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How can banks effectively stabilize their retail customers saving behavior? The impact of contractual rewards on saving persistence and cash flow volatility

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**How can banks effectively stabilize their retail customers' saving behavior?  
The impact of contractual rewards on saving persistence and cash flow volatility**

Tobias Schlueter, Soenke Sievers and Thomas Hartmann-Wendels

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**Abstract:** We examine the saving behavior of banks' retail customers. Our unique dataset comprises the contract and cash flow information for approximately 2.2 million individual contracts from 1991 to 2010. We find that contractual rewards, i.e., qualified interest payments, and government subsidies, effectively stabilize saving behavior. The probability of an early contract termination decreases by approximately 40%, and cash flow volatility drops by about 25%. Our findings provide important insights for the newly proposed bank liquidity regulations (Basel III) regarding the stability of deposits and the minimum requirements for risk management (European Commission DIRECTIVE 2006/48/EC; in Germany, translated into the MaRisk). Finally, the results inform bank managers how the price setting via deposit interests influences their funding.

*JEL classification: G01, G21, G28*

**Keywords:** Basel III, MaRisk, retail saving behavior, deposit funding, saving plans, contractual rewards, interest rate bonus, saving persistence, cash flow volatility

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# 1. Introduction

During the 2008/2009 financial crisis banks' funding by retail customers proved to be more stable than wholesale or even interbank funding. Retail customers provided a "sticky" financing base for many banks, and those banks that relied heavily on retail deposits handled the illiquidity and malfunction of other funding channels better than the banks that did not. Therefore, retail deposits and in particular their management and methods for evaluating future developments receive great attention from practitioners and regulators in the aftermath of the financial crisis. Recent examples include The Economist (2011), "Despite low interest rates and dismal returns, there is hot competition for customer deposits"<sup>1</sup>; Turner (2009), "Turner Review: A regulatory response to the global banking crises"; and primarily regulatory attempts (Basel III) outlined by the Basel Committee (2010, 2011a, 2011b).

Although current research focuses on causation, the course of the financial crises and the possible effects of new financial regulations (Aebi et al., 2012; Moshirian, 2011; Claessens et al., 2009; Klomp and de Haan, 2012; Hakenes and Schnabel, 2011), only a limited amount of research on the saving behavior of retail customers is available. Consequently, this paper seeks to address how a bank can guide the saving behavior of its retail customers by employing a unique dataset consisting of the contract and cash flow information for approximately 2.2 million individual saving contracts from 1991 to 2010 in Germany.

Today, retail and corporate deposits represent the liabilities of banks to a great extent. In the case of Germany, approximately 40% of all liabilities stem from non-bank funding.<sup>2</sup> Since 2009, banks have shifted their refinancing toward retail clients (e.g., Deutsche Bank's acquisition of Postbank, Germany's largest retail-focused bank). Moreover, many

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<sup>1</sup> See The Economist, May 12th 2011, available at <http://www.economist.com/node/18654578>.

<sup>2</sup> See publicly available monthly reports at [www.bundesbank.de](http://www.bundesbank.de). All statistics are as of December 2010.

smaller banks are focusing on bidding for deposits (e.g., Santander, IKB direkt and BMW Bank). In addition to these observable changes in banking practices, new financial regulations concentrate on retail deposits. As induced by Directive 2006/48 of the European Commission (among others), in 2009, the revised minimum requirements for risk management (MaRisk) have been published by the federal banking regulation authorities in Germany. These requirements compel banks to establish detailed liquidity gap analyses and projection methods for the behavior of their retail customers (Bafin, 2009). However, because this legislation is based on the abovementioned EC Directive, similar legislation is available in other European countries as well. Thus, forecasts of cash inflows and outflows are now mandatory for banks. Additionally, one of the main aspects of Basel III is the management of liquidity risk (Basel Committee, 2011a). For the first time, banks are being asked to fulfill quantitative requirements for their liquidity risk positions on a harmonized European basis. Thus, retail deposits will be classified as ‘stable’ or ‘less stable’. Because this newly introduced classification directly influences the buffers of highly liquid assets that banks will have to establish, banks’ funding structures, particularly the quality of their deposit funding, will receive attention in the light of the new financial regulations. In sum, controlling and managing retail deposit funding will be one of the core topics for banks over the next several years until the full adoption of Basel III. The ability to forecast and influence retail customers’ behavior will be crucial to banks’ funding strategies as well as to their recognition by the regulation authorities.

To shed light on these important issues, we explore the unique dataset provided by a German retail-focused building association (‘Bausparkasse’). This dataset consists of detailed cash flow and customer characteristics for more than two million contracts from 1991 to

2010. This rich dataset is well suited for our analysis because the bank specializes in providing saving and loan contracts for retail customers. In the beginning, the customer signs a saving contract with the bank and starts to save money. After a certain time, she will be offered a mortgage loan from that bank within predetermined conditions.<sup>3</sup> Although this initially appears to be special, it is a representative saving product in Germany. On average, one-third of all Germans have a contract with a building association.<sup>4</sup> Furthermore, approximately 9% (i.e., 140bn. €) of all German retail deposits are held by the German building associations whose contracts are popular for saving purposes.<sup>5</sup> Put differently, the majority of German customers saves money on the offered contract and terminates the saving contract after a few years. We note the contractual setting. That is, the bank offers some tariffs with contractual rewards for their customers. First, a contract can be equipped with a certain interest bonus (i.e., the customer will be rewarded if she saves for a longer period of time). These ‘bonus contracts’ pay a basis interest and an additional qualified interest on deposited cash if the customer saves longer than, for example, four years. If one terminates the contract within the first four years, the customer will lose her interest bonus but keep the basis interest. Thus, where is the disadvantage in choosing a ‘bonus contract’? The cost of choosing a ‘bonus contract’ stems from the higher interest that the customer faces for the credit option. In other words, there is a tradeoff between receiving higher interest rates during the saving period and paying a higher credit interest rate in case the mortgage is taken after 40% to 50% of the agreed contract volume has been saved. More precisely, interest bonus contracts offer, on average, an interest rate 1% higher than

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<sup>3</sup> See section 2 for details.

<sup>4</sup> In 2010, there are 29,982,925 individual contracts, as shown in the annual report of the industry association for 2010 on p. 83, which is available at [http://www.bausparkassen.de/fileadmin/user\\_upload/VPB\\_GB\\_2010.pdf](http://www.bausparkassen.de/fileadmin/user_upload/VPB_GB_2010.pdf).

<sup>5</sup> See the publicly available monthly reports at [www.bundesbank.de](http://www.bundesbank.de). All statistics are as of December 2010.

that offered by a non-interest bonus contract during the saving period, which comes at a cost of an approximately 1.3% higher credit interest rate. Although choosing the right contract is a complicated problem from a household perspective (Cocco, 2005; Campbell, 2006), we note that the mean contract volume is below 20,000 €, as shown in the empirical analysis. Consequently, customers must use other significant sources of funding to buy or refurbish real estate, and evaluating the importance of the credit option from a customer's perspective may not be critical. However, we acknowledge that this fact introduces self-selection issues, which we address via panel estimators (i.e., customer fixed effects models) and various matching procedures in section 6.

The existence of both contract types (i.e., contracts with and without bonus clauses) allows us to analyze whether the bank can increase the customers' saving persistence by offering the contractual reward. If so, the key question becomes by how much can the bank increase the customers' saving persistence? Put differently, in light of recent regulations on the stability of deposits, the economic significance of the reward becomes important. Is early contract termination, on average, reduced by 10%, 20% or 30%? How much longer can the average customer be induced to provide funds to the bank? Is this effect on customer behavior linear in the interest bonus rates that range from 0.5% to 2.5%?

The second reward that a customer can receive is a government subsidy called Wohnungsbauprämie ('wop'). This subsidy is exclusively paid to the customers of building associations who meet certain eligibility conditions that are determined by a German law. The conditions mainly depend on the customer's taxable income.<sup>6</sup> Savings up to an amount of 1024 € (married) or 512 € (single) per year are subsidized with a factor of 8.8% (i.e., a customer can receive an extra 90 € or 45 € per year, respectively). All savings that exceed

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<sup>6</sup> See [http://www.bausparkassen.de/uploads/mit\\_download/House\\_Building\\_Premium.pdf](http://www.bausparkassen.de/uploads/mit_download/House_Building_Premium.pdf) for details.

1024 € or 512 €, respectively, are not further subsidized. Primarily, the incentive character of this saving subsidy is similar to that of the interest bonus. Here, the customer loses the complete subsidy if she saves for less than seven years. In other words, if the customer draws on the deposited cash within seven years, she must repay the obtained subsidies. Thus, wop exhibits a reward characteristic similar to that of the interest bonus. The difference emerges in the required length of the saving duration (i.e., four years for the interest bonus vs. seven years for wop).

The aim is to analyze the retail behavior holistically. Apart from the saving duration (i.e., the time period during which the customer funds the bank), the smoothness of the deposit cash inflows is significant to the bank. Thus, is the volatility of the cash inflows ('vola') reduced by the qualified interest bonus and wop? If yes, then we turn to the economic significance of this result and ask the following: by how much is the volatility of the cash inflows reduced? Analyzing the saving duration together with the cash flow volatility will yield a comprehensive method of describing the behavior of retail customers.

Our results are as follows. First, regarding the saving duration as an outcome variable, we predict and find that contractual rewards (i.e., qualified interest payments and government benefits) effectively stabilize saving behavior. The probability of early contract termination decreases by approximately 40%, and cash flow volatility decreases by approximately 25%. More precisely, the impact of an interest bonus on the saving duration is stable (i.e., proportional to the contract volume), while the impact of wop varies in increasing contract volume. Second, we consider the bank's funding volatility, which captures whether the bank has smooth and steady deposit inflows. We find that interest bonuses and wop eligibility lead to more stable cash flows. Last, with respect to the question of whether the re-

ward mechanisms are substitutes or complements, our results show that for the contracts with interest bonuses *and* wop eligibility, both rewards will act as complements (i.e., increasing the probability of saving persistence and decreasing cash flow volatility).

This study contributes to several bodies of literature. First, our findings highlight insights for the newly proposed bank liquidity risk regulations (Basel III) regarding the stability of deposits and the minimum requirements for risk management. In particular, our analysis of interest bonuses provides important insights because these rewards are typical for many other banks' saving contracts. For example, many banks offer saving contracts with rising interest rates over time such that the customer is rewarded if she saves for a longer period of time. Discussions with bank practitioners reveal that some of their most important deposit products are of this type. Therefore, we believe that the generated insights regarding interest bonuses may be transferred to other banking products with similar structures.

