Portfolio Rebalancing and Consumption Response of Households to Monetary Policy Shocks

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Abstract

Using micro-level administrative data from India, we examine the portfolio rebalancing and consumption response of households to changes in interest rate. By exploiting variation in the timing of expiry of term deposits, we find that when interest rate falls, households rebalance their portfolio from safe assets to risky assets. We estimate the interest elasticity of risky investment to be -26 and the interest elasticity of consumption to be -0.3. The effects on consumption and risky investment are smaller for term depositors with automatic renewal. Households with existing loans have a larger consumption effect but a smaller portfolio rebalancing effect.

Keywords: Monetary Policy, Household Finance, Portfolio Rebalancing, Consumption, Savings, Liquidity

JEL Classification: D12, D14, D91, E21, E22, E52, G21, G50

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1. Introduction

The effectiveness of monetary policy depends on the monetary transmission mechanisms. Through changes in interest rates, central banks have the potential to influence households' consumption and savings choices, as well as financial portfolio decisions. These channels have been examined by recent macroeconomic models that combine heterogeneous agent models with different asset portfolios (Kaplan et al. (2018)), sticky households' expectations (Auclert et al. (2020)), and marginal propensity to take risk (Kekre and Lenel (2022)). Nonetheless, direct evidence of households' *concurrent* decisions in these domains remains scarce. We seek to bridge the gap by using micro-level administrative data from India to quantify households' portfolio and consumption decisions when faced with monetary policy shocks.

Evidently, monetary policy affects households differently due to their composition of income and components of wealth (McKay and Wolf (2023)). One key consideration is savings. However, previous research on monetary policy primarily focuses on heterogeneity in liquid wealth (Kaplan et al. (2014)), house ownership (Disney et al. (2010)) and mortgage contract type (Di Maggio et al. (2017)). Little is known about safe assets in the form of bank deposits. Here, we focus on term deposits, which offer a fixed interest rate for a predetermined period. Term deposits contribute to a sizeable component of the economy and play an important role in the household's balance sheet[1]. As such, it is of interest to study how the contract rigidity of term deposits could impact and influence the monetary policy pass-through. In this paper, we contribute to the literature by simultaneously examining term depositors' portfolio and consumption choices when faced with interest rate shocks.

We centre our study around the Reserve Bank of India's decision to reduce the bank rate (discount rate) by 75 basis points in April 2016. As there is a tight pass-through from the bank rate to the term deposit rate of financial institutions, we can estimate directly how changes in interest rate impact households' decisions. Using a difference-in-differences strategy from March 2016 to October 2016, we find that when interest rate falls, households increase consumption by 3 percent (796 rupees, 11 USD [2]) and risky investments by 255 percent (9,394 rupees, 125 USD) after the expiry of their term deposits. The increase in risky investment is about 12 times as much as the increase in consumption. We estimate the interest elasticity of

[1] In the U.S., bank deposits to GDP ratio is approximately 80 percent, with close to 2 trillion dollars of large time deposits, and 10 trillion dollars' worth of saving and small-time deposits in 2019. Recent work that study term depositors include Artavanis et al. (2022) who examine the impact of policy uncertainty on early withdrawals by households in Greece.

[2] To convert to USD, the exchange rate of 75 Indian Rupee to 1 USD (as of April 2021) can be used.

risky investment to be -26. In contrast, the interest elasticity of consumption stands at -0.3. Consequently, our results suggest a small direct effect (through consumption) and a large indirect effect through portfolio reallocation after interest rate cuts. To the best of our understanding, we are among the first to estimate the interest elasticity of risky investment. For interest elasticity of consumption, our results are consistent with earlier literature which finds a small sensitivity of consumption to changes in interest rate using aggregate time-series (Campbell and Mankiw (1989), Yogo (2004), Canzoneri et al. (2007)).

Estimating the impact of changing interest rates for savers has several challenges involving research design and data availability. First, monetary policy is implemented nationwide and applies to all households. It is difficult to find a comparison group to identify the policy effect. To overcome this identification challenge, we exploit the maturity of term deposits after changes in interest rates. The interest rate is constant throughout the tenure of the term deposits. When the central bank reduces interest rates, the pass-through of lower interest rates might be limited for households holding term deposits due to the fixed interest, hindering the ability of expansionary monetary policy to stimulate households' consumption. As such, the pass-through might be more effective after the maturity of term deposit since term depositors are offered a new (lower) interest rate based on the benchmark interest rates. Similar to Di Maggio et al. (2017), we exploit variation around the maturity of term deposits after changes in interest rates. We argue that the change in interest rates for term depositors would be unexpected at the time when they started their term deposits, and thus is independent of their individual characteristics. We thus can compare the consumption and portfolio rebalancing behaviour of individuals with early maturity of term deposits to those with late maturity.

Second, households respond to changes in interest rate in different domains, such as consumption, savings and asset portfolio decisions. One needs a large and representative sample with information on various consumer outcomes to provide a better understanding of these behavior. We address the second challenge by relying on a comprehensive proprietary dataset from an India financial institution. This individual-level panel data on 184,144 randomly chosen individuals has detailed information on monthly credit card, debit card, savings account, term deposits as well as mutual fund and direct equity investments. The comprehensive dataset allows us to not only study household consumption behavior but also portfolio rebalancing after changes in interest rate. Using new flows into the portfolio originated from the bank, we can estimate the increase in investments into risky assets, as well as households' share of risky assets in the entire portfolio. In addition, we can determine the

exact stock from their individual stock holdings. This will allow us to increase our understanding of households' willingness to take risk when they rebalance their portfolios.

To shed light on how individuals rebalance their financial portfolio, we focus on the risky asset share, which is defined as the ratio between risky assets (mutual funds and equities). and total assets held by households. Here, total assets include both safe assets (bank deposits) and risky assets. In our study, we find that term depositors increase their risky asset share by 0.36 percentage points, a 5 percent increase relative to the average value. This suggest that households rebalance their portfolio when interest rate falls, shifting from safe assets to more risky assets. We further investigate the type of equities households purchase by exploring our rich data in the individual-stock-month level. Based on our estimates, we find that households prefer stocks with low systemic risk. For each unitary increase in the stock's beta, the likelihood that individuals purchase the stock reduced by 0.6 percent. This builds on the findings of Jiang and Sun (2020) and Daniel et al. (2021) which illustrate how households reach for income by purchasing stocks with high dividends when interest rate falls. In our case, we focus on another dimension, stock's beta.

We further investigate the heterogeneous effects. First, we provide evidence that contractual design for term deposits play an important role for the monetary policy pass-through. For households with term deposits that automatically renew (upon expiry), we estimate their interest elasticity of consumption to be 0.3 and interest elasticity of risky investment to be -12. In comparison, for households that chose not to automatically renew their term deposits, we find the interest elasticity of consumption to be -1 and interest elasticity of risky investment to be -43. Hence, households who automatically renew their term deposits have a lower inclination to rebalance their portfolio. Moreover, while households with non-auto-renewal contracts increased their spending, those with auto-renewal contracts ended up decreasing their consumption when faced with a fall in interest rate. As such, contractual rigidities from auto-renewal of term deposits matters. Furthermore, we find that households with existing loans are more interest elastic with respect to consumption but more interest inelastic when it comes to portfolio investments. The larger increase in spending could be attributed to liquidity. Since households that borrow are most likely to have liquidity needs, they spend more when the term deposits expire. However, liquidity cannot explain why borrowers have a lower propensity to rebalance their portfolios relative to those without loans.

How do we explain households' consumption and portfolio choices in our study? We now turn to the mechanisms. As we explore changes in households' decisions upon expiry of term deposits, there are two possible reasons that could explain our results. The first channel is

the liquidity channel, whereby households intend to consume more or invest more due to the increase in liquidity. The second channel is the rebalancing channel, in which households respond to changes in interest rates. To increase our understanding on these two channels, we conducted additional tests. Based on our analysis, we find that the liquidity channel itself cannot fully explain our results, and that the rebalancing channel matters.

In our examination of households with existing loans, we have provided some evidence that liquidity matters for consumption. We further test for the liquidity channel in the following ways. First, we examine whether the size of expired term deposits influence households' choices. Should the liquidity channel holds, we would expect households with the highest amount of expired term deposits to respond more, as they enjoy the largest inflow in liquidity. Indeed, we find that for each percentage increase in the value of expired term deposits, risky investments and consumption increased by 692 rupees and 42 rupees respectively. However, we do not find evidence of an increase in risky asset share, suggesting that the size of expired term deposits cannot fully explain households' portfolio rebalancing decisions.

Second, we explore the pass-through by the amount of liquid wealth households have prior to the expiry of term deposits. Based on the amount of their savings account balances in March 2016, we separate them in liquid savings decile. In this case, if our results are driven by liquidity, we should expect to see households with lower (prior) liquid savings rebalancing to a larger extent. Nonetheless, we obtained the opposite results. Households with more liquid savings invest more in absolute terms and have a larger increase in risky asset share. Moreover, there are no statistically significant differences in terms of consumption across the liquid savings deciles. Consequently, there is a lack of evidence suggesting our results are driven purely by the liquidity channel.

To test for the rebalancing channel, we focus on the interest rate previously locked in by term depositors. The rebalancing channel predicts that households who experienced a larger fall in interest rate are impacted to a larger extent, and hence would be more responsive to the interest rate cuts. Consequently, we will expect to see households with higher initial interest rates to be more responsive if the rebalancing channel holds true. Indeed, we find that the higher the interest rate that households locked in, the larger the impact of consumption and investments into risky assets, as well as risky asset share. This suggest that interest rate matters and corroborates the rebalancing channel.

We acknowledge that there are several concerns in our study. One consideration lies in the fact that we are only using data from a single bank and do not have full balance sheet of these households. In addition, some households could be paid in cash, and we are unable to

track their behaviour. We address this issue through the following ways. First, we would like to highlight that our key focus in this paper is to estimate the pass-through based on the expiry of term-deposits. As we can account for 86 percent of the expired term deposits, the leakages are unlikely to influence our results. Next, we focus on a sub-group of population – term depositors who credit their salary to the bank. It is most likely that our bank is the dominant bank for this group of households due to the greater convenience involved. Our main result still holds: portfolio rebalancing occurs and that the increase in investments into risky assets is larger than that of consumption. Finally, we would like to highlight that the Central Bank interest rate cut affects all banks in India at the same time and we conduct our analysis using the difference-in-differences methodology. There are no differential incentives between the treatment and the control group to switch to financial service from other banks. Therefore, it is unlikely to bias our results.

In terms of external validity, we note that our sample likely belongs to the top 25 percent of the Indian population based on their wealth distribution (Badarinza et al. (2019)). Nonetheless, we centre our analysis on this group of households for a few reasons. First, this is a large group of households (around 250 million people) which have access to the financial services. As we are concerned about how households rebalance their entire portfolio, it is essential that we only look at this particular group who have access to various investment products. Second, term deposits are one of the most popular ways of portfolio allocation globally and in India. In our sample, 32 percent of households hold term deposits during the time period. Furthermore, our sample is also comparable to developed countries such as the U.S. in terms of the average bank deposits and monthly consumption.

Related Literature. This paper contributes to several strands of research. First, this paper adds to the literature that study monetary policy transmission mechanisms through households using micro-data. The novel contribution is that we focus on savers and study the impact of monetary policy on both household consumption and risky investment at the same time. Recent studies in the literature have focused on borrowers and examined the monetary policy transmission through flexible mortgage contract and mortgage refinancing (Di Maggio et al. (2017), Auclert (2019), Cloyne et al. (2020)). Instead of studying how borrowers respond to a fall in cost of borrowing, this paper takes a different approach by investigating how savers respond to changes in interest rate. In examining the impact of monetary policy, prior studies have focused on different aspects of the household balance sheet. These include how changes in interest rate impact households' demand for income generating assets (Daniel et al. (2021)), and how they affect changes in consumption along the liquid asset distribution (Holm et al.

(2021)). Here, we highlight a potential friction of the monetary pass-through through contractual rigidities from term deposits, and how they seek to rebalance their portfolio.

In doing so, this paper seeks to contribute to the risk-taking channel of monetary policy, whereby investors developed a greater appetite for taking risk when interest rates are low (Borio and Zhu (2012), Campbell and Sigalov (2021)). Earlier studies have provided evidence that institutions such as banks and mutual funds do invest in riskier assets in the face of low interest rate (Maddaloni and Peydro (2011), Di Maggio and Kacperczyk (2017), Lu et al. (2019)). This is generally attributed to institutional frictions such as agency issues (Feroli et al. (2014)) and cost of leverage (Drechsler et al. (2018)). However, there is little evidence on the impact on individuals until recently. This includes the use of randomised laboratory experiments (Lian et al. (2018)) and the study of inflows into income-oriented equity funds (Jiang and Sun (2020)). In this paper, we provide evidence that term deposits shift their assets away from bank deposits. This increases their risky asset share. Moreover, the increase in stocks is centred on stocks with low beta stocks, which has a lower systematic risk.

