.

Results The results are presented in Table 2. Across all outcomes, we find no meaningful differences in reported behavioral adjustments between the Positive rate and Zero lower bound conditions. We therefore focus our discussion on differences between the Negative rate and the Positive rate condition. In the Positive rate condition, approximately 26% of respondents report that they would reduce their deposit balances, while nearly all others would leave their deposits unchanged. The fraction reducing their deposits increases by 39 pp when rates fall below zero (Panel A, Column 1; $p < 0.01$).

The share of respondents who report that they would increase consumption rises by approximately 9 pp when rates fall below zero (Panel A, Column 6; $p < 0.01$), relative to a baseline of 4% in the positive-rate condition. This increase is entirely driven by a decline in the fraction reporting no change in spending (Panel A, Column 5; $p < 0.01$). A share of 13% reporting increased spending when rates turn negative could generate a substantial rise in overall amount of spending—as suggested by the register-based estimates in Section 2—when intensive-margin adjustments are large, for example due to purchases of big-ticket items.

Negative interest rates are also associated with higher fractions indicating a reallocation of funds towards stocks (Panel B, Column 3, 13 pp, $p < 0.01$) and pension accounts (Panel B, Column 6, 10 pp, $p < 0.01$), compared to 39% and 9% in the Positive rate condition. Again, these shifts are entirely driven by declines in the tendency to report no changes in stock or pension allocations (Panel B, Columns 2 and 5, both $p < 0.01$).

Robustness Our findings on households' differential responses to rate cuts into negative territory are robust to a range of sensitivity checks, such as including partial responses, excluding participants with extreme response times, controlling for a broad set of covariates, extending the sample to include respondents with self-reported deposit balances below DKK 50,000, or restricting the sample further to those with deposit balances

Table 2 Responses to rate cuts in negative vs. positive territory

Panel A	Deposits			Consumption		
	(1) Decrease	(2) No change	(3) Increase	(4) Decrease	(5) No change	(6) Increase
Negative rate	0.388***	−0.365***	−0.023***	−0.003	−0.090***	0.093***
	(0.019)	(0.020)	(0.008)	(0.011)	(0.014)	(0.009)
ZLB	0.038	−0.054**	0.016	−0.006	−0.002	0.007
	(0.026)	(0.027)	(0.011)	(0.015)	(0.018)	(0.012)
Constant	0.264***	0.703***	0.033***	0.072***	0.890***	0.038***
	(0.018)	(0.019)	(0.007)	(0.011)	(0.013)	(0.008)
R^2	0.09	0.07	0.01	0.00	0.01	0.01
Observations	6,231	6,231	6,231	6,231	6,231	6,231
Panel B	Stocks			Pension		
	(1) Decrease	(2) No change	(3) Increase	(4) Decrease	(5) No change	(6) Increase
Negative rate	−0.005	−0.124***	0.130***	0.030***	−0.134***	0.103***
	(0.010)	(0.022)	(0.021)	(0.012)	(0.017)	(0.013)
ZLB	−0.005	−0.011	0.016	0.019	−0.032	0.012
	(0.013)	(0.029)	(0.028)	(0.016)	(0.022)	(0.017)
Constant	0.057***	0.557***	0.386***	0.074***	0.836***	0.090***
	(0.010)	(0.021)	(0.020)	(0.011)	(0.015)	(0.012)
R^2	0.00	0.01	0.01	0.00	0.01	0.01
Observations	6,231	6,231	6,231	6,231	6,231	6,231

Notes: This table displays regressions of dummy variables for decreasing, not changing or increasing the behavior of interest in response to the rate cut on dummy variables for the Negative rate condition and the Zero lower bound condition, the Positive rate condition being the omitted base category. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

of at least DKK 75,000 or DKK 100,000 (Appendix Table B.5).

Summary Households report stronger adjustments to nominal rate cuts below zero than to rate cuts in the positive domain—consistent with the strong adjustments detected in the register data. Households thus appear to think fundamentally differently about negative rates, suggesting that distinct motives—such as loss aversion—are at play.

3.5 Results: Reasoning underlying responses to negative rates

We now analyze the motives underlying different behavioral adjustments to negative rates as measured in the open-ended questions.

Coding scheme Before our main collection, we developed a coding scheme for our open-ended data following the guidelines in Haaland et al. (2025). Our scheme contains a total of 44 codes, and each response can receive multiple codes. We include mechanisms central to textbook models as well as arguments that respondents frequently raised in pilot collections. In particular, the scheme contains the following families of codes: (i) "behavioral factors" such as loss aversion around a reference point of constant nominal wealth, or perceiving banks charging negative rates as unfair; (ii) "savings motives"

such as intertemporal substitution, income effects or references to the general importance of saving; (iii) "return considerations" including return differentials between other assets and bank deposits; (iv) "macroeconomic expectations" such as adjustments in the outlook for growth or inflation; (v) "inelasticity to interest rates", including arguments such as adjustment frictions; (vi) "non-participation" indicating a general unwillingness to participate in the asset class in question; (vii) "being unaffected" including references to the small size or likely transitory nature of the cut or to having deposits below the deposit cutoff; (viii) "adjustments along other margins" for references to changes in behaviors other than the one asked about; and (ix) a set of codes for non-classifiable responses such as arguments not contained in our scheme, junk, or simply repeating the behavioral response for the margin in question.

One caveat is that the open-ended data capture only what respondents explicitly articulate, which rarely matches the level of precision with which mechanisms are defined in economic models. For example, a respondent may explain a reduction in deposit balances by stating a desire to avoid losing money. This would offer no definite proof that loss aversion in the economist's sense—i.e., a kink in the utility function at the current level of wealth—is underlying the respondent's decision. Yet, responses that focus on losses, losing money or avoiding losses would strongly suggest that concerns related to loss aversion are a consciously held motive for the respondent.

We rely on human coding by trained research assistants, and each response is double-coded.[18] Appendix D provides details on the coding procedure (including an overview of all codes with example responses) as well as quality checks for the open-ended data and a validation with a closed-ended question.

Consumption We start with describing the reasoning underlying reported adjustments in spending. Given the question wording, respondents likely focus on forces that were pivotal in shifting their behavior in a particular direction, omitting other—potentially opposing—factors playing a more minor role. We therefore describe respondents' considerations conditional on the different possible reported behavioral responses.

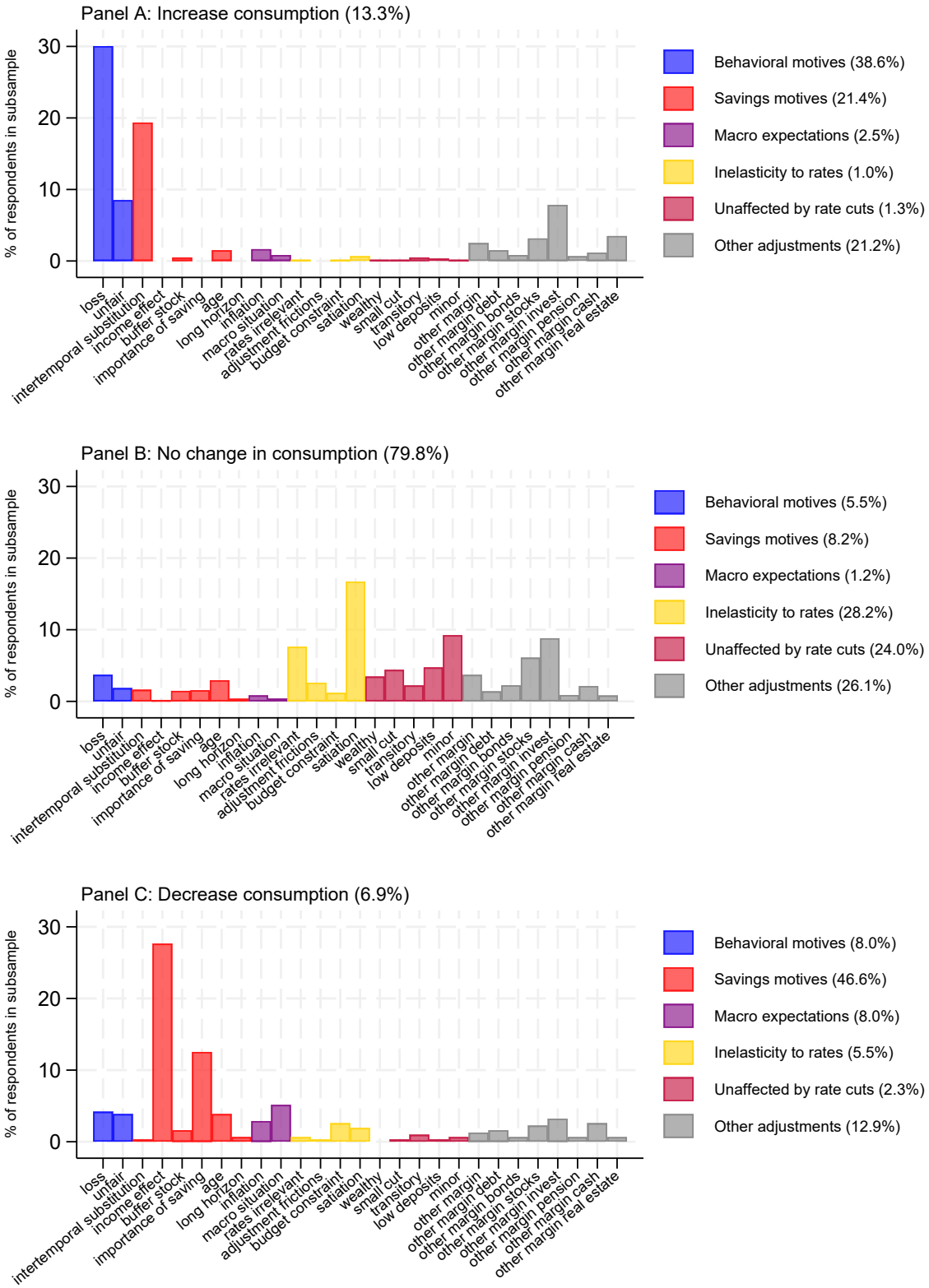
Figure 8 displays histograms of the frequency of different considerations among respondents who would increase, not change or decrease consumption in response to negative rates. Among those increasing their consumption, respondents most frequently cite an aversion to losses as motive (about 30%). For example, one respondent argues:

If I lose money by keeping it in the bank, I might as well spend that money instead.

About 19% raise more standard intertemporal substitution arguments, as in the following example:

[18] AI-based approaches were not feasible at the time of our study due to the University of Copenhagen's data protection guidelines for data collected through the Danish survey infrastructure.

Figure 8 Motives behind consumption responses to negative rates



Notes: This figure displays the frequencies of different motives behind adjustments in consumption in response to a rate cut below zero as measured in the open-ended question for those planning to increase (Panel A), not change (Panel B) or decrease (Panel C) consumption. On the right, we display the fractions of respondents mentioning at least one motive from a given family of motives.

If my financial situation permits, a negative interest rate might lead me to accelerate purchases of consumer goods that I would otherwise have planned for a later time.

About 9% of those reporting that they would increase spending view negative rates as reflecting greed or immoral behavior by banks:

I think it's completely unreasonable with negative interest rates, as the banks already charge substantial fees for administering our deposits and outstanding balances in the bank.

Many of those not planning to change spending cite an insensitivity of their consumption behavior to interest rates (28%), for instance in the form of adjustment frictions or a general satiation with current consumption levels as in the response below:

I already have what I need.

Most others not adjusting their consumption argue that they would not be affected by the rate cut, e.g., due to its small size (3%) or holding deposits below the cutoff at which rates turn negative (5%). Among households indicating planned reductions in spending, income effects are the most frequently cited motive (28%):

If my disposable income decreases, I will reduce my spending accordingly.

Stock investment Figure 9 displays motives underlying different adjustments in stock holdings when rates fall below zero. Among respondents who state that they would increase their stock holdings, an aversion to losses (30%) or considerations about returns and return differentials (46%) are most frequently raised. For instance, the following respondent points out the attractiveness of stock investment from a return perspective:

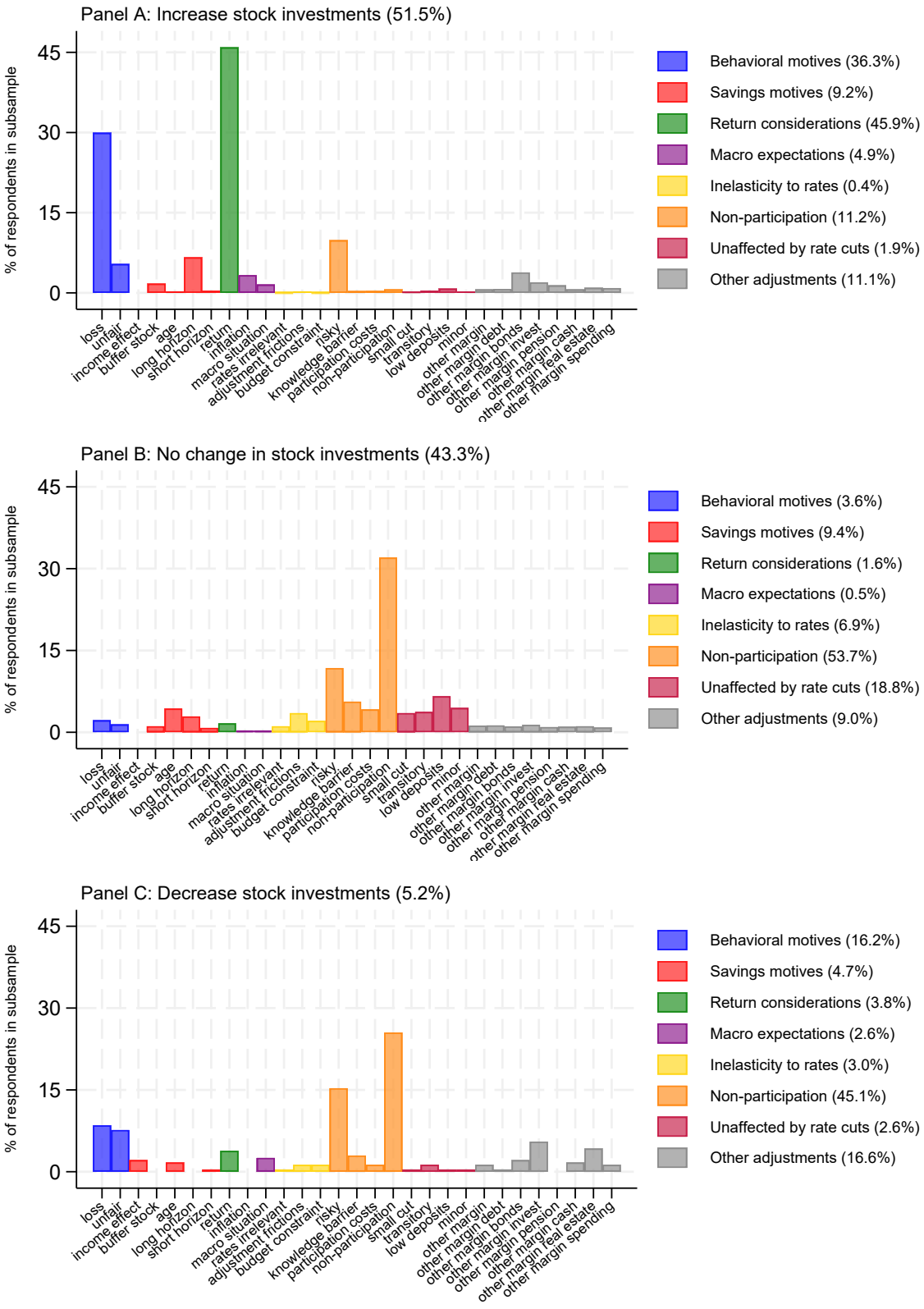
I already invest the majority, but I'd become even more focused on investing and getting a somewhat better return than −1%.

Those who report not adjusting their stock investments mostly invoke one of two broader classes of arguments: not being meaningfully affected by the rate cut (19%) or a reluctance to participate in the stock market (54%)—consistent with the increase in stock holdings in response to the 2019-21 rate cuts being driven by changes in the intensive margin (Section 2.6). Some participants cite specific reasons for their unwillingness to invest in stocks, such as participation costs (4%), lack of knowledge about stocks (6%), or the riskiness of stocks (12%):

I'm not the type to invest in stocks. I feel most secure with risk-free investment options.

Those reporting a reduction in stock investment invoke similar arguments as those indicating no change. Given the small number of respondents reporting a reduction in stock investment, these results should be interpreted more cautiously.

Figure 9 Motives behind stock holding responses to negative rates



Notes: This figure displays the frequencies of different motives behind adjustments in stock holdings in response to a rate cut below zero as measured in the open-ended question for those planning to increase (Panel A), not change (Panel B) or decrease (Panel C) stock holdings. On the right, we display the fractions of respondents mentioning at least one motive from a given family of motives.

Pension accounts Appendix Figure A.9 describes the arguments respondents invoke to explain how they would adjust (or not adjust) their savings in pension accounts in response to the rate cut, respectively. The available samples are smaller than for consumption and stock holdings, so these estimates are somewhat less precise. Loss aversion (28%) and return differentials (31%) are the core drivers of increases in pension holdings, while decisions not to adjust savings in pension accounts are driven by varying motivations, including not being affected by the cut (24%), adjustment frictions (11%), not holding a pension account (3%) or considerations regarding one's age (13%).

Considerations for rate cuts in negative vs. positive territory Lastly, we ask whether households' reasoning differs when rates turn negative compared to rate cuts within the non-negative domain. Specifically, we estimate equation (4) using indicators for different lines of reasoning as outcomes. For parsimony, we aggregate all codes within the inelasticity family, all codes within the non-participation family, and all codes within the not-being-affected family. In addition, we focus on the most frequent other codes: loss aversion, perceived unfairness, intertemporal substitution, income effects, return considerations, and references to the importance of saving. We restrict our attention to adjustments in consumption and stock holdings, as the effective sample size becomes very small for pension holdings, for which only 10% of participants report their reasoning.

Table 3 presents the results. For both consumption and stock holdings, the "non-standard" motives of loss aversion and perceived unfairness are largely absent for cuts within non-negative territory, but become frequent with negative rates. For consumption, motives centered on intertemporal substitution also become significantly more common when rates fall below zero, whereas references to income effects and the general importance of saving are similarly prevalent across conditions. For stocks, return considerations and arguments reflecting a general reluctance to hold stocks are equally common in negative and non-negative territory. For both consumption and stocks, significantly fewer respondents report being unaffected by the cut when rates fall below zero.