Second, we are the first to analyze how the government subsidy (wop) influences customer behavior within such a comprehensive sample. This incentive allows us to add to the recent literature on the inter-temporal choices of people. In short, this literature documents time inconsistencies and preference reversals that incorporate consumers' temptations and self-control problems (Thaler, 1981; Green et al., 1994; Casari, 2009). Based on the preferences developed by Gul and Pesendorfer (2001, 2004), who capture these issues, Krusell et al. (2010) show that if consumers are tempted by "excessive" impatience, the optimal government policy is to subsidize savings. If the dynamic self-control preferences (Gul and Pesendorfer 2001, 2004) represent real consumer behavior, then this form of government saving subsidy can improve welfare for present biased agents.



In sum, in light of the new, revised role of retail deposits in the funding strategies of banks and the new proposed regulation, our analysis will depict the economic impact of contractual reward mechanisms on retail customer behavior. The paper proceeds as follows. Section 2 describes the related literature and outlines the institutional setting. The theoretical considerations are addressed in section 3, whereas section 4 describes the data set and the estimation procedure. The main results are presented in section 5, and section 6 presents the robustness checks. The final section concludes the paper.

## **2. Related Literature and Background**

Retail deposits represent one of the most important funding classes of banks. Managing and guiding the behavior of retail customers is most challenging for banks that rely heavily on deposit funding. Already Diamond and Dybvig (1983) notice the immense threat to a bank if retail customers draw on their deposited cash. Because of term transformation and the illiquidity of bank assets, liquidity risk arises and ultimately results in a bank run, which causes a bank failure. Deposits can often be drawn on immediately and thus exhibit a stochastic cash flow pattern. These features motivate possible questions regarding future predictability, but the academic literature on their management is scarce.

Although there is ample evidence on how interest rate pass-through and macroeconomic forces influence how banks price their retail products (e.g., Hofman and Mizen, 2004; ECB, 2009), little is known about customer reactions to price setting. Some studies observe changes in non-bank deposit volumes at the bank level (e.g., Gatev and Strahan, 2006). However, in general, the studies fail to depict the fraction of retail and corporate deposit volumes with respect to non-bank deposits or even to relate a certain deposit volume change to individual customers.

One could suggest that the guidance of retail behavior could be related to relationship banking. However, this strand of literature mainly focuses on credits and mortgages. In addition, most studies address corporate customers (Agarwal et al., 2010; Ongena et al., 2011). In other words, the topic mainly concerns relationship lending to firms (Boot, 2000; Ongena and Smith, 2000; Agarwal et al., 2006; Agarwal and Hauswald, 2008; Degryse et al., 2009; Agarwal and Hauswald, 2010). Studies on customer development find that retail customers evolved during the last few decades and are now better informed than they were

in the past (e.g., Turner, 2009). Consequently, switching behavior may have increased in recent years because customers will take advantage of the best savings offers available.

Next, because of the major difficulties associated with observing customer reactions on the individual level for a complete bank, some studies only analyze surveys (Humphrey, 2010; Simon et al., 2010), where aspects such as customer loyalty are addressed. Finally, the household finance literature considers the people's views and questions how they invest their capital (Campbell, 2006; Calvet et al., 2007; Bergstresser and Poterba, 2004). In contrast, our perspective takes the reverse approach; we take the bank's perspective and analyze how a bank can influence the behavior of its customers, regardless of what other investments they undertake.

With respect to the impact of government subsidies, Engelhardt (1996) documents the effects of government subsidization on saving activity in Canada. Only two studies have been conducted on the German government subsidy wop. Börsch-Supan and Stahl (1991) and Rotfuß and Westerheide (2010) analyze the consequences of the subsidy from a political economics perspective. Both studies take advantage of cross-sectional data provided by the Federal Bureau of Statistics for the years 1978 and 1983 as well as 1993 and 2003. The researchers find that no crowding out effects emerge if the German government exclusively subsidizes certain contract types. However, whether the wop subsidy guides behavior during the lifetime of a saving contract cannot be determined.

To the best of our knowledge, no study has yet analyzed contract designs that reward a special saving behavior.

It will be necessary to give a short introduction to the German building association system with its specialties but first of all its commonalities with typical banking products for retail

customers (see also Börsch-Supan and Stahl, 1991; Scholten, 2000).<sup>7</sup> The building associations in Germany ('Bausparkassen') are banks whose external funding consists almost completely of retail deposits. The main objective of the bank is to grant loans for homebuilding or refurbishment to retail savers. Because not all customers take loans, the deposit volumes typically exceed the banks' loan volumes. Retail deposits that are not required to fund loans can be invested in other restricted asset classes (e.g., highly rated government bonds, certain corporate bonds or stocks). A typical saving contract is closed on a contract volume. Usually, the customer saves up to 40% of that volume during the first few years. The customer can always exit the contract and withdraw her capital during that time, and the customer will not be forced to bring up her pre-agreed saving amount. If the sum of the deposits reaches 40% of the contract volume, the customer will be eligible to obtain a loan with pre-specified conditions on the remaining 60% of the contract volume after a short waiting period. If the customer does not take a loan, she can continue saving. The specialty of this type of product is that during the contract's lifetime, the contractual conditions do not vary (i.e., the deposit interest and future loan rates are fixed at the start of the contract). To facilitate homebuilding and private savings after the Second World War, the German government introduced the subsidy wop in 1952.<sup>8</sup> This upper-bounded subsidy is exclusively paid to the customers of Bausparkassen who save a minimum amount per year and meet certain eligibility conditions that are mainly based on the customer's income. The customer loses her subsidy if the customer withdraws her deposits during the first seven years. Because only the retail savers of building associations can obtain the subsidy and

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<sup>7</sup> See also the description of the German building association system provided by the private savings association entitled "The "Bauspar" system in German available at [http://www.bausparkassen.de/fileadmin/user\\_upload/english/The\\_Bauspar\\_System\\_in\\_Germany.pdf](http://www.bausparkassen.de/fileadmin/user_upload/english/The_Bauspar_System_in_Germany.pdf)

<sup>8</sup> See the law entitled "Bausparkassen Act" available at [http://www.bausparkassen.de/fileadmin/user\\_upload/english/Bausparkassen\\_Act.pdf](http://www.bausparkassen.de/fileadmin/user_upload/english/Bausparkassen_Act.pdf)

because the banks promote their product by highlighting the greater return attributable to the government grant, we refer to wop as a contractual reward for our contracts.

### 3. Theoretical Considerations

We screen the contractual settings, which include more than forty different contract tariffs, and find six contract tariffs that offer a qualified interest bonus.<sup>9</sup> These six contract tariffs pay an interest bonus if the customer saves for more than four years. For those tariffs, the customer earns an extra interest on her deposited cash during the contract’s duration. However, if the customer terminates the contract within the first four years, the interest bonus is lost. In fact, 20% of all observed contracts are equipped with this contractual feature.<sup>10</sup> Furthermore, approximately 36% of all contracts are wop eligible. However, this government subsidy will be lost if the customer draws on her deposited cash within the first seven years of saving.

Early contract termination is sanctioned because of the interest bonus or wop. Thus, we classify the contracts according to saving duration into the following four groups:

Case	Description	Duration (years)	Label (coded as)
1	Contracts that would break interest bonus standards	$< 4$	1
2	Contracts that would fulfill interest bonus standards	$\geq 4$	0
3	Contracts that would break wop subsidy standards	$< 7$	1
4	Contracts that would fulfill wop subsidy standards	$\geq 7$	0

We expect the contracts with interest bonus features to be less likely to result in case 1 and the contracts with wop subsidies to be less likely to result in case 3. In other words, the

<sup>9</sup> See section 4 for details.

<sup>10</sup> Recall from the introduction that the cost of choosing a ‘bonus contract’ is attributable to the fact that the customer faces higher interest rates for the credit option. Therefore, choosing the right contract is a complex problem from a household perspective, as shown by Cocco (2005) and Campbell (2006). Given the choice option, we address self-selection issues via panel estimators (i.e., customer fixed effects models and various matching procedures) in section 6. Note that we verified that the trade-off is only related to the interest bonus and the price for the future valid credit rate. In particular, the sales force does not receive a higher commission if one or the other contracts are sold to the customer.

probability that a contract has a saving duration of less than four years decreases if interest bonuses are offered (i.e.,  $\Delta P(\text{Duration} < 4) \leq 0$ <sup>11</sup> if the contract **has an interest bonus clause**). The probability that a contract has a duration of less than seven years decreases if wop subsidies are offered (i.e.,  $\Delta P(\text{Duration} < 7) \leq 0$  if the contract **has wop eligibility**). To provide an idea of the possible consequences of early contract termination, the table below presents four exemplary contracts that highlight the possible losses or gains via rewards. Because of an early contract termination, the first exemplary contract loses the complete interest bonus sum of 1,006 € whereas the third contract loses 279 € of the wop:

Case	Contract event	Saving duration (years)		Required duration for reward (years)	Sum of cash-inflows (€)	Basis interest (%)	Sum of basis interest (€)	Interest bonus rate (%)	Sum of interest bonus (€)	Sum of wop (€)
1	Loses bonus	<b>3</b>	<	4	20,000	2	1,006	2	<b>1,006</b>	0
2	Keeps bonus	5	>	4	15,430	2	1,302	2	1,302	0
3	Loses wop	<b>6</b>	<	7	10,054	2	532	0	0	<b>279</b>
4	Keeps wop	8	>	7	9,154	2	650	0	0	328

Several studies find that retail customers behave in a sticky and slow manner or are much less informed than corporate customers such that retail customers exhibit suboptimal behavior (e.g., Kahn et al., 1999; Calem and Mester, 1995). However, we expect reward mechanisms to influence the behavior of the bank's customers. Therefore, our first hypothesis emphasizes saving persistence:

H1: Tariffs with interest bonus as well as the government subsidy wop statistically and economically increase saving persistence duration and thus decrease the probability of early contract termination.

<sup>11</sup>  $\Delta$  (i.e., Delta) indicates change. In our case, it refers to change in probability (**P**).

Notice that we first seek to document a relationship, but secondly we explore the economic significance of positively guided portfolio behavior (i.e., we analyze the impact of the rewards in terms of increased saving duration). In other words, are contractual rewards powerful enough to change and influence customer behavior to a large extent? Do the contractual rewards affect the structure of the banks' deposit funding? The answers to these questions are not obvious because customer behavior may be sticky. Specifically, at the time that a consumer signs the contract, she could also arrange automatic (e.g., monthly) money transfer orders that are normally not revisited because liquidity flexibility may be ensured via other customer channels. Conversely, when confronting with bigger capital needs of a 'normal' household, customers may quickly remember that they have saved a significant amount in this product. To summarize the first and the following hypotheses, we present an overview in Table 1.