Finally, this paper seeks to contribute to the recent macroeconomic literature that incorporates Heterogeneous Agents (HA) into the New Keynesian (NK) literature (Christiano et al. (2005), Kaplan and Violante (2018), Kekre and Lenel (2022)). Our findings are consistent with the small direct effect of consumption and large indirect effects highlighted in several HANK models. We also find heterogeneous effects on consumption based on liquidity wealth which is consistent with the wealthy hand-to-mouth literature (Kaplan and Violante (2018)). Moreover, our empirical work documenting portfolio rebalancing is in line with recent HANK literature studying heterogeneous portfolio investments (Luetticke (2021)). By providing direct evidence of the heterogeneous effects on consumption and portfolio rebalancing simultaneously, we seek to highlight the importance of the different channels. The main difference from previous literature is that we can quantify the effect of falling interest rate on both consumption and portfolio rebalancing at the same time and can estimate the interest elasticity of consumption and investments empirically. Through our estimates from the risky asset share, we add to the literature on how households manage their financial portfolio.

The remainder of the paper is organised as follows. Section 2 provides information about the monetary policy and institutional background in India, as well as the proprietary dataset. Section 3 provides details about the empirical methodology. We discuss our main results in Section 4. Finally, Section 5 concludes.

2. Background and Data

In this section, we provide some background information of monetary policy in India, as well as Indian households' savings and portfolio choices, and describes the data used in this paper.

2.1 Monetary Policy in India

Monetary policy in India is regulated by its central bank, the Reserve Bank of India (RBI), with a mandate to meet its primary objective of price stability, while being cognizant of economic growth. From 2016 to 2021, the main objective is to maintain an annual inflation rate of 4%, with a lower and upper tolerance of 2% and 6% respectively. In 2016, the annual inflation rate was 4.5% and was stable throughout the time period.

Based on an assessment of the macroeconomic conditions, there are many direct and indirect instruments that are available for the implementation of monetary policy. These include bank rate (discount rate), repo rate (repurchase option rate), cash reserve ratio, as well as open market operations. We centre our discussion on the use of bank rate. The bank rate refers to the interest rate that RBI makes long-term loans to the commercial banks. As compared to the repo rate which seeks to provide overnight liquidity to banks, it does not require securities and bonds as collateral. Consequently, bank rate is higher than the repo rate and has a more direct impact on the interest rate charged by commercial banks. The difference between the bank rate and repo rate is based on a policy rate corridor. For instance, a 100-basis point corridor would mean that the bank rate is higher than the repo rate by 100 basis points.

The reserve bank's monetary policy committee is charged with the responsibility of fixing the benchmark interest rates in India. Out of the six members of the monetary policy committee, three members will be from the RBI, with the remaining three members appointed by the central government. The members are required to maintain confidentiality seven days before and after the rate decision. Changes in the interest rate are subsequently made known at the bi-monthly monetary policy committee meetings.

Figure 1 shows the pass-through from the bank rate to the one-year term deposit rate offered by the financial institution (in our dataset) from 2014 to 2017. With reference to Figure 1, there was a fall in the bank rate from 2014 to 2017. The bank rate was constant at 9% throughout 2014, before falling from January 2015 onwards. In particular, it fell by 75 basis points from March 2016 to April 2016. On 5th April 2016, the central bank announced two changes. First, the repo rate is reduced by 25 basis points. Second, the policy rate corridor is

reduced from 100 basis points to 50 basis points. This led to a fall in the bank rate by 75 basis points. This change in policy rate corridor is unexpected and has surprised many in the media[3].

[Insert Figure 1]

There is a clear pass-through from bank rate to term deposit rate. Figure 1 shows that the interest rate offered by the term deposits followed the bank rate closely. For the one-year term deposit rate (without any premature withdrawal), it was above 8.75% prior to December 2014. From January 2015 to April 2016, it fell by 140 basis points in line with the changes in the bank rate. In comparison, the inflation rate merely fell by 40 basis points from 2015 to 2016 (4.9% to 4.5%). We note that there was a 125-basis point fall in term deposit rate from November 2016 to December 2016. This is due to demonetization[4]. A huge increase in money supply into the banking system led to a fall in the cost of funds, leading to a fall in interest rates offered by commercial banks.

2.2 Household's Savings and Portfolio Investment Choices in India

In India, 80% of the population have bank accounts. With 27 public sector banks, 21 private sector banks and 49 foreign banks, the banking sector in India is highly competitive. Households in India are offered a variety of instruments to save and invest. For bank deposits, they can either deposit in regular savings account or term deposits. Regular savings accounts offer savers the flexibility to withdraw money at any time. It usually comes with a debit card for customers to pay for their purchases directly and for them to withdraw money at the ATM. For the rest of this paper, when we refer to savings account, we refer to regular savings account (current account without cheques). In our study, the nominal interest rate offered by the financial institution for savings account remain unchanged at 4 percent per annum.

In comparison, term deposits (or time deposits) are long-term instruments that offer a higher interest rate, as compared to the savings account. For example, in January 2015, the one-year term deposit offered a nominal interest rate of 8.75 percent per annum. Besides offering higher interest rates, there are other benefits associated with a term deposit. First, it has low

[3] See for instance, https://www.financialexpress.com/industry/banking-finance/narrowing-policy-corridor-raising-reverse-repo-rate-surprising/233023/

[4] On 8 November 2016, the Indian government announced the demonetization of all 500 and 1000 rupees banknotes of the Mahatma Gandhi Series for tackling black money.

risk (with the RBI offering insurance for up to 1 lakh (100,000 Indian rupees)) and offers tax deduction (under Section 80C in the Income Tax Act). Moreover, the interest rate is constant throughout the tenure of the term deposits, ensuring a stable return (regardless of market fluctuations). However, term depositors lose liquidity during the tenure of the term deposit. Upon maturity of the term deposits, term depositors are then offered a new interest rate. They can choose to renew their term deposits or withdraw them.

The financial institution (used in our dataset) offers 2 types of term deposits: contracts with auto-renewal and non-auto-renewal options. For non-auto-renewal contracts, there is a choice between premature withdrawal facility and without premature withdrawal facility. An early withdrawal of the term deposits for the former involves a lower interest rate (based on the shorter time period which the deposit is held), and a penalty of 0.5% if the term deposits are held less than 1 year and 1% for those between 1 year to 5 years. For example, if a term depositor chooses to withdraw prematurely after 1 year and that the short-term and long-term interest rate is 5 percent and 8 percent respectively, the interest rate enjoyed by the term depositor will be reduced from 8 percent to 4 percent. For the latter, the term deposit cannot be closed by the depositor before the expiry date. Generally, those equipped with premature withdrawal facility offers lower interest rate (of around 20 basis points) as compared to those without premature withdrawal facility. For auto-renewal contracts, there is only premature withdrawal facility available. In India, term deposits are one of the most popular ways of portfolio allocation. According to the Securities and Exchange Board of India (SEBI) Investor Survey in 2015, more than 95 percent Indian household investors prefer to park their money in term deposits over risky assets such as mutual funds or equities. Overall, 66 percent of household assets are being kept as bank term deposits and cash in India. It is also easy and convenient to open accounts for term deposits and mutual funds as most commercial banks offer facilities for both savings and investment purposes.

In terms of financial assets, households can choose to invest directly in stocks, bonds or indirectly through mutual funds (offered by commercial banks as well). To purchase equities directly from the stock market, households are required to open a dematerialization account (Demat account). This will allow them to transfer or purchase the securities electronically. Mutual funds in India are similar to those based in the U.S. Managed by a professional money manager, they offer asset diversification and economies of scale for investors with limited time and knowledge in portfolio management (as compared to direct participation in the stock markets). Mutual funds are also highly liquid as investors can buy and sell the units easily. Based on their risk appetite, investors can choose to invest in equity or debt of specific sectors

or countries. In this paper, we classify all flows into direct equity investments and mutual fund investments as investments in risky assets. There are at least 60 million retail investors in India that had invested in the stock market (both directly and indirectly). From 2014 to 2017, Indian equities market performed well in general. Figure A1 in the Online Appendix presents the prices of the S&P Bombay Stock Exchange Sensitive Index (SENSEX), India's benchmark stock index during this time period.

2.3 Data

We use a unique, proprietary dataset obtained from a leading bank in India. It is one of the top four banks in India by assets and market capitalisation and has more than 18,000 branches and ATMs across India. It offers a plethora of banking products and financial services, such as credit and debit cards, savings account, term deposit accounts and mutual funds. It also provides brokerage services. As it offers a full range of financial services, it is likely that most households in India bank only at one institution. According to the World Bank Global Findex Database 2017, there are 1.57 billion current and savings account in Indian banks. In comparison, India has a population of 1.35 billion in 2017.

Our sample contains consumer financial transaction data of 181,144 individuals, which is a random, representative sample of the bank's customers from 2014 to 2017 in 9 different cities, namely Ahmedabad, Bangalore, Bhubaneshwar, Chennai, Delhi, Gurgaon, Kolkata, Mumbai and Surat. They represent states (Haryana, Delhi, Gujarat, Maharashtra, Odisha, Karnataka and Tamil Nadu) from different parts of India and with differing levels of GDP (See Figure A2). Here, we have information of the bank transaction level data on individual accounts, as well bank balances. The key advantage of the linked dataset is that we can consolidate the individual's entire balance sheet with the bank. We also have demographic information of individual households, such as their occupation, city, gender, age and income (if they credit their salary directly into the bank).

Consequently, our data allows us to measure both flow and stock variables of the household. Flow variables include savings, investments, spending and borrowing. In terms of savings flows, we have information of the term deposits that have expired and renewal of term deposits. Hence, we can track what term deposits do with their money upon expiry of term deposits. For flows in households' financial portfolio, we have two main components: risk investments and insurance premium. The former includes the change in investments into mutual funds and individual stocks, while the latter includes life insurance and general

insurance. Next, we turn to consumption flows. To measure consumption flows, we rely on the transaction level flows of cash withdrawals (at the ATM, as well as over the counter in the bank), card spending (both credit and debit card spending) and utilities. We define total consumption as the sum of these three components. In terms of borrowing, we focus on loan repayments.

Regarding the stock variables, we have monthly balances of their safe assets and risky assets. Safe assets balances include both term deposits and savings accounts. Subsequently, we can back out the change in savings account based on the monthly differences in savings account balances. The balances for risky assets are derived from the brokerage account balance (also known as Demat accounts in India) for each individual stock/fund that the household owns. Here, we can identify the name, total value and quantity of each stock owned by the household. Consequently, we have information of the characteristics of each stock, including the stock's beta. To shed light on how households rebalance their portfolio, one key variable of interest is the risky asset share, which is defined as the ratio between risky assets and total assets (sum of safe assets and risky assets).

We now turn to the time period. A fall in the bank rate from 2015 to 2016 led to a fall in the term deposit rates, as the bank had a cheaper source of borrowing from the central bank. Specifically, there was a fall in bank rate of 75 basis points in April 2016, leading to a subsequent fall in term deposit rates from May 2016. With reference to Figure 1, for a 12-month Term Deposit (without any premature withdrawal), it fell by 140 basis points from January 2015 to April 2016 (from 8.75% to 7.35%). On the other hand, there had been no change to the interest rate offered in the regular savings account. It remained constant at 4%. In this paper, we focus on the period March 2016 to October 2016 and centre our study on the behaviour of term depositors with expired term deposits during the period May 2016 to October 2016. We abstract from November 2016 onwards due to the presence of demonetization (which is not representative of a typical monetary shock).

Table 1 shows basic descriptive statistics of our sample. Panel A presents the demographics. There are 184,144 households[5] with an average age of 46.5. Also, the sample is predominantly male, and 61 percent of the sample are married. 32 percent of the sample possess at least 1 term deposits, with 13 percent of the households (24,244 households) having expired term deposits during this time. Among the group of households with expired term deposits,

[5] To prevent outliers from driving our results, we winsorized the original sample provided to us at 1% and 99% based on the size of risky investments and consumption.

11,270 households opted for the auto-renewal feature, while 12,974 chose not to have it. Furthermore, 17 percent of the sample have investments in risky assets, and 26 percent of the households credit their salary with the bank.

[Insert Table 1]

For savings balance, Panel B report that the average amount of bank deposits is 571,288 rupees (7,600 USD), with 314,690 rupees from term deposits and 256,509 rupees from savings account. In terms of investment flows, Panel C highlights that the average risky investments and insurance premium is 8,518 rupees, and 81 rupees respectively. The average value of holdings in the Demat Account is 523,045 rupees, while the average risky asset share is 0.1, implying that households hold 10 percent of their total assets in risky holdings. Panel D further show that for these individuals, the average monthly consumption is around 22,221 rupees (296 USD). This can be broken down to cash withdrawals (12,368 rupees), card spending (9,566 rupees) and utilities (288 rupees). Finally, the average loan repayments are around 5,823 rupees.

3. Empirical Methodology

We adopt a difference-in-differences strategy to measure the impact of a decrease in interest rate on term deposits upon expiry. As there is a huge penalty when term depositors withdraw money from their term deposits prematurely, our identification hinges on the fact that these savers can only be "treated" with the new interest rate upon expiry of their term deposits (and not when the policy is implemented). In this case, a fall in the interest rate is a feature of the term deposits, and not an endogenous choice of the term depositor.