Robustness As for behavioral adjustments, we demonstrate the robustness of our findings on reasoning to including partial responses, excluding participants with extreme response times, extending the sample to include respondents with deposit balances below DKK 50,000 or restricting it further to those with balances of at least DKK 75,000 or DKK 100,000. For parsimony, we again restrict our attention to adjustments in consumption and stock holdings and focus on aggregate codes from the insensitivity family, the non-participation family, and the not-being-affected family, as well as the individual codes for loss aversion, perceived unfairness, intertemporal substitution, income effects, return considerations, and general references to the importance of saving. The frequency of these codes varies little across different sample definitions (Appendix Figure A.10).

Table 3 Motives behind responses to rate cuts in negative vs. positive territory

Panel A: Consumption

	(1) Loss	(2) Unfair	(3) Intertemporal substitution	(4) Income effect	(5) Save	(6) Inelasticity	(7) Not affected
Negative rate	0.070***	0.027***	0.035***	−0.009	0.005	−0.029	−0.153***
	(0.004)	(0.003)	(0.004)	(0.008)	(0.006)	(0.020)	(0.022)
ZLB	0.005	0.007	0.011*	−0.006	0.001	−0.010	0.016
	(0.004)	(0.005)	(0.006)	(0.010)	(0.008)	(0.026)	(0.029)
Constant	0.002	0.002	0.004	0.029***	0.016***	0.250***	0.344***
	(0.002)	(0.002)	(0.003)	(0.007)	(0.006)	(0.019)	(0.021)
R^2	0.01	0.00	0.00	0.00	0.00	0.00	0.02
Observations	5,561	5,561	5,561	5,561	5,561	5,561	5,561

Panel B: Stocks

	(1) Loss	(2) Unfair	(3) Return	(4) Inelasticity	(5) Non-participation	(6) Not affected
Negative rate	0.160***	0.028***	−0.029	−0.029***	−0.021	−0.087***
	(0.007)	(0.005)	(0.021)	(0.011)	(0.019)	(0.017)
ZLB	0.011	0.005	−0.042	−0.025*	0.013	−0.028
	(0.007)	(0.007)	(0.027)	(0.013)	(0.026)	(0.023)
Constant	0.008**	0.010**	0.274***	0.062***	0.214***	0.177***
	(0.004)	(0.004)	(0.020)	(0.011)	(0.018)	(0.017)
R^2	0.03	0.00	0.00	0.00	0.00	0.01
Observations	5,560	5,560	5,560	5,560	5,560	5,560

Notes: This table displays regressions of dummy variables for different motives behind adjustments in consumption (Panel A) and stock holdings (Panel B) in response to rate cuts on dummy variables for the Negative rate condition and the Zero lower bound condition, the Positive rate condition being the omitted base category. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Motives and behavioral responses to negative rates In Appendix E.3 we show that the motives identified in the open-ended data predict households' behavioral responses to negative rates—both actual adjustments to the 2019-21 cuts measured in administrative data and survey-reported adjustments. This evidence (i) underscores the importance of these motives for households' decisions and (ii) further corroborates the validity of hypothetical ex-post surveys to measure the motives behind observed real-world behavior.

Summary Taken together, loss aversion, perceived unfairness, intertemporal substitution, and shifts in the perceived return differential between stocks and deposits are the key motives behind reported responses to negative rates. A general insensitivity to interest rates and a broad reluctance to hold stocks limit the extent of these adjustments.

3.6 Additional mechanisms

Attention Our survey evidence suggests that non-standard motives—particularly loss aversion and perceived unfair behavior of banks—as well as more standard forces such as intertemporal substitution and perceived return differentials are central to households'

adjustments to negative interest rates. We elicit these motives conditional on respondents noticing the interest rate change, thereby abstracting from one mechanism that may be important in practice: attention. In particular, negative deposit rates may be more likely to attract households' attention due to their greater salience or higher media coverage. Appendix Figure A.11 highlights that the period of negative interest rates was indeed associated with an increased coverage of deposit interest rates in Danish news and a spike in Google searches about the topic. In our survey, 90% of respondents report that they were aware in 2019-21 that deposit rates had turned negative. Heightened attention therefore likely contributed to the strong behavioral responses observed in the administrative data.

That said, our survey evidence shows that rate cuts into negative territory trigger stronger behavioral responses even conditional on attention (see Section 3.4 and Table 2). Therefore, while elevated attention may further amplify the effects of negative interest rates relative to rate cuts in non-negative territory, it is not the sole driver of the difference. This suggests that the differences we observe in the register-based analysis are likely to reproduce, at least qualitatively, in future episodes of negative rates with potentially lower media coverage.

Coarse thinking Another mechanism that could amplify responses to rate cuts when rates fall below zero is coarse thinking (Graeber et al., 2025; Mullainathan, 2002; Mullainathan et al., 2008). Rather than processing deposit rates as continuous objects, households may group them into coarse categories such as negative and non-negative. A rate cut from zero to below zero would then cross a salient category boundary and trigger a discrete behavioral response, while similar-sized rate changes within a category would have much weaker effects.

4 Conclusion

We study how households respond when deposit rates drop below zero and what economic reasoning governs household behavior in negative territory. While a common view holds that deposit rates cannot be negative because of substitution toward cash, the long-run decline in monetary policy rates combined with the digitalization of the financial system makes it increasingly likely that deposit rates break the zero lower bound.

To learn about behavioral responses to rate changes below zero, we study a major episode of negative deposit rates in Denmark using comprehensive administrative micro data and exploiting cross-bank variation in interest rate policies. We find that households respond strongly when deposit rates turn negative. They reduce deposit balances, not to hold cash, but rather to increase consumption and investment in risky assets.

To learn about the reasoning underlying these responses, we conduct a large-scale survey with Danish households. We find that nominal loss aversion, perceived unfairness

of banks charging interest, intertemporal substitution and shifts in the perceived return differential between stocks and deposits are key drivers of behavioral responses whereas a general insensitivity to interest rates and a broad reluctance to invest in stocks dampen the adjustments.

These findings have important implications for monetary policy transmission. First, our findings provide support for the notion that zero is a critical bound, below which depositors respond more strongly to rate changes, potentially disciplining bank' decisions about pass-through. Second, the nature of depositor responses below zero is primarily to consume more, which suggests that, conditional on pass-through, policy rate cuts in negative territory may have particularly strong consumption effects.

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Online Appendix

Household Behavior Below the Zero Lower Bound

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Summary of the Online Appendix

Section A contains additional figures.

Section B contains additional tables.

Section C provides details on the imputation of consumption.

Section D contains detail on the coding of the open-ended data.

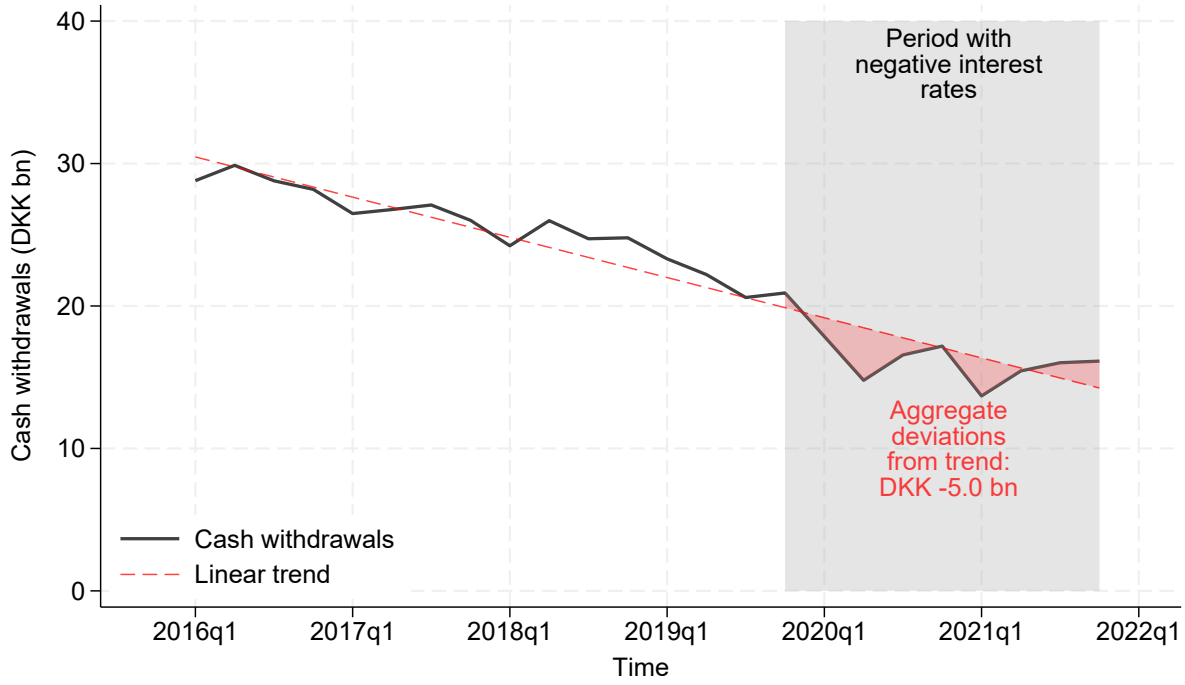
Section E presents additional analyses.

Section F provides background on the preregistration, ethics and data availability.

Section G provides the full survey instructions.

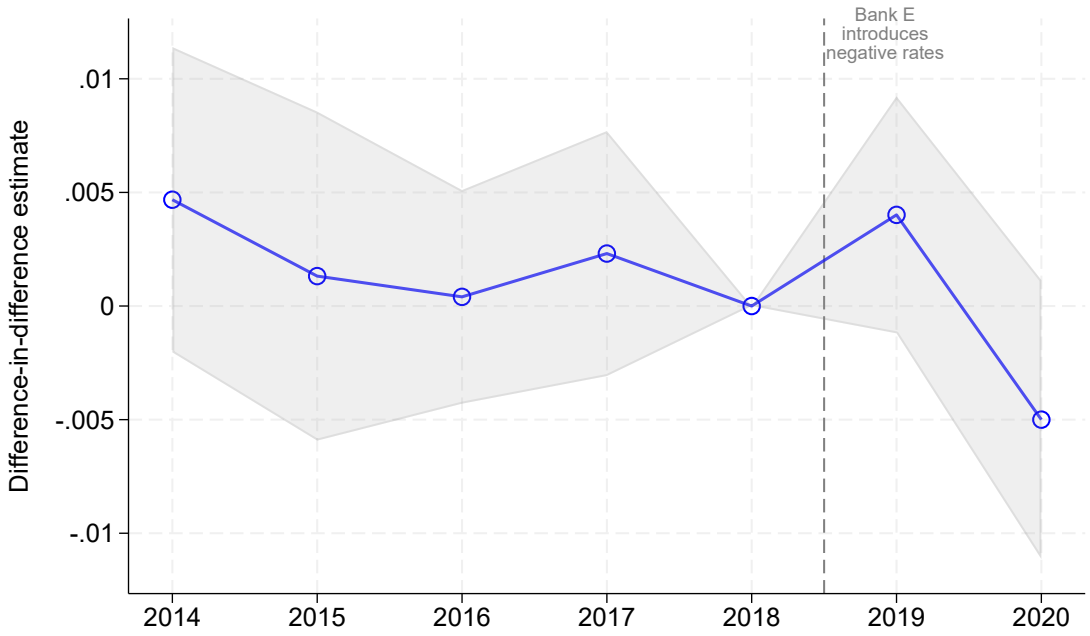
A Additional figures

Figure A.1 Aggregate cash withdrawals: Bank counter and ATM



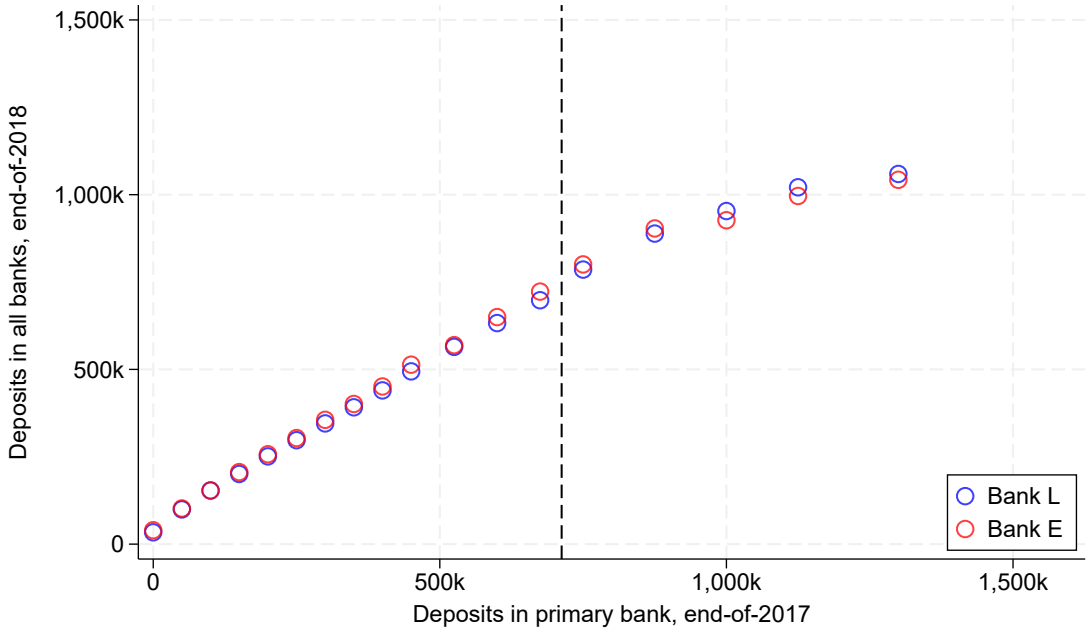
Notes: This figure shows a seasonally adjusted time series of aggregate cash withdrawals from banks (black solid line) and the linear trend in this series (red dashed line). The series includes both withdrawals at the counter and from automatic teller machines. The red areas represent deviations from the linear trend during the period with negative interest rates. To construct the seasonally adjusted series, we obtain the error terms from a regression of the raw quarterly outcomes on indicators for first, second, third and fourth quarter, and add back the mean of the raw quarterly observations taken over the same period. The raw data is from official statistics published by the Danish Central Bank (Table DNBSHI).

Figure A.2 Differential cash stock market returns in administrative data



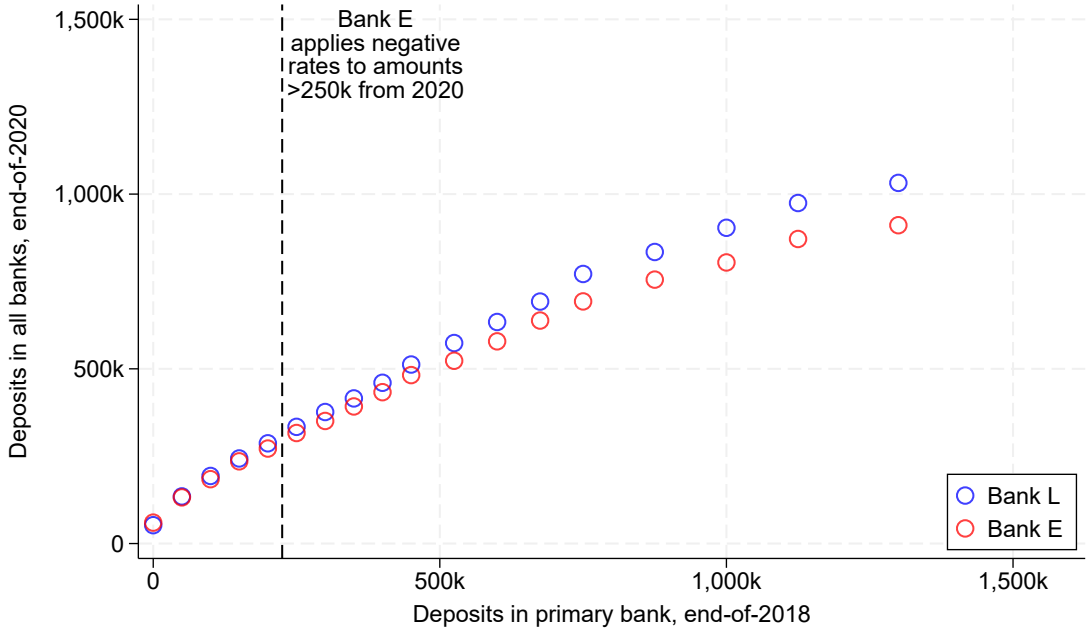
Notes: This figure shows the differential cash stock market return for the treatment group relative to the control group (conditional on covariates). In a first step, we use the administrative data to compute the cash stock market return for each individual as dividends plus realized capital net gains relative to the portfolio value. We then use this return as the outcome in the baseline dynamic difference-in-difference model (dollar-weighted).

Figure A.3 Depositor responses in administrative data: Placebo test



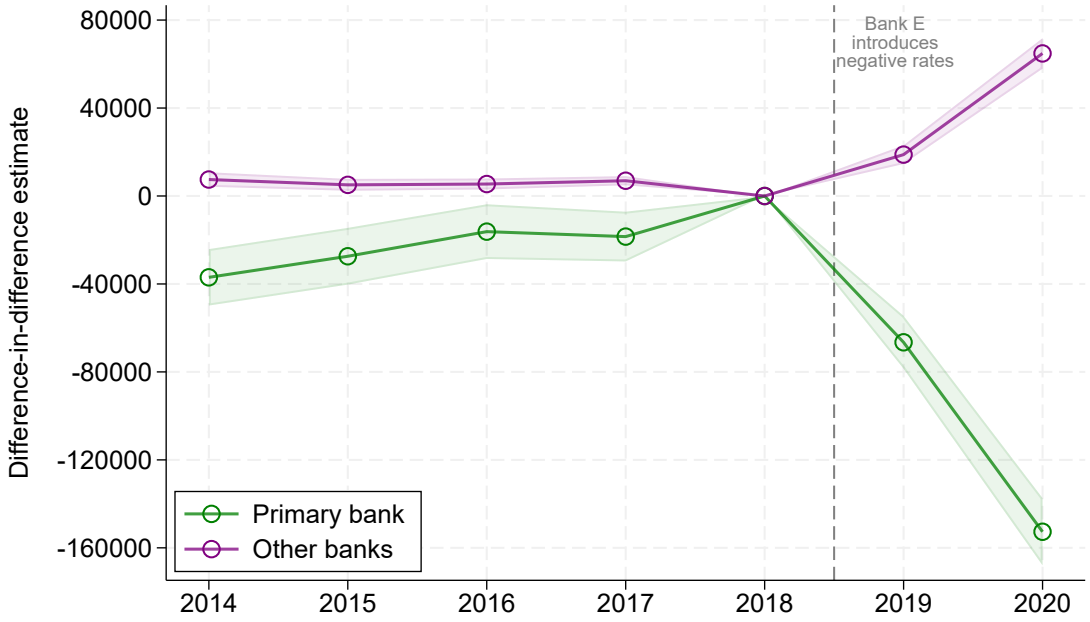
Notes: This figure shows results analogous to Figure 4, but for the year period before the introduction of negative interest rates. The binned scatterplot shows individuals' deposits in their main bank at the end of 2017 on the horizontal axis and their deposits in all banks at the end of 2018 on the vertical axis. The dashed vertical line indicates the threshold level of deposits at which Bank $\mathscr{E}$ started applying negative interest rates in 2019. The sample includes all individuals whose main bank at the end of 2017 was Bank $\mathscr{E}$ (red line) or Bank $\mathscr{L}$ (blue line).