*----Please insert Table 1 approximately here----*

Regarding the relative importance of both contractual reward mechanisms (i.e., interest bonus vs. wop), the following interesting question emerges. Consider the case of increasing contract volume. Because the interest bonus is defined as a percentage of deposited cash, the perceived 'bonus clause's value' should remain stable (i.e., regardless of how much money the customer invests she will always lose 'x'-percent of the invested capital if she terminates the contract too early). However, wop is an upper-bounded contractual reward (i.e., a customer receives at most 45 € (single) or 90 € (married) per year). Therefore, the



subsidy's perceived value should be decreasing in absolute contract volume. Put differently, because the retail customer gains a fixed absolute amount, the additional return on the contract assigned to the wop reward decreases in deposit volume. Since low-volume contracts can generate high returns with a wop reward, we predict that the wop impact will be high on lowering the probability of early contract termination for this particular class. In contrast, the absolute value of an interest bonus will be negligible for low-volume contracts. For high-volume contracts, the perceived importance of a possible wop reward loss will have less value than the perceived loss of the interest bonus, which will add up to a much greater absolute amount than wop. Comparing the average amounts of interest bonuses and wop for the volume classes, we find that the value of the interest bonuses exceeds the value of wop, on average, for the contract volumes higher than 20,000 € (see Table 2, Panel B). Therefore, we predict that with an increasing contract volume, the perceived risk of losing interest bonuses outweighs the perceived loss of wop-saving rewards. Thus, we assume that the following holds true:

H2: While the impact of the interest bonus on saving persistence is stable (i.e., proportional to the contract volume), the impact of wop decreases as the contract volume increases such that the relative importance of the two rewards flips at a certain critical contract volume.

Thus far, we have been silent on the second dimension of saving behavior (i.e., the volatility of retail deposit fund inflows for the bank). One might suggest that customers save on a regular basis for this type of saving product and use, for instance, automatic debit transfer

systems that lead to even cash flows in every period. However, practically we observe that cash flows vary for most contracts during the saving period (i.e., approximately 75% of all contracts are subject to cash flow variations). Whether and how contractual features reduce funding volatility has yet to be determined. During the last twenty years, the aggregate interest on our observed contracts has been, on average, market competitive if the contract is equipped with interest bonus clauses. For descriptive statistics on this feature, we sum the basis interest rate and, if offered, the additional interest bonus rate, and we compare this value to a market-wide savings bonds rate with a duration of one year. Although the returns of our savings contracts fall short compared with the returns of the market-wide savings bonds during the first year of the contract, the average return of our contracts with interest bonuses exceeds the market-wide interest rate during the subsequent years.<sup>12</sup> Although exemplary, this result shows that, on average, the attractiveness of our saving contracts grew after the contract has been signed because the contract locked in a stable interest rate. Therefore, we hypothesize that cash inflows to the contracts with interest bonuses should be smoother because these contracts offer more attractive returns that are comparable with market-wide deposit facilities. Further, as a customer is requested to save a minimum amount of 1024 € (married) or 512 € (single) per year to receive the maximal possible government subsidy (8.8% of these savings), we argue that a customer saves more and more stable than a customer who is not eligible for wop. Therefore, we hypothesize the following:

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<sup>12</sup> In the underwriting year, the basis interest falls short by 1.5% in comparison with the market rate, whereas an interest bonus contract falls short by 0.4%. During the contract's lifetime, the interest bonus contract returns exceeded, on average, the return on the savings bond by 0.2%, whereas the sole basis interest still falls short, on average, of the market-wide interest.

H3: Both interest bonuses and wop eligibility lead to smoother and less volatile cash flows.

Of further interest will be the interplay between the two reward mechanisms. Are wop and interest bonuses substitutes or complements? On the one hand, because wop sanctions a contract termination within seven years, one could expect an additional interest bonus sanctioning a termination within four years to not affect customer behavior given that wop already affects saving persistence. On the other hand, because both rewards work additively (i.e., increase the absolute amount of cash available to the retail customer), we expect the two incentives to act as complements.

H4: For contracts with interest bonus features and wop eligibility, wop and the interest bonus will act as complements and thus increase the probability of saving persistence while decreasing cash flow volatility.

Finally, referring to the absolute value of the interest bonus defined as a percentage, we expect to find that the higher the interest bonus is, the greater the impact on saving behavior.

H5: The higher the interest bonus is, the higher the probability of saving persistence and the lower the cash flow volatility.

The next section will present the data and the estimation procedures.

## 4. Data and Estimation Procedure

### Sample Description

Our dataset is obtained from a large bank in Germany whose business objective is to accept saving deposits ('Bauspareinlagen') from retail customers and to grant loans from these aggregate savings to mainly customers for housing finance activities ('Bauspardarlehen'). In Germany, only 23 specialist credit institutions are authorized to conduct this type of business. Although this low number may initially appear restrictive, it is important to know that this type of savings product is offered in almost every bank branch in Germany. The product is available everywhere because the specialist credit institutions cooperate with typical banks or are owned by banking groups and use their distribution networks (e.g., the ten 'LBS' building associations belong to approximately 400 savings and loans associations, 'Schwäbisch Hall' belongs to more than 1,300 cooperative banks and 'BHW' is owned by Postbank and Deutsche Bank). Therefore, a contract with a building association is commonly offered if customers contact their banks and ask for savings products. Thus, our analysis produces general insights into a popular, widespread retail customer product. Furthermore, as outlined in more detail below, our sample seems representative compared with the publicly available industry statistics for this type of credit institution.

The main sample consists of information regarding 2,182,743 contracts with available cash flow data during the 20-year period from 1991 to 2010. Because customers can save on a monthly or yearly basis, we obtain aggregated annual data yielding approximately 14 million contract-year observations. We limit our analysis to retail customers.<sup>13</sup> Additionally, their contracts must not have already existed when our data coverage begins in

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<sup>13</sup> We omit 328,080 contracts that are negotiated with other banks, corporate clients or government authorities.

1991, and the saving period must have been completed by the end of 2010. During the two decades, the bank offers approximately 40 different contract tariffs. We obtain all of the information for each contract covering (e.g., the contract type, pay scale, volume, offered deposit interest rates, offered interest bonus rates and recommended saving amount<sup>14</sup>). We also obtain the full cash flow information during each contract's lifetime. Thus, we can observe the amount of saved money, the entry and exit times of the contract and the specific saving patterns. Because the customers must have voluntarily saved their money, we drop all contracts that are referred to as bridge-financing.<sup>15</sup> This special contract type is closed directly with another real estate mortgage and induces a strictly forced saving purpose. We also observe whether the customer is eligible for the government saving subsidy wop.<sup>16</sup> Turning to the descriptive statistics, the sum of all contract volumes exceeds 35 bn. €, where the average contract has a volume of roughly 16,000 €, as shown in Table 2, Panel A.

----Please insert Table 2 approximately here----

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<sup>14</sup> The recommended saving amount has an informative character. It informs the customer, what she optimally needs to save per year before she can draw on her contractually agreed credit sum. Recall that after the saving phase, the contracts must be allocated among the customers to obtain the credit amount. The allocation will generally become effective if approximately 40% or 50% (depending on the tariff) of the contract sum has been saved. For further information, see [http://www.bausparkassen.de/fileadmin/user\\_upload/english/The\\_Bauspar\\_System\\_in\\_Germany.pdf](http://www.bausparkassen.de/fileadmin/user_upload/english/The_Bauspar_System_in_Germany.pdf).

<sup>15</sup> In total, 426,061 contracts are dropped.

<sup>16</sup> In addition to the government subsidy wop, employers commonly pay an additional employee savings allowance (Vermögenswirksame Leistungen) denoted as "VL" to their employees. This benefit does not bind the customer to the saving contracts analyzed in this study. Put differently, the employee is entitled to this allowance if she invests in, for example, certain equity funds. The customer is free to switch and keep the VL on her own. Thus, we do not refer to VL as a contractual reward, but we do control for VL in our regressions. For additional information on this topic, see [http://www.bausparkassen.de/uploads/mit\\_download/Arbeitnehmer\\_Sparzulage\\_En.pdf](http://www.bausparkassen.de/uploads/mit_download/Arbeitnehmer_Sparzulage_En.pdf). All results are qualitatively similar if we drop all contracts with VL payments.

Furthermore, the average customer deposits 5,027 €. Thus, the complete deposit sum is slightly more than 11 bn. € during the twenty years of observation. Only 16% of all customers execute their loan options and take, on average, a loan of 7,843 €. Regarding the reward distribution among our contracts, we find that 36% are wop eligible and 20% are equipped with interest bonuses, which range from 0.5% to 2.5% depending on the tariff. Panel B of Table 2 presents the contract volume classes, the corresponding frequencies of the rewards within the contract volumes and their average values. Below within Panel B, we present the possible customer occupations and age classes as well as the corresponding frequencies. Panel C of Table 2 presents the evolution of the quantity of active contracts for the selected years. The number decreases in 2010 and some years before because the newly signed contracts that have not finished saving by the end of 2010 are dropped. Finally, we add macroeconomic data, which we obtain from the German Central Bank (Deutsche Bundesbank) and from the Federal Statistical Offices. We use these data as a set of control variables that capture the market interest levels for deposits and loans, the GDP or the average stock index during the contract's lifetime.

Regarding the main variables of interest (i.e., saving duration and cash flow volatility), the descriptive statistics suggest that rewards may have a great impact as summarized in Table 3.

*----Please insert Table 3 approximately here----*

Panel A of Table 3 presents the average contract duration for the savers and loan takers. According to this table, 32% of all contracts are terminated within four years, and 59% of

all contracts are terminated within seven years. Further, by comparing the durations of the contracts that are entitled to rewards, we observe that the average duration is significantly extended by approximately two years if interest bonuses are offered (6.71 vs. 4.88) and by approximately four years if the contract is wop eligible (8.91 vs. 4.88). Panel B shows that cash flow volatility is significantly reduced by both rewards (0.10 vs. 0.15 for interest bonus and 0.08 vs. 0.16 for wop). First conjectures regarding the impact of rewards can also be drawn from Figure 1.

*----Please insert Figure 1 approximately here----*

Panel A of Figure 1 presents histograms on the saving durations for the contracts without any rewards, for those with interest bonuses and for the contracts with wop eligibility. Each type of reward seems to lengthen the duration of customer saving. Panel B presents the estimated distribution of *vola* for the contracts with and without bonuses (left column) as well as for the contracts with and without wop (right column). Both rewards seem to decrease *vola*, as the distributions are skewed towards zero.