Our identification strategy seeks to exploit the timing of the interest rate adjustment after the implementation of an expansionary monetary policy. Here, the pass-through might be more effective after the maturity of term deposit since term depositors are offered a new (lower) interest rate based on the benchmark interest rates. Similar to Di Maggio et al. (2017), we exploit within-individual variation around the maturity of term deposits after changes in interest rate. The change in interest rate for term depositors would be unexpected at the time when they started their term deposits and is independent of their characteristics. We thus compare the consumption and portfolio investment behaviour of individuals with early maturity of term deposit to those with late maturity.

We focus on the time period between March 2016 to October 2016[6]. As shown in Figure 1 earlier, there was a fall in the bank rate by 75 basis points in April 2016 (which is driven by an unexpected change in the policy rate corridor). It is evident that those with expired term deposits post April 2016 would face lower interest rates as compared to the interest rate that they had locked in previously. Hence, we compare the outcomes of term depositors who already experienced a fall in interest rate with those who have not experienced the same fall in interest rate. Particularly, we use a difference-in-differences approach to explore the change in household's consumption and portfolio decisions after the expiry of term deposits. Households without any expired term deposits all belong to the control group. For households with expired term deposits, they belong to the control group before expiry of the term deposits and are treated once their term deposits have expired. We highlight three examples in Figure 2. In March 2016, the entire sample belong to the control group. In May 2016, the treatment group refers to term depositors with expired term deposits in May 2016. On the other hand, the control group include those with expired term deposits in June, July, August, September and October 2016, as well as households without expired term deposits. In July 2016, the treatment group is represented by individuals with expired term deposits in May, June and July 2016. Conversely, the control group relates to term depositors with expired term deposits in August, September and October 2016, together with those without expired term deposits.

[Insert Figure 2]

In our benchmark specification, we analyse our data at the individual-month level. We consider how individual households change their consumption, investments in risky assets and savings at the monthly level. Formally, we run the following regression:

$$Y_{it} = \gamma_i + \lambda_t + \beta_1 I_{it} + \epsilon_{it} \quad (1)$$

The dependent variable Y_{it} can be broadly classified into three main categories: bank deposits, financial portfolio, as well as spending. For bank deposits, we are interested to examine the amount of expired term deposits, term deposits that have been renewed and changes in (liquid) saving account. This will allow us to have a better understanding of how

[6] In our specification, we include 2 months prior to the fall in interest rate and focus on the time period March 2016 to October 2016 (8 months). For robustness, we also vary the time period to May 2016 to October 2016 (6 months). The results are presented in the Online Appendix.

term depositors manage their safe assets upon expiry of their term deposits. For financial portfolio, we would like to find out changes in risky investments (that include both mutual fund investments and direct investments), as well as insurance premium (that comprise both life insurance and general insurance). The above are all flow variables. In addition, we study changes in the risky asset share, which is the fraction of wealth allocated to risky asset. For spending, we focus on total consumption, which is the sum of cash withdrawals, card spending and utilities. Furthermore, we examine loan repayments. We abstract from taking logarithms as changes in investment and savings could potentially be negative.

The indicator variable I_{it} is a binary variable that is equal to 1 after the expiry of the term deposits (treatment group), and 0 before its expiry (control group). γ_i is the individual dummy variable to absorb differences in individual preferences while λ_t is the month dummy variable to control for time fixed effects. Standard errors are all clustered by taking the product of the following groups: 2 Account Types indicating if salary is credited into the bank, 5 types of occupations, and 9 cities. This gives us 90 groups.

In addition, we study the dynamics of the change using the following distributed lag model:

$$Y_{it} = \gamma_i + \lambda_t + \sum_{\tau=-4}^{4} \beta_\tau I_{it+\tau} + \epsilon_{it} \quad (2)$$

The results can be interpreted as an event study, with coefficient of the lag variables $\beta_1, \beta_2, \beta_3, \beta_4$ measuring the additional marginal response after the expiry of the term deposits. Likewise, the coefficient of the lead variable $\beta_{-1}, \beta_{-2}, \beta_{-3}, \beta_{-4}$ measure the relationship between the treatment and control group before expiry. The lag variables are useful to assess the cumulative response after the expiry of term deposits. On the other hand, the lead variables are expected to be statistically insignificant from one another, as this would imply that there is no evidence of reverse causality and that the use of difference in difference analysis is appropriate. Here, γ_i is the individual dummy variable to absorb differences in individual preferences while λ_t is the month dummy variable to control for time fixed effects.

To further shed light on the households' preferences for different type of risky assets, we then make use of our rich dataset that contains information of the individual's stock transactions (from the direct equity investments in the Demat account). Consequently, we can analyse each household's financial transactions using our data at the individual-stock-month level. Similar to Daniel et al. (2021), we use an indicator variable "Net Buy" to indicate whether

the holding of stock j by household i has increased or decreased during the time period. The variable Net Buy is equal to 1 if the stock j's position for household i has increased as compared to the previous month, -1 if the stock j's position for household i has decreased and 0 if it remains unchanged. Here, we focus on the investors who have at least 1 transaction (buy or sell) during the sample time period (March to October 2016).

From the individual-stock-month level data, we seek to examine how investors switch between different types of risky assets. We do so by running the following regression:

$$Y_{ijt} = \gamma_i + \lambda_t + \delta_j + \beta_1 I_{it} + \beta_2 I_{it} X_j + \epsilon_{it} \quad (3)$$

Here, we let the dependent variable Y_{ijt} be the "Net Buy" indicator variable for stock j held by household i and X_j be the time invariant beta of stock j (which is determined from its average value 1 year prior to the fall in interest rates). The indicator variable I_{it} remains unchanged from the previous equation. It is a binary variable that is equal to 1 after the expiry of the term deposits (treatment group), and 0 before its expiry (control group). We include individual fixed effects, time fixed effects, stock fixed effects as well as individual-stock fixed effects. We are interested in the interaction term between the indicator variable I_{it} and the beta of the stock. For instance, if the coefficient of the interaction term is negative, it will suggest that existing investors demand for stocks with lower beta.

Finally, we move on to the heterogeneous effects of our main results at the individual-month level. To study the heterogeneous effects of contract design and demographics on monetary policy pass-through, we include the interaction term between the treatment indicator and the variable of interest:

$$Y_{ijt} = \gamma_i + \lambda_t + \delta_j + \beta_1 I_{it} + \beta_2 I_{it} X_i + \epsilon_{it} \quad (4)$$

In examining the role played by the type of term deposits, X_i is a binary variable that is equal to 1 if the term deposit has the feature of auto-renewal, and 0 otherwise. In examining the impact of loans, X_i is a binary variable that is equal to 1 if the term depositor has an outstanding loan with the bank and 0 otherwise. In terms of demographics, X_i refers to the variable of interest, such as age, marital status and gender. By examining the heterogeneous responses, it will increase our understanding of the monetary policy pass-through.

4. Empirical Results

In this section, we discuss our main findings. We first present our results from the baseline difference-in-differences regressions in Section 4.1. Thereafter, Section 4.2 highlights the heterogeneity responses, while Section 4.3 explores the possible explanations. Section 4.4 further shows the robustness checks and external validity.

4.1 Baseline Difference-in-Differences Regressions

A fall in interest rate could affect households' decisions in several ways. When increase rate falls, households are likely to consume more and save less as the opportunity cost of consumption has been reduced (substitution effect from the consumption Euler equation). Nonetheless, as interest income from bank deposits decreases, savers will experience a fall in income, leading to a fall in consumption (income effect). To make up for the lost in savings income, households might also choose to rebalance their portfolio and invest in risky assets. Empirically, it is of interest to quantify the different effects for savers. As highlighted in Section 3, we focus on households in India with expired term deposits and examine their portfolio choices and consumption decisions when faced with interest rate cuts.

The key assumption underpinning the use of the difference-in-differences strategy lies in the treatment and control group having common trends. To show that there is common pre-trend, we estimate the distributed lag model in Equation (2) based on our data at the individual-month level from March 2016 to October 2016. In Figure 3, we present the results of four key variables: amount of expired term deposits, risky asset share, portfolio investments and consumption. These graphs can be considered as difference-in-differences coefficients from an event-study point of view 4 months before and 4 months after the expiry of term deposits. The x-axis represents the months prior to expiry (-4 to -1), point of expiry (period 0) and the months after expiry (1 to 4) of the term deposits. Observations before expiry (period 0) should be interpreted as the difference between the treatment and control group before the groups are treated (i.e. expiry of term deposits). To validate that there is a common trend before treatment, the difference-in-differences coefficients should not be different from zero.

[Insert Figure 3]

We introduce the event study graph based on the amount of expired term deposits in Figure 3 Panel A. It is evident that the expiry of term deposits happens at period 0, providing

validity of our analysis. Before the expiry of term deposits, the coefficients are bunching around zero, suggesting that the groups have common pre-trends. After the expiry of term deposits, the coefficients are again bunching at zero, signifying that there are no additional term deposits that have expired.

Next, we turn to risky investments, with Figures 3 Panel B and C showing the event study graphs based on the risky asset share and portfolio investment flows respectively. In both cases, we see that the coefficients are not statistically significant from zero prior to the expiry of term deposits. However, portfolio rebalancing takes place upon expiry of term deposits. After the expiry of term deposits, the risky asset share increased sharply, and portfolio investment flows continue to grow. As such, the increase in risky investments remained elevated several months after the expiry of term deposits. Finally, Figure 3 Panel D highlights the event study graph for consumption. Prior to expiry of the term deposits, the coefficients are statistically insignificant from zero, suggesting that they follow similar pre-trends. Subsequently, consumption increased at the point of expiry (period 0), before declining towards zero. As such, households only increased their consumption at the point of expiry.

Put together, we find that households rebalanced their portfolio towards risky assets and increased their consumption upon expiry of their term deposits in an environment when interest rate has decreased. Why do households not respond prior to the expiry of term deposits? There are many possible reasons. First, the interest rate offered by the savings account from the bank in our sample is constant at 4% throughout this period, signifying that there is no pass-through from the monetary policy to the savings account. In comparison, there is a clear pass-through from the RBI bank rate to term deposit rate (as shown in Figure 1). Due to the nominal rigidity in savings deposit rate, savers are therefore only impacted through changes in their term deposit interest rate and react when their term deposits expire. Another reason could be attributed to the presence of inertia in portfolio rebalancing (Brunnermeier and Nagel (2008), Andersen et al. (2020)). Just like the payday effect, households only pay attention upon expiry of their term deposits, and not when the central bank reduces the interest rate. There is also the possibility of liquidity concerns. While households might have the intention to adjust their portfolio and consumption, they do not have the financial resources to do so (until the term deposits expire). We will have an in-depth discussion of the channels in Section 4.3.

Formally, we turn to the difference-in-differences results in Table 2 which is based on our regressions in Equation (1). Before we discuss our results, we would like to highlight that except for total consumption (which is statistically significant at the 5 percent level), all the results in Table 2 are statistically significant at the 1 percent level, and that the workings are

available in the online appendix. Our estimates for the marginal propensity and interest elasticities are presented in Table A1 and A2 respectively. Table A3 further documents the breakdown of these variables into sub-components.

[Insert Table 2]

We first examine the difference-in-differences results for bank deposits in Panel A of Table 2. This includes both term deposits and savings account. While they are both considered to be safe assets, term deposits offer a higher interest rate at the expense of lower liquidity. As seen from Column 1, the average amount of term deposits that has expired is around 58,857 rupees (785 USD). From these expired term deposits, 13,196 rupees (Column 2) have been renewed as term deposits, while 23,829 rupees (Column 3) go into their savings accounts. This means that relative to the amount of term deposits that have expired, the marginal propensity for renewal is 0.22, while the marginal propensity for saving account is 0.40. Why is there a higher increase in the savings account over renewed term deposits? One reason is attributed to the nominal rigidity of savings deposits. As highlighted earlier, interest rate offered by the saving accounts remained unchanged, while interest rate from term deposits fell. This makes renewing term deposits less attractive relative to savings account. Put together, 62 percent of the expired term deposits go back to bank deposits as safe assets.

Next, we turn to their financial portfolio. Panel B of Table 2 presents the regression results of household's investments into risky assets. In Column 1, the difference-in-difference estimators show that on average, there is an increase in total risky investments by 9,394 rupees. Correspondingly, the marginal propensity to invest out of expired term deposits is 0.16. In comparing households' investments before their expiry of term deposits, we find that investments grew by 255 percent. Based on the fall in RBI's bank rate, the interest elasticity of risky investments is estimated to be – 26. We further find in Table A3 Panel A that the growth in risky investments is driven primarily by mutual fund investments (9,013 rupees, statistically significant at the 1 percent level) rather than direct investments (380 rupees, not statistically significant at the 10 percent level). This could be attributed to the fact that mutual funds are deemed to be more a practical and convenient option, and that there are more costs involved in buying directly from the stock markets.