Figure A.4 Depositor responses in administrative data: Robustness



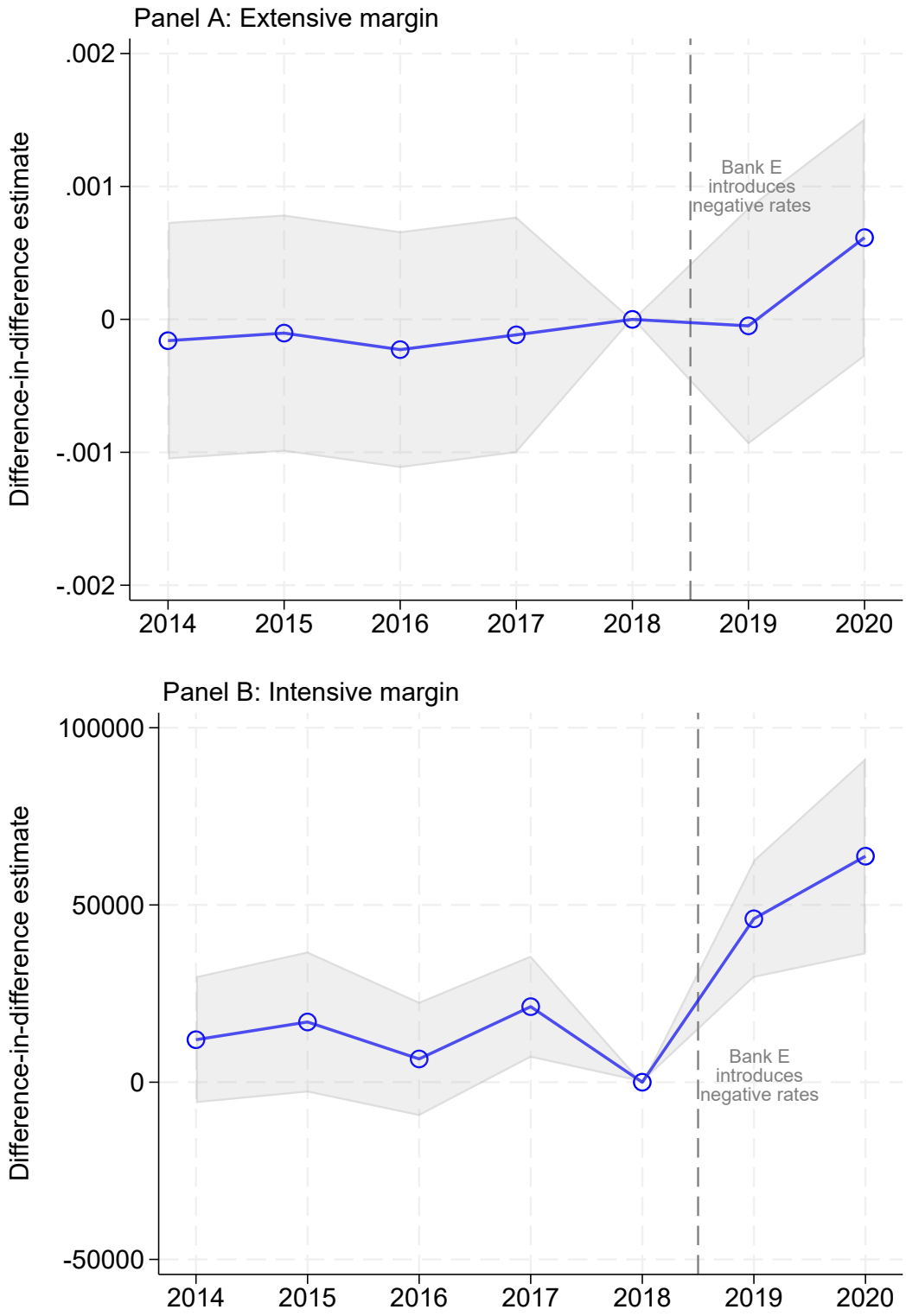
Notes: This figure illustrates how individuals exposed to negative interest rates in 2019-2020 changed their deposit holdings. The binned scatterplot shows individuals' deposits in their main bank at the end of 2018 on the horizontal axis and their deposits in all banks at the end of 2020 on the vertical axis. The dashed vertical line indicates the threshold level of deposits at which Bank $\mathscr{E}$ started applying negative interest rates in 2020. The sample includes all individuals whose main bank at the end of 2018 was Bank $\mathscr{E}$ (red line) or Bank $\mathscr{L}$ (blue line).

Figure A.5 Deposit shifting responses in administrative data



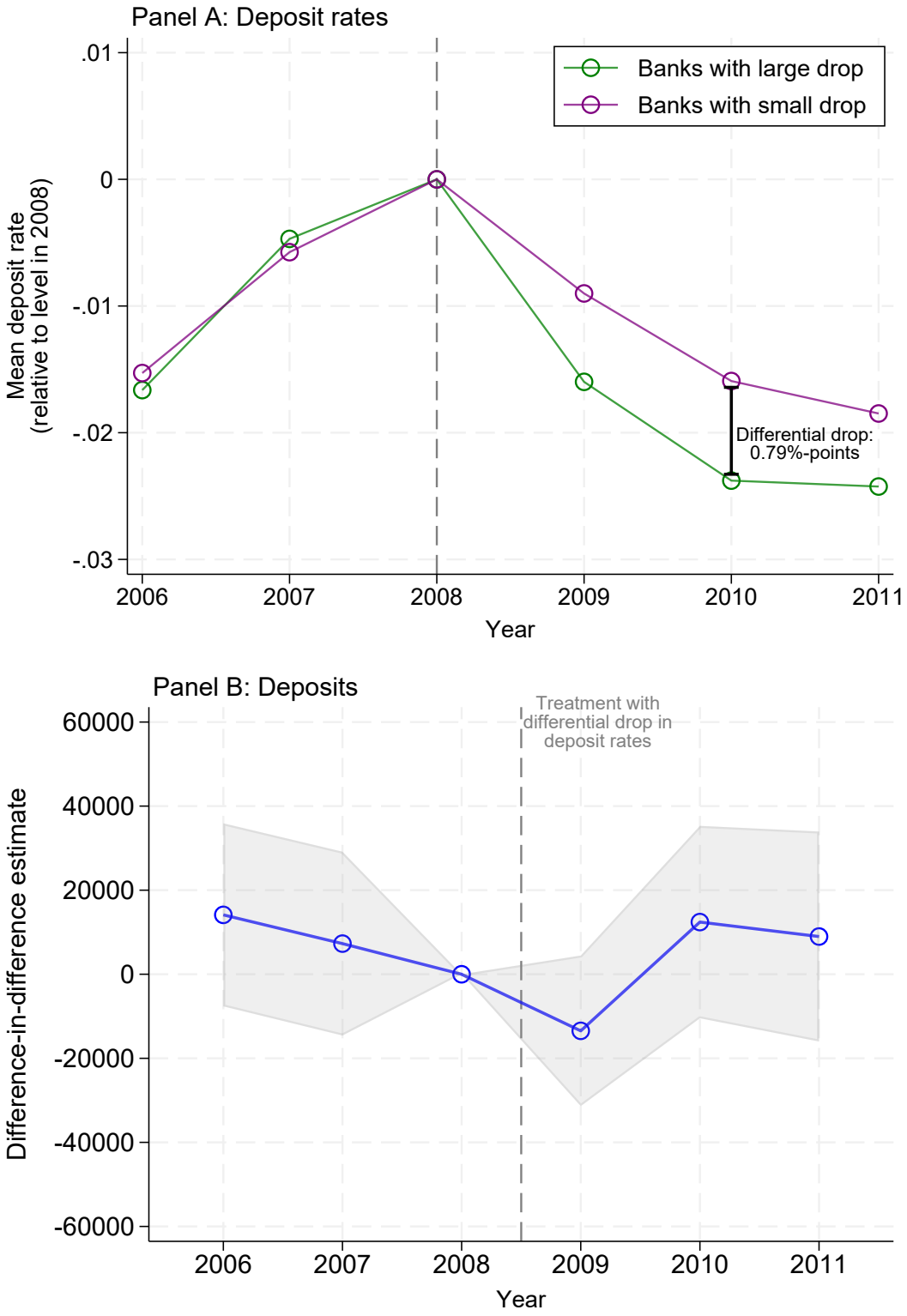
Notes: This figure shows dynamic difference-in-difference estimates of behavioral responses to the onset of negative interest rates on two outcomes: deposits in the main bank (green line) and deposits in other banks (purple line). The sample is individuals holding deposits between DKK 750,000 and 1.5 million in bank E ("treatment") or bank L ("control") at the end of 2018.

Figure A.6 Stock market responses in administrative data, extensive vs intensive margin



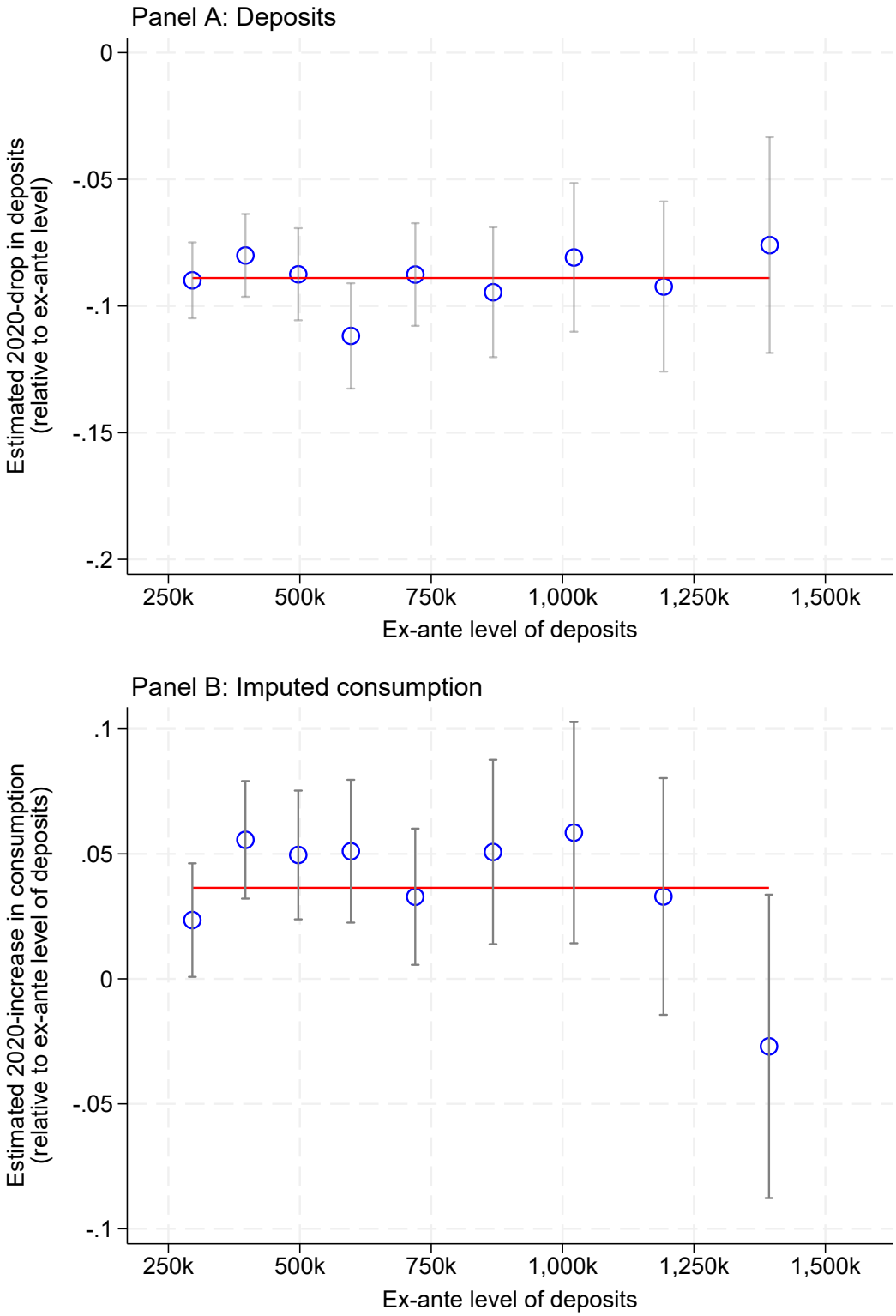
Notes: This figure shows dynamic difference-in-difference estimates of the stock market behavioral responses to the onset of negative interest rates distinguishing the extensive margin (Panel A) and the intensive margin (Panel B). For the extensive margin the outcome is an indicator for holding any stocks. For the intensive margin, the outcome is the value of the stock portfolio and the estimation sample is restricted to individual holding any stocks in 2018.

Figure A.7 Deposit rate cut in the positive domain



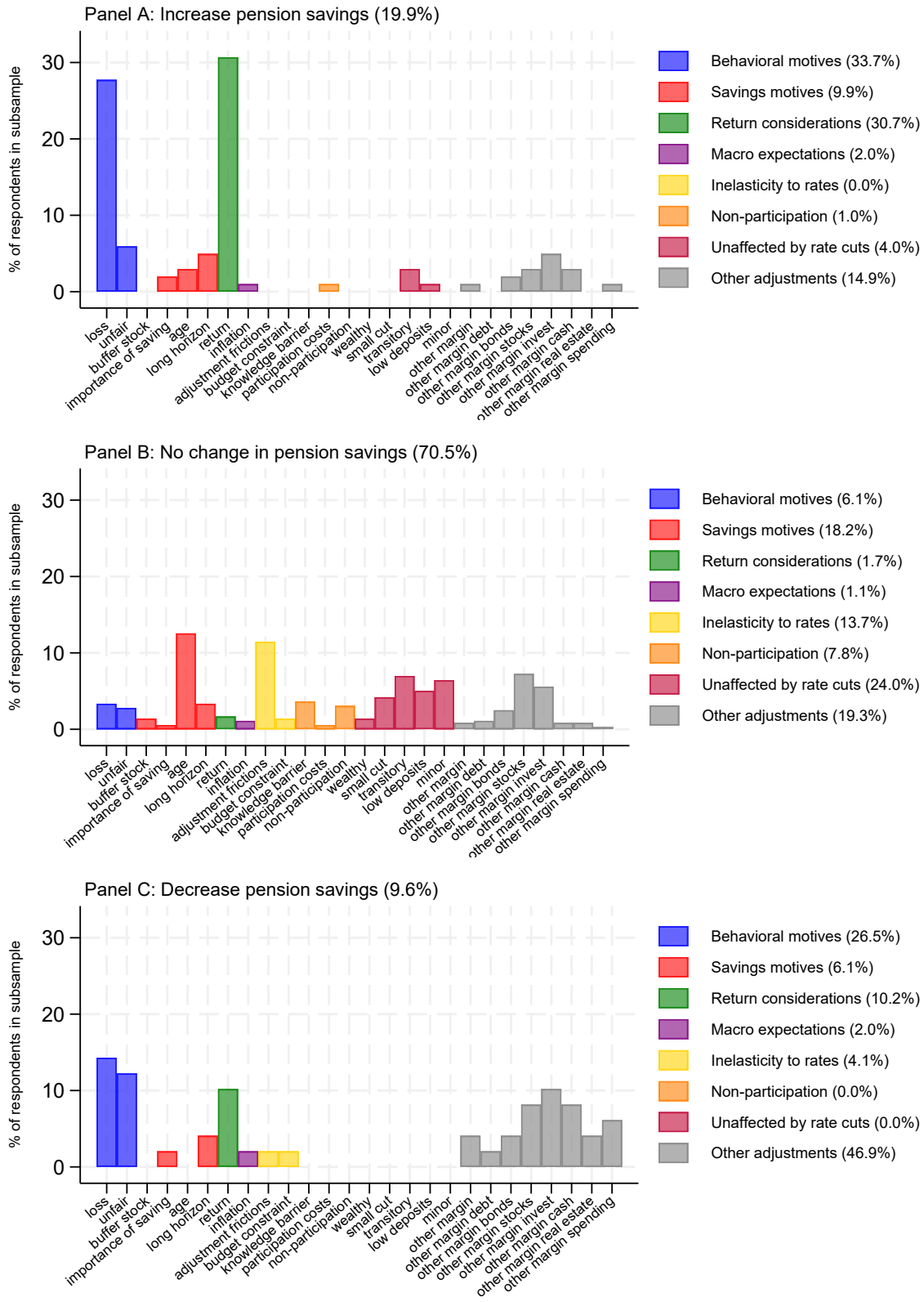
Notes: The figure reports results on depositor responses to deposit rate cuts in positive territory. Panel A shows the differential drop in deposit rates between 2008 and 2010. Panel B shows shows difference-in-difference estimates of deposit responses to the differentially larger deposit rate drop.