### **Sample Representativeness**

Before we consider the estimation strategy, we briefly analyze whether our sample is consistent with the overall industry statistics to ensure that our results are not driven by any particular characteristics of the bank that provided us with the data. Recall that every second German household has at least one *bauspar* contract and that the total contract

(bauspar) sum is approximately 763 bn. € or roughly 30% of the gross domestic product.<sup>17</sup> Moving from the macroeconomic perspective to our dataset, we can compare our summary statistics to the publicly available industry statistics. First, we consider the general market reports provided by the Deutsche Bundesbank from 1994 to 2010. These reports address contract volume and credit volume. We notice that in our dataset, the average contract volume is 16,138 €, which is close to the average contract volume (21,219 €) in the market-wide data reported by the Deutsche Bundesbank. The similarity is even more pronounced if we compare the credit volume based on all of the contracts that have been signed (in contrast to the subpopulation of contracts that have used their credit option). The per contract credit volume is 1,114 € for our sample and 1,183 € for the complete German market. Next, we analyze the annual reports (only available in German) produced by the Association of Private Bausparkassen available from 2003 to 2010. If we match our dataset to the average contract volume class provided by this association, our results are again close. For example, 44% of our contracts show a saving amount between 0 € and 10,000 €, whereas 32% of the contracts from the private building association data do so. However, 43% of our contracts show a contract amount between 10,000 € and 25,000 €, whereas 41% of the contracts from the industry do so. Thus, although the saving amounts seem to be a bit smaller than average, they are nevertheless, close. As a last check, we match the job classification in our dataset to the classification scheme provided by the Association of Private Bausparkassen from 2003 to 2010. Here, this association distinguishes the following six occupations. The first number is the frequency of the occupations within our dataset, and the second frequency is the industry statistic: 1) blue-collar workers (28%/ 20%), 2) white-collar workers (23%/ 39%), 3) civil servants (2%/ 7%), 4) retirees (23%/ 13%), 5) self-

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<sup>17</sup> See [http://www.bausparkassen.de/fileadmin/user\\_upload/english/The\\_Bauspar\\_System\\_in\\_Germany.pdf](http://www.bausparkassen.de/fileadmin/user_upload/english/The_Bauspar_System_in_Germany.pdf)



employed workers (3%/ 4%) and 6) students/apprentices/pupils (22%/ 16%). We acknowledge minor differences (i.e., regarding blue-collar workers), but overall, it is evident that our sample is close to the overall industry statistics.

In sum, the comparisons indicate that our sample seems not to be impaired in any particular way.

### **Estimation Strategy**

With respect to the estimation strategy for the main analysis, we first generate the ‘reward’ indicator variables<sup>18</sup>, which are equal to one if the customer receives interest bonuses or the government subsidy wop during the contract’s duration. Further, we group the contract volume and the customers’ ages into different classes to determine whether saving behavior differs among the groups.<sup>19</sup>

To analyze saving persistence, we must define the point in time of a saving termination. After the contract has begun and the customer starts to save, we will refer to a contract as terminated if the following holds true: the customer has stopped saving and she draws on her deposited cash; and the customer does not switch the contract terms. While the first two conditions are easily understood, we must explain the last one. Customers are allowed to change their contract terms (e.g., raise the contract volume). In this case, the bank will assign a new identification number to that contract. Although the situation of deposited cash will not change for the bank, the bank treats the old contract as completed and labels the changed contract as new business. It is not possible to match these closed and newly intro-

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<sup>18</sup> We do not employ the actual €-amount of interest bonus or wop. Because both rewards become larger as the saving duration increases, duration and €-values will be highly correlated, and the results will be misleading.

<sup>19</sup> Our results are robust to a variation of group formation.

duced contracts. Therefore, we exclude all of the contracts that end or start because of contract amendments.<sup>20</sup> For a contract termination, the pre-agreed contractual saving amount does not have to be reached. The time span from the contract's beginning until its termination will be regarded as the contract's saving duration. If the customer executes her loan option, the time span beginning from the contract's start until the loan payoff will be the saving duration. The saving duration is of key interest for our analysis. To examine how the reward mechanisms impact the saving duration, we first employ ordinary least squares (OLS) to control whether a main effect of interest bonuses and wop exists. By doing so, we determine whether the customer saves longer if contractual rewards are offered, and if so, by how much longer the customer saves for. Whether the customer saves for more than four years or seven years is important for keeping the interest bonus and wop, respectively. Thus, we employ logit models because the dependent variable can be coded as 'one' if the customer terminates her contract early and 'zero' otherwise.<sup>21</sup> The economic significance of our results will be shown by the average marginal effects for the independent variable, which displays the change in probability if a contract is arranged with a certain reward. We then employ interaction effects to analyze the impact of rewards on saving behavior for various classes of contract volumes and calculate marginal effects that are in line with Ai and Norton (2003) and Karaca-Mandic et al. (2012). In the final robustness tests, we employ panel OLS and panel logit models with customer fixed effects to control for the unobserved customer characteristics. We also use propensity score matching to alleviate concerns regarding possible self-selection issues.

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<sup>20</sup> In total, 210,950 contracts are dropped.

<sup>21</sup> As discussed in 3. Theoretical Considerations.

The second key outcome variable for the bank is cash flow volatility (vola). In other words, does the customer provide funding for the bank on a smooth, regular basis, or are the customer's cash flows volatile and irregular? For each contract, we define vola as the standard deviation of cash inflows normalized by the total cash inflows of that contract:

$$vola_i = \frac{sd(\text{cash-inflows}_i)}{\sum \text{cash-inflows}_i},$$

where  $i$  refers to the number of each contract.

Here, the main analysis is based on OLS regressions with vola as the dependent variable. In addition, we use quantile regressions. More precisely, we show the impact of our independent variables on the 10%, 50% and 90% quantiles of the vola distribution. We perform these estimates because the bank and the regulators may be interested in other parts of the distribution rather than only the conditional mean, as it is the case for OLS. In particular, the banks and regulators may be interested if the extreme volatility of cash flows is significantly reduced by interest bonuses and if wop helps in these aspects of the distribution.

The next section presents the main models and the results.

## 5. Econometric analysis and main results

First, we analyze saving persistence by using OLS and logit models. The basic models detect contract, customer-specific and macroeconomic information. The OLS models focus on saving duration in general:

$$\begin{aligned} \text{saving duration}_i &= \alpha + \beta_1 \text{ interest bonus} + \beta_2 \text{ wop} \\ &+ \sum_c \theta_c \text{ other contract characteristics} \\ &+ \sum_d \gamma_d \text{ customer characteristics} \\ &+ \sum_e \eta_e \text{ market characteristics} + \varepsilon_i \end{aligned}$$

where the dependent variable ‘saving duration’ is measured in years. ‘Interest bonus’ and ‘wop’ are described in the previous chapters. ‘Other contract characteristics’, ‘customer characteristics’ and ‘market conditions’ are to be described. Finally,  $i$  = the contract number, and  $\varepsilon_i$  is the error term. Using logit models, we estimate the impact of rewards on the change in probability of early contract termination:

$$\begin{aligned} y_i &= \alpha + \beta_1 \text{ interest bonus} + \beta_2 \text{ wop} \\ &+ \sum_c \theta_c \text{ other contract characteristics} \\ &+ \sum_d \gamma_d \text{ customer characteristics} \quad , \\ &+ \sum_e \eta_e \text{ market characteristics} + \varepsilon_i \end{aligned}$$

where the dependent variable  $y_i$  is equal to zero if the contract duration is greater than the duration required to obtain the reward and one if the reward requirements are violated as a consequence of an early contract termination. In particular, we employ the following ‘other contract characteristics’: the indicator variables for the contract volume (eight volume

buckets<sup>22</sup>), the offered deposit interest, the demanded but fixed loan interest relevant to the execution of the loan option, the recommended saving rate, and the contractual group (i.e., the return-optimized contract or the mortgage-optimized contract). In addition to these contract variables, saving behavior is influenced by the customer characteristics. Therefore, we take advantage of the following characteristics: the customer's age at the start of the contract and her occupation. Saving behavior is related to age because young people are not likely to have the same needs and saving behavior as middle-aged or elderly people. Second, the customer's occupation is collected by the bank and categorized into nine classes. Because the customer's occupation is linked to her savings capability and lifestyle, we expect the occupation to have a strong influence on saving persistence. Finally, we include an indicator variable that detects whether the customer receives employer-based VL. These three variables are good proxies for income and allow us to focus on our treatment variables (i.e., interest bonus and wop).

We employ the market data to control for the general macroeconomic environment during the contract's lifetime. Because most contracts are active for several years, it is essential to control for the interest level of the deposits and for the mortgage loan rates. We use the EURIBOR with three months' duration and a ten-year mortgage rate for the high-quality lenders. Further, we take advantage of the German DAX stock index as a proxy for competing non-bank investment opportunities. The GDP controls for the general state of the economy during the saving period.<sup>23</sup>

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<sup>22</sup> See Table 2, General summary statistics for the employed volume classes. The results are robust to a variation of classes.

<sup>23</sup> We obtain publically available market-wide data from Deutsche Bundesbank and the Federal Statistical Bureaus. In unreported robustness checks, we further analyze the impacts of additional market characteristics (e.g., the unemployment rate, building cost indices or various other deposit and loan interest figures). All of the results remain qualitatively similar.

The OLS results depicted in Table 4 suggest that both contractual rewards lengthen the saving duration.

*----Please insert Table 4 approximately here----*

We estimate three different models. The first model incorporates only contractual information, the second model includes the customer characteristics and the third model also controls for the market conditions. All three models show that interest bonuses have a significant positive impact and that wop helps increase the saving duration. Thus, the models generate the first evidence in support of hypothesis 1. The models provide a good model fit, as shown by the adjusted R-squared, which ranges from 0.39 to 0.45. As expected, the contracts that are designed to obtain higher saving returns and that demand a higher loan rate exhibit a negative impact on duration. Apart from interest bonuses, the basis deposit rate positively impacts saving duration. Model (2) of Table 4 shows that the customer characteristics add important information. For example, the effects on duration differ among the different age classes and among the different occupations. The model fit increases significantly with the inclusion of customer information, as indicated by the unreported likelihood ratio tests. However, from the bank's perspective, it is important if the customer saves for more than four years or even seven years. Turning to the logit models in Table 5, we first present the impact of interest bonuses (i.e., we classify the contracts according to a contract lifetime of more or less than four years). Because failure (i.e., loss of the interest bonus) is coded as one, we expect to observe a negative coefficient of the interest bonus. We estimate four models. The first model presents the main effect of the interest

bonus, the second model interacts the interest bonuses with the contract volume classes, the third model is estimated on all of the contracts that do not receive wop, and the last model presents the effects of interest bonuses and wop on the volume classes.