There is also evidence that households purchase more insurance. We find that households increase their insurance premium by 1,574 rupees (Column 2) and that it is attributed primarily to life insurance (Table A3 Panel B). While we have no detailed

information of the life insurance that are being purchased, life insurance products are usually bundled with an investment component. These include whole life and endowment policies, as well as investment-linked policies. Consequently, it is most likely that there is an increase in risky investments through life insurance too.

We then compute the impact on the risky asset share in Column 3. In examining the fraction of wealth in risky assets, we find that the risky asset share increased by a value of 0.36 percentage points, which is an increase of 5 percent relative to its average (before expiry of term deposits). Our findings are consistent with the theoretical models of Merton (1969) and Merton (1971), whereby a decrease in interest rate corresponds to an increase in wealth allocated to risky assets. To the best of our knowledge, we are among the first to rely on micro data to quantify the estimates of interest elasticity of risky investment and marginal propensity to invest through safe assets. This is an important contribution to the literature. For instance, our estimates for risky investment have implications for the numerous exercises in calibration that study household's portfolio allocations in monetary policy.

Having covered households' savings in both safe and risky assets, we proceed to examine spending in Table 2 Panel C. The difference-in-differences estimators reported in Column 1 show that on average, there is an increase in total consumption by 796 rupees. This increase in consumption is approximately 3 percent, translating the interest elasticity of consumption to be -0.3. By comparing with the amount of term deposits that have expired, we estimate the marginal propensity to consume to be 0.01. Our findings are at the lower end of typical estimates based on the vast literature on consumption response to income shocks (Jappelli and Pistaferri (2010)), and builds on the recent literature that focus on how households delay consumption out of their expected income until it is made available to them (eg. Baugh et al. (2021)). The key difference between our results and the existing literature is that we focus on changes in the liquidity of individuals' own assets, rather than changes such as tax refunds (Gelman et al. (2022)) or credit card limits (Gross et. al. (2020)). This is in line with the permanent income hypothesis, whereby households are less responsive when it comes to changes in their own money.

We further document in Table A3 Panel B that changes in consumption can be broken down into cash withdrawals (436 rupees), card spending (345 rupees) and utilities (15 rupees). The fact that cash withdrawals are larger than card spending is expected as most of the Indian population prefer to purchase goods using cash. Nonetheless, we acknowledge that cash withdrawals might not necessarily for current consumption. Households might want to have a stock of cash at hand for future consumption. Since the opportunity cost of holding cash is

interest rate, and it has fallen, the optimal stock of cash might tend to increase as well. Consequently, our consumption estimates could be a higher bound as it also includes planned consumption as well.

Finally, we turn to borrowing in Column 2 of Table 2 Panel C, which reports that there is an increase in loan repayments by 1,638 rupees. In quantifying the magnitude of loan repayments, the marginal propensity to repay loan is estimated to be 0.03, which is larger than consumption, but smaller than investments in risky assets. It is most likely that the increase in loan repayment is to repay existing loans and not attributed to new loans. This is because we do not find any evidence of households having more new loans upon expiry of their term deposits. This is reported in Table A4 where we investigate whether households take up new home loans or personal loans upon expiry of term deposits. Now, why do these term depositors pay more of their existing loans? One possible reason could be attributed to the higher interest rates of borrowing that were established previously. For households who have chosen loan contracts with fixed interest rates, the cost of borrowing remains high while the rate of return from term deposits falls. Hence, it is more attractive to pay back their existing loans.

In sum, we find that households respond in different ways when their term deposits expire in an environment with falling interest rate. For each 100 rupees that have expired in term deposits, 22 rupees go towards renewal of term deposits, while 40 rupees are transferred to their savings account. Moreover, 16 rupees are allocated towards risky investments and 3 rupees used for insurance premium. In terms of spending, 1 rupee is allocated for consumption, while 3 rupees towards loan repayments. Put together, we can account for 86 cents of the term deposits that has expired.

To further examine portfolio rebalancing across different types of stocks, we turn to the estimates of the impact on individual stocks for investors who have made at least one transaction (buy or sell) during this time period (March 2016 to October 2016). Based on the individual-stock-month data structure in Equation (3), we seek to study how investors rebalance across different types of stocks. Particularly, we focus on the size of stock's beta, which is based on the Capital Asset Pricing Model in relation to the benchmark indices provided by two major stock exchange in India, BSE and NSE. As the stock's beta is a measurement of the fluctuations of stock to the overall market, it is a measurement of the volatility or systematic risk. The average value of the stock beta during this period was 1.1.

The impact on individual stocks is highlighted in Table 3. Column 1 shows that investors are 0.8 percent (significant at 1 percent) more likely to purchase stocks with zero beta (and hence zero systematic risk) upon expiry of the term deposits. Nonetheless, for each unitary

increase in beta, the impact on the likelihood of the investor to purchase the stock fell by 0.6 percent. This suggests that investors demand for stocks with lower systemic risk when interest rate falls. Besides having "Net Buy" as the dependent variable, we further examine 2 other closely related outcomes: changes in value and changes in quantity for the individual stocks owned by existing investors. To reduce the possibility of outliers (such as stocks with extremely small or large prices) driving our results, we apply the inverse hyperbolic sine on both outcomes. This transformation allows us to retain negative valued observations (when stocks are being sold), while allowing a similar interpretation as the log transformation (Carroll et al. (2003), Bellemare and Wichman (2020)). Columns 2 and 3 show that for each unitary increase in the beta, the impact on changes in the value and quantity for the stock is smaller by 6 percent and 2 percent respectively.

[Insert Table 3]

As such, we find that there is a decrease in demand for stocks with high beta. Our findings build on the work of Jiang and Sun (2020) and Daniel et al. (2021) which documented households "reaching for income" by demanding for income generating assets (such as high-dividend stocks) when faced with a fall in interest rate. This is attributed to households' preference for current income. Here, we find that while households increase their investments in risky assets, they move towards stocks which are less volatile relative to the market.

4.2 Heterogeneity response

In this section, we study the heterogeneous response due to contractual types and demographics of term depositors.

First, we investigate whether contractual design plays an important role in influencing the monetary pass-through based on Equation (4). The commercial bank in our study offers two types of contracts: Auto-renewals and non-auto-renewals. A priori, we should expect to see term depositors with auto renewal contracts to be more interest inelastic due to consumers' inertia in auto-renewal contracts. Table 4 Panel A reports the regression results that considers the auto-renewal feature. All the results are statistically significant at the 1 percent level.

[Insert Table 4]

Column 1 shows that households with non-auto-renewal contracts increased their investments in risky assets by 12,830 rupees and that the increase in investments for households with an auto-renewal contract is lesser by 7,459 rupees. We estimate the interest elasticity of risky investment for auto-renewals and non-auto-renewals to be -12 and -43 respectively. Hence, while both term depositors with auto-renewal and non-auto renewal contracts increased their investments in risky assets, those who automatically renew are relatively less sensitive to changes in interest rates.

We turn to consumption and savings account in Columns 2 and 3 respectively. Similarly, households with the auto-renewal feature are less responsive. While households with non-auto-renewal contracts increased their consumption by 2,238 rupees and savings by 37,145 rupees, households with the auto-renewal feature decreased their consumption by 890 rupees and increased their savings by 8,242 rupees. For households with non-auto-renewal term deposits, the interest elasticity of consumption is estimated to be -1. In contrast, for those with auto-renewal term deposits, the interest elasticity of consumption is estimated to be 0.3. The fact that households with auto-renewal term deposits spend less (when interest rate fell) is particularly interesting. This is contrary to the prediction of the consumption Euler equation, and could be attributed to the income effect. As these households seek to rebalance their portfolio towards risky assets, they end up cutting their spending.

Our findings suggest that contractual rigidities in the form of auto-renewal of term deposits could be a potential friction for the monetary pass-through. Due to consumers' inertia in auto-renewal contracts, the monetary policy pass-through is more limited. This has potential policy implications. Upon examining the rigidity of mortgage contracts (fixed rate and adjustable rate), Garriga et al. (2017) showed that the transmission mechanism is stronger under adjustable-rate mortgages vis-à-vis fixed rate mortgages. Here, we find a potential friction in the deposit market that undermine the monetary pass-through: Households without auto-renewal contracts are more sensitive to changes in interest rate. Nonetheless, we acknowledge that this could also be a selection issue as households who chose for auto-renewals could be less interest sensitive in the first place. As highlighted in Section 2.2, there are two types of contracts: Auto-renewals and non-auto-renewals. For auto-renewal contracts, there is only premature withdrawal facility available, which offers a lower interest rate (of around 20 basis points). Consequently, there could be selection bias. While we are unable to disentangle the 2 channels, this information could be important for policymakers in designing their policies.

Next, we study how having outstanding loans after the maturity of their term deposits play a role in the monetary pass-through. As households usually take up loans to finance their spending, they should respond more to consumption and less to investments in risky assets upon expiry of term deposits. Indeed, this is what we found. Table 4 Panel B reports the regression results. Column 1 shows that households without outstanding loans after the maturity of their term deposits increased their investments into risky assets by 10,590 rupees (significant at 1 percent) and that the increase in risky investments for households with outstanding loans is lesser by 7,045 rupees (significant at 1 percent). Column 2 finds that households without outstanding loans after the maturity of their term deposits increased their consumption by 461 rupees (not significant at 10 percent) and that the increase in consumption for households with outstanding loans is lesser by 1,948 rupees (significant at 5 percent). In contrast, there is no statistically significant differences when it comes to changes in savings account for those with and without existing loans.

Finally, we turn to the role of demographics. From Table A5, we find that age plays an important role in portfolio rebalancing. Specifically, for each additional increase in age, the increase in risky investment is larger by 352 rupees. On the contrary, we do not find evidence regarding the role of gender and marital status in influencing the pass-through effect. Consequently, we seek to highlight another dimension for older households: portfolio rebalancing. Among others, age-related heterogeneity in monetary policy have previously been examined by Wong (2019) and Berg et al. (2021)[7]. In a world with ageing population, portfolio rebalancing responses could potentially change the effectiveness of monetary policy.

4.3 Possible Explanations

We have documented that after interest rate falls, households rebalance their portfolio when their term deposit expires. They also spend more and repay loans. What then drives households to rebalance their portfolio? Based on our setting, this can be due to two possible factors. First, it can be attributed to the liquidity channel. Households respond upon expiry of their term deposits due to lack of liquidity. As term deposits become liquid, households

[7] Using micro-data, Wong (2019) reported that the younger households have the maximum response to expansionary monetary policy due to mortgage debt refinancing. On the other hand, Berg et al. (2021) used a structural vector auto-regression to show that older households have a higher consumption response than younger households due to wealth effects.

consume and invest more. The second reason is due to the rebalancing channel. With a fall in interest rate from their term deposits, households reach for yield by investing in risky assets. To increase our understanding of these two possible channels, we conducted additional tests and discuss them in this section.

We first test for the liquidity channel by examining how the size of expired term deposits influence households' choices. Here, we replace the treatment indicator in Equation (1) with the treatment intensity based on the size of their term deposits. More precisely, treatment intensity here refers to the interaction between (logarithm of) the size of the expired term deposits and the treatment indicator in Equation (1). This will allow us to examine whether changes in liquidity drives our results. As the larger the expired term deposits, the greater the increase in liquidity, we should expect to see larger portfolio rebalancing of households amongst those with higher expired term deposits if the liquidity channel holds true.

Table 5 Panel A reports the results. We find that households with larger expired term deposits do not increase their risky asset share, even though they invest and consume more in absolute terms. Column 1 and 2 shows that for each percentage increase in expired term deposits, risky investments and consumption increased by 692 rupees and 42 rupees respectively. Both coefficients are statistically significant at the 1 percent level. As household with larger expired term deposits have higher assets, it is expected that they invest and consume more in absolute terms. However, we do not see changes in terms of asset allocation. Column 5 reports that the risky asset share increased by 0.00338 percent, which is economically and statistically insignificant.

To further investigate the liquidity channel, we examine households' consumption and portfolio rebalancing response by liquid wealth position. Based on the amount of money they have in their liquid savings deposit account (prior to the monetary policy shock); we separate them in 10 different bins. In this case, we divide the households into deciles based on their savings balance on March 2016, before re-estimating the following difference-in-difference equation from March 2016 to October 2016:

$$Y_{it} = \gamma_i + \lambda_t + \beta_1 I_{it} + \sum_{j=2}^{10} \beta_j I_{it} X_j + \epsilon_{it} \quad (5)$$

X_j is a binary variable that is equal to 1 if the term depositor belongs to the jth decile. For instance, X_{10} refers to term depositors in the 10th decile (highest amount of savings).

Using Equation (5), we then estimate the coefficients from each bin and examine their differential responses. If the liquidity channel is true, we should expect changes in consumption and portfolio rebalancing mainly for households with liquidity constraints (i.e. those at the lowest deciles of liquid bank savings) since they do not have other resources to invest or consume. For those with high bank savings, they can use their bank savings to invest or consume before the expiry of term deposit. Figure 4 presents the coefficients of each bin.