Figure A.8 Stability of point estimates in administrative data



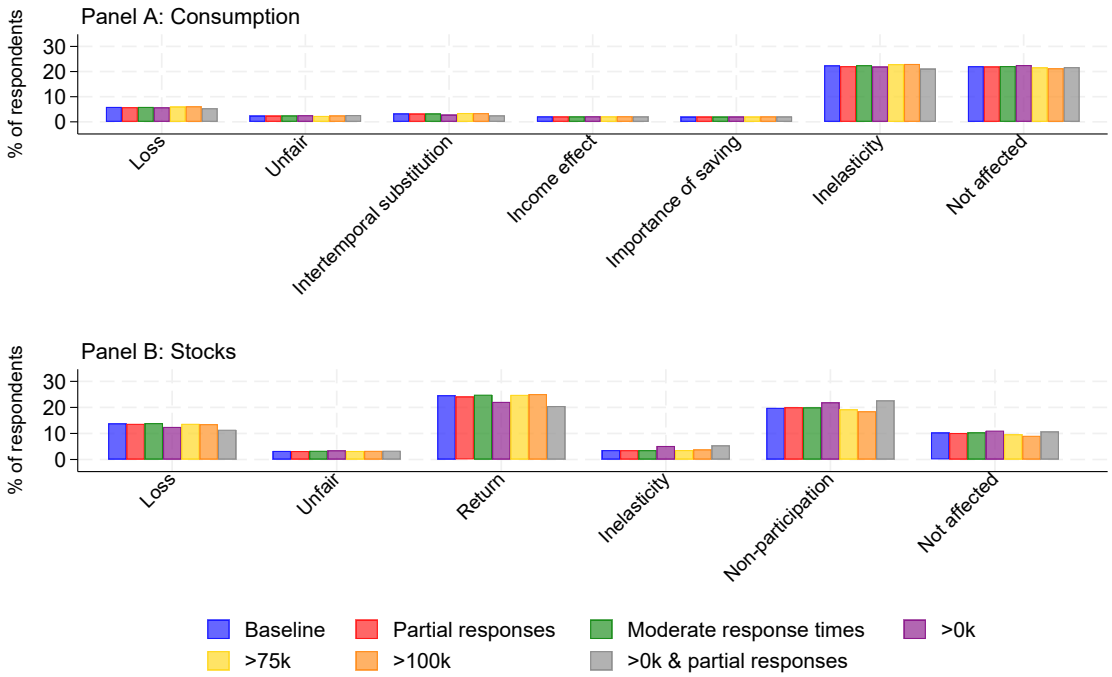
Notes: This figure shows estimated effects on deposits (Panel A) and imputed consumption (Panel B), both scaled by the ex ante level of deposits, for narrower deposit ranges. The red lines are simple averages of the point estimates across bins.

Figure A.9 Motives behind pension account holding responses to negative rates



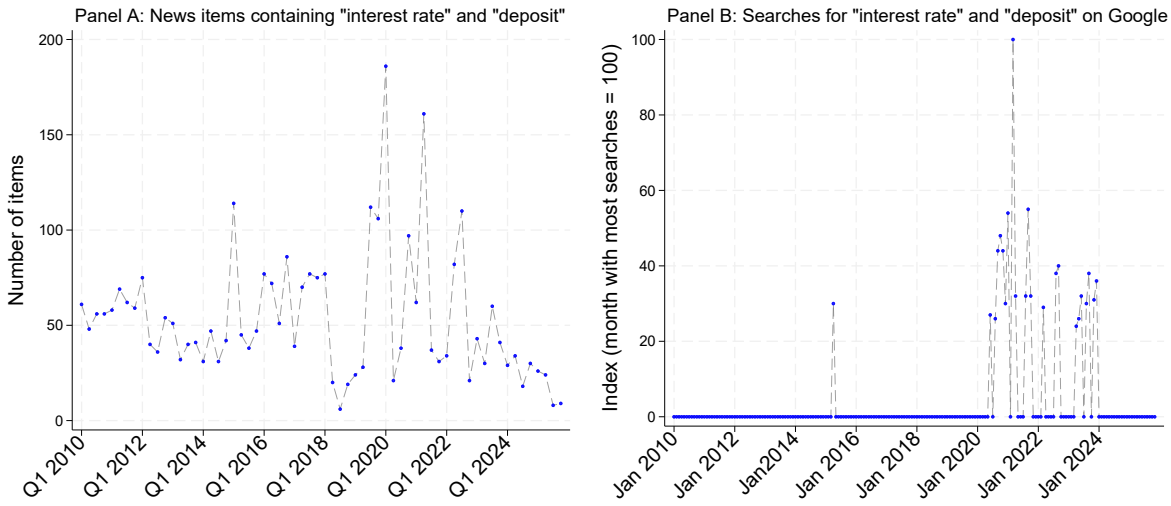
Notes: This figure displays the frequencies of different motives behind adjustments in pension account holdings in response to a rate cut below zero as measured in the open-ended question for those planning to increase (Panel A), not change (Panel B) or decrease (Panel C) pension account holdings. On the right, we display the fractions of respondents mentioning at least one motive from a given family of motives.

Figure A.10 Motives behind responses to negative rates: Robustness



Notes: This figure displays the frequencies of different motives behind adjustments in consumption (Panel A) and stock holdings (Panel B) in response to a rate cut below zero as measured in the open-ended question. The frequencies are reported for the baseline sample (blue), for samples including partial responses (red) or using only responses above the 2nd and below the 98th percentile in terms of response time (green), for a sample not restricted to those with deposits of at least 50,000 kroner (yellow), for samples that are restricted further to those with at least 75,000 kroner (purple) or 100,000 kroner (orange), and for a sample that includes partial responses *and* is not restricted to those with deposits worth at least DKK50,000 (gray).

Figure A.11 News coverage and Google searches for deposit rates



Notes: This figure displays the number of news items (Panel A) and Google searches (Panel B) using the words "interest rate" and "deposit". The number of news items is based on the news archive from the Danish firm Infomedia, which monitors Danish news for analysis purposes. News items include online publications, print publications, and TV and radio features, and are restricted to editorial sources (i.e., outlets that employ a news editor).

B Additional tables

Table B.1 Summary statistics

	(1) Bank E	(2) Bank L	(3) Other banks
Age	60.3	62.4	61.6
	(14.4)	(14.5)	(15.0)
Female (%)	46.5	44.8	45.4
	(49.9)	(49.7)	(49.8)
Copenhagen (%)	10.9	17.4	10.9
	(31.2)	(37.9)	(31.2)
Higher education (%)	46.2	48.1	40.6
	(49.9)	(50.0)	(49.1)
Income (DKK)	594,817	604,710	544,695
	(1,031,907)	(1,102,238)	(950,557)
Employed (%)	66.9	60.4	62.8
	(47.1)	(48.9)	(48.3)
Deposits (DKK)	1,115,787	1,112,823	1,091,942
	(692,837)	(892,839)	(703,303)
Net wealth (DKK)	2,409,509	2,686,896	2,355,716
	(3,552,206)	(8,805,823)	(4,549,802)
Stocks (DKK)	434,590	677,448	426,188
	(1,834,602)	(7,566,114)	(2,792,617)
Stock owners (%)	58.7	52.5	52.6
	(49.2)	(49.9)	(49.9)
Housing value (DKK)	1,852,228	1,715,525	1,743,893
	(4,747,860)	(4,490,448)	(5,021,994)
Home owners (%)	73.4	70.1	69.6
	(44.2)	(45.8)	(46.0)
Debt (DKK)	1,051,060	871,078	944,607
	(3,910,738)	(3,622,831)	(4,033,990)
Debtors (%)	64.1	63.5	57.8
	(48.0)	(48.1)	(49.4)
Pension contribution (DKK)	11,077	9,733	11,055
	(51,419)	(62,436)	(65,371)
Pension savers (%)	19.6	14.2	17.9
	(39.7)	(34.9)	(38.3)
Consumption (DKK)	237,675	241,410	197,868
	(915,107)	(2,255,502)	(1,793,265)
Number of observations	9,173	32,128	66,856

Notes: The table shows summary statistics for our main sample: individuals holding deposits in the range DKK 750,000 - 1.5 million in Bank $\mathcal{E}$ (Column 1), Bank $\mathcal{L}$ (Column 2) or any other bank (Column 3) at the end of 2018.

Table B.2 Additional behavioral margins in administrative data

Inflows and outflows	
Inflows:	
Wages	-4,296
	(6,558)
Outflows:	
Consumption	88,182***
	(17,202)
Pension contributions	1,831***
	(448)
Interest payments	2,070***
	(233)
Net inflows	-68,142***
	(17,669)
Assets and liabilities	
Δ Assets:	
Deposits	-90,840***
	(7,217)
Stocks	33,406***
	(8,393)
Real estate	-6,336
	(9,614)
Δ Liabilities:	
Debt	-3,962
	(8,627)
Δ Net assets	-63,257***
	(15,633)
Discrepancy	-4,885

Notes: The table shows results analogous to Table 1 for a larger set of outcomes. The estimate for *Net inflows* is obtained using inflows minus outflows as the outcome variable. The estimate for Δ*Net assets* is obtained using the change in assets minus the change in liabilities as the outcome variable. *Discrepancy* is the difference between the estimated effect on net inflows and the estimated effect on Δ net assets.

Table B.3 Summary statistics of survey sample

	Contact population	All completes	Completes with deposits >50k (main sample)				
	(1) Mean	(2) Mean	(3) Mean	(4) Median	(5) SD	(6) p25	(7) p75
Age	43.4	49.1	50.7	54	14.3	41	62
Female (%)	50.0	45.0	42.6	0	49.5	0	100
Copenhagen (%)	13.4	12.4	12.2	0	32.8	0	0
Higher education (%)	35.2	51.0	56.0	100	49.6	0	100
Income (DKK)	394,182	517,375	570,912	473,112	923,796	324,794	633,604
Employed (%)	80.8	84.9	87.4	100	33.1	100	100
Deposits (DKK)	162,015	230,947	281,424	138,496	535,778	62,744	298,810
Net wealth (DKK)	332,890	740,477	942,075	319,465	5,401,224	18,371	1,078,229
Stocks (DKK)	141,558	346,922	419,443	0	4,539,806	0	137,099
Stock owners (%)	27.0	43.0	48.7	0	50.0	0	100
Housing value (DKK)	615,106	984,067	1,160,364	816,148	3,654,988	0	1,357,370
Home owners (%)	44.8	62.4	70.4	100	45.7	0	100
Debt (DKK)	594,486	840,751	942,807	557,838	3,566,748	2,441	1,162,496
Debtors (%)	70.4	78.6	79.5	100	40.4	100	100
Observations	89,647	9,164	6,159				

Notes: The table shows summary statistics for our survey sample. The number of observations in Column 2 is somewhat smaller than our full survey sample because register data are missing for 207 of the respondents who completed the survey.

Table B.4 Balance checks for survey sample

	(1) Mean Negative rate	(2) Mean ZLB	(3) Mean Positive rate	(4) p-value (1)=(2)=(3)
Age	50.7	51.1	50.9	0.74
Female (%)	42.2	42.7	46.5	0.15
Copenhagen (%)	12.4	11.3	11.9	0.72
Higher education (%)	56.1	55.6	55.7	0.96
Income (DKK)	578,662	527,026	548,654	0.08
Employed (%)	87.5	86.5	87.8	0.76
Deposits (DKK)	283,634	269,135	274,840	0.67
Net wealth (DKK)	941,203	959,120	932,048	0.99
Stocks (DKK)	432,646	322,038	404,959	0.45
Stock owners (%)	48.9	47.3	48.3	0.75
Housing value (DKK)	1,130,430	1,476,165	1,094,911	0.57
Home owners (%)	70.3	71.5	69.9	0.82
Debt (DKK)	928,000	1,130,109	878,267	0.65
Debtors (%)	79.6	79.7	78.5	0.83
Observations	4,995	592	572	
F-test, all variables				0.95

Notes: The table tests for the balance of respondent characteristics across the three treatment conditions in the survey.

Table B.5 Survey-reported responses to rate cuts in negative vs. positive territory: Robustness

	(1) Baseline	(2) Partial responses	(3) Moderate response times	(4) With controls	(5) >0k	(6) >75k	(7) >100k responses	(8) >0k & partial
Panel A: Reduce deposits								
Negative rate	0.388***	0.379***	0.388***	0.385***	0.348***	0.400***	0.409***	0.322***
	(0.019)	(0.019)	(0.020)	(0.020)	(0.016)	(0.021)	(0.022)	(0.013)
ZLB	0.038	0.027	0.035	0.047*	0.030	0.060**	0.083***	0.025
	(0.026)	(0.026)	(0.027)	(0.027)	(0.021)	(0.028)	(0.030)	(0.017)
Constant	0.264***	0.269***	0.266***	0.265***	0.266***	0.257***	0.254***	0.260***
	(0.018)	(0.018)	(0.019)	(0.018)	(0.015)	(0.019)	(0.020)	(0.012)
R^2	0.09	0.08	0.09	0.128	0.07	0.09	0.09	0.06
Observations	6,231	6,499	5,987	6153	9,371	5,478	4,728	13,914
Panel B: Increase consumption								
Negative rate	0.093***	0.093***	0.091***	0.095***	0.090***	0.093***	0.094***	0.086***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.010)	(0.011)	(0.007)
ZLB	0.007	0.005	0.003	0.014	0.016	0.009	0.011	0.011
	(0.012)	(0.011)	(0.012)	(0.012)	(0.010)	(0.013)	(0.014)	(0.009)
Constant	0.038***	0.038***	0.039***	0.035***	0.037***	0.039***	0.039***	0.038***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)	(0.009)	(0.009)	(0.006)
R^2	0.01	0.01	0.01	0.039	0.01	0.01	0.01	0.01
Observations	6,231	6,499	5,987	6153	9,371	5,478	4,728	11,113
Panel C: Increase stock holdings								
Negative rate	0.130***	0.125***	0.127***	0.130***	0.116***	0.131***	0.136***	0.108***
	(0.021)	(0.021)	(0.022)	(0.021)	(0.017)	(0.023)	(0.024)	(0.015)
ZLB	0.016	0.014	0.017	0.027	0.024	0.020	0.023	0.014
	(0.028)	(0.028)	(0.029)	(0.028)	(0.023)	(0.031)	(0.033)	(0.020)
Constant	0.386***	0.385***	0.390***	0.384***	0.346***	0.389***	0.392***	0.331***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.016)	(0.022)	(0.023)	(0.014)
R^2	0.01	0.01	0.01	0.126	0.01	0.01	0.01	0.01
Observations	6,231	6,499	5,987	6153	9,371	5,478	4,728	11,102
Panel D: Increase pension savings								
Negative rate	0.103***	0.102***	0.102***	0.104***	0.084***	0.095***	0.101***	0.069***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.011)	(0.014)	(0.015)	(0.010)
ZLB	0.012	0.015	0.013	0.017	0.015	0.001	0.009	0.006
	(0.017)	(0.017)	(0.018)	(0.018)	(0.014)	(0.019)	(0.020)	(0.013)
Constant	0.090***	0.088***	0.090***	0.088***	0.094***	0.098***	0.094***	0.099***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.010)	(0.013)	(0.014)	(0.009)
R^2	0.01	0.01	0.01	0.043	0.01	0.01	0.01	0.01
Observations	6,231	6,499	5,987	6153	9,371	5,478	4,728	11,483

Notes: This table displays regressions of dummy variables for reducing deposits or for increasing consumption, stock holdings, cash holdings or pension holdings in response to rate cuts on dummy variables for the Negative rate condition and the Zero lower bound condition, the Positive rate condition being the omitted base category. Column 1 repeats the baseline estimations from Table 2, while the other columns demonstrate robustness to including partial responses (Column 2), using only responses above the 2nd and below the 98th percentile in terms of response time (Column 3), controlling for background characteristics (Column 4), not restricting the sample to those with deposits of at least DKK50,000 (Column 5), restricting it further to those with at least DKK75,000 (Column 6) or with at least DKK100,000 (Column 7), and to including partial responses *and* not restricting to those with deposits worth at least DKK50,000 (Column 8). The increase in the sample size in Column 8 reflects an unexpectedly high degree of attrition, as explained in Appendix F. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

C Imputation of consumption

This appendix provides more details about the framework for imputing consumption. Conceptually, it builds on the intertemporal budget constraint, which implies that consumption equals net income flows minus the increase in net wealth:

$$\text{consumption}_{i,t} = \text{income}_{i,t} - \text{tax}_{i,t} + \Delta\text{debt}_{i,t} - \Delta\text{assets}_{i,t} \tag{5}$$

Our empirical implementation measures *income* with the broadest possible measure of pre-tax annual disposable income, which includes labor income, pension income, self-employment income, housing income, net interest income, dividend income, net transfers from pension accounts, and realized stock market net gains. It also includes an imputed measure of unrealized stock market net gains equal to the value of the stock portfolio in the beginning of the year multiplied by the percentage change in the leading Danish stock market index over the year.

Moreover, we measure *tax* as the sum of all direct tax payments over the year (not VAT, excise duties etc); Δ*debt* as the change in the market value of all debt and Δ*assets* as the change in deposit balances and in the market value of security portfolios. Most categories of income, assets and debt are reported to the tax authorities by employers or financial institutions for the purpose of tax enforcement and have a small margin of error (Alstadsæter et al., 2019). The main exception is self-employment income and foreign income and assets, which are mostly self-reported.

Our measure of assets excludes housing assets because we do not have accurate market values. This has two implications. First, in years where a given household does not buy or sell properties, expenditure related to repair and renovation contributes to imputed consumption whereas changes in housing prices have no bearing on imputed consumption. Second, in years where a given household buys or sells properties, the transaction price enters imputed consumption, a problem we address by excluding individual-year observations with property transactions from the sample when the outcome is imputed consumption.

We highlight three measurement challenges that we attempt to address in the paper. First, asset transfers to other family members lower the individual's assets and thus increase imputed consumption. Second, cash withdrawals lower the individual's (observable) assets and thus increase imputed consumption. Third, stock market returns above the index return raise the market value of the stock portfolio more than the stock market income included in the income measure and thus decrease imputed consumption.

D Coding of open-ended data on motives

This appendix describes details of the coding procedure for the open-ended measures of reasoning analyzed in Section 3.5.

Overview of codes Table D.1 provides a detailed overview of all codes contained in our scheme, along with example responses. The coding scheme was devised before the main data collection and informed by both pilot interviews and economic theory. Each response can receive multiple codes. Coders were instructed to code conservatively and err on the side of coding a response as "other" (non-classifiable).

Manual coding We rely on human coding, for two main reasons: first, at the time of our data collection, the use of AI methods was not feasible in our setting due to restrictions at the University of Copenhagen on the usage and storage of data collected through the Danish survey infrastructure; second, human coding offers a high degree of reliability in capturing the often subtle nature of the responses. Each response is independently coded by two research assistants. In case of conflicts, a third research assistant makes a final decision. This procedure reduces measurement error, and allows us to check the quality of our coding scheme by calculating the inter-rater reliability. All coders participate in several joint training sessions, during which we explain the coding scheme and discuss representative examples. The coders received a manual with examples from pilot data, which contained more extensive explanations than Table D.1 below. This manual can be found under `https://drive.google.com/file/d/1qku8g3Se2R6EA6wK6qothg-pYMOXuB-n/view?usp=sharing`.

Quality of the open-ended data Our hand-coded data are of high quality. 73% of all responses can be classified using our scheme in the sense of receiving a code that is not from the "other" family (see Table D.1 below). About half of the responses assigned to the "other" family (13% of the overall sample) give meaningful explanations not contained in our scheme, while the other half (13%) provide junk responses, simply restate their behavioral response or write responses that imply misunderstanding of our questions. We detect a high inter-rater reliability: if a given family of codes (out of the ten families described in Section 3.5 and displayed in Table D.1) is assigned by one of the two initial coders, there is a 70% chance that the other coder assigns the family as well. 85% of the families of codes identified by the initial two coders align with the final version.