*----Please insert Table 5 approximately here----*

Model (1) of Table 5 clearly indicates that a saving duration of less than four years is less likely if an interest bonus is offered (interest bonus coefficient -2.53). Apart from the statistical significance, the economic impact is of special importance. We address this topic by estimating the average marginal effects, which display the change in probability if an interest bonus is offered. Incorporating interest bonuses reduces the probability of early contract termination within four years by 30%. That is, interest bonuses appear to help increase saving duration (measured in years) and to influence the probability of longer saving duration to a great extent. Thus, the results support hypothesis 1. Further, with respect to customer effects, we find that the inclusion of the effects is informative but predictable. For example, in comparison to blue-collar workers, the probability of short saving is 6% higher for self-employed people and lower for doctors. According to model (2) of Table 5, we find that the impact of interest bonuses does not differ among different contract volumes (i.e., the marginal effects ranging between -22% to -31% do not differ statistically). To better examine the relationship between interest bonuses and contract volume, we plot the evolution of the interest bonus impact across different volume classes.

*----Please insert Figure 2 approximately here----*

The first column of Panel A, Figure 2 displays the average marginal effects of an interest bonus across the different contract volume classes. The change in probability of early contract termination is presented on the y-axis. The results suggest that the impact of interest bonuses reduces the probability of early contract termination by approximately 30% and that this impact is stable for various contract volumes. Therefore, regarding the interest bonus, we find strong support for hypothesis 2.

Model (3) of Table 5 establishes a pure interest reward effect on bank customer behavior by suppressing all of the contracts that are eligible for wop. Thus, the behavior is not distorted by any subsidization effects. The effect of interest bonuses on the probability of early contract termination increases in this setting up to a change in probability of -42%. Thus, our first findings are underlined (i.e., the qualified interest reward guides the behavior of the bank's retail portfolio to a large extent). Overall, in the context of Basel III, these findings may help regulators understand how stable retail deposits are and how banks can influence funding via interest rate rewards.

Because a saving duration of less than four years is not only sanctioned by the interest bonus but also by wop, we also estimate the model using interaction effects for both interest bonuses and wop with volume classes. The results of model (4) in Table 5 are presented graphically in Panel B of Figure 2. It is worth noting that the effect of wop on the probability of early contract termination dominates the interest bonus effect in almost all of the contract volume classes. This *ex ante*, unanticipated finding is especially interesting because a loss in the interest bonus for the high-volume contracts leads, on average, to a larger abso-



lute loss than the loss of the wop subsidy.<sup>24</sup> Thus, we find that the interest bonus effect is dominated by the wop effect even if the value of the interest bonus exceeds the received wop.

We now conduct a comprehensive analysis of the government subsidization wop (i.e., we classify the contract as a failure if its duration is less than seven years). As outlined in the introduction, this analysis allows us to add to the recent literature on the inter-temporal choices of people. This literature documents time inconsistencies and preference reversals by incorporating consumers' temptations and self-control problems (Thaler, 1981; Green et al., 1994; Casari, 2009). In this context, Krusell et al. (2010) show that the optimal government policy is to subsidize savings if consumers are tempted by "excessive" impatience. Thus, as a government saving subsidy, wop may improve the welfare of the present biased agents because the intertemporal consumption allocation is guided toward the future such that the customer saves more. Because the customer will be allowed to keep wop if she saves for a longer period of time, we expect negative coefficients of wop in the logit models.

*----Please insert Table 6 approximately here----*

We estimate three models. Model (1) of Table 6 presents a marginal effect of -38% if the contract is wop-eligible. That is, the probability of a contract termination within seven years is reduced by 38% if wop is received. Consistent with the interest bonus, wop influences customer behavior to a great degree (i.e., we find strong evidence consistent with

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<sup>24</sup> Up to a contract volume of 20,000 € (contract volume class no. 4), the average wop amount per contract is larger than the received interest bonuses. For all higher contract volumes, the average interest bonus is more valuable than the wop. See also the discussion in section 4, Data and Estimation Procedure.

hypothesis 1 for both the wop and the bonus). Model (3) of Table 6 presents the results for the wop effects on the contracts that do not have an interest bonus clause. Again, the effect of wop is highly economically significant.

The second model interacts wop with the contract volume classes. The results indicate that the wop effect clearly differs across the contract volumes. For the contracts between 10,000 € and 30,000 €, the wop effect is clearly larger than for all of the other volumes. This effect is graphically presented in column 2 of Panel A, Figure 2. The impact can be described as a strict convex, U-shaped function. Regarding hypothesis 2, we do not find a strictly decreasing impact of wop on saving duration in increasing contract volumes. The customers signing contract volumes between 10,000 € and 30,000 € are more strongly induced to save for longer periods of time than those with smaller contract volumes. However, although the realized returns due to wop are greater for smaller saving amounts<sup>25</sup>, wop reduces the probability of early termination by approximately 25% even for the lowest volume class. For contracts of 30,000 € and more, the wop effect decreases as suggested but remains significantly negative. Overall, these results confirm Krusell et al.'s (2010) theoretical predictions that a negative tax (i.e., a subsidy) can improve an individual's welfare. More explicitly, Krusell et al. (2010, p. 2079) state, "The direction of the change is the expected one: when temptation is characterized by 'excessive' impatience, the optimal policy is to subsidize savings."

We have yet to analyze cash flow volatility. Apart from the duration of saving, the smoothness of cash inflows is the second dimension of customer behavior considered in this study. To analyze vola, we first use the OLS models with vola as the dependent variable.

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<sup>25</sup> Recall the absolute upper-bounded value for wop subsidization.

----Please insert Table 7 approximately here----

The vola models differ from the persistence models in the following way. First, we do not employ the interaction effects of rewards with contract volume classes because there is no a priori reason explaining why interest bonuses or wop should differ across volumes in explaining the vola of cash flows. Second, regarding the market variables, we also control for the average volatility of market deposit rates during the contract's duration to detect the variation of competing deposit products. Furthermore, the data sample is slightly smaller than the one used in the analysis of saving duration because cash flow volatility requires cash inflows to appear several times. All of the contracts with only a single cash inflow are dropped.

Model (1) of Table 7 presents the OLS results and shows that both interest bonus and wop negatively impact vola and smoothen cash flows for the bank. The effect of interest bonuses clearly outperforms the effect of wop (coefficient estimate of -0.23 vs. -0.05, respectively). A higher unconditional basic deposit rate lowers vola as well. This finding is as suggested (i.e., the higher the guaranteed deposit rate is, the more attractive the product is and the more competitive it is against other market products). With respect to customer properties, significant differences emerge, but these differences are economically small. The market-wide control variables exhibit a strong impact on vola such that the higher the competing deposit market rates are, the higher the vola of cash flows. This finding could be due to a market environment in which more attractive deposit products compete with the possible savings in our observed contract. However, a high market deposit rate volatility seems to

lead to more stable cash inflows to the observed contracts. It seems that in times of market stress and unsteadiness, the customer appreciates the offer of guaranteed interest on our contracts.

Apart from OLS, which estimates the conditional mean of vola, the estimation of certain quantiles of vola's distribution is also of interest for banks. In other words, we estimate the quantile regressions for the 10%, 50% and 90% quantiles to analyze how the control variables affect the cash flow vola in extreme cases.<sup>26</sup> We take advantage of the robust quantile regressions, as noted by Angrist et al. (2006), Chamberlain (1994) and Powell (1984). We find that the interest bonus in all of the quantiles effectively lowers cash flow volatility. This effect is most pronounced in the 90% quantile, where the point estimate of the interest bonus is -0.27. Thus, we provide support for hypothesis 3 by finding that both the interest bonus and wop lower the variability of cash inflows to the bank.

Altogether, we find that both mechanisms can guide retail behavior. That is, the rewards stabilize the behavior by helping to generate longer saving durations and smoother cash flows. Regarding the newly proposed financial regulations (Basel III), the rewards offer opportunities to strengthen the quality of a bank's deposit funding. In the case of interest bonuses, the results can be transferred to other banking products that offer similar interest payment structures.

With respect to hypothesis 4, researchers, policymakers and bank practitioners are interested in the additivity of both reward mechanisms. Thus, does an interest bonus impact customer behavior if the contract is already wop-eligible? If so, how large will the effect attributable to the second offered reward be? These considerations will be of capital importance if the bank designs contract tariffs and contractual features.

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<sup>26</sup> The results for the various other quantiles are qualitatively similar.

----Please insert Table 8 approximately here----

For saving persistence, the main results suggest that wop eligibility has a strong impact. Assuming that the customers who receive wop are actually compelled to save for more than seven years, an additional measurable effect of the interest bonus remains unclear. Because wop defines the stricter condition (i.e., the customer is required to save for at least seven years), we estimate the change in probability of early contract termination if the wop-eligible contracts are equipped with an additional interest bonus clause. As shown in model (1) of Table 8, we find that the interest bonus further reduces the probability of early contract termination by another 14% during the first four years of saving. That is, the two rewards are not substitutes but complements. The impact of the two rewards seems to be subadditive on the duration of saving. Model (2) of Table 8 estimates the effects of additivity on cash flow vola and finds that vola is most reduced by the introduction of the interest bonus (coefficient estimate of -0.10). However, the introduction of wop yields the same impact on vola regardless of whether the contract has an interest bonus. For vola, both rewards seem to have an additive effect. Therefore, the analysis of retail behavior finds strong evidence in support of hypothesis 4.

Thus far, we have been silent on the absolute value of the interest bonuses that range from 0.5% to 2.5% depending on the tariff. If the bank management wants to guide customer behavior by introducing interest bonuses, the bonus value gains attention. Then the following question arises: how will the customer behavior differ if the bank offers a 0.5% or 2.5% interest bonus (or interest rates in between)? We compare the impacts of different bonus

values on saving persistence and cash flow volatility. Model (3) of Table 8 finds that a 0.5% bonus reduces the probability of early contract termination by approximately 16%. It is interesting that the measured impact remains stable for the interest bonuses with values ranging from 1.5% to 2.5% (i.e., the effect on customer behavior does not vary if the interest bonus exceeds 1.5%). Turning to model (4) of Table 8, we find that the same pattern holds true for cash flow volatility. Thus, we reject hypothesis 5, which claims that higher offered interest bonuses will have a greater impact on retail behavior. This finding (i.e., the equal impacts of differing interest bonuses on consumer behavior) could be used to pricing policies in banking practice.