[Insert Figure 4]

Figure 4 Panel A shows that the risky asset share increases as households' liquid savings increase. In addition, Figure 4 Panel B establishes that households at the highest liquid savings deciles exhibit the largest effect on risky investment. While households at the highest deciles increased their investments into risky assets by around 20,000 rupees, those at the lowest deciles increased their investments by less than 10,000 rupees. It has been highlighted in the literature that richer households rebalance more towards risky assets (Calvet et. al. (2009). Here, we add to the literature by showing that households with higher liquid savings rebalance towards a greater risky share when faced with a fall in interest rate. Finally, we find that there are no statistically significant differences between consumption along the savings deciles in Figure 4 Panel C. These findings are contrary to the predictions of the liquidity channel which predicts that households with the least savings deposits would be the most responsive. As such, our result in Figure 4 suggests that investments into risky assets cannot be fully explained by the investment or consumption plan of liquidity constrained households.

We now turn to the rebalancing channel. Similar to our previous test for the liquidity channel, we rely on treatment intensity, rather than the treatment indicator in Equation (1). In this specification, treatment intensity relates to the interaction between the initial interest rate and the treatment indicator in Equation (1). This will allow us to examine whether changes in interest rate do impact households' portfolio decisions. Due to the variation in the interest rates that are being locked in by different individuals, households are impacted to different extent. Indeed, if the rebalancing channel holds, we will expect to see households with higher initial interest rates investing and consuming more as they experienced larger change in interest rates.

Table 5 Panel B presents the results. Here, we find that as the interest rates that are locked in increased by 100 basis points, risky investments and risky asset share increased by 1,195 rupees (Column 1) and 0.047 percent (Column 2) respectively. This corroborates the rebalancing channel. Moreover, consumption increased by 85 rupees (Column 3) and deposits

in savings account grew by 3,053 rupees (Column 4) for each 100 basis points increase in locked-in interest rates. All the results are statistically significant at the 1 percent level. As households who experienced a larger fall in interest rates are more responsive in making consumption and portfolio choices, it suggests that interest rates do matter.

[Insert Table 5]

Put together, we find evidence supporting the rebalancing channel and that liquidity channel by itself cannot fully explain our results. Evidence of the rebalancing channel also allays other concerns that there could be delayed responses by households with term deposits. For instance, it is possible that households elect to rebalance their portfolios upon expiry of their term deposits, and not due to changes in interest rates. Nonetheless, we find that term depositors with higher locked-in interest rates have a higher propensity to invest and consume. If it is purely due to delayed responses, we should not expect to see locked-in interest rates influencing their choices.

4.4 Robustness and External Validity

In this section, we address several concerns of our results and discuss some aspects of external validity. One consideration is that households in our sample might have banking relationships with other banks, and they consume and invest using services from other banks. While our dataset is comprehensive, we only have the data from a single bank and do not have full balance sheet of these households. Nonetheless, we would like to highlight that our objective is to estimate the monetary policy pass-through based on the expiry of term-deposits. As we can account for 86 percent of the total term deposits, other banking accounts are unlikely to influence our results.

In addition, we address this issue by focusing on a sub-group of population – term depositors who credit their salary to the bank. It is most likely that our bank is the dominant bank for this group of households due to the greater convenience involved. Table A6 presents the results. Here, our main result still holds: portfolio rebalancing occurs and that the increase in investments into risky assets is larger than that of consumption. Furthermore, the central bank interest rate cut affects all banks in India at the same time and we conduct our analysis using the difference-in-differences methodology. There are no differential incentives between

the treatment and the control group to switch to financial service from other banks. Therefore, it is unlikely to bias our results.

Another concern relates to the time period. While our dynamic specification provides strong evidence that households respond upon expiry of the term deposits, the time period in which it belongs to the control group varies depending on the exact month of expiry. One could be concerned that there are unobserved changes for a particular group of households. To address this concern, we vary our sample period and control group in different ways. Our results are robust in all different specifications. In the Online Appendix, we highlight two different cases. In Table A7, we focus on the period after the interest rate cut has taken place (May 2016 to October 2016). In Table A8, the sample only comprises of those with expired term deposits. In other words, we remove those without any expired term deposits during the time period, addressing concerns that they might not be a good control group.

We are also cognizant of the possibility of early withdrawals. We allay the concerns in the following ways. Firstly, we note that our empirical strategy is in line with the intention-to-treat analysis. Even though there is the possibility of early withdrawals, we are focussing on the initial treatment that is being assigned (expiry date). In addition, there are no anticipation effects. Should there be early withdrawals, we should expect to see a sharp change in consumption and portfolio rebalancing prior to expiry. Nonetheless, we see from our event study graphs that there is no evidence of anticipation effect from the period of policy announcement (April 2016) to the expiry date. The behaviour of the subjects with term deposits during this period is similar to those of the control group (households without expired term deposits) prior to expiry.

Finally, we would like to discuss the external validity of our results. We note that this is not entirely representative of India's population. 20 percent of the population is still unbanked. Furthermore, more than 50 percent of the Indian population do not have financial assets. Comparing our sample with the distribution of Indian Household Balance Sheet (Badarinza et al. (2019)), our sample is likely to belong to the top 25 percent of the Indian population. Nonetheless, we focus on this group of households for a few reasons. First, this is a large group of households (around 250 million people) which have access to the financial services. As we are concerned about how households rebalance their entire portfolio, it is essential that we only look at this particular group who have access to various investment products. Second, term deposits are one of the most popular ways of portfolio allocation in India. According to the Securities and Exchange Board of India (SEBI) Investor Survey in 2015, more than 95 percent Indian household investors prefer to park their money in term

deposits over risky assets such as mutual funds or equities. In our sample, 46 percent of households hold term deposits at one point in time.

Globally, there is a huge amount of term deposits parked in commercial banks. For instance, countries in the Euro area report that approximately 50 percent of domestic private non-financial deposits are term deposits with maturity of more than 1 year. Hence, it is important for policymakers to understand the monetary policy pass-through through the lens of term depositors too. Our sample is also comparable to developed countries. From our sample, the average bank deposits are approximately 571,288 rupees (USD 7,600). In comparison, the 2016 Federal Reserve Survey of Consumer Finance found that the median account balance in the U.S. is around USD 7,000. Lastly, our data comes from (mass market) retail customers from one of the leading banks in India. They are not primarily affluent individuals.

5. Conclusion

An understanding of monetary transmission mechanisms is crucial to conduct effective monetary policy. In this paper, we provide direct evidence of monetary transmission mechanisms through households using micro-level administrative data from India. Our results suggest a small direct effect and quantify a large indirect effect through portfolio reallocation after interest rate cuts. For each 100 rupees that have expired in term deposit, 1 rupee go towards consumption, while 16 rupees are allocated towards risky investments. We further examine heterogeneity of the pass-through and elasticities across liquid wealth position, as well as contract design and demographics.

Our findings have policy implications. For instance, this could allow us to better understand the implications of monetary policy on inequality. There has been much interest in studying "the savings glut of the rich" (Mian et al. (2020)) and the large heterogeneity and persistence in the differences of wealth returns (Fagereng et al. (2020)). Prior studies have also documented how monetary policy impact inequality in labour earnings and consumption in the United States (Coibion et al. (2017)) and wealth inequality in the United Kingdom (Bunn et al. (2018)). Here, we relate to how monetary policy could impact inequality as households rebalance their portfolios and invest in risky assets. With different portfolio choice between households of different income and wealth level, monetary policy could exacerbate inequality due to the expected higher returns when equity markets boom in a low interest rate environment.

References

Andersen, S., Campbell, J.Y., Nielsen, K.M. and Ramadorai, T., 2020. Sources of inaction in household finance: Evidence from the Danish Mortgage Market *American Economic Review*

Artavanis, N., Paravisini, D., Garcia, C.R., Seru, A. and Tsoutsoura, M., 2022. *One Size Doesn't Fit All: Heterogeneous Depositor Compensation During Periods of Uncertainty* (No. w30369). National Bureau of Economic Research.

Auclert, A. 2019. Monetary Policy and the Redistribution Channel. *American Economic Review, 109(6),* pp.2333-67

Auclert, A., Rognlie, M. and Straub, L., 2020. Micro Jumps, Macro Humps: monetary policy and business cycles in an estimated HANK model. *National Bureau of Economic Research. Working Paper 26647*

Badarinza, C., Balasubramaniam, V. and Ramadorai, T., 2019. The household finance landscape in emerging economies. *Annual Review of Financial Economics*, *11*, pp.109-129

Baugh, B., Ben-David, I., Park, H. and Parker, J.A., 2021. Asymmetric Consumption Smoothing. *American Economic Review*, *111*(1), pp.192-230

Bellemare, M.F. and Wichman, C.J., 2020. Elasticities and the inverse hyperbolic sine transformation. *Oxford Bulletin of Economics and Statistics*, *82*(1), pp.50-61

Berg, K.A., Curtis, C.C., Lugauer, S. and Mark, N.C., 2021. Demographics and monetary policy shocks. *Journal of Money, Credit and Banking*, *53*(6), pp.1229-1266

Borio, C., Zhu H., 2012. Capital Regulation, risk-taking and monetary policy: A missing link in the transmission mechanism? *Journal of Financial Stability, 8(4),* pp.236-251

Brunnermeier, M.K. and Nagel, S., 2008. Do wealth fluctuations generate time-varying risk aversion? Micro-evidence on individuals. *American Economic Review*, *98*(3), pp.713-36.

Bunn, P., Pugh A., and Yeates, C., 2018. The Distributional Impact of Monetary Policy Easing in the UK Between 2008 and 2014, Staff Working Paper No. 720.

Calvet, L.E., Campbell, J.Y. and Sodini, P., 2009. Fight or flight? Portfolio rebalancing by individual investors. *The Quarterly Journal of Economics*, *124*(1), pp.301-348.

Campbell, J.Y. and Mankiw, N.G., 1989. Consumption, income, and interest rates: Reinterpreting the time series evidence. *NBER macroeconomics annual*, *4*, pp.185-216.

Campbell, J.Y. and Sigalov, R., 2021. Portfolio choice with sustainable spending: A model of reaching for yield. *Journal of Financial Economics*

Canzoneri, M.B., Cumby, R.E. and Diba, B.T., 2007. Euler equations and money market interest rates: A challenge for monetary policy models. *Journal of Monetary Economics*, *54*(7), pp.1863-1881.

Carroll, C.D., Dynan, K.E. and Krane, S.D., 2003. Unemployment risk and precautionary wealth: Evidence from households' balance sheets. *Review of Economics and Statistics*, *85*(3), pp.586-604

Christiano, L. J., Eichenbaum, M., and Evans, C. L., 2005. Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of Political Economy*, 113(1), pp.1–45.

Cloyne, J., Clodomiro F., and Paolo S., 2020. Monetary Policy when Households have Debt: New Evidence on the Transmission Mechanism." *Review of Economic Studies*, 87(1), pp.102–129.

Coibion, O., Gorodnichenko, Y., Kueng, L. and Silvia, J., 2017. Innocent Bystanders? Monetary policy and inequality. *Journal of Monetary Economics*, *88*, pp.70-89

Daniel, K., Garlappi, L. and Xiao, K., 2021. Monetary policy and reaching for income. *The Journal of Finance*, *76*(3), pp.1145-1193

Di Maggio, M., Kermani, A., Keys, B. J., Piskorski, T., Ramcharan, R., Seru, A., and Yao, V. 2017. Interest rate pass-through: Mortgage rates, household consumption, and voluntary deleveraging. *American Economic Review*, *107*(11), pp 3550-88.

Di Maggio, M and Kacperczyk, M., 2017. The unintended consequences of the zero lower bound policy. *Journal of Financial Economics*, *123*(1), pp.59-80.

Disney, R., Gathergood J. and Henley, A., 2010. House Price Shocks, Negative Equity and Household Consumption in the United Kingdom. *Journal of European Economic Association*, 8(6), pp.1179-1207.

Drechsler, I., Savov, A., and Schnabl, P. 2018. A model of monetary policy and risk premia. *The Journal of Finance*, *73*(1), pp.317-373.

Fagereng, A., Guiso, L., Malacrino, D. and Pistaferri, L., 2020. Heterogeneity and persistence in returns to wealth. *Econometrica*, *88*(1), pp.115-170

Feroli, M., Kashyap, A., Schoenholtz, K. and Shin, H., 2014. Market tantrums and monetary policy. *Proceedings of the U.S. Monetary Policy Forum 2014*

Garriga, C., Kydland, F.E. and Šustek, R., 2017. Mortgages and monetary policy. *The Review of Financial Studies*, *30*(10), pp.3337-3375.