We use a randomly chosen 10% subsample to validate the open-ended responses using a more traditional closed-ended question. In particular, after responding to the open-ended question on motives behind adjustments to stock holdings, this subsample receives a closed-ended question that displays potential considerations for decisions regarding stock holdings.[1] The respondents are asked to tick all considerations that played a role

[1]The subsample is randomly drawn from the 22.5% of respondents (i) that were asked about stock adjustments in one of the open-ended questions and (ii) for whom adjustments to stock holdings were

in their decision. Figure D.1 displays the frequency of different responses on reasoning underlying adjustments to stock holdings as calculated from the open-ended and from the structured question. While almost all considerations are more frequently indicated in the structured than in the open-ended question, the relative frequencies of different lines of thought are similar across the two measurements. These differences are common when comparing open-ended with closed-ended measurements (Chopra et al., 2025; Link et al., 2025) and could reflect priming through the provided response options or lower effort costs of responding to the closed-ended question. Table D.2 highlights that explanations given in the open-ended question are highly predictive for the response options selected in the closed-ended question.

Taken together, these patterns highlight the validity and reliability of the open-ended data and our coding scheme.

elicited as the last behavioral margin. The latter condition makes sure that no subsequent open-ended responses are contaminated through priming or information contained in the structured response options.

Table D.1 Coding scheme and example responses for open-ended data on motives

Code	Description	Example responses
	— Behavioral motives: —	
loss	Not wanting to suffer a loss by keeping money in a bank account. Only used when respondents explicitly mention losses, losing money, or synon yms.	*Consumption:* "If I lose money by keeping it in the bank, I might as well spend the money instead." *Stock holdings:* "Because I would lose money by keeping it in the bank and gain by keeping it in stocks." *Cash:* "If I can't keep the money in the bank without losing money, I would rather hold the money myself." *Pension holdings:* "I would rather save more for pension, than pay interests on deposits."
unfair	Considering the reduction in rates to be unfair, immoral, or a sign of the greed of banks. Used for any negative normative or emotionally loaded statements.	*Consumption:* "The banks are greedy and unreasonable. There is no possibility of avoiding paying. At the same time, they always earn profits and pay large returns to rich major shareholders." *Stock holdings:* "The banks already earn plenty. And then it is completely unthinkable that you must pay for keeping money in the bank." *Cash:* "The bank is a requirement for receiving my salary, paying bills etc., I should not have to pay for this, I would go far to avoid paying the bank more than what is necessary." *Pension holdings:* "For me it is a matter of principles. I should not pay for the bank to "borrow" my money. I would instead put my money into my pension savings or invest it in another way. Imagine if the banks had to pay us when we borrow money for a house or something similar. It would never happen."
private	Wanting to make financial decisions without those being tracked by banks or being observable by anyone else.	*Consumption:* "It is none of the state's business what I spend my money on." *Stock holdings:* "We are being surveilled too much. I love Spanish/Greek/Italian circumstances, more and preferably only cash. The banks are scamming us from cradle to the grave." *Cash:* "I already have a continuous need for cash, partly because it makes it easier to manage my consumption and partly because it gives me a sense of privacy regarding my consumption."
trigger	Having considered taking an action for a long time, with the rate cut being a good opportunity.	*Stock holdings:* "I have considered investing in stocks for a long time. A change in interest rates like this would for me be a push to start investing."
	— Savings motives: —	
intertemporal substitution	The reduction in rates making saving less attractive compared to consumption. Also used whenever respondents refer to consumption, larger durable purchases, or stock purchases being moved across periods.	*Consumption:* "I would move forward purchases of consumer goods that I would have bought later either way. My total consumption over time would not change much."
income effect	The reduction in rates meaníng that one has to save more to achieve a given savings goal. Also used when respondents argue that the reduction in rates directly reduces available income.	*Consumption:* "As I will have less money available, I have to reduce my consumption." *Stock holdings:* "If I have a smaller disposable income, I will put less money into stocks."

Table continued on next page.

Table D.1 *(continued)* Coding scheme and example responses for open-ended data on motives

Code	Description	Example responses
	***— Savings motives** (continued) —*	
buffer stock	References to a target buffer of wealth or savings for unexpected expenses or income shocks.	*Consumption:* "I don't change my behavior when interest rates change. I always have a buffer in my account and invest the rest in stocks." *Stock holdings:* "I like to a have a "buffer" on my account, so I don't have to sell stocks in case there is a sudden need for money." *Cash:* "Realistically, the situation does not seem likely to happen again. But I want to have a buffer in free funds, but with as few expenses as possible." *Pension holdings:* "I don't need more than 100,000 DKK as a buffer. Therefore, I would invest the money instead - and not in pensions, as I don't want it to be locked in until retirement age."
importance of saving	References to the importance of saving in a generic sense.	*Consumption:* "I would still save, no matter what." *Stock holdings:* "I would save more money." *Cash:* "I would be careful with my money. And I would like to have as much as I can possibly scrape together for when I retire." *Pension holdings:* "Consumer prices have bigger impact. It's always better to have savings than none. There are often fees for changing."
age	References to higher age, being retired, or being close to retirement. Sometimes with reference to the importance of saving and of avoiding risk. Not used for references to being young.	*Consumption:* "As a state pensioner, it is necessary to examine your expenses and save where it is possible." *Stock holdings:* "I'm a pensioner and not interested in entering the stock market." *Cash:* "I wouldn't change anything. I'm a pensioner and I don't have bigger amounts to juggle around with." *Pension holdings:* "I'm a pensioner. I don't know if I could change my payouts even if I wanted to."
long horizon	Having a long investment horizon. Also used for more generic mentions of the long run.	*Consumption:* "If possible, I would try to save, to secure my economy in the long term." *Stock holdings:* "My investments in stocks are long-term, so minor changes in the interest rate, will not lead to changes in the portfolio." *Cash:* "I think long term." *Pension holdings:* "I don't see any reason to change, since it is a very long-term investment."
short horizon	Having a short investment horizon. Also used for more generic mentions of the short run.	*Consumption:* "I don't have such a large deposit that it has any impact in the short run. [. . .]" *Stock holdings:* "[. . .] Because of my age, possible stock investments should be short-term – which isn't necessarily an advantage." *Cash:* "In the short term, I would withdraw a bit more cash. But in the long term, I would find another way to invest my money." *Pension holdings:* "I already have an employer-funded pension of 18% and also want money for consumption while my children are younger. Therefore, I will not bind more funds in long-term savings, even though it might be more sensible economically."

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Table D.1 *(continued)* Coding scheme and example responses for open-ended data on motives

Code	Description	Example responses
	— Return considerations —	
return	Wanting to achieve a high return.	*Stock holdings:* "Stocks yield a higher return." *Cash:* "Cash is worth the same tomorrow as today, thus no negative interest rate, so therefore more cash." *Pension holdings:* "Because it yields a higher return to place the money in the pension savings."
	— Macro expectations —	
inflation	References to inflation, inflation expectations, or protection against inflation.	*Consumption:* "It doesn't matter much, when the interest rate is low, the inflation is typically also low." *Stock holdings:* "As the interest rates already are so low that they do not even cover yearly inflation, my funds are invested in stocks." *Cash:* "[. . .] I don't want to hold cash, since cash loses value over time." *Pension holdings:* "Even though the nominal interest rate is changed, the real interest rate does not necessarily change, why I would not change behavior."
macro situation	Thoughts about aggregate economic conditions (positive or negative).	*Consumption:* "I would save as much as possible, as a lowering of the deposit interest, could forewarn a "break" in the Danish economy." *Stock holdings:* "A low interest rate normally implies a healthy economy (low inflation), which is good for the stock price." *Cash:* "The overall situation in the world, combined with the increased costs to financial institutions, will probably cause me to feel more secure by holding more cash." *Pension holdings:* "If the economy is so bad that there are negative interest rates, I might as well save it [i.e., my money] for a better future, and they [i.e. the pension fund] can invest it for me. (If it goes wrong, I'm lost anyways)."
	— Inelasticity to rates —	
rates irrelevant	Interest rates generally not mattering for the decision in question.	*Consumption:* "Changes in the interest rate are not included in my considerations regarding disposable income. It is just extra for the savings." *Stock holdings:* "Interest rates and stocks are for me two separate factors." *Cash:* "I would not change my cash balance because of interest rate changes." *Pension holdings:* "My pension level is appropriate and the interest rate level, does not change this."
adjustment frictions	Changing levels of spending or asset holdings being difficult, e.g., due to prior commitments (e.g., mortgage payments, rent, paying into a savings plan, sending money to kids that are studying). Also used for references to a spending or saving "habit" or to inertia in decisions in a general or vague sense.	*Consumption:* "It basically comes down to, that I don't want to change my consumption habits." *Stock holdings:* "To be completely honest I think I'm too lazy to react to the new interest rate changes." *Cash:* "Cash is almost impossible to get hold of, after banks have closed almost all physical branches and ATM machines." *Pension holdings:* "The interest rate is constantly changing, and I usually don't have the time or overview to make ongoing changes, even though I probably should."

Table continued on next page.

Table D.1 *(continued)* Coding scheme and example responses for open-ended data on motives

Code	Description	Example responses
	***— Inelasticity to rates** (continued)—*	
budget constraint	Having a low income, leaving no room to change the behavior in question.	*Consumption:* "Because I can't afford to change my expenses." *Stock holdings:* "I can't afford to buy stocks." *Cash:* "My income only just covers the fixed expenses, so I don't have the option of changing much." *Pension holdings:* "I would still not be able to afford to pay more into pensions."
satiation	Already consuming, spending or investing enough, with an additional unit not increasing utility, sometimes for sustainability reasons.	*Consumption:* "I have what I need and wish for." *Stock holdings:* "[. . .] already have sufficient funds in stocks." *Pension holdings:* "I have already invested sufficiently in pension."
	— Non-participation —	
risky	The asset class in question being very / too risky.	*Stock holdings:* "I like to keep money in the bank, where there is no risk. Because I'm risk averse." *Cash:* "I don't want to have a bigger amount of cash lying around. It is too risky." *Pension holdings:* "Money can only be stored safely in the bank. I would think that it is a temporary payment for safety and hope the interest rate will be positive again soon."
knowledge barrier	Lack of knowledge of finances in general, of the workings of negative interest rates, or of the asset class in question.	*Consumption:* "I don't have sufficient understanding of the impact of the interest rate on my household finances, for it to change my consumption." *Stock holdings:* "I don't know anything about the stock market." *Cash:* "Because I don't have a good understanding of it and then it's best and safest to not change anything. [...]" *Pension holdings:* "I don't have sufficient understanding of what the interest rate change means, to assess what is advantageous in relation to pensions."
participation costs	Monetary costs and non-monetary costs (time cost, psychological cost) of participating in the asset class in question.	*Stock holdings:* "I don't have the time or energy in my everyday life to invest and keep an eye on the stocks." *Cash:* "I normally don't have a very large deposits, and 1% of almost nothing is not worth spending time on." *Pension holdings:* "It is too much work for too little profit. It would be optimal to temporarily increase the pension contribution and lower it again, when the interest rate is no longer negative, but then you need to keep an eye on it constantly."
non-participation	Reference to current non-participation or to only participating with small amounts in the asset class in question.	*Stock holdings:* "I have never bought stocks." *Cash:* "I don't store cash." *Pension holdings:* "I don't have any pension plan."

Table continued on next page.

Table D.1 *(continued)* Coding scheme and example responses for open-ended data on motives

Code	Description	Example responses
	— Unaffected by rate cuts —	
wealthy	Rate change not mattering to respondents because they have high levels of resources to deal with the situation.	*Consumption:* "With solid personal finances, an interest rate change of 1% is unimportant." *Stock holdings:* "[. . .] we have a very healthy economic situation, and I don't spend the time on keeping an eye on various adjustments up and down." *Cash:* "I would not worry since I generally don't have a lack of money." *Pension holdings:* "I have a good economy and wouldn't give it much thought."
small cut	The rate cut is very small.	*Consumption:* "1% is not enough to affect my economic situation." *Stock holdings:* "The interest rate change is too small for me to change my investment strategy." *Cash:* "I don't store cash, and the negative interest rate should be much higher before I would consider doing it." *Pension holdings:* "The interest rate change is too small to change my economic situation."
transitory	Expecting that rates will change again soon, it making sense to wait, or only changing decisions if the rate change persists.	*Consumption:* "I think it is for a shorter period and will wait and see." *Stock holdings:* "I think it wouldn't last long with the negative interest rate and therefore leave the holdings as they were." *Cash:* "I think it is problematic to have to change one's savings, and hoping that it's only a temporary interest rate change, I wouldn't do anything." *Pension holdings:* "Pension savings is a long-term investment, and I think that the interest rate change is short-term only, so I wouldn't change anything."
low deposits	The rate cut not applying or applying only to a small fraction of one's deposits because of the 100,000 kroner threshold.	*Consumption:* "I don't have savings over 100,000 – so an interest rate change will not affect my consumption." *Stock holdings:* "I regularly invest in stocks among other things, so I seldomly have more than 100,000 in deposits." *Cash:* "If you have less than 100,000, the interest rate change doesn't make a difference." *Pension holdings:* "I don't have more than 100,000 in the bank, so the change doesn't affect me."
minor	Generic statements that one's finances will not be much affected without stating an explicit reason.	*Consumption:* "It wouldn't have much impact on my economic situation." *Stock holdings:* "It wouldn't have any real effect on my financial situation." *Cash:* "There is no impact on our economic situation." *Pension holdings:* "It wouldn't make a big difference to me."

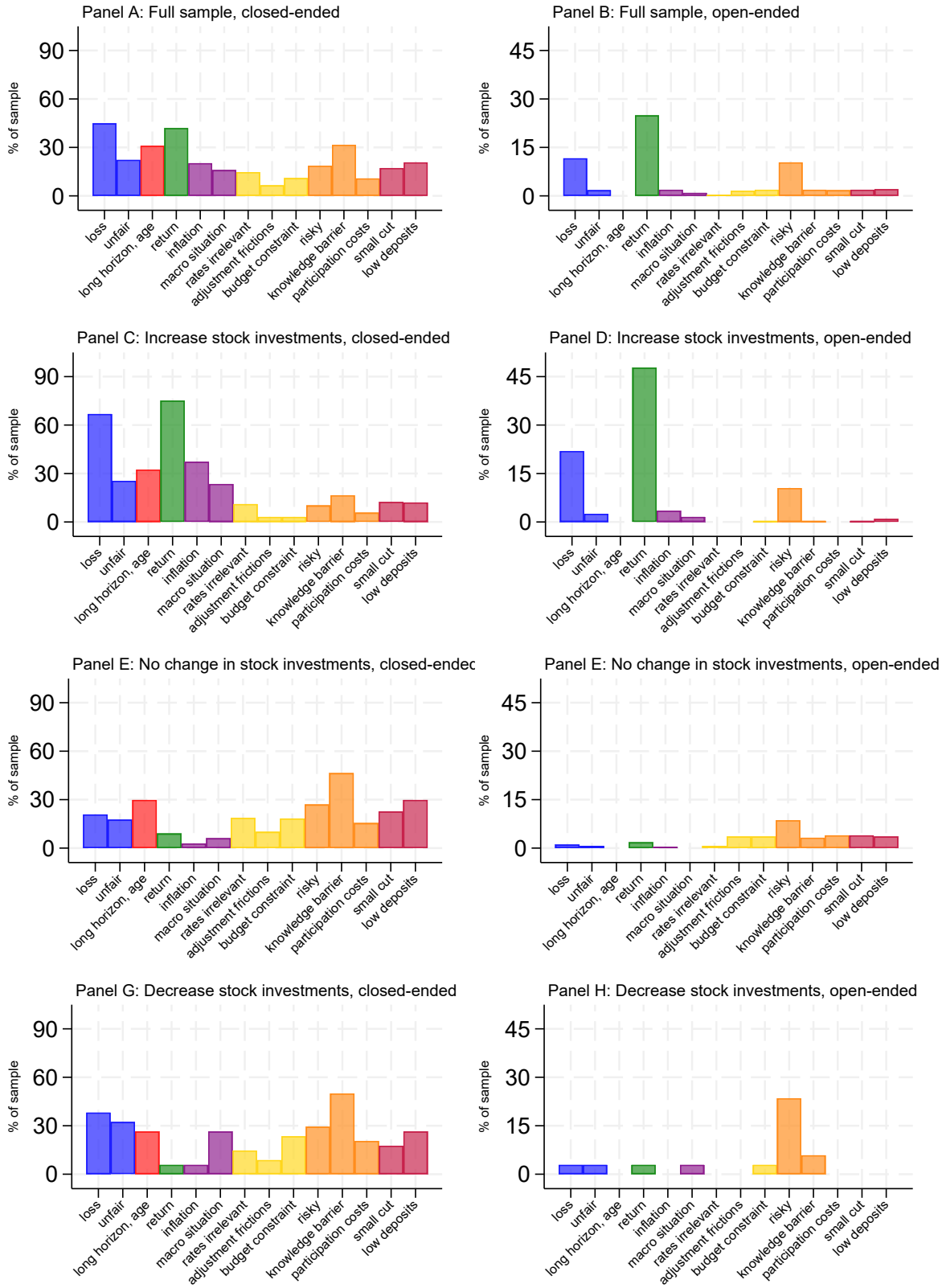
Table continued on next page.

Table D.1 *(continued)* Coding scheme and example responses for open-ended data on motives

Code	Description	Example responses
	— Adjustments along other margins —	
other margin <subcode>	Responding to the rate cut in a different way than by adjusting the behavior in question. The optional <subcode> can be "debt", "bonds", "stocks", "invest", "pension", "cash", "real estate" or "spending", and is used when a particular alternative adjustment margin is specified.	*Consumption:* "I would bring down debt instead." *Stock holdings:* "I wouldn't invest in stocks, but in real estate." *Cash:* "I would rather invest in stocks or bonds, than holding cash." *Pension holdings:* "I will start saving more cash."
	— Other —	
other	Responding to the question but not falling under any of the codes above.	*Consumption:* "I will pay my bills." *Stock holdings:* "I don't really want to explain why." *Cash:* "I have always trusted our bank advisor."
not danish	Responding in any other language than Danish.	"It's just 1%."
restate	Simply repeating how one would adjust (or not adjust) the behavior in question, without giving an explanation.	*Consumption:* "I will not change my expenses because of negative interest rates." *Stock holdings:* "I will definitely invest in stocks." *Cash:* "I won't withdraw cash." *Pension holdings:* "I won't pay more into pension than I do now."
misunderstanding	Not responding to the question asked but instead writing arguments responding to some other question, or not understanding the scenarios.	*Consumption:* "I would probably open a bank account in a different bank." *Stock holdings:* "I won't invest in stocks, if I have to pay interest rates for it." *Cash:* "I would spread out cash between different banks." *Pension holdings:* "I don't understand this question."
DK	Saying that one does not know why one would adjust (or not adjust) the behavior in question in the indicated way.	"I don't know." "I have no idea."
junk	Gibberish.	"blah blah."