## 6. Further robustness

This section provides additional robustness tests of our main results. For the first test, the bank provides additional information on the customer's identity for 1,503,738 contracts.<sup>27</sup> Thus, we identify 1,097,022 individual customers and can observe whether they have closed more than one contract from 1991 to 2010. We find that 19.28% have negotiated at least one other contract with the bank during the time frame of our study (max. 10 contracts per customer). By using customer fixed effects to control for unobserved customer heterogeneity, we can address two possible concerns regarding the previous models. First, the possible distortions attributable to a paucity of customer-based information can be addressed. The unobserved customer characteristics that impair saving behavior are identified by the fixed effect. As the customer signs another contract, on average, four years after the first one, the customer's income situation, marital status, household size and other characteristics are unlikely to vary to any great extent. Therefore, the fixed effects that control for the unobservable customer characteristics will highlight the real impacts of the contract structure. Second, we address a possible self-selection bias of our data. At the start of the contract, the customers are free to choose among the contractual tariffs with or without interest bonuses. Thus, the customers who choose the contracts with interest bonus clauses may belong to a certain group of customers with a specific pattern of saving behavior. Imagine a possible bias attributable to the effect that only the customers who know *ex ante* that they will save for more than four years sign an interest bonus contract and all of the customers who are doubtful about their future saving attitudes select themselves into the contract tariffs without interest bonuses (i.e., without any possibility of sanctioning). The

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<sup>27</sup> The identification is strictly anonymous (i.e., we do not obtain the customer names). It is not possible to obtain the identification information for all 2.2 million contracts.

main effect of an interest bonus (i.e., increasing saving persistence) would then be due to an unobservable self-selection effect of the customers. This effect would bias and bring into question the economic significance of our main findings (i.e., that interest bonuses reduce the probability of early contract termination by approximately 30% (see Table 5)). However, note that the customers who sign contracts with the bank have already addressed search costs because they must have contacted their bank and must have gathered information on this type of product. Further, they have agreed to pay a provision to the sales force. Thus, we can accept that every customer who decides to enter a contract is willing to assume that she is able to save for a certain time period (i.e., the customers should be homogenous in such a way that they have the intention to save for a longer time period as for example compared to very interest rate sensitive customers). Thus, our setting certainly reduces the possible degree of self-selection. Additionally, we compare the characteristics of the customers who agree to the contracts with and without interest bonuses and find that these characteristics are almost equally distributed between the two groups.

However, the fixed effects estimations highlight the pure contractual reward effect and alleviate possible distortions due to unobservable customer preferences and the customers' self-evaluations regarding their saving intentions. We can easily move from the previous pooled OLS regression to a panel model if the dependent variable is the saving duration (in terms of years) or the cash flow volatility. However, if we turn from logit to panel logit models, we must also observe different saving durations among the customers' contracts as classified in terms of durations more or less than four years (seven years, respectively). In the panel logit models, we have approximately 300,000 contracts for 115,000 customers who behave differently in terms of saving duration. Here, the average customer has 2.5



contracts.<sup>28</sup> We estimate the customer fixed effects panel logit models that “cross out” the possible unobserved customer characteristics. The results for the panel OLS and panel logit models underline our findings regarding the impacts of the interest bonus and the wop on saving persistence and cash flow volatility.

----Please insert Table 9 approximately here----

It is worth noting that the effect of an interest bonus on saving persistence increases even in this setting. We attribute this finding to the possibility that if customers decide repeatedly in favor of this banking product, they may highly value an additional interest bonus.

On the one hand, controlling for unobserved customer heterogeneities identifies concerns regarding a paucity of customer characteristics and self-selection issues. However, on the other hand, controlling for unobserved customer heterogeneities requires customers to sign more than one contract with the bank. This requirement itself could produce a possible selection bias towards a certain product affirmative customer group. Therefore, we also address the concern of possible self-selection bias by using various propensity score matching methods in which the group with interest bonus contracts serves as the ‘treated’ group and all other ‘untreated’ contracts do not have an interest bonus clause. The aim of this statistical method is to provide an unbiased estimation of the treatment effects (i.e., in our case, an unbiased self-selection free effect of qualified interest payments on customer behavior) (Rosenbaum and Rubin, 1983; Lu, 2012; Wu, 2010; Autore et al., 2009). We perform a variety of matching procedures on the complete sample of approximately 2.2 million con-

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<sup>28</sup> Most often, the contracts are negotiated one after the other (i.e., the customer saves for several years, ends one contract and starts a new one).

tracts. Basically, we present propensity score matching with exactly one treated contract matched to one untreated contract ('1:1') as well as one treated contract matched to three untreated contracts ('1:3').<sup>29</sup> In particular, the matching algorithms try to identify one untreated contract (1:1) or three untreated contracts (1:3) for every treated contract (i.e., contracts with an interest bonus). In the case of 1:1 matching, every untreated contract can only be used once for matching (i.e., matching without replacement). In the case of 1:3 matching, three untreated contracts are linked with replacement to one contract with an interest bonus. In both cases, the matched, untreated contracts have to be as similar to the treated contracts as possible. In our case, the algorithms define similarity in terms of contract volume, the year of the contract's start, customer occupation, age, wop eligibility and the availability of employer-based VL.

*----Please insert Table 10 approximately here----*

Table 10 presents the results of the 1:1 and 1:3 propensity score matching and the regression results for saving persistence and vola on the generated subsample. Columns 1 and 2 present the frequencies of the variables employed for the matching contracts with and without interest bonuses. The 1:1 matching shows that those characteristics exhibit little variation if the interest bonus contracts are compared with their matched untreated contracts. Models (1) and (2) perform OLS estimations on the generated subsample of 846,666 contracts for saving persistence and vola. The results still indicate that interest bonuses have a significant impact on duration and vola. However, the magnitude of interest bonuses

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<sup>29</sup> In unreported robustness checks, we also perform Mahalanobis matching, which allows for replacements. The results remain qualitatively unchanged.

decreases to 2.34 (in comparison with 3.02, see Table 4). In unreported robustness checks, we re-estimate the logit models of Table 5. The marginal effect of interest bonus on saving duration adds up to -26%, and if all of the wop-eligible contracts are dropped, this effect adds up to -38% (compared with -30% and -42%, respectively, in Table 5). The effect of interest bonus on vola remains almost unchanged when compared with the main results presented in Table 7. Models (3) and (4) present the same estimations but are based on a subsample produced by 1:3 matching (i.e., for each contract with an interest bonus, three almost similar contracts without an interest bonus are selected). Therefore, the models are based on 423,333 contracts with the interest bonus and 1,269,999 contracts without the bonus. Because of the allowed replacement, the summary shows that the matched, untreated contracts are even closer to our treated group. Again, the results of models (3) and (4) are close when compared with the main results of Table 4 and Table 7. The interest bonus effect on saving persistence adds up to 2.30 and is highly significant. The estimation of logit models shows that interest bonuses reduce the probability of early contract duration by approximately -23% and -34% if the wop-eligible contracts are dropped.<sup>30</sup>

Thus, by employing matching algorithms to estimate the effects of interest bonuses on saving duration and cash flow volatility in an unbiased manner, we find that the results remain stable and do not seem to suffer from the possible self-selection of customers. Depicting only a small variation in marginal effects (1:1: -26% vs. -30%; 1:3: -23% vs. -30%), we have strong confidence in the economic significance of our main results, which indicate that qualified interest payments can guide the behavior of a bank's retail portfolio to a large extent.

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<sup>30</sup> The results are not tabulated.

## 7. Conclusion and discussion

This article finds that contractual granted financial rewards (i.e., qualified interest bonuses and government subsidies) for saving contracts significantly stabilize retail funding and provide effective guidance for customer behavior. Focusing on the interest bonuses, this study finds that the extended saving duration of roughly two years indicates that a bank can actually influence the duration of capital commitment by retail customers. Furthermore, rewards seem to have a great impact on smoothing cash inflows to the bank. Achieving both greater persistence and smoother cash flows is of capital importance for banks. The measures of possible future liquidity gaps or the grade of term transformation will be influenced if the bank has effective instruments to guide large parts of its retail deposit funding. Turning to the absolute level of interest bonuses, we find that for the interest bonus values ranging from 1.5% to 2.5%, the realized change in guided behavior remains constant. This finding shows banks that even small incentives can induce desirable saving behavior from retail customers. Turning to the additivity of the abovementioned contractual rewards, we find that the governmental subsidy also has an important impact on retail behavior. Though similar in reward structure, the two rewards are complements rather than substitutes. Consequently, our findings may inform the recent literature on the inter-temporal choices of people, which documents consumers' temptations and self-control problems. Thus, this form of government saving subsidy can improve the welfare of the present biased agents. In sum, with respect to the tasks established by new financial regulations (Basel III), banks will be able to prove that those contractual rewards will lead to retail portfolios that are more persistent and thus higher in quality.

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## Appendix 1: Variable description

variable	description	application
<b>dependent variables</b>		
saving duration	duration of saving until deposits are drawn on by customer. Measured in years.	saving persistence models
vola	standard deviation of cash inflows by contract normalized by total cash inflows per contract	cash flow models
<b>independent variables</b>		
<b>contract terms</b>		
interest bonus	indicator variable. '1' if contract has an interest bonus clause. This bonus is lost if the customers terminates saving within four years.	all models
wop subsidy	indicator variable. '1' if contract is wop eligible. Wop is lost if the customers terminates saving within seven years.	all models
return optimized contract	indicator variable. '1' if the contract is return optimized for saving purpose, i.e., the customer gains a higher deposit rate but faces a higher, possible loan rate. '0' if the contract is mortgage optimized.	all models
contract volume	the contract volume on which the contract is signed. Categorical variable. One value for each volume class. Classes in € are: '1': <5,000, '2': 5,000-10,000, '3': 10,000-20,000, '4': 20,000-30,000, '5': 30,000-40,000, '6': 40,000-50,000, '7': 50,000-100,000, '8': >100,000	all models
deposit rate	the offered basis interest. The customer receives this unconditional interest rate on his saved investment.	all models
agreed loan rate	the pre-agreed loan rate. If the customer fulfills all contractual conditions she will be offered a mortgage on this loan rate. She saves between 40% and 50% of contract volume and will be eligible to obtain a loan on the remaining 60% of contract volume paying the up-front agreed loan rate.	all models
takes loan	indicator variable. '1' if the customer has executed her loan option.	all models
recommended savings rate	information on the customer optimally needs to save per year before she can draw on her contractually agreed credit sum. Recall, that building societies apply an allocation system, to determine when exactly the customer can use the credit option.	all models
waiting period	the minimum saving duration before the customer can obtain a loan. Measured in years.	all models
<b>customer characteristics</b>		
occupation	the customer's occupation at contract start. Categorical variable. Classes are: '1': blue collar worker, '2': self-employed, '3': white collar worker, '4': civil servant, '5': retiree, '6': doctor, '7': student/ apprentice/ pupil, '8': pensionary, '9': other	all models
age	the customer's age at contract start. Categorical variable. Classes are: '1': <18, '2': 18-24, '3': 25-44, '4': 45-65, '5': >65.	all models
employer benefits	indicator variable. '1' if the contract has cash inflows from employer based "Vermögenswirksame Leistungen". German employers can pay this aid. This benefit does not bind the customer to the saving contracts we analyze in this study. Put differently, the employee is entitled to this allowance if she invests, e.g., in certain equity funds. The customer is free to switch saving products and keep VL on her own. Thus, this reward will not be labeled as contractual reward in our analysis.	all models
<b>economic conditions</b>		
market deposit interest	average of EURIBOR with a duration of three months during the saving period of the contract	all models
market loan interest	average of the 10-year mortgage loan during the contract's saving period	all models
stock index	average DAX value during the contract's saving period	all models
GDP	average GDP during the contract's saving period	all models
ending during crises	indicator variable. '1' if the contract ends in the years 2001, 2002 or 2008.	all models

*Notes:*

This table presents a short description of the employed model variables. The last column informs which models take advantage of which variables.