Gelman, M., Kariv, S., Shapiro, M.D. and Silverman, D., 2022. Rational illiquidity and consumption: Theory and evidence from income tax withholding and refunds. *American Economic Review*, *112*(9), pp.2959-91

Gross, T., Notowidigdo, M.J. and Wang, J., 2020. The marginal propensity to consume over the business cycle. *American Economic Journal: Macroeconomics*, *12*(2), pp.351-84

Holm, M.B., Paul, P. and Tischbirek, A., 2021. The transmission of monetary policy under the microscope. *Journal of Political Economy*, *129*(10)

Jappelli, T. and Pistaferri, L., 2010. The consumption response to income changes. *Annual Review of Economics*, pp.479-507

Jiang, H. and Sun, Z., 2020. Reaching for dividends. *Journal of Monetary Economics*, *115*, pp.321-338

Kaplan, G., Violante, G.L., Weidner 2014. The wealthy hand-to-mouth. *National Bureau of Economic Research*, No. w20073

Kaplan, G., Moll, B. and Violante, G.L., 2018. Monetary policy according to HANK. *American Economic Review*, *108*(3), pp.697-743.

Kaplan, G. and Violante, G.L., 2018. Microeconomic Heterogeneity and Macroeconomic Shocks. *Journal of Economic Perspectives*, *32*(3), pp.167-194

Kekre, R. and Lenel, M., 2022. Monetary policy, redistribution, and risk premia. *Econometrica*, *90*(5), pp.2249-2282

Lian, C., Ma, Y. and Wang, C., 2018. Low interest rates and risk taking: Evidence from individual investment decisions, *Review of Financial Studies*

Lu, L., Pritsker, M., Zlate, A., Anadu, K. and Bohn, J., 2019. Reach for yield by US public pension funds. *FRB Boston Risk and Policy Analysis Unit Paper No. RPA*, pp.19-2

Luetticke, R., 2021. Transmission of monetary policy with heterogeneity in household portfolios. *American Economic Journal: Macroeconomics*, *13*(2), pp.1-25

Maddaloni, A. and Peydró, J.L., 2011. Bank risk-taking, securitization, supervision, and low interest rates: Evidence from the Euro-area and the US lending standards. *The Review of Financial Studies*, *24*(6), pp.2121-2165

Mian, A.R., Straub, L. and Sufi, A., 2020. *The Saving Glut of the Rich* (No. w26941). National Bureau of Economic Research

McKay, A. and Wolf, C.K., 2023. Monetary Policy and Inequality. *Journal of Economic Perspectives*, *37*(1), pp.121-144

Merton, R. 1969. Lifetime Portfolio Selection under Uncertainty: The Continuous Time Case *The Review of Economics and Statistics*, 51 (3), pp.247-257

Merton, R. 1971. Optimal Consumption and Portfolio Rules in a continuous time model. *Journal of Economic Theory*, 3 (4), pp.373-412

Wong, A. 2019. Refinancing and the transmission of monetary policy to consumption, *Working Paper*

Yogo, M., 2004. Estimating the elasticity of intertemporal substitution when instruments are weak. *Review of Economics and Statistics*, *86*(3), pp.797-810.

Table 1. Summary Statistics

	Number	Mean	SD
	(1)	(2)	(3)
Panel A: Household Information			
Age	184,144	46.5	14.7
Female (in %)	184,144	0.23	0.43
Married (in %)	184,144	0.61	0.49
Households with term-deposits (in %)	184,144	0.32	0.47
Households with (expired) term-deposits (in %)	184,144	0.13	0.34
Households with (auto-renewal) term-deposits (in %)	184,144	0.06	0.24
Households with investments in risky assets (in %)	184,144	0.17	0.38
Households that credit salary (in %)	184,144	0.26	0.44
Panel B: Bank Balances			
Term Deposits	1,473,152	314,690	1,885,058
Savings Account	1,473,152	256.509	819,561
Total Bank Deposits	1,473,152	571,288	2,168,905
Panel C: Financial Portfolio			
Total Risky Investments	1,473,152	8,518	883,464
Total Insurance Premium	1,473,152	81	67,529
Demat Account Balance	1,473,152	523,045	60,200,000
Risky Asset Share	1,473,152	0.100	0.26
Panel D: Spending			
Total Consumption	1,473,152	22,2221	55,448
Cash Withdrawals	1,473,152	12,368	47,050
Card Spending	1,473,152	9,566	26,655
Utilities	1,473,152	288	2,060
Loan Repayments	1,473,152	5,823	104,769

The results presented in this table are obtained using our sample data from March 2016 to October 2016. At the individual-month level, we report the summary statistics of household information (Panel A), bank balances (Panel B), financial portfolio (Panel C), as well as spending (Panel D). We include the number of observations, mean, as well as the standard deviation. All the data are reported in India rupee. To convert to USD, the exchange rate of 75 Indian Rupee to 1 USD (as of April 2021) can be used.

Table 2. Benchmark DID Regression Estimates

Panel A: Bank Deposits			
Dep. Var.:	Term Deposits Expired	Term Deposits Renewed	Δ Savings Account
	(1)	(2)	(3)
Treat	58,857***	13,196***	23,829***
	(5,700)	(4,821)	(6,268)
Obs.	1,473,152	1,473,152	1,473,152
R Square	0.265	0.264	0.027
Individual FE	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel B: Financial Portfolio			
Dep. Var.:	Risky Investments	Insurance Premium	Risky Asset Share
	(1)	(2)	(3)
Treat	9,394***	1,574***	0.00359***
	(1,368)	(367.8)	(0.000435)
Obs.	1,473,152	1,473,152	1,473,152
R Square	0.050	0.132	0.963
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel C: Spending			
Dep. Var.:	Total Consumption	Loan Repayments	
	(1)	(2)	
Treat	796.4**	1,638***	
	(303.2)	(614.7)	
Obs.	1,473,152	1,473,152	
R Square	0.358	0.187	
Individual Fixed Effects	Y	Y	
Month Fixed Effects	Y	Y	

Note: This table reports the impact of a fall in interest rate on Bank Deposits (Panel A), Financial Portfolio (Panel B), as well as Spending and Borrowing (Panel C) on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator (treat) is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. In Panel A, the dependent variables refer to the amount of term deposits that have expired, term deposits that have been renewed, as well as changes reported in their savings account. In Panel B, the dependent variables refer to the amount of risky investments and insurance premium, as well as the share of risky asset. In Panel C, we focus on the total amount of consumption and loan repayments. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table 3. Individual Stocks

Dep. Var.:	Net Buy	Δ Value	Δ Quantity
	(1)	(3)	(5)
Treat	0.00753***	0.0794***	0.0250**
	(0.00274)	(0.0290)	(0.0120)
Beta * Treat	-0.00609***	-0.0635***	-0.0181*
	(0.00194)	(0.0199)	(0.00923)
Observations	892,576	892,576	892,576
R-squared	0.173	0.163	0.148
Individual Fixed Effect	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Stock Fixed Effects	Y	Y	Y
Individual-Stock Fixed Effects	Y	Y	Y

Note: This table reports the impact of a fall in interest rate on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. For the dependent variables, Net Buy is an indicator variable to indicate whether the stock holding has increased (1), decreased (-1) or unchanged (0). Δ Value refers to the inverse hyperbolic sine of changes in the value of the stock holding, while Δ Quantity refers to the inverse hyperbolic sine of changes in the quantity of the stock holding. The variable, Beta (derived from CAPM) is obtained from two leading stock exchanges in India, NSE and BSE. For all the regressions, individual fixed effects, month fixed effects, stock fixed effects and individual-stock fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-stock-month level.

Table 4. Heterogeneous Effects

Panel A: Auto-renewal			
Dep. Var.:	Risky Investments	Total Consumption	Δ Savings Account
	(1)	(2)	(3)
Treat	12,830***	2,238***	37,145***
	(1,945)	(337.6)	(8,506)
Auto-renewal x Treat	-7,459***	-3,128***	-28,903***
	(1,832)	(545.3)	(6,373)
Obs.	1,473,152	1,473,152	1,473,152
R Square	0.050	0.358	0.027
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel B: Loan Indicator			
Dep. Var.:	Risky Investments	Total Consumption	Δ Savings Account
	(1)	(2)	(3)
Treat	10,590***	460.5	23,806***
	(1,435)	(321.4)	(6,321)
Loan Indicator x Treat	-7,045***	1,978**	135.2
	(2,408)	(771.3)	(7,876)
Observations	1,473,152	1,473,152	1,473,152
R-squared	0.050	0.358	0.027
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y

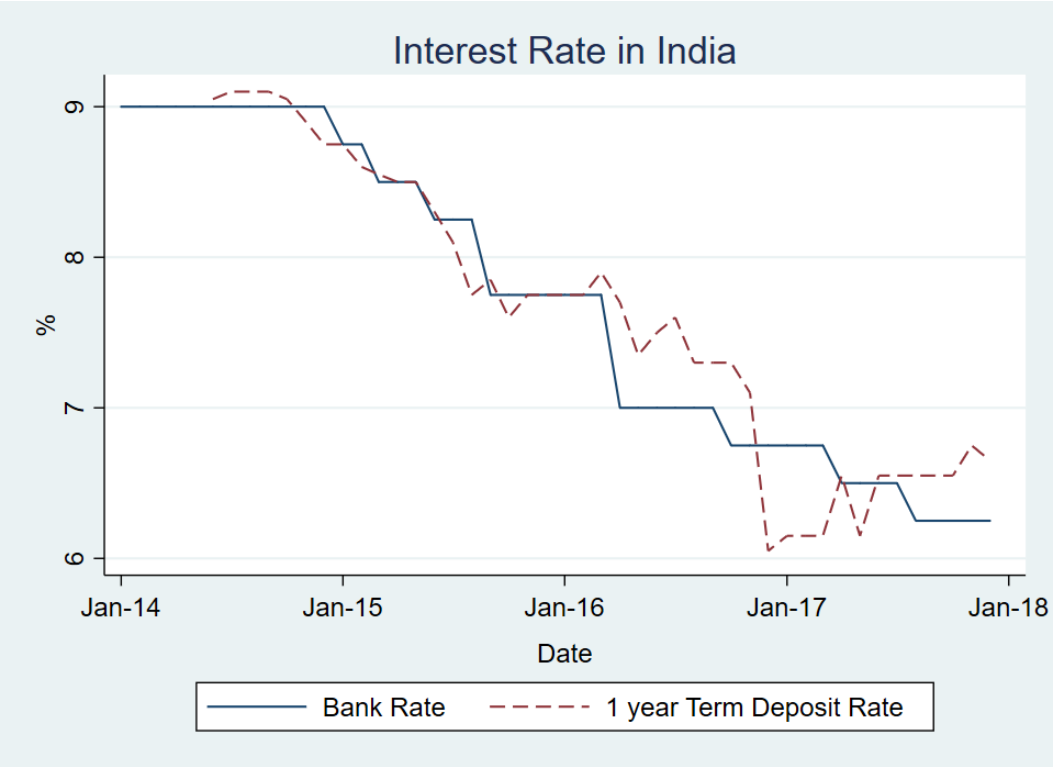
Note: This table reports the impact of a fall in interest rate on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. In Panel A, Auto-renewal is an indicator that is equal to one if the household has an autorenewal term deposit and zero otherwise. In Panel B, Loan indicator is equal to one if the individual has an existing loan with the bank and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. They include the amount of risky investments, changes in the savings balances, consumption spending, and the share or risky asset. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table 5. Treatment Intensity

Panel A: Size of Term Deposits				
Dep. Var.:	Risky Investments	Risky Asset Share	Total Consumption	Δ Savings Account
	(1)	(2)	(3)	(4)
Treat * Size of Term Deposits	636.3***	4.73e-08	36.06**	-532.1
	(110.5)	(2.72e-05)	(16.36)	(752.5)
Obs.	1,473,152	1,473,152	1,473,152	1,473,152
R Square	0.050	0.027	0.358	0.963
Individual Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y
Panel B: Interest Rate				
Dep. Var.:	Risky Investments	Risky Asset Share	Total Consumption	Δ Savings Account
	(1)	(2)	(3)	(4)
Treat * Interest Rate	1,142***	0.000437***	82.47**	3,053***
	(156.4)	(5.08e-05)	(35.55)	(563.4)
Obs.	1,473,152	1,473,152	1,473,152	1,473,152
R Square	0.050	0.027	0.358	0.963
Individual Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y