Notes: This table provides an overview of all codes contained in the coding scheme, along with example responses from our main data collection.

Figure D.1 Motives behind stock holding responses to rate cuts: Frequencies as measured in open-ended vs closed-ended question



Notes: This figure displays the frequencies of different motives behind adjustments in stock investments in response to rate cuts as measured in a closed-ended (Panels A, C, E, and G) and in an open-ended question (Panels B, D, F, and H), pooled across the Negative rate condition, the Zero lower bound condition, and the Positive rate condition.

Table D.2 Motives behind stock holding responses to rate cuts: Predictiveness of open-ended for closed-ended measure

	Dependent variable: Selected the mechanism in closed-ended survey question (binary)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Loss	Unfair	Age, long horizon	Return	Inflation protection	Macro Situation	Ajustustment frictions
Open-ended: Loss	0.380***	0.235***	−0.109**	0.318***	0.107*	0.012	−0.028
	(0.053)	(0.061)	(0.054)	(0.057)	(0.060)	(0.051)	(0.026)
Open-ended: Unfair	0.542***	0.481***	−0.147	−0.064	−0.029	0.184	0.034
	(0.051)	(0.137)	(0.111)	(0.146)	(0.113)	(0.142)	(0.084)
Open-ended: Age or long horizon	−0.011	0.011	0.446***	−0.023	0.064	0.026	−0.036
	(0.067)	(0.051)	(0.063)	(0.074)	(0.058)	(0.057)	(0.032)
Open-ended: return	0.246***	0.048	0.052	0.434***	0.212***	0.100**	−0.033*
	(0.045)	(0.039)	(0.043)	(0.041)	(0.043)	(0.039)	(0.019)
Open-ended: Inflation protection	0.363**	−0.160***	−0.201	0.195	0.417**	0.297*	−0.062***
	(0.177)	(0.025)	(0.132)	(0.150)	(0.181)	(0.171)	(0.013)
Open-ended: Macro situation	−0.139	−0.289***	0.228	0.236*	0.172	0.400**	−0.031
	(0.152)	(0.060)	(0.160)	(0.132)	(0.173)	(0.202)	(0.026)
Open-ended: Adjustment frictions	−0.214**	−0.177***	−0.246***	−0.267***	−0.135***	−0.134***	0.033
	(0.090)	(0.026)	(0.062)	(0.032)	(0.021)	(0.023)	(0.098)
Open-ended: Budget constraint	−0.245***	−0.049	−0.264**	−0.220***	−0.132***	0.032	0.015
	(0.092)	(0.065)	(0.103)	(0.042)	(0.023)	(0.101)	(0.086)
Open-ended: Risky	0.110*	0.167***	0.058	−0.037	−0.052	0.108*	0.030
	(0.060)	(0.064)	(0.061)	(0.058)	(0.050)	(0.056)	(0.036)
Open-ended: Knowledge barrier	0.004	0.217*	−0.187**	−0.255***	−0.028	0.039	−0.004
	(0.128)	(0.131)	(0.090)	(0.049)	(0.075)	(0.101)	(0.088)
Open-ended: Participation costs	−0.102	−0.049	−0.012	−0.277***	−0.149***	−0.159***	0.182
	(0.145)	(0.106)	(0.150)	(0.058)	(0.030)	(0.027)	(0.129)
Open-ended: Small cut	−0.060	−0.046	0.154	−0.240***	−0.058	−0.029	0.250*
	(0.117)	(0.111)	(0.153)	(0.070)	(0.076)	(0.083)	(0.131)
Open-ended: Low deposits	0.067	0.012	0.055	0.148	−0.004	−0.071	−0.065***
	(0.139)	(0.104)	(0.132)	(0.139)	(0.107)	(0.043)	(0.014)
R^2	0.17	0.10	0.10	0.26	0.10	0.06	0.04
Observations	626	626	626	626	626	626	626

Table continued on next page.

Table D.2 *(continued)* Motives behind stock holding responses to rate cuts: Predictiveness of open-ended for closed-ended measure

	Dependent variable: Selected the mechanism in closed-ended survey question (binary)					
	(1) Budget constraint	(2) Risky	(3) Knowledge barrier	(4) Participation costs	(5) Small cut	(6) Low deposits
Open-ended: Loss	−0.063**	−0.085**	−0.049	−0.023	−0.051	−0.077*
	(0.024)	(0.043)	(0.057)	(0.036)	(0.039)	(0.042)
Open-ended: Unfair	0.030	−0.238***	−0.007	−0.006	−0.173***	−0.001
	(0.084)	(0.042)	(0.145)	(0.095)	(0.026)	(0.123)
Open-ended: Age or long horizon	−0.091***	0.010	−0.206***	−0.019	0.083	−0.058
	(0.029)	(0.059)	(0.049)	(0.044)	(0.061)	(0.055)
Open-ended: Return	−0.111***	−0.098***	−0.196***	−0.053**	−0.057*	−0.149***
	(0.017)	(0.031)	(0.036)	(0.024)	(0.031)	(0.030)
Open-ended: Inflation protection	0.022	−0.183***	−0.067	−0.096***	−0.166***	0.069
	(0.117)	(0.025)	(0.153)	(0.017)	(0.029)	(0.148)
Open-ended: Macro situation	−0.027	−0.227***	−0.065	−0.052*	0.033	−0.239**
	(0.047)	(0.070)	(0.133)	(0.030)	(0.172)	(0.109)
Open-ended: Adjustment frictions	−0.081*	−0.217***	0.062	0.001	0.126	−0.056
	(0.045)	(0.035)	(0.157)	(0.098)	(0.151)	(0.134)
Open-ended: Budget constraint	0.630***	−0.147	0.082	−0.130***	−0.194***	0.191
	(0.123)	(0.095)	(0.133)	(0.028)	(0.034)	(0.144)
Open-ended: Risky	−0.082***	0.233***	0.129**	0.019	−0.033	−0.011
	(0.025)	(0.061)	(0.062)	(0.044)	(0.044)	(0.052)
Open-ended: Knowledge barrier	0.113	0.004	0.508***	0.110	−0.071	−0.015
	(0.139)	(0.125)	(0.093)	(0.113)	(0.087)	(0.128)
Open-ended: Participation costs	−0.026	0.380***	0.440***	0.584***	0.122	−0.033
	(0.099)	(0.143)	(0.132)	(0.136)	(0.133)	(0.121)
Open-ended: Small cut	0.126	−0.077	−0.064	0.257*	0.738***	−0.066
	(0.126)	(0.086)	(0.127)	(0.136)	(0.085)	(0.114)
Open-ended: Low deposits	0.096	−0.036	−0.030	−0.108***	0.042	0.543***
	(0.120)	(0.104)	(0.132)	(0.017)	(0.123)	(0.110)
R^2	0.14	0.09	0.11	0.10	0.10	0.08
Observations	626	626	626	626	626	626

Notes: This table displays regressions of dummy variables indicating different motives behind adjustments in stock investments in response to rate cuts as measured in a closed-ended question on dummy variables for different motives as measured in an open-ended question, pooled across the Negative rate condition, the Zero lower bound condition, and the Positive rate condition. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

E Additional analyses

E.1 Survey evidence on adjustments to cash holdings

In our main analysis of the survey data, we focus on adjustments to consumption, stock holdings and pension holdings, for which we can match motives elicited in the survey with actual decisions measured in register data. In this appendix, we analyze respondents' reasoning about adjustments to cash holdings.

Lack of predictiveness for register-based consumption measure One potential concern with our register-based measure of consumption spending is that it might capture changes in cash holdings. As explained in Section 2.2, the episode of negative rates in 2019-21 was not associated with a change in overall cash holdings in the Danish economy—where cash generally plays a very limited role. To further address this concern, we examine whether survey-reported adjustments to cash holdings are predictive of our register-based consumption measure using the approach from the validation exercise in Section 3.3. In particular, we estimate versions of equation (3) where register-based spending in the year in which a household is first exposed to negative rates is regressed on a dummy variable indicating whether a household reports they would increase cash holdings in response to negative rates, a lagged dependent variable, and controls.

Table E.1 shows that reporting an increase in cash holdings is—if anything—negatively associated with our register-based consumption measure, though the estimate does not reach statistical significance ($p = 0.52$). The estimate remains similar if we add a dummy for reporting an increase in spending. Taken together, these patterns further mitigate concerns that our register-based spending measure captures changes in cash holdings.

Responses to rate cuts in negative vs. positive territory We next follow the approach in Section 3.4 to examine whether households report different cash adjustments to rate cuts in negative vs. non-negative territory. In particular, we estimate versions of equation (4) where dummy variables for different reported adjustments to cash holdings are regressed on dummy variables indicating the Negative rate or the ZLB condition.

The results are shown in Table E.2. The fraction of respondents indicating they would increase their cash holdings rises by 18 pp in the Negative rate condition (Column 3; $p < 0.01$), up from a baseline of 8% in the Positive rate condition. Reported adjustments are similar across the ZLB and the Positive rate condition—as for the other behavioral margins. The non-negligible fraction indicating an increase in cash holdings may appear at odds with the fact that overall cash holdings in Denmark's economy did not change when negative rates were introduced in 2019-21. One potential explanation could be that households underestimate the impracticalities of holding cash in a highly digitized payment system. Another explanation is that our survey only measures whether households would make any adjustment—not the size of the adjustment. Households may thus

Table E.1 Predictiveness of stated intention to increase cash holdings on register-based consumption

	Consumption in t relative to deposits in $t-1$ (register)	
	(1)	(2)
Increase cash (survey)	−0.060	−0.069
	(0.049)	(0.049)
Increase consumption (survey)		0.098
		(0.066)
R^2	0.433	0.434
Observations	1,952	1,95

Notes: This table examines the predictive power of stated intentions to increase cash holdings for how households actually adjusted consumption, as measured in the register data, when they were first exposed to negative deposit rates in their main bank in 2019-21. It displays estimates of the coefficient γ in equation (3), which captures the predictive power of dummy variables indicating particular (directional) behavioral adjustment as reported in the survey for the register-based outcome of interest at the end of the year when a respondent was first affected by negative rates, conditional on a lagged dependent variable. The results displayed in column 2 are estimated using dummies for both intended increases in cash holding and consumption. Robust standard errors are in parentheses.

plan small increases in cash holdings that have limited aggregate impact.

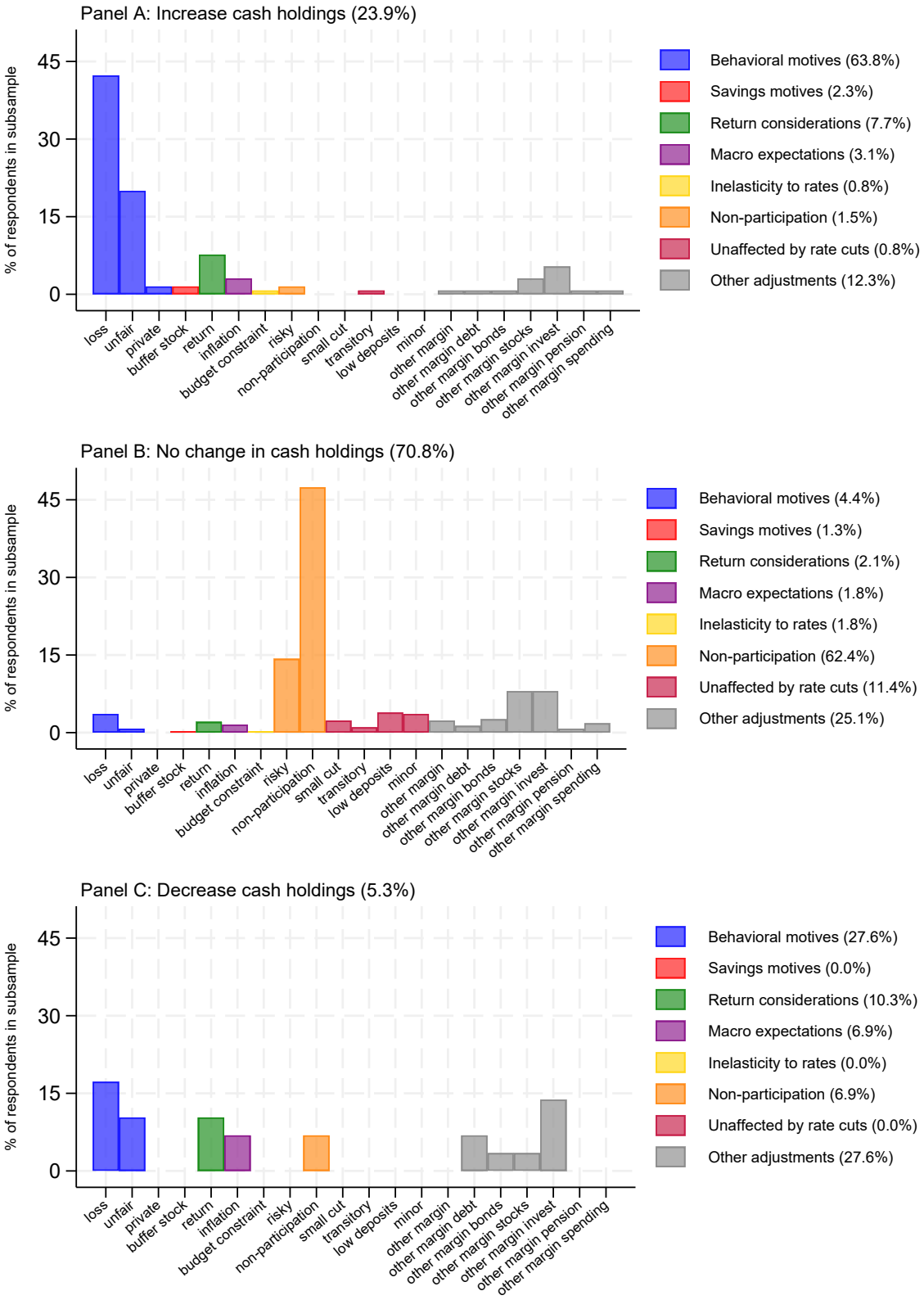
Reasoning underlying responses to negative rates Figure E.1 describes the arguments respondents invoke to explain how they would adjust (or not adjust) their cash holdings in response to negative rates in the open-ended responses. The available sample is smaller than for consumption and stock holdings (discussed in the main Section 3.5), so these estimates are somewhat less precise. For cash, those reporting an increase mostly refer to an aversion to losses (42%) or immoral and unfair practices by banks (20%), while those planning no change mostly cite a general unwillingness to hold cash (47%).

Table E.2 Responses of cash holdings to rate cuts in negative vs. positive territory

	Cash		
	(1) Decrease	(2) No change	(3) Increase
Negative rate	0.016*	−0.194***	0.177***
	(0.009)	(0.015)	(0.013)
ZLB	0.010	−0.018	0.007
	(0.012)	(0.020)	(0.016)
Constant	0.040***	0.878***	0.083***
	(0.008)	(0.014)	(0.011)
R^2	0.00	0.03	0.03
Observations	6,231	6,231	6,231

Notes: This table displays regressions of dummy variables for decreasing, not changing or increasing cash holdings in response to the rate cut on dummy variables for the Negative rate condition and the Zero lower bound condition, the Positive rate condition being the omitted base category. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Figure E.1 Motives behind cash holding responses to negative rates



Notes: This figure displays the frequencies of different motives behind adjustments in cash holdings in response to a rate cut below zero as measured in the open-ended question for those planning to increase (Panel A), not change (Panel B) or decrease (Panel C) cash holdings. On the right, we display the fractions of respondents mentioning at least one motive from a given family of motives.

E.2 Preferences and behavioral responses to negative interest rates

In this appendix, we provide additional evidence on how measures for respondents' preferences predict their behavioral responses to the 2019-21 rate cuts.

Measures We elicit loss aversion through an incentivized task involving six binary choices between a guaranteed payment of DKK 0 and a lottery offering a 50% chance of winning DKK 60 and a 50% chance of losing varying amounts. This task follows a standard elicitation of nominal loss aversion (Abeler et al., 2011). Given that the local curvature of the utility function is close to zero, the measure should not capture risk aversion. Instead, the number of times a respondent chooses the safe over the uncertain amount can be interpreted as a measure of loss aversion. We exclude respondents with more than one switching point between safe and uncertain payoffs (1.7% of our sample) as well as those who are classified as loss-loving according to our measure (5.3% of our sample). In addition, we employ standard unincentivized measures of patience and risk aversion that have been validated by previous literature (Falk et al., 2018). These measures are elicited on categorical scales from 0 to 10, which we take as cardinal. The exact wording can be found in the instructions presented in Appendix G. We z-score the three preference measures using their sample means and standard deviations.

Empirical approach We follow a similar approach as in the validation exercise (Section 3.3).In particular, we focus on respondents who, at some point in 2019-21, became exposed to negative interest rates at their main bank, and the year in which these respondents first faced negative rates. We then regress the outcome of interest in that year jointly on our three preference measures, a lagged dependent variable and the same set of controls as included earlier.[2]

Results The results are presented in Table E.3. A one–standard deviation increase in loss aversion is associated with post-rate cut deposit holdings that are lower by 1.8% of initial deposit balances (Column 1; $p < 0.1$). Loss aversion also predicts somewhat higher consumption and stock-holding (conditional on baseline outcomes), though these associations are more noisily measured (Columns 2 and 3; $p = 0.70$ and $p = 0.19$, respectively). Risk aversion appears to push in the opposite direction: a one–standard deviation increase in risk aversion is associated with deposit balances that are higher by 3.4% of initial deposits (Column 1; $p < 0.01$) and with consumption and stock holdings that are lower by 5.9% (Column 2; $p < 0.05$) and 5.0% (Column 3; $p < 0.01$) of baseline deposits (conditional on baseline outcomes). Patience is weakly associated with higher stock holdings but does not appear to matter for the other behavioral outcomes.

[2]For this exercise, we do not restrict the sample to respondents with bank deposits of at least 50,000 kroner *at the time of the survey*. This restriction is applied only in analyses that rely on responses to the hypothetical rate-cut scenarios, which are not designed to be relevant for respondents with lower deposit balances. Because the exercise in this Appendix uses only preference measures among the survey-elicited variables, we do not impose this restriction and instead use the largest possible sample.

Taken together, while there is suggestive evidence that loss aversion is associated with stronger responses to negative interest rates, risk aversion appears to limit the extent to which households are willing to withdraw funds from deposits—even when one must pay interest to the bank.