**Table 1: Summary of hypotheses**

# hypothesis	reasoning	econometric technique	outcome (=dependent) variable	explanatory variables (measurement)	results in table
H1	Tariffs with interest bonus as well as the governmental subsidy wop statistically and economically increase saving persistence duration and thus decrease the probability of early contract termination.	OLS/ logit	saving persistence measured in years, in which a contract is not terminated	interest bonus indicator/ wop subsidy	Table 4: OLS (model 1 - 3) Table 5: logit - interest bonus (model 1 - 4) Table 6: logit - wop (model 1 - 3)
H2	While the impact of interest bonus on saving persistence is stable, i.e., proportional to contract volume, the impact of wop is decreasing in increasing contract volume, so that the relative importance of the two rewards flips at a certain critical contract volume.	OLS/ logit	saving persistence measured in years, in which a contract is not terminated	interest bonus indicator/ wop subsidy indicator <b>interactions with contract volume</b>	Table 5: logit - interest bonus (model 2 - 4) Table 6: logit - wop (model 2, 3)  flipping effect Table 5: logit - interest bonus (model 4) Figure 2: margin plots
H3	Both, interest bonus as well as wop eligibility lead to smoother and less volatile cash flows.	OLS/ quantile regressions (qreg)	cash flow volatility on contract level	interest bonus indicator/ wop subsidy	Table 7: OLS/ qreg (model 1 - 4)
H4	For contracts with interest bonus features and wop eligibility, wop and interest bonus will act as complements and thus increase saving persistence's probability and decrease cash flow volatility.	OLS/ logit	saving persistence measured in years, in which a contract is not terminated/ cash flow volatility on contract level	interest bonus and wop subsidy indicator by rewarding scheme	Table 8: OLS/ logit (model 1 - 2)
H5	The higher the interest bonus, the higher the savings persistence's probability and the lower the cash flow volatility.	OLS/ logit	saving persistence measured in years, in which a contract is not terminated/ cash flow volatility on contract level	indicators splitting the interest bonus in distinct classes	Table 8: OLS/ logit (model 3 - 4)

*Notes:*

This table summarizes the main testable hypotheses. Column 1 reports the hypotheses number, while column 2 states the hypotheses. Column 3 shows the employed econometric technique. Column 4 reports the outcome, i.e., dependent variables, and column 5 shows the respective main explanatory variables used in the regression analysis. Finally, column 6 provides the table number.

**Table 2: General summary statistics**

**Panel A: Summary statistics on contract information**

		total sample sum	per contract			
			mean	p50	min	max
contract volume	€	35,350,000,000	16,138	10,999	500	2,370,000
deposit inflows	€	11,010,000,000	5,027	3,398	1	886,682
deposit interest offered by contract	%		2	2	0.5	3
deposit interest paid	€	806,000,000	368	199	0	81,866
credit volume (16% of contracts have credit)	€	2,672,000,000	7,843	4,890	1	799,792
credit interest charged by contract	%		5	5	1.9	7
credit interest received	€	348,100,000	1,022	604	0	64,376
government saving subsidies (wop) (36% of contracts have subsidy)	€	213,300,000	267	227	1	1,596
interest bonus offered	%		1	2	0.5	2.5
interest bonus paid (20% of contracts have contract reward)	€	106,900,000	253	140	1	36,974

**Panel B: Distribution of contracts according to characteristics among the sample**

<u>Distribution of contract volume</u>			<u>Distribution of rewards among contract volumes</u>				
€ amount	# (thousands)	%	Percentage of contracts with:			average value per contract (€)	
			interest bonus	wop	bonus or wop	interest bonus	wop
< 5,000	71	3.24	17%	34%	44%	84	< 115
5,000 – 10,000	566	25.82	25%	37%	51%	153	< 188
10,000 – 20,000	1,040	47.52	21%	35%	47%	220	< 288
20,000 – 30,000	294	13.43	15%	37%	45%	363	> 332
30,000 – 40,000	73	3.35	9%	39%	44%	677	>> 320
40,000 – 50,000	36	1.65	5%	41%	44%	944	>> 321
50,000 – 100,000	93	4.25	3%	41%	42%	1,143	>> 335
> 100,000	16	0.73	2%	30%	31%	2,228	>> 300

<u>Distribution of occupation</u>			<u>Distribution of age</u>		
	# (thousands)	%		# (ths.)	%
blue collar worker	460	21.00	< 18	68	3.10
self-employed	71	3.24	18 – 24	263	12.00
white collar worker	416	19.01	25 – 44	856	39.09
civil servant	15	0.69	45 – 65	728	33.26
retiree	396	18.06	> 65	275	12.55
doctor	3	0.13			
student / apprentice / pupil	287	13.12			
pensionary	2	0.1			
others	540	24.67			

**Panel C: evolution of data sample**

year	1992	1995	1997	2000	2005	2010
no. active contracts (thousands)	85	312	678	1,086	1,101	169

*Notes:*

This table presents summary statistics on the main dataset. N = 2,182,743. Panel A presents summary statistics of contractual variables for the whole sample as well as information on the contract level (min, mean, median and max). Panel B presents summaries on the frequency of different contract volumes, the fraction of contracts that do have interest bonuses and wop eligibility. Further we present average values of contractual rewards for each contract volume class. We show the distribution of customer's age at contract start and her occupation. Panel C describes the dynamic evolution of the data set.

**Table 3: Summary statistics of key outcome variables**

<b>Panel A: Saving persistence</b>				
Average contract duration (in years)	mean	p50	min	max
average of all contracts	6.49	6	1	19
only saving	5.71	6	1	19
saving and loan taking	10.78	11	2	19
Distribution of duration acc. to critical saving's times				
duration within the range of:	years	≤ 4	> 4 and ≤ 7	≤ 7
	%	32	26	59
	#	708,993	580,424	1,289,417
Average duration ordered by contractual rewards	interest bonus (yes / no)	wop (yes / no)	avr. Duration years	no. contracts #
	0	0	4.88	1,152,105
	1	1	8.14***	182,920
	1	1/0	6.71***	423,333
	1/0	1	8.91***	797,936
	0	1	9.15***	615,016
	1	0	5.68***	240,413
<b>Panel B: Cash Flow volatility</b>				
Average cash flow volatility	mean	p50	min	max
All contracts	0.13	0.06	0	0.71
Contracts				
with interest bonus	0.10***	0.06	0	0.71
without interest bonus	0.15	0.09	0	0.71
with wop	0.08***	0.05	0	0.71
without wop	0.16	0.10	0	0.71

*Notes:*

This table presents summary statistics of our two key outcome variables, 1) saving persistence, i.e., the duration of each saving contract, and 2) cash flow volatility, i.e., the smoothness of cash inflows.

Panel A presents at first average contract durations. Hereafter the fraction of contracts which end 4 or 7 years after the contract's beginning are presented. Those critical durations would cause sanctions with regard to the loss of interest bonus if offered by the contractual setting ('4 years') or could cause the loss of the governmental saving subsidy wop if the contract is eligible ('7 years'). Further, average contract durations are presented with respect to the two contractual reward mechanisms. Each reward facilitates longer saving on average which is underlined by an univariate sample mean comparison test.

Panel B presents summary statistics on the volatility of cash flows as calculated by the standard deviation of cash flows by contract. 'vola' is winsorized on the 1% level. Univariate sample mean comparison tests yield first evidence that contracts with interest bonus or contracts eligible for wop exhibit lower cash flow volatility. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

**Table 4: OLS results for saving persistence**

	model (1)	model (2)	model (3)
interest bonus	2.12***	2.18***	3.02***
wop subsidy	2.49***	2.47***	2.39***
return optimized contract	-1.37***	-1.40***	-1.72***
contract volume in € (ref.: < 5,000)			
5,000 – 10,000	0.05	0.10	0.03
10,000 – 20,000	0.20	0.25	0.18
20,000 – 30,000	0.23	0.32*	0.25*
30,000 – 40,000	0.32	0.40**	0.33**
40,000 – 50,000	0.48**	0.56***	0.47***
50,000 – 100,000	0.72***	0.80***	0.72***
> 100,000	0.61***	0.73***	0.69***
deposit rate	1.82***	1.83***	2.66***
agreed loan rate	0.19	0.21	-0.00
takes loan	0.35***	0.26	0.15
recommended savings rate	1.84	2.16*	3.42***
waiting period	-0.23**	-0.22***	-0.32**
occupation (ref.: b.c. worker)			
self-employed	(-)	-0.64***	-0.38***
white collar worker	(-)	-0.05	0.03
civil servant	(-)	0.05	0.12**
retiree	(-)	-0.15*	-0.03
doctor	(-)	0.66***	0.79***
student/ apprentice/ pupil	(-)	0.32***	0.18***
pensionary	(-)	-0.79*	-0.58**
other	(-)	-0.74***	-0.60***
age (ref.: < 18)			
18 – 24	(-)	-0.37***	-0.41***
25 – 44	(-)	-0.08	-0.17***
45 – 65	(-)	-0.15	-0.29***
> 65	(-)	-0.52***	-0.74***
employer benefits	(-)	0.62***	0.60***
economic conditions			
market deposit interest	(-)	(-)	0.11
market loan interest	(-)	(-)	1.20
stock index	(-)	(-)	-0.00
GDP	(-)	(-)	0.41**
ending during crises	(-)	0.28	-0.05
constant	-0.46	-0.74	-47.44**
adjusted R <sup>2</sup>	0.39	0.42	0.45
N	2,182,743	2,182,743	2,182,743

*Notes:*

This table presents OLS regression estimates of saving persistence. The dependent variable of each model is the observed saving duration of each contract measured in years. For a complete variable description see Appendix 1. We estimate three different models, which first incorporate only contract design, then additional customer characteristics and last the macroeconomic environment. Positive coefficients are expected for interest bonus and wop. Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start (see Petersen, 2009). We report adjusted R<sup>2</sup>. ‘N’ is the number of observations. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