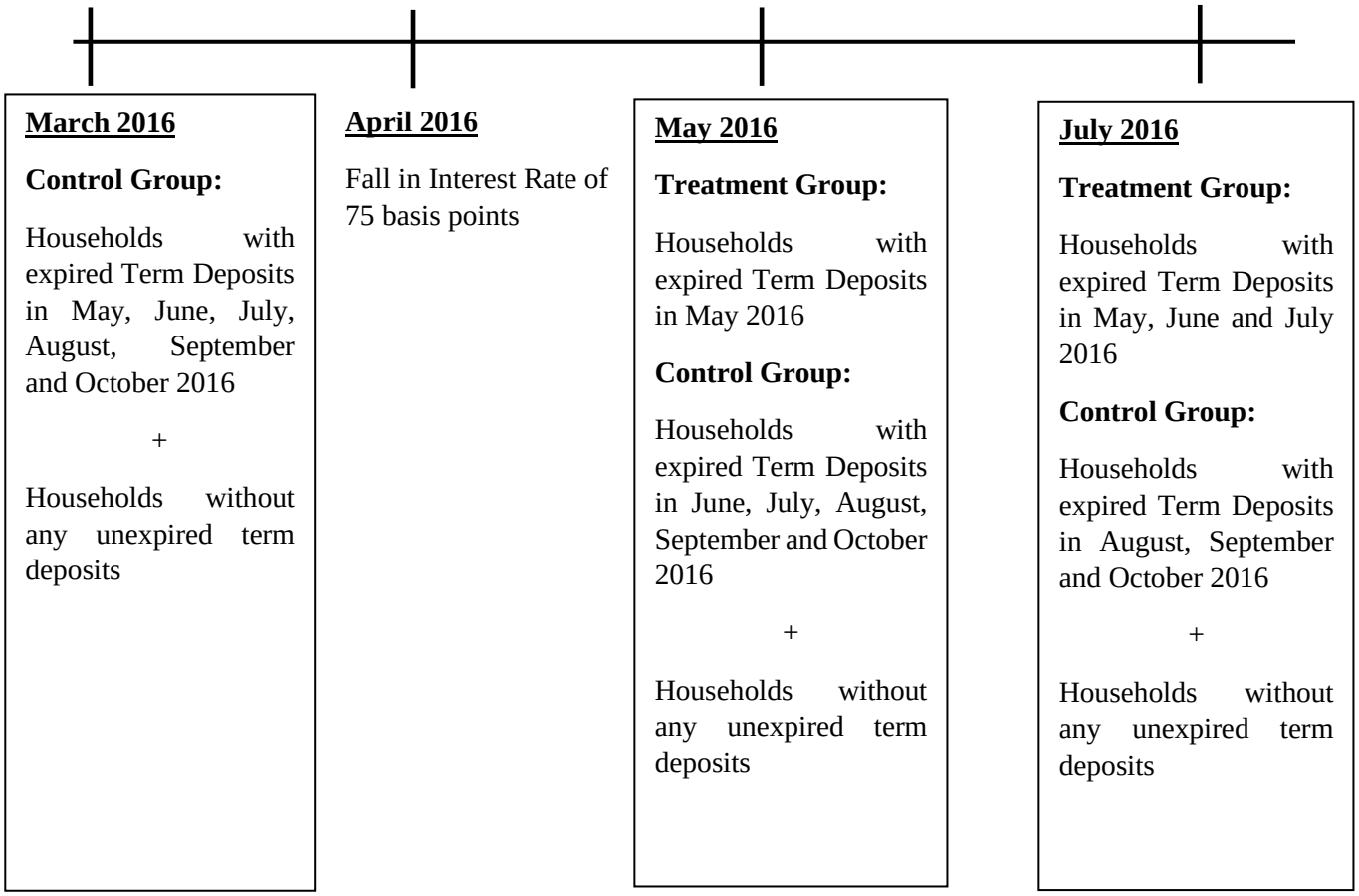
Note: This table reports the impact of a fall in interest rate on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group) based on treatment intensity. The treatment intensity is calculated based on the product of a predetermined variable and the treatment indicator, which is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. In Panel A, the treatment intensity relates to the interaction term between logarithm of the individual's size of term deposits and the treatment indicator. In Panel B, the treatment intensity refers to the interaction term between the locked-in interest rate that term depositors received and the treatment indicator. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. They include the amount of risky investments, share of risky asset, consumption spending and changes in the savings balances. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Figure 1. India's Interest Rate



Note: This figure shows the bank rate (discount rate) determined by India's central bank (Reserve Bank of India), as well as the 1 year Term Deposit rate (with no early withdrawals allowed). The former is the rate in which the Reserve Bank of India lends money to private bank, while the latter is the rate in which the private bank pays its term depositors.

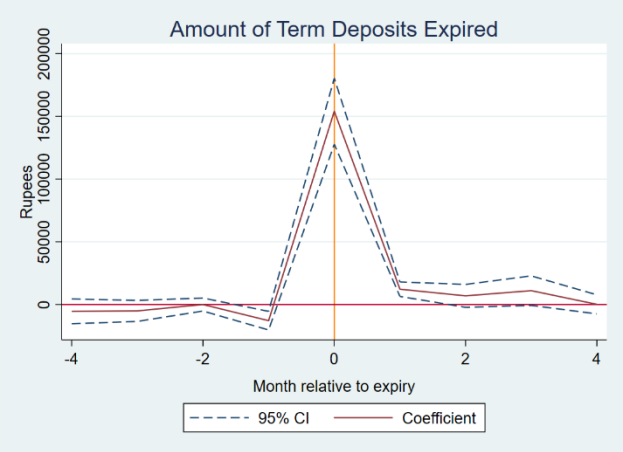
Figure 2. Identification Strategy



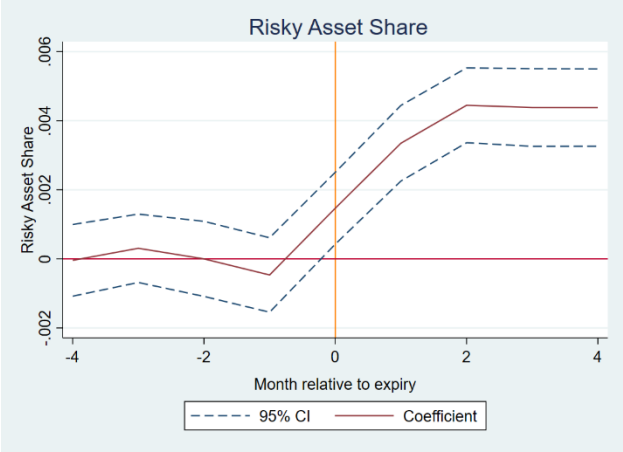
Note: This figure provides examples in terms of the treatment and control groups at different time periods.

Figure 3: Event Study

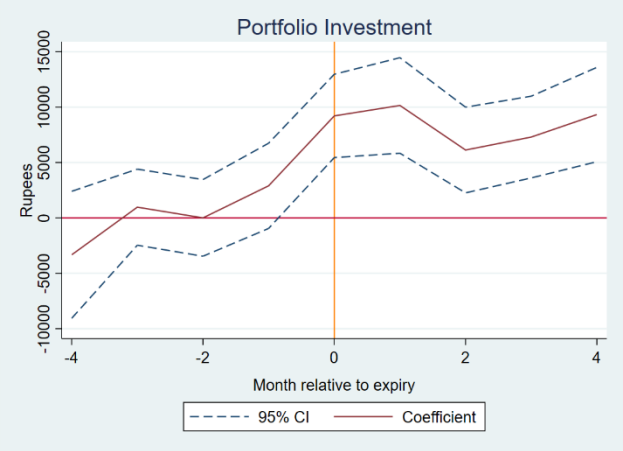
Panel A:



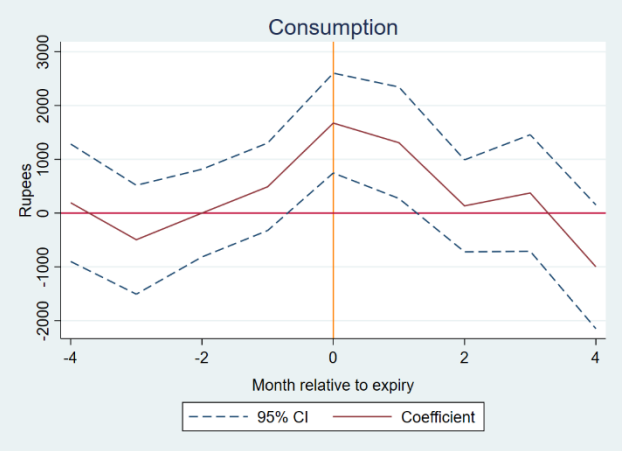
Panel B:



Panel C:



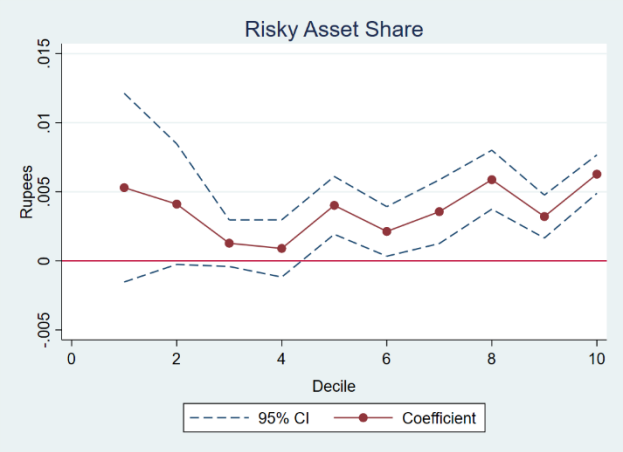
Panel D:



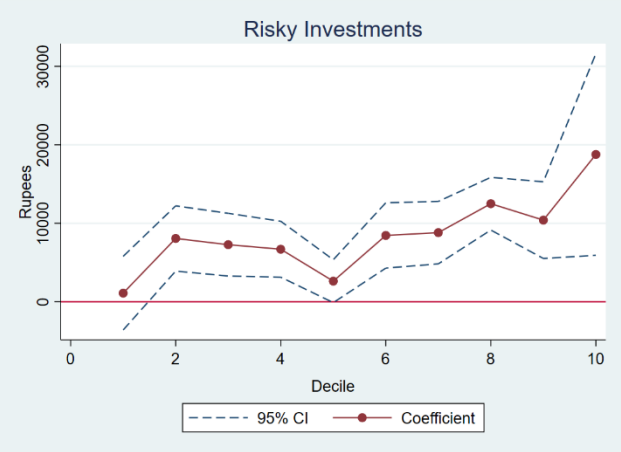
Note: This figure shows the dynamics of the average treatment effect on the amount of term deposits that have expired (Panel A), risky asset share (Panel B), portfolio investment (Panel C) and consumption (Panel D). The x-axis denotes the month after expiry of the term deposits.

Figure 4: Heterogeneous Effects on Consumption and Portfolio Allocation by Liquid Savings deciles

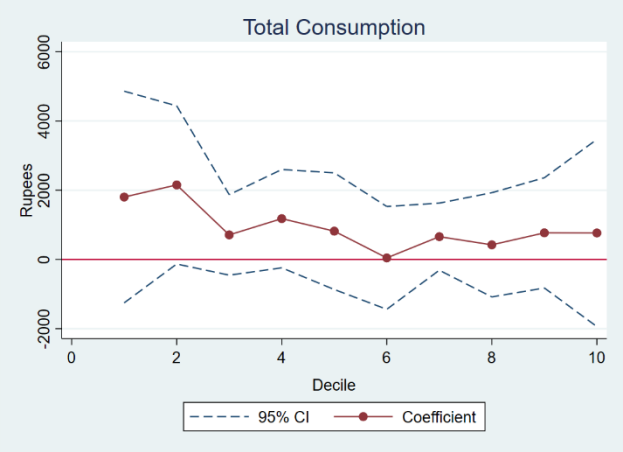
Panel A:



Panel B:



Panel C:



Note: This figure shows the heterogeneous effects of risky asset share (Panel A), risky investments (Panel B) and total consumption (Panel C) by savings deciles (liquid wealth position).

Internet Appendix
Not Intended for Publication

Table A1. Pass-through Effect

Variables	Treatment Indicator	Marginal propensity out of expired term deposits
Expiry	58857	
Renewal	13196	0.22
Δ Savings Account	23829	0.40
Risky Investments	9394	0.16
Insurance	1574	0.03
Consumption	796	0.01
Loan Repayment	1638	0.03
Total Pass-through		0.86

Note: This table reports the workings to calculate the marginal propensity out of expired term deposits.

Table A2. Calculation of Percentage Changes and Interest Elasticity

Variables	Treat	Average Value (Before Treat)	Percentage Change	Interest Elasticity[8]
Panel A: Overall				
Consumption	796 rupees	23,964 rupees	3%	-0.3
Risky Investment	9,394 rupees	3,691 rupees	255%	-26
Panel B: With auto-renewal				
Consumption	-890 rupees	25,638 rupees	-3%	0.3
Risky Investment	5,371 rupees	4,509 rupees	119%	-12
Panel C: Without auto-renewal				
Consumption	2,238 rupees	22,698 rupees	10%	-1
Risky Investment	6,661 rupees	2,958 rupees	418%	-43

Note: This table reports the workings to calculate percentage changes and interest elasticities.

[8] Based on a fall in interest rate of 9.77 percent.