Table E.3 Preferences and behavioral responses

	Outcome in t relative to deposits in $t-1$			
	(1) Deposits	(2) Consumption	(3) Stocks	(4) Pension
Loss aversion (z)	-0.018^{*}	0.009	0.015	-0.001
	(0.010)	(0.023)	(0.012)	(0.001)
Risk aversion (z)	0.034^{***}	-0.059^{**}	-0.050^{***}	0.000
	(0.011)	(0.027)	(0.015)	(0.001)
Patience (z)	-0.012	-0.015	0.021^{*}	0.000
	(0.010)	(0.023)	(0.012)	(0.001)
Outcome in $t-1$ relative to deposits in $t-1$		0.561^{***}	1.195^{***}	0.868^{***}
		(0.027)	(0.022)	(0.022)
R^2	0.099	0.545	0.866	0.700
Observations	2,834	2,127	2,834	2,834

Notes: This table examines the predictiveness of different preference measures for how households adjusted different margins of behavior over the year in which they were first exposed to negative deposit rates in their main bank in 2019-21, conditional on controls. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

E.3 Motives and behavioral responses to negative rates

In this appendix, we examine to what extent the open-ended considerations elicited in our survey predict households' behavioral responses to negative rates. We consider both actual adjustments to the 2019-21 cuts, as measured in the register data, and the survey-reported adjustments. For power reasons, we focus on consumption and stock holdings, for which we have the largest available samples.

Empirical approach When relating considerations to behavioral responses measured in the register data, we follow a similar approach as in the validation exercise in Section 3.3. We focus on respondents in the Negative rate condition who were actually exposed to negative rates in 2019-21. The outcome is measured in the year t in which the respondent became first exposed. We aim to compare behavioral responses across participants citing *different* motives. To this end, we choose as baseline motive b the motive that suggests the most negative or muted response in the outcome of interest (for consumption: income effects; for stock holdings: non-participation), and compare participants citing another motive m to this group. For each motive $m \neq b$, we estimate the following specification:

$$y_{i,t} = \alpha + \beta_m \mathbf{1}(\text{Motive}_m)_i + \gamma \mathbf{1}(\text{Neither motive})_i + \delta y_{i,t-1} + \mu X_i + \epsilon_{i,t}, \qquad (6)$$

where $\mathbf{1}(\text{Motive}_m)_i$ is an indicator for citing motive m. The dummy $\mathbf{1}(\text{Neither motive})_i$ indicates participants who cite neither the baseline motive nor motive m (i.e., those who only cite third motives or no motive at all). Thus, the omitted category consists of participants who cite the baseline motive but not motive m, and β_m captures the incremental effect of citing motive m. We include a lagged dependent variable and scale both the current and lagged values of the register-based outcome of interest—$y_{i,t}$ and $y_{i,t-1}$—by ex-ante deposits. X_i is a vector of controls capturing both baseline characteristics and changes in some variables from year $t-1$ to year t.[3]

When using survey-reported adjustments as outcomes, we follow an analogous approach. Because the survey directly asks respondents how they would change their behavior, these specifications do not include a lagged dependent variable.

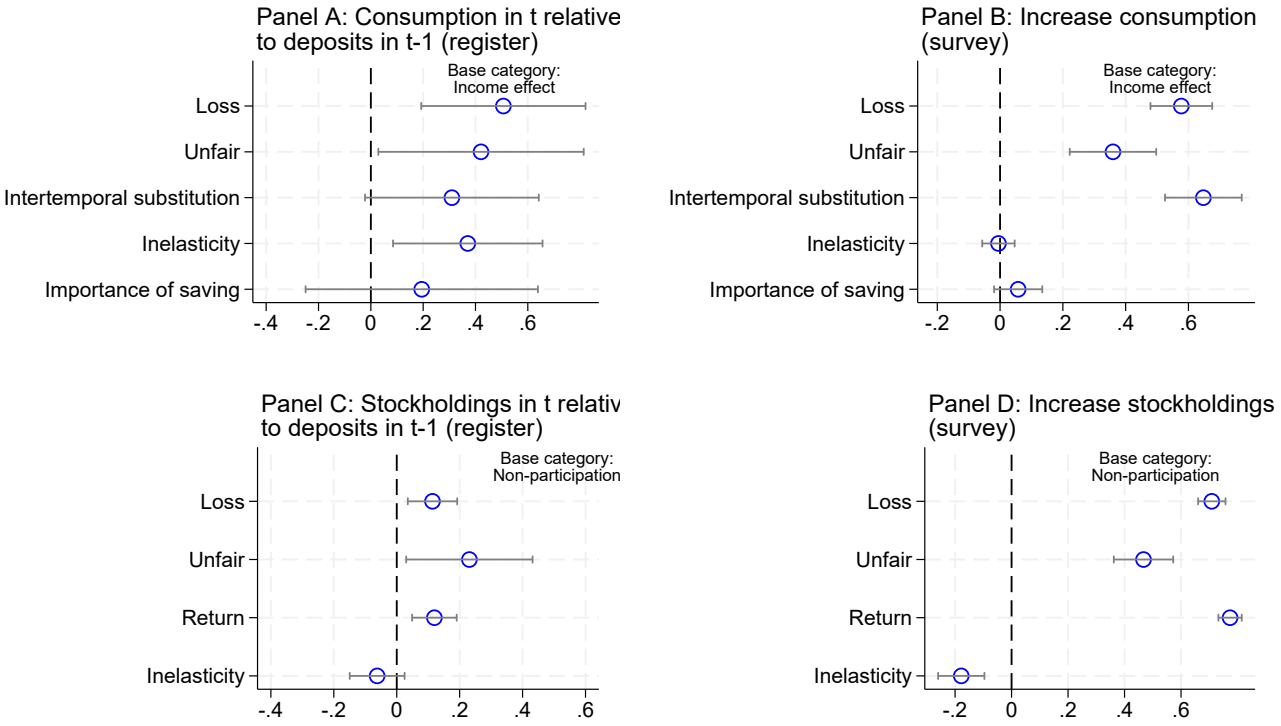
Results The results are presented in Figure E.2. We begin with the register-based outcomes. Panel A shows that, conditional on ex-ante spending, individuals who cite loss aversion spend significantly more than those citing income effects only—a large difference corresponding to 50% of ex-ante deposits ($p < 0.01$). Viewing banks' behavior as unfair and intertemporal substitution motives are also associated with sizable differences relative to citing income effects ($p < 0.05$ and $p = 0.07$). The large magnitudes could reflect an important role for big-ticket purchases: some individuals may shift such purchases forward to avoid losses, while others cut back in response to lower disposable income from negative deposit rates. Households only invoking income effects spend significantly less than those citing a general inelasticity of consumption to interest rates ($p < 0.05$) and about as much as those emphasizing the general importance of saving.

Turning to stocks, shown in Panel C, respondents citing loss aversion, perceived unfairness, or return differentials hold stock positions that are 11–23% of baseline deposits higher than those citing general non-participation motives (all $p < 0.05$), conditional on initial holdings. By contrast, respondents reporting insensitivity of stock investment to interest rates exhibit a response similar to that of non-participants. The patterns in the register-based outcomes are largely mirrored in the survey-based outcomes (Panels B and D).

Taken together, the key motives identified in Section 3.5 are associated with significantly different adjustments to negative rates—as measured in both self-reports and in administrative data.

[3] In particular, we control for year fixed effects, main bank fixed effects, municipality of residence, gender, marital status, age, and deciles of income, total debt, stock holdings, deposits, and housing value, as well as changes in the number of children, marital status, and employment status.

Figure E.2 Motives and behavioral responses



Notes: This figure examines the predictiveness of motives underlying behavioral responses to a hypothetical rate cut below zero as measured in our survey for (i) how households actually adjusted different margins of behavior when they were first exposed to negative deposit rates in their main bank in 2019-21 (Panels A and C) and (ii) households' reported behavioral responses to the hypothetical rate cut (Panels B and D). It displays estimates of the coefficient β_m in equation (6). In Panels A and C, this captures the effect of citing a particular motive in the open-ended question on the behavior of interest as measured in the register data in the year when a respondent was first exposed to negative rates, conditional on a lagged dependent variable and controls. In Panels B and D, it captures the effect on a dummy for reporting a particular adjustment in the survey, conditional on controls. Each panel is based on the subsample of respondents from our main sample who were exposed to negative interest rates on deposits at their main bank at some point during 2019-21. The estimates include 95% confidence bands calculated using robust standard errors.

F Research transparency

Preregistration We preregistered our survey at the AEA RCT Registry (AEARCTR-0015155). The preregistration includes details on the sample, survey distribution, target number of respondents (9,400), survey design, survey instructions, and research questions. The following notes document a few deviations from the preregistration.

- In our preregistration, we indicated that we would work with both complete and partial responses to our survey. While an unexpectedly high number of individuals started our survey (16,573 respondents proceeding to the survey after reading the introductory page outlining the content and format), there was also an unexpectedly high rate of attrition, with only 9,371 respondents completing the full survey. The relatively high dropout seems to primarily reflect two factors: (i) some participants exited the survey after being asked about their actual bank deposit balances, which may have felt intrusive; and (ii) others dropped out upon encountering the first hypothetical scenario, potentially due to a reluctance to exert cognitive effort to engage with this type of question.

  Eventually, we decided to focus on complete responses, for the following reasons: first, including partial responses would have led to strong variation of the available working sample across analyses and outcomes, complicating the interpretation of our results. Second, given the dropout patterns outlined above, attrition likely indicates a general unwillingness to exert effort, to pay attention, or to respond truthfully when responding to the survey.

  We believe that our focus on complete responses is unproblematic. First, our final number of completes is almost identical to our initially targeted sample size. Second, Table F.1 below shows that completes are more likely to be male and have somewhat higher average education, income and wealth than those starting the survey. However, these differences are modest. Third, our main results are fully robust to including partial responses (Appendix Table B.5 and Appendix Figure A.10).
- In our preregistration, we had not specified a separate analysis for respondents with varying levels of deposits. In our main analysis, we focus on individuals who report bank deposits worth at least DKK50,000—for whom the rate cut for deposits starting at DKK100,000 can be expected to be meaningful. As explained in Section 3.1, this restriction somewhat increases average income and wealth, but otherwise has no strong effects on the composition of our sample. Moreover, we analyze the data for respondents across all levels of deposits (Appendix Table B.5 and Appendix Figure A.10). Our results are robust across all sample definitions, but—as expected—feature somewhat smaller magnitudes when including respondents for which the rate cut will not apply due to having low deposits.

Ethics approval The study obtained ethics approval from the University of Copenhagen.

Data and code availability We will make our data and code available upon publication to the extent this is possible given legal restrictions in the Danish data infrastructure.

Conflicting interests We declare that we have no conflicting interests.

Table F.1 Summary statistics of respondents starting vs. completing the survey

	Mean	
	(1) Past first page	(2) All completes
Age	49.0	49.1
Female (%)	50.8	45.0
Copenhagen (%)	11.9	12.4
Higher education (%)	45.4	51.0
Income (DKK)	458,537	517,375
Employed (%)	82.3	84.9
Deposits (DKK)	210,348	230,947
Net wealth (DKK)	605,874	740,477
Stocks (DKK)	260,804	346,922
Stock owners (%)	37.6	43.0
Housing value (DKK)	839,828	984,067
Home owners (%)	58.1	62.4
Debt (DKK)	718,555	840,751
Debtors (%)	76.4	78.6
Observations	16,142	9,164

Notes: The table shows means of different covariates among those starting the survey (i.e., proceeding beyond the informational welcome page) and among those completing the survey.

G Survey instructions

There is a cross-randomization on three levels:

1) 80% of respondents are randomized into the Negative Rates condition, 10% into the ZLB condition, 10% into the Positive Rates condition. The conditions differ as follows: Questions with a "_N" at the end only appear in the Negative Rates condition. Questions with a "_Z" at the end only appear in the ZLB condition. Questions with a "_P" at the end only appear in the Positive Rates condition.

2) The order of screens 3, 15, 16 and 5 is fully randomized with equal probability for each combination.

3) Every respondent only sees a random two out of the following four questions: 3c, 5c, 15c and 16c. The following combinations are possible (ignoring order):
- 3c, 5c (80% probability)
- 3c, 15c (5% probability)
- 3c, 16c (5% probability)
- 5c, 15c (5% probability)
- 5c, 16c (5% probability)

Question 6 only appears for a random 10% of the overall sample within the random 22.5% (90% $\times$ 25%) of the overall sample for which question 5c is included AND appears last (i.e., after screens 3, 15, 16).

Note: The instructions below are for the order 3, 15, 16, 5.

Screen 1: Welcome & About this survey

Welcome

Thank you so much for participating in this survey on household finances - we really appreciate it!

In this survey, we will ask you about your financial decisions under a hypothetical scenario in which the interest rates that banks pay on deposits change.

The survey includes several multiple choice questions and two open-text questions, where we would like you to write down your thoughts. It takes about 2 minutes to complete each of the two open-text questions and around 12 minutes to complete the entire questionnaire.

We recommend taking this survey on a computer rather than on a phone. You can always

interrupt and continue where you left off by using the link in your invitation letter – even on a different device.

Please take your time to respond carefully.

Screen 2: Changes in deposits

<![if Negative Rates condition]>

Question 2a_N

Interest rate drop from 0% to –1%

In 2019 and 2020, many Danish banks introduced negative interest rates on bank deposits. For every krone above a certain threshold, customers would need to pay interest to the bank for keeping money at the bank.

Please imagine a hypothetical scenario where the interest rate in all Danish banks is initially 0% on all deposits. All Danish banks – including the bank where you have your NemKonto – then lower the interest rate on amounts in excess of 100,000 kroner from 0 to –1%.

This means that for every krone up to 100,000 kroner, the interest rate remains at 0%. For every krone above 100,000 kroner, you now have to pay an interest rate of 1% to the bank.

For deposits at other banks than the one where your NemKonto is, the interest will be –1% starting from the first krone.

Illustration:

[Next button]

<![endif]>

<![if ZLB condition]>

Question 2a_Z

Interest rate drop from 1% to 0%

Sometimes, banks pay higher interest rates on the part of their customers' deposits that exceeds a certain threshold. This means that customers receive a higher interest rate on every krone above the threshold than on every krone below the threshold.

Please imagine a hypothetical scenario where the interest rate in all Danish banks is initially 0% on all deposits up to 100,000 kroner and 1% on every krone above this threshold. All Danish banks – including the bank where you have your NemKonto – then lower the interest rate on amounts in excess of 100,000 kroner from 1% to 0%.

This means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 0%. For every krone above the threshold, the bank now pays 0% instead of 1%.

Illustration:

[Next button]

<![endif]>

<![if Positive Rates condition]>

Question 2a_P

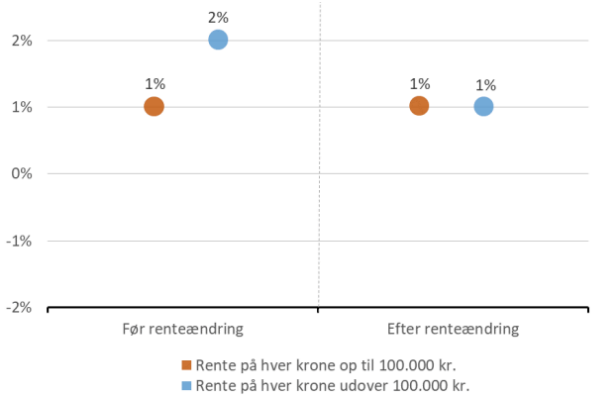
Interest rate drop from 2% to 1%

Sometimes, banks pay higher interest rates on the part of their customers' deposits that exceeds a certain threshold. This means that customers receive a higher interest rate on every krone above the threshold than on every krone below the threshold.

Please imagine a hypothetical scenario where the interest rate in all Danish banks is initially 1% on all deposits up to 100,000 kroner and 2% on every krone above this threshold. All Danish banks – including the bank where you have your NemKonto – then lower the interest rate on amounts in excess of 100,000 kroner from 2% to 1%.

This means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 1%. For every krone above the threshold, the bank now pays 1% instead of 2%.

Illustration:



[Next button]

<![endif]>

Question 2b

Imagine you are aware of this change in the interest rates on bank deposits, and that your economic and financial situation is otherwise identical to your actual current situation.

Would you do something to change the amount of money you have on your bank accounts because of the change in interest rates?

Note: We refer to the combined amount on all your bank accounts, those at your main bank as well as those at other banks.

- I would reduce the total amount on my bank accounts.
- I would not change the total amount on my bank accounts.
- I would increase the total amount on my bank accounts.

Screen 3: Changes in consumption spending

<![if Negative Rates condition]>

Question 3a_N

Interest rate drop from 0% to –1%: Consumption expenditure

Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 0% to -1%.

[Dropdown with text "Click here to review detailed explanation of the situation"

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up to the 100,000 kroner threshold, the interest rate remains at 0%. But for every krone above the threshold, you now have to pay an interest rate of 1% to the bank instead of 0%.

The threshold applies to your deposits across all your accounts at the bank where you have your NemKonto.

If you transfer money to another bank than the one where your NemKonto is, you will have to pay the 1% interest rate on every krone at the other bank."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if ZLB condition]>

Question 3a_Z

Interest rate drop from 1% to 0%: Consumption expenditure

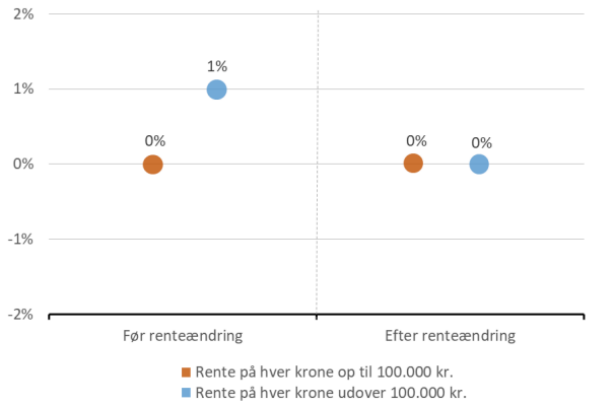
Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 1% to 0%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 0%. For every krone above the threshold, the bank now pays 0% instead of 1%.

Illustration:



<![endif]>

end of dropdown]

<![endif]>

<![if Positive Rates condition]>

Question 3a_P

Interest rate drop from 2% to 1%: Consumption expenditure

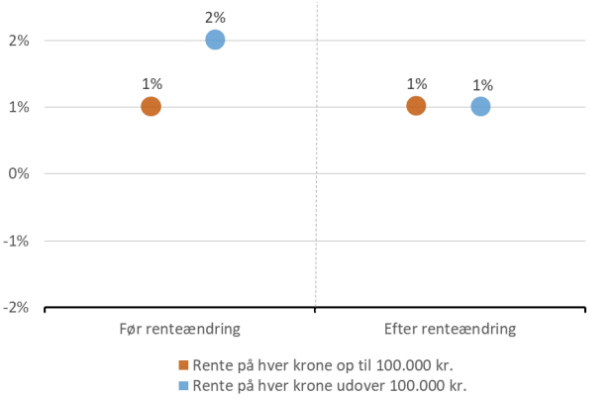
Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 2% to 1%.

[Dropdown with text "Click here to review detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 1%. For every krone above the threshold, the bank now pays 1% instead of 2%."

Illustration:



<![endif]>

end of dropdown]

<![endif]>

Question 3b

Would the change in interest rates make you change your expenses on consumption items, including purchases of larger durable items (e.g. electronics, kitchen appliances or cars), vacations and trips, as well as non-durable goods and services (e.g. groceries, clothes, restaurant meals)?

Note: Increasing your expenses on consumption items can mean purchasing more goods and services and/or purchasing goods and services of higher quality. Changes in spending may also be due to postponing or bringing forward purchases that you had already planned.

- I would increase my expenses
- I would not change my expenses
- I would decrease my expenses

[show question 3c only in 90% of the cases – see above for the exact randomization]

Question 3c

We would like to learn about the reasons behind your decision.

Please explain why you would respond to the change in rates in this way.

Please respond in two to three full sentences.

[Open-text box]

Screen 15: Changes in cash holdings

<![if Negative Rates condition]>

Question 15a_N

Interest rate drop from 0% to –1%: Cash holdings

Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 0% to –1%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up to the 100,000 kroner threshold, the interest rate remains at 0%. But for every krone above the threshold, you now have to pay an interest rate of 1% to the bank instead of 0%.

The threshold applies to your deposits across all your accounts at the bank where you

have your NemKonto.

If you transfer money to another bank than the one where your NemKonto is, you will have to pay the 1% interest rate on every krone at the other bank."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if ZLB condition]>

Question 15a_Z

Interest rate drop from 1% to 0%: Cash holdings

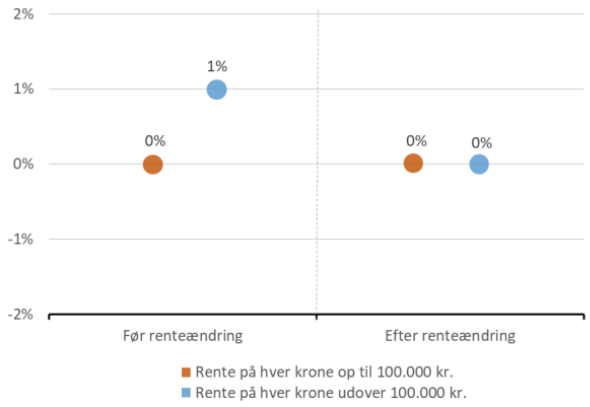
Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 1% to 0%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 0%. For every krone above the threshold, the bank now pays 0% instead of 1%."

Illustration:



<![endif]>

end of dropdown]

<![endif]>

<![if Positive Rates condition]>

Question 15a_P

Interest rate drop from 2% to 1%: Cash holdings

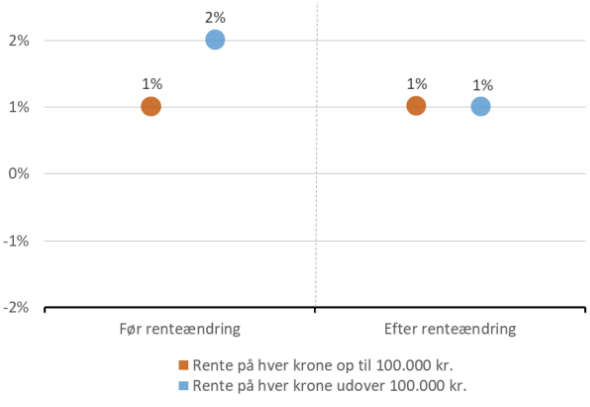
Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 2% to 1%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 1%. For every krone above the threshold, the bank now pays 1% instead of 2%."

Illustration:



<![endif]>

end of dropdown]

<![endif]>

Question 15b

Would you change how much money you hold in cash because of the change in interest rates?

Note: By cash we refer to bank notes and coins.

- I would hold less cash.
- I would not change how much cash I hold.
- I would hold more cash.

[show question 15c only in 10% of the cases – see above for the exact randomization]

Question 15c

We would like to learn about the reasons behind your decision.

Please explain why you would respond to the change in rates in this way.

Please respond in two to three full sentences.

[Open-text box]

Screen 16: Changes in pension saving

<![if Negative Rates condition]>

Question 16a_N

Interest rate drop from 0% to –1%: Pension saving

Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 0% to –1%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up to the 100,000 kroner threshold, the interest rate remains at 0%. But for every krone above the threshold, you now have to pay an interest rate of 1% to the bank instead of 0%.

The threshold applies to your deposits across all your accounts at the bank where you have your NemKonto.

If you transfer money to another bank than the one where your NemKonto is, you will have to pay the 1% interest rate on every krone at the other bank."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if ZLB condition]>

Question 16a_Z

Interest rate drop from 1% to 0%: Pension saving

Please think about the **same situation as before** where banks lower the interest rate on every krone in excess of 100,000 kroner from 1% to 0%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 0%. For every krone above the threshold, the bank now pays 0% instead of 1%."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if Positive Rates condition]>

Question 16a_P

Interest rate drop from 2% to 1%: Pension saving

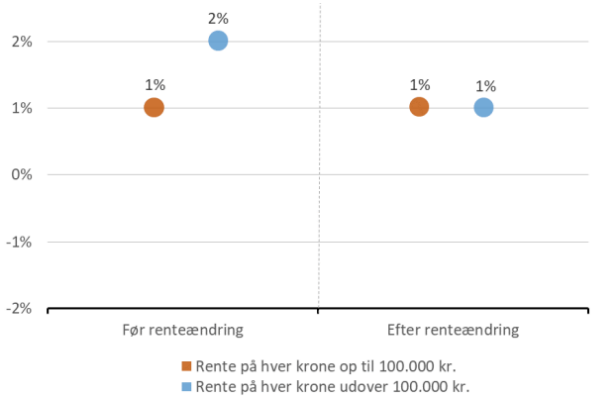
Please think about the **same situation as before** where banks lower the interest rate on every krone in excess of 100,000 kroner from 2% to 1%.

[Dropdown with text "Click here to review a detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 1%. For every krone above the threshold, the bank now pays 1% instead of 2%.

Illustration:



<![endif]>

end of dropdown]

<![endif]>

Question 16b

Would you change the amount of money you pay into or withdraw from pension saving accounts because of the change in interest rates?

- I would pay less into or withdraw more from pension saving accounts.
- I would not change how much I pay into or withdraw from pension saving accounts.
- I would pay more into or withdraw less from pension saving accounts.

[show question 16c only in 10% of the cases – see above for the exact randomization]

Question 16c

We would like to learn about the reasons behind your decision.

Please explain why you would respond to the change in rates in this way.

Please respond in two to three full sentences.

[Open-text box]

Screen 5: Changes in equity purchases

<![if Negative Rates condition]>

Question 5a_N

Interest rate drop from 0% to –1%: Stock investment

Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 0% to –1%.

[Dropdown with text "Click here to review detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up to the 100,000 kroner threshold, the interest rate remains at 0%. But for every krone above the threshold, you now have to pay an interest rate of 1% to the bank instead of 0%.

The threshold applies to your deposits across all your accounts at the bank where you have your NemKonto.

If you transfer money to another bank than the one where your NemKonto is, you will have to pay the 1% interest rate on every krone at the other bank."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if ZLB condition]>

Question 5a_Z

Interest rate drop from 1% to 0%: Stock investment

Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 1% to 0%.

[Dropdown with text "Click here to review detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 0%. For every krone above the threshold, the bank now pays 0% instead of 1%."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if Positive Rates condition]>

Question 5a_P

Interest rate drop from 2% to 1%: Stock investment

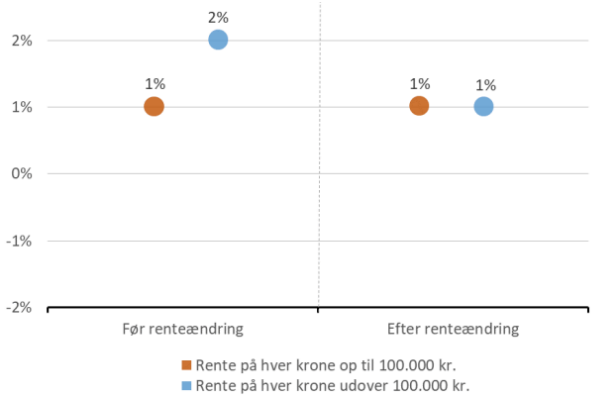
Please think about the **same situation as before**, where banks lower the interest rate on every krone in excess of 100,000 kroner from 2% to 1%.

[Dropdown with text "Click here to review detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 1%. For every krone above the threshold, the bank now pays 1% instead of 2%."

Illustration:



<![endif]>

end of dropdown]

<![endif]>

Question 5b

Would you change how much money you invest in stocks because of the change in interest rates?

Note: By stocks we refer to individual stocks, but also shares in stock mutual funds and other stock-based securities like ETFs.

- I would invest more money in stocks or would start to invest in stocks.
- I would not change how much money I invest in stocks.
- I would invest less money in stocks or would stop investing in stocks.

[show question 5c only in 90% of the cases – see above for the exact randomization]

Question 5c

We would like to learn about the reasons behind your decision.

Please explain why you would respond to the change in rates in this way.

Please respond in two to three full sentences.

[Open-text box]

Screen 6: Reasons behind changes in equity purchases: Structured

[Note: Only show this question for 10% of the overall sample, all from the 22.5% of responses where question 5c is shown AND comes after questions 3, 15 and 16]

Question 6a

Please think again about why you would [“invest more” / “not change how much you invest” / “invest less”] in stocks when the interest rate on every krone above 100,000 kroner falls from [0% to –1%/1% to 0%/2% to 1%].

Would any of the following considerations play a role? Please tick all that apply.

[randomize the order of the following response options except for the last one]

- I don’t like suffering a loss by keeping money in a bank account.
- I consider the reduction in rates to be unfair or immoral.
- Stock investment offers protection against inflation.
- The reduction in rates changes my expectations about the general situation of the economy.
- Changing my stock holdings is difficult, e.g., because of fees for selling and buying, because it takes time, or because I am too disorganized or not the type for changes.
- I typically do not consider interest rates when deciding about my stockholdings.
- The reduction in rates is very small.
- My deposits do not exceed 100,000 kroner or do not exceed it by much.
- The reduction in rates makes stocks relatively more attractive as a way to earn a return on my savings.
- Stock investment is very risky.
- I have little knowledge of stocks as an investment option.
- Stock market participation takes a lot of time, is stressful, and/or costs money.
- I do not have any money to invest.
- Stock investment only makes sense with a sufficiently long investment horizon.
- None of the above.

Screen 8: Other behavioral adjustments

<![if Negative Rates condition]>

Question 8a_N

Interest rate drop from 0% to –1%: Other responses

We already asked you about changes in bank deposits, cash, consumption spending, pension saving and stock investment in the hypothetical situation.

[Dropdown with text “Click here to review detailed explanation of the situation”.

<![if clicked, show this text:]>

“The change in interest rates means that for every krone up to the 100,000 kroner threshold, the interest rate remains at 0%. But for every krone above the threshold, you now have to pay an interest rate of 1% to the bank instead of 0%.

The threshold applies to your deposits across all your accounts at the bank where you have your NemKonto.

If you transfer money to another bank than the one where your NemKonto is, you will have to pay the 1% interest rate on every krone at the other bank."

Illustration:

<![endif]>

end of dropdown]

<![endif]>

<![if ZLB condition]>

Question 8a_Z

Interest rate drop from 1% to 0%: Other responses

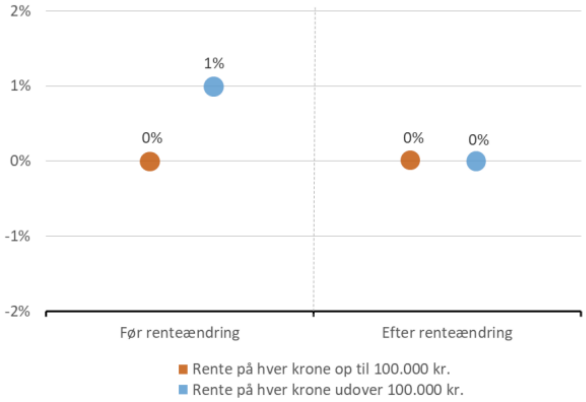
We already asked you about changes in bank deposits, cash, consumption spending, pension saving and stock investment in the hypothetical situation.

[Dropdown with text "Click here to review detailed explanation of the situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 0%. For every krone above the threshold, the bank now pays 0% instead of 1%."

Illustration:



<![endif]>

end of dropdown]

<![endif]>

<![if Positive Rates condition]>

Question 8a_P

Interest rate drop from 2% to 1%: Other responses

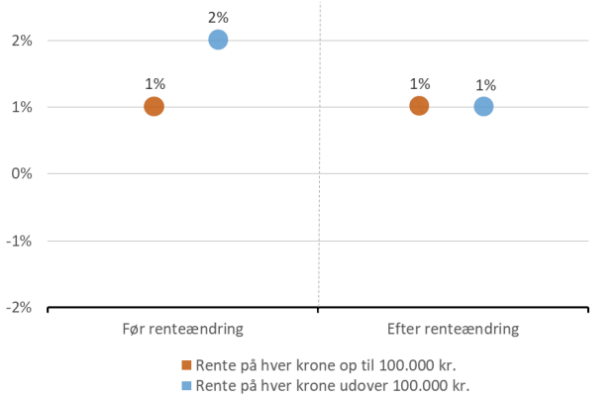
We already asked you about changes in bank deposits, cash, consumption spending, pension saving and stock investment in the hypothetical situation.

[Dropdown with text "Click here to review a detailed explanation of the hypothetical situation".

<![if clicked, show this text:]>

"The change in interest rates means that for every krone up until the 100,000 kroner threshold, the interest rate remains at 1%. For every krone above the threshold, the bank now pays 1% instead of 2%."

Illustration:



<![endif]>

end of dropdown]

<![endif]>

Question 8b

Are there any other ways in which you would react to the change in interest rates? Please tick all that apply.

[randomize the order of the following response options except for the last two]

- I would buy gold.
- I would repay my debt more quickly.

- I would invest more in real estate (e.g., homes, home improvements).
- I would increase my charitable giving.
- I would transfer more funds to friends or relatives, in the form of loans or gifts.
- Other: ___.
- None

Screen 9: End of hypothetical scenario

Question 9a

End of the hypothetical scenario

The part of the survey containing a hypothetical scenario is now over. From now on, please think about your actual current situation in the real world.

Screen 10: Actual deposits

Question 10a

Your actual bank deposits

We would like to ask you some questions on your actual bank deposits.

Please think of all your deposits at your main bank (the bank where your NemKonto is). How much was the total combined amount of money on these accounts at the end of the previous month?

Include both accounts held solely by you and any accounts held jointly with your spouse or partner

- Less than 10,000 kroner
- Between 10,000 and 25,000 kroner
- Between 25,000 and 50,000 kroner
- Between 50,000 and 75,000 kroner
- Between 75,000 and 100,000 kroner
- Between 100,000 and 150,000 kroner
- Between 150,000 and 200,000 kroner
- Between 200,000 and 500,000 kroner
- Between 500,000 and 1,000,000 kroner
- More than 1,000,000 kroner
- Prefer not to say.

Question 10b

Out of this amount, what fraction (in %) is held in joint accounts with your spouse or partner?

___ %

Question 10c

Imagine you put one additional krone into an account at your main bank. What interest rate do you think your bank would currently pay on this additional krone?

___ %

Question 10d

In 2019 and 2020, many Danish banks introduced negative interest rates on bank deposits. Were you aware of this at the time?

- Yes
- No

Screen 11: Loss aversion

Question 11a

Six decisions

Next we ask you to make a series of six decisions. For each decision, we ask you to choose between:

(a) You are sure not to win or lose anything. This means you receive DKK 0 with certainty.
(b) You win DKK 60 with 50% chance and lose a specific amount with 50% chance. The size of the loss varies across the six decisions.

Note: If you are among the respondents who are selected to win a gift card, the outcome of one of your six decisions will be added to or deducted from the amount on the card.

[Dropdown with text "Click here for further explanation"

<![if clicked, show this text:]>

"If you win a gift card, we will select one of your six decisions at random. If you chose option (a) in this decision, nothing will be added or deducted, so the gift card will be worth 1,000 kroner. If you chose option (b), we will randomize between either adding 60 kroner to the gift card or deducting the loss amount stated in the selected decision problem."

<![endif]>

end of dropdown]

[Show following table by default:]

	Option (a)	Option (b)
Decision 1	**DKK 0** for sure	**Winning DKK 60** with 50% chance or **losing DKK 20** with 50% chance
Decision 2	**DKK 0** for sure	**Winning DKK 60** with 50% chance or **losing DKK 30** with 50% chance
Decision 3	**DKK 0** for sure	**Winning DKK 60** with 50% chance or **losing DKK 40** with 50% chance
Decision 4	**DKK 0** for sure	**Winning DKK 60** with 50% chance or **losing DKK 50** with 50% chance
Decision 5	**DKK 0** for sure	**Winning DKK 60** with 50% chance or **losing DKK 60** with 50% chance
Decision 6	**DKK 0** for sure	**Winning DKK 60** with 50% chance or **losing DKK 70** with 50% chance

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Screen 12: Background characteristics and additional questions

Question 12a

Lastly, we would like to ask you two additional questions about yourself.

How do you see yourself: are you a person who is generally willing to take risks, or do you try to avoid taking risks?

Please use a scale from 0 to 10, where a 0 means you are "completely unwilling to take risks" and a 10 means you are "very willing to take risks". You can also use the values in-between to indicate where you fall on the scale.

[Answer slider ranging from 0 to 10.]

In comparison to others, are you a person who is generally willing to give up something today in order to benefit from that in the future?

Please use a scale from 0 to 10, where a 0 means you are "completely unwilling to give up something today" and a 10 means you are "very willing to give up something today". You can also use the values in-between to indicate where you fall on the scale.

[Answer slider ranging from 0 to 10.]

Screen 13: Feedback

Question 13a

If you have any thoughts or input you would like to share with us, either regarding household finances or the questionnaire you just completed, please write them in the box below:

[Open-text box]

Screen 14: Goodbye

Question 14a

Thank you for your answers.

Remember that we are giving away a total of 30 GoGift gift cards to those who complete the entire questionnaire.

If you win a gift card, you will be notified directly in your e-Boks by 1st of May, 2025.

Please close your browser to complete the questionnaire.