Table A3. Breakdown of Equities, Consumption and Insurance

Panel A: Equities			
Dep. Var.:	Risky Investments	Mutual Fund Investments	Direct Investments
	(1)	(2)	(3)
Treat	9,394***	9,013***	380.6
	(1,368)	(1,403)	(291.9)
Obs.	1,473,152	1,473,152	1,473,152
R Square	0.050	0.059	0.121
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y

Panel B: Consumption				
Dep. Var.:	Total Consumption	Cash Withdrawals	Card Spending	Utilities
	(1)	(2)	(3)	(4)
Treat	796.4**	436.2*	344.7**	15.44**
	(303.2)	(257.7)	(145.7)	(7.206)
Obs.	1,473,152	1,473,152	1,473,152	1,473,152
R Square	0.358	0.274	0.471	0.286
Individual Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y

Panel C: Insurance			
Dep. Var.:	Insurance	Life Insurance	General Insurance
	(1)	(2)	(3)
Treat	1,574***	1,687***	-112.7**
	(367.8)	(379.6)	(53.34)
Obs.	1,473,152	1,473,152	1,473,152
R Square	0.132	0.130	0.161
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y

Note: Building on the results in Table 2, this table reports the breakdown of Equities (Panel A), Consumption (Panel B) and Insurance (Panel C). This table shows the impact of a fall in interest rate on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table A4. New Loans

Panel A: Loan Values in Rupee		
Dep. Var.:	Home Loan	Personal Loan
	(1)	(2)
Treat	583.9	-42.49
	(1,535)	(139.0)
Obs.	1,473,152	1,473,152
R Square	0.129	0.131
Individual Fixed Effects	Y	Y
Month Fixed Effects	Y	Y
Panel B: Loan Take-up		
Dep. Var.:	Home Loan	Personal Loan
	(1)	(2)
Treat	2.59e-05	-8.26e-05
	(0.000165)	(0.000221)
Obs.	1,473,152	1,473,152
R Square	0.137	0.134
Individual Fixed Effects	Y	Y
Month Fixed Effects	Y	Y

Note: This table shows the impact of a fall in interest rate on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group) based on new loans taken up with the bank. In Panel A, the outcome variables are in absolute value (rupees) for home loan and personal loan. In Panel B, the outcome variable is based on the indicator variable, Loan Take-up rate which is equal to one when a new home or personal loan is taken up, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table A5. Heterogeneous Effects

Panel A: Age			
Dep. Var.:	Risky Investments	Total Consumption	Δ Savings Account
	(1)	(2)	(3)
Treat	-8,143***	1,367	5,102
	(3,009)	(908.5)	(12,444)
Age x Treat	351.6***	-11.45	375.5
	(73.25)	(15.44)	(334.4)
Observations	1,473,152	1,473,152	1,473,152
R-squared	0.050	0.358	0.027
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel B: Gender			
Dep. Var.:	Risky Investments	Total Consumption	Δ Savings Account
	(1)	(2)	(3)
Treat	14,213***	622.3	38,799***
	(2,872)	(899.3)	(9,559)
Female x Treat	-5,390	194.8	-16,746
	(3,428)	(944.0)	(11,742)
Observations	1,473,152	1,473,152	1,473,152
R-squared	0.050	0.358	0.027
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel C: Marital Status			
Dep. Var.:	Risky Investments	Total Consumption	Δ Savings Account
	(1)	(2)	(3)
Treat	9,291***	585.7	19,772**
	(1,962)	(373.5)	(9,132)
Married x Treat	186.1	379.6	7,311
	(1,999)	(436.2)	(6,561)
Observations	1,473,152	1,473,152	1,473,152
R-squared	0.050	0.358	0.027
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y

Note: This table reports the impact of a fall in interest rate on risky investments, change in savings balances, as well as total spending on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator (treat) is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. We also include the following interaction term. In Panel A, Age refers to the continuous variable, age of the term depositor. In Panel B, Female is an indicator that is equal to one if the term depositor is a female. In Panel C, Married is an indicator that is equal to one if the term depositor is a female. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table A6. DID Regression Estimates for Salary Creditors only

Panel A: Bank Deposits			
Dep. Var.:	Term Deposits Expired	Term Deposits Renewed	Δ Savings Account
	(1)	(2)	(3)
Treat	52,748***	27,045***	12,656***
	(7,896)	(5,689)	(4,390)
Obs.	389,008	389,008	389,008
R Square	0.296	0.260	0.043
Individual FE	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel B: Financial Portfolio			
Dep. Var.:	Risky Investments	Insurance Premium	Risky Asset Share
	(1)	(2)	(3)
Treat	6,205***	944.5	0.00288***
	(2,043)	(652.3)	(0.000564)
Obs.	389,008	389,008	389,008
R Square	0.034	0.133	0.946
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel C: Spending			
Dep. Var.:	Total Consumption	Loan Repayments	
	(1)	(2)	
Treat	1,389***	617.9	
	(513.2)	(1,706)	
Obs.	389,008	389,008	
R Square	0.375	0.204	
Individual Fixed Effects	Y	Y	
Month Fixed Effects	Y	Y	

Note: In this table, we only focus on the sub-sample of households that credit their salary with the bank. Here, we report the impact of a fall in interest rate on Bank Deposits (Panel A), Financial Portfolio (Panel B), as well as Spending and Borrowing (Panel C) on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator (treat) is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. In Panel A, the dependent variables refer to the amount of term deposits that have expired, term deposits that have been renewed, as well as changes reported in their savings account. In Panel B, the dependent variables refer to the amount of risky investments and insurance premium, as well as the share of risky asset. In Panel C, we focus on the total amount of consumption and loan repayments. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table A7. DID Regression Estimates for 6 months only

Panel A: Bank Deposits			
Dep. Var.:	Term Deposits Expired	Term Deposits Renewed	Δ Savings Account
	(1)	(2)	(3)
Treat	101,976***	40,219***	49,326***
	(9,998)	(5,636)	(10,314)
Obs.	1,104,864	1,104,864	1,104,864
R Square	0.315	0.284	0.053
Individual FE	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel B: Financial Portfolio			
Dep. Var.:	Risky Investments	Insurance Premium	Risky Asset Share
	(1)	(2)	(3)
Treat	9,900***	2,012***	0.00370***
	(1,533)	(664.5)	(0.000484)
Obs.	1,104,864	1,104,864	1,104,864
R Square	0.080	0.172	0.968
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel C: Spending			
Dep. Var.:	Total Consumption	Loan Repayments	
	(1)	(2)	
Treat	751.6*	1,891	
	(403.0)	(1,138)	
Obs.	1,104,864	1,104,864	
R Square	0.405	0.222	
Individual Fixed Effects	Y	Y	
Month Fixed Effects	Y	Y	

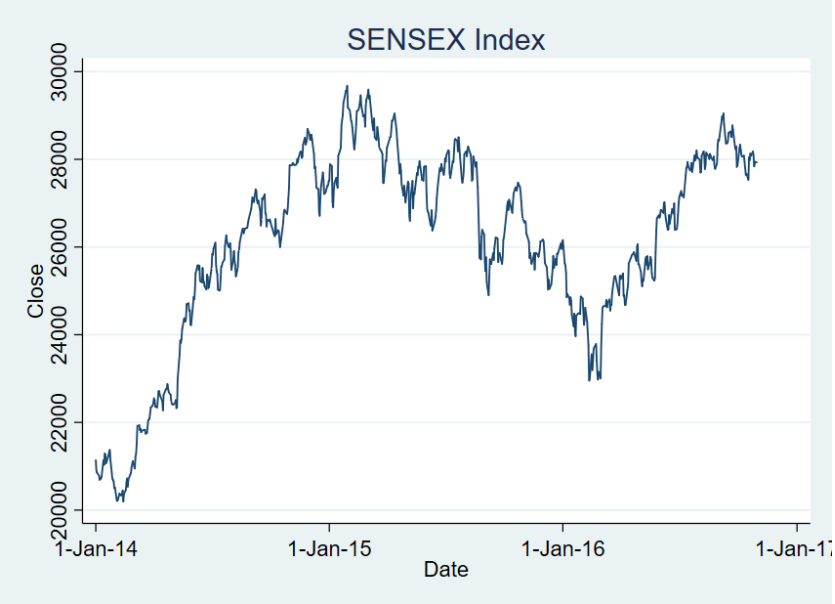
Note: In this table, the results presented in this table are obtained using data from May 2016 to October 2016. Here, we report the impact of a fall in interest rate on Bank Deposits (Panel A), Financial Portfolio (Panel B), as well as Spending and Borrowing (Panel C) on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator (treat) is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. In Panel A, the dependent variables refer to the amount of term deposits that have expired, term deposits that have been renewed, as well as changes reported in their savings account. In Panel B, the dependent variables refer to the amount of risky investments and insurance premium, as well as the share of risky asset. In Panel C, we focus on the total amount of consumption and loan repayments. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Table A8. DID Regression Estimates for Term Depositors only

Panel A: Bank Deposits			
Dep. Var.:	Term Deposits Expired	Term Deposits Renewed	Δ Savings Account
	(1)	(2)	(3)
Treat	124,169***	43,187***	61,019***
	(10,421)	(5,245)	(12,065)
Obs.	193,952	193,952	193,952
R Square	0.276	0.282	0.017
Individual FE	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel B: Financial Portfolio			
Dep. Var.:	Risky Investments	Insurance Premium	Risky Asset Share
	(1)	(3)	(2)
Treat	6,205***	2,363***	0.00257***
	(1,705)	(886.6)	(0.000418)
Obs.	193,952	193,952	193,952
R Square	0.069	0.133	0.964
Individual Fixed Effects	Y	Y	Y
Month Fixed Effects	Y	Y	Y
Panel C: Spending			
Dep. Var.:	Total Consumption	Loan Repayments	
	(1)	(2)	
Treat	1,432***	2,959***	
	(446.4)	(1,114)	
Obs.	193,952	193,952	
R Square	0.371	0.184	
Individual Fixed Effects	Y	Y	
Month Fixed Effects	Y	Y	

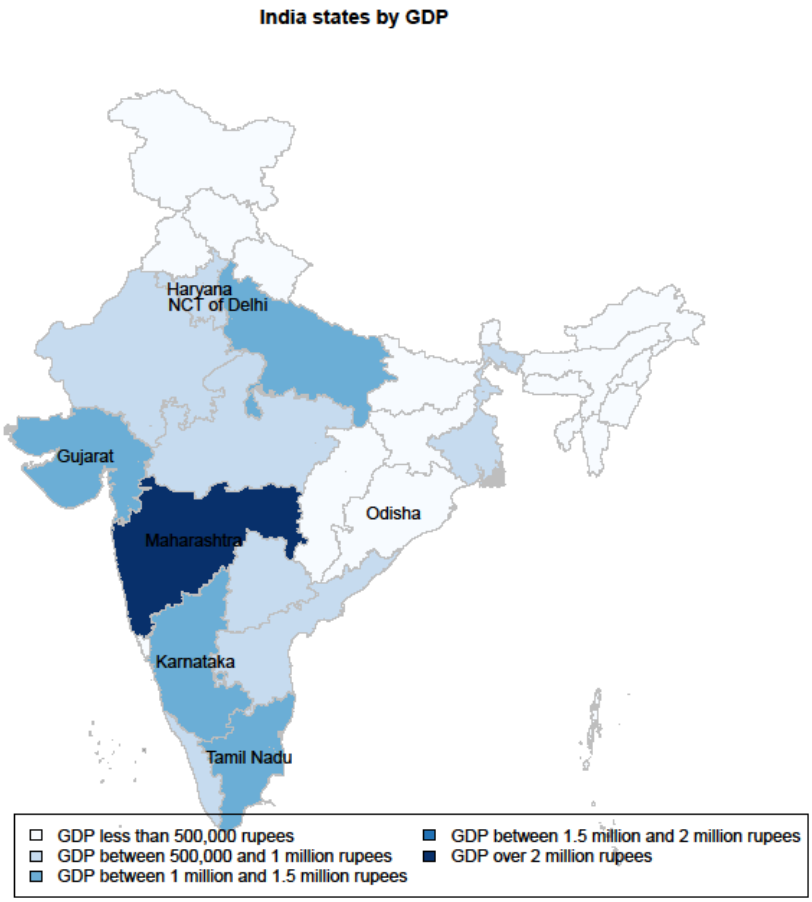
Note: In this table, we only focus on the sub-sample: those with expired term deposits only. Here, we report the impact of a fall in interest rate on Bank Deposits (Panel A), Financial Portfolio (Panel B), as well as Spending and Borrowing (Panel C) on depositors whose term deposit expired early (treatment group) relative to those without any expired term deposits or whose term deposit expired in a later month (control group). The treatment indicator (treat) is equal to one after the expiry of the term deposit for that individual in that month, and zero otherwise. Each column represents the estimation of its corresponding dependent variable that is indicated in the first row. In Panel A, the dependent variables refer to the amount of term deposits that have expired, term deposits that have been renewed, as well as changes reported in their savings account. In Panel B, the dependent variables refer to the amount of risky investments and insurance premium, as well as the share of risky asset. In Panel C, we focus on the total amount of consumption and loan repayments. For all the regressions, individual fixed effects and month fixed effects are imposed. Standard errors are clustered by account type x city x occupation. The robust standard errors are reported in parenthesis. *,**,*** denote statistically significant levels at 10%, 5% and 1% respectively. The results presented in this table are obtained using data from March 2016 to October 2016. The data structure is at individual-month level.

Figure A1. S&P Bombay Stock Exchange Sensitive Index (SENSEX)



Note: This figure shows India's leading Stock Market Index, the SENSEX from 2014 to 2016.

Figure A2. Location of States in India



Note: This figure shows India's states by GDP. The darker the colour, the higher is the GDP for the state.