**Table 5: Logit results for saving persistence – focus on interest bonus**

	model (1)		model (2)		model (3)		model (4)	
	coef	Δ prob (%)	coef	Δ prob (%)	coef	prob (%)	coef	Δ prob (%)
<b>interest bonus</b>	<b>-2.53***</b>	<b>-0.30***</b>	<b>-2.35***</b>	<b>-0.30***</b>	<b>-2.92***</b>	<b>-0.42***</b>	<b>-2.40***</b>	<b>-0.30***</b>
wop subsidy	-2.34***	-0.34***	-2.34***	-0.34***	(-)	(-)	-1.37***	-0.34***
return optimized contract	1.47***	0.19***	1.47***	0.19***	1.46***	0.24***	1.46***	0.19***
contract volume (ref.: < 5,000)								
5,000 – 10,000	-0.19*	-0.03*	-0.15**	-0.03	-0.06	-0.01	-0.03	-0.03**
10,000 – 20,000	-0.18	-0.03	-0.14*	-0.03	0.03	0.01	0.07	-0.03*
20,000 – 30,000	-0.16	-0.02	-0.12	-0.02	0.04	0.01	0.06	-0.03
30,000 – 40,000	-0.21	-0.03	-0.19*	-0.03	-0.08	-0.00	-0.07	-0.03*
40,000 – 50,000	-0.34**	-0.05**	-0.32***	-0.05**	-0.21*	-0.03	-0.21*	-0.05***
50,000 – 100,000	-0.57***	-0.08***	-0.56***	-0.07***	-0.44***	-0.06***	-0.44***	-0.08***
> 100,000	-0.64***	-0.09***	-0.62***	-0.08***	-0.55***	-0.07***	-0.55***	-0.08***
<b>bonus * contract volume</b>								
<b>5,000 – 10,000</b>	(-)	(-)	<b>-0.21</b>	<b>-0.31***</b>	<b>0.06</b>	<b>-0.43***</b>	<b>-0.16</b>	<b>-0.31***</b>
<b>10,000 – 20,000</b>	(-)	(-)	<b>-0.19</b>	<b>-0.30***</b>	<b>0.17</b>	<b>-0.42***</b>	<b>-0.13</b>	<b>-0.30***</b>
<b>20,000 – 30,000</b>	(-)	(-)	<b>-0.19</b>	<b>-0.31***</b>	<b>0.19</b>	<b>-0.42***</b>	<b>-0.14</b>	<b>-0.30***</b>
<b>30,000 – 40,000</b>	(-)	(-)	<b>-0.05</b>	<b>-0.29***</b>	<b>0.36</b>	<b>-0.40***</b>	<b>0.00</b>	<b>-0.30***</b>
<b>40,000 – 50,000</b>	(-)	(-)	<b>0.03</b>	<b>-0.28***</b>	<b>0.40</b>	<b>-0.38***</b>	<b>0.08</b>	<b>-0.28***</b>
<b>50,000 – 100,000</b>	(-)	(-)	<b>0.32</b>	<b>-0.24***</b>	<b>0.71***</b>	<b>-0.33***</b>	<b>0.38</b>	<b>-0.24***</b>
<b>&gt; 100,000</b>	(-)	(-)	<b>0.44</b>	<b>-0.22***</b>	<b>0.88***</b>	<b>-0.31***</b>	<b>0.50</b>	<b>-0.23***</b>
wop subsidy * contract volume								
5,000 – 10,000	(-)	(-)	(-)	(-)	(-)	(-)	-0.64***	-0.30***
10,000 – 20,000	(-)	(-)	(-)	(-)	(-)	(-)	-1.36***	-0.37***
20,000 – 30,000	(-)	(-)	(-)	(-)	(-)	(-)	-1.04***	-0.35***
30,000 – 40,000	(-)	(-)	(-)	(-)	(-)	(-)	-0.67***	-0.30***
40,000 – 50,000	(-)	(-)	(-)	(-)	(-)	(-)	-0.64***	-0.29***
50,000 – 100,000	(-)	(-)	(-)	(-)	(-)	(-)	-0.64***	-0.27***
> 100,000	(-)	(-)	(-)	(-)	(-)	(-)	-0.33	-0.24***
deposit rate	-2.29***	-0.33***	-2.29***	-0.33***	-2.39***	-0.46***	-2.29***	-0.33***
agreed loan rate	-0.14	-0.02	-0.14	-0.02	-0.04	-0.01	-0.14	-0.02
takes loan	-0.76***	-0.11***	-0.76***	-0.11***	-1.21***	-0.23***	-0.76***	-0.11***
recommended savings rate	-2.62***	-0.38***	-2.62***	-0.38***	-3.72***	-0.72***	-2.65***	-0.38***
waiting period	0.30***	0.04***	0.30***	0.04***	0.34***	0.07***	0.30***	0.04***
occupation (ref.: worker)								
self employed	0.42***	0.06***	0.42***	0.06***	0.46***	0.09***	0.42***	0.06***
white collar worker	0.03	0.00	0.03	0.00	0.04	0.01	0.03	0.00
civil servant	-0.05	-0.01	-0.05	-0.01	-0.04	-0.01	-0.05	-0.01
retiree	-0.10**	-0.01**	-0.10**	-0.01**	-0.15***	-0.03***	-0.10**	-0.01**
doctor	-0.54***	-0.07***	-0.53***	-0.07***	-0.47***	-0.09***	-0.52***	-0.07***
student /apprentice/ pupil	-0.12***	-0.02***	-0.12***	-0.02***	-0.13***	-0.02***	-0.11***	-0.02**
pensionary	0.50	0.07	0.50	0.07	0.51	0.10	0.50	0.07
other	0.72***	0.11***	0.72***	0.11***	0.76***	0.15***	0.72***	0.11***
age (ref.: < 18)								
18 – 24	0.49***	0.07***	0.49***	0.07***	0.50***	0.10***	0.49***	0.07***
25 – 44	0.20***	0.03***	0.20***	0.03***	0.18***	0.04***	0.20***	0.03***
45 – 65	0.16**	0.02**	0.15**	0.02**	0.09	0.02	0.16**	0.02**
> 65	0.58***	0.08***	0.58***	0.08***	0.56***	0.11***	0.58***	0.08***
employer benefits	-0.67***	-0.10***	-0.67***	-0.10***	-0.70***	-0.14***	-0.67***	-0.10***
economic conditions								
market deposit interest	0.11	0.02	0.10	0.02	0.06	0.01	0.11	0.02
market loan interest	-1.21	-0.18	-1.21	-0.18	-1.04	-0.20	-1.20	-0.17
stock index	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GDP	-0.37*	-0.05*	-0.37*	-0.05*	-0.34	-0.06	-0.37	-0.05*
ending during crises	-0.22	-0.03	-0.22	-0.03	-0.27	-0.05	-0.23	-0.03
constant	47.58*		47.53*		43.58		47.01*	
Pseudo R <sup>2</sup>	0.31		0.31		0.18		0.31	
N	2,182,743		2,182,743		1,384,807		2,182,743	

*Notes:*

This table presents logit estimates on the probability of saving duration being **less than 4 years** ('default'). The dependent variable in each model is '1' if the duration is less than 4 years and '0' otherwise. For a complete variable description see Appendix I. Since interest bonus is lost due to a saving termination within this period the bonus-coefficient is expected to be negative. We estimate four different models: The first one without interactions terms, the second interacts bonus eligibility with different contract volumes. For the third model all contracts having wop eligibility are dropped to eliminate possible disturbing effects of a second reward. The last model presents interactions of interest bonus and wop with contract volume classes. Negative coefficients are expected for interest bonus and wop. For each model the coefficient as well as the average marginal effects are reported (or discrete effects for the categorical variables). Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start. We report Pseudo-R<sup>2</sup>. 'N' is the number of observations. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.



**Table 6: Logit results for saving persistence - focus on wop**

	model (1)		model (2)		model (3)	
	coef	$\Delta$ prob (%)	coef	$\Delta$ prob (%)	coef	$\Delta$ prob (%)
interest bonus	-2.54***	-0.39***	-2.55***	-0.39***	(-)	(-)
<b>wop subsidy</b>	<b>-2.07***</b>	<b>-0.38***</b>	<b>-1.37***</b>	<b>-0.38***</b>	<b>-1.38***</b>	<b>-0.34***</b>
return optimized contract	1.53***	0.22***	1.52***	0.22***	1.44***	0.19***
contract volume (ref.: < 5,000)						
5,000 – 10,000	-0.03	-0.00	0.09	-0.02*	0.15**	-0.00
10,000 – 20,000	-0.40***	-0.06***	-0.04	-0.07***	0.00	-0.05***
20,000 – 30,000	-0.56***	-0.08***	-0.16*	-0.09***	-0.11	-0.07***
30,000 – 40,000	-0.53***	-0.08***	-0.26***	-0.09***	-0.25**	-0.08***
40,000 – 50,000	-0.68***	-0.10***	-0.44***	-0.12***	-0.44***	-0.11***
50,000 – 100,000	-0.91***	-0.14***	-0.70***	-0.16***	-0.65***	-0.14***
> 100,000	-0.69***	-0.11***	-0.61***	-0.12***	-0.61***	-0.11***
<b>wop subsidy * contract volume</b>						
<b>5,000 – 10,000</b>	(-)	(-)	<b>-0.39***</b>	<b>-0.31***</b>	<b>-0.35***</b>	<b>-0.28***</b>
<b>10,000 – 20,000</b>	(-)	(-)	<b>-0.88***</b>	<b>-0.41***</b>	<b>-0.73***</b>	<b>-0.36***</b>
<b>20,000 – 30,000</b>	(-)	(-)	<b>-0.96***</b>	<b>-0.43***</b>	<b>-0.84***</b>	<b>-0.39***</b>
<b>30,000 – 40,000</b>	(-)	(-)	<b>-0.69***</b>	<b>-0.39***</b>	<b>-0.60***</b>	<b>-0.35***</b>
<b>40,000 – 50,000</b>	(-)	(-)	<b>-0.65***</b>	<b>-0.39***</b>	<b>-0.62***</b>	<b>-0.36***</b>
<b>50,000 – 100,000</b>	(-)	(-)	<b>-0.57***</b>	<b>-0.37***</b>	<b>-0.57***</b>	<b>-0.36***</b>
<b>&gt; 100,000</b>	(-)	(-)	<b>-0.27***</b>	<b>-0.32***</b>	<b>-0.28***</b>	<b>-0.30***</b>
deposit rate	-2.29***	-0.35***	-2.28***	-0.35***	-4.32***	-0.61***
agreed loan rate	-0.32	-0.05	-0.31	-0.05	0.95*	0.13**
takes loan	0.50***	0.08***	0.51***	0.08***	0.59***	0.08***
recommended savings rate	-2.27**	-0.34**	-2.26**	-0.34**	-0.88	-0.12
waiting period	0.45***	0.07***	0.45***	0.07***	1.47***	0.21***
occupation (ref.: b.c. worker)						
self-employed	0.49***	0.07***	0.49***	0.07***	0.20***	0.03***
white collar worker	0.01	0.00	0.01	0.00	-0.04*	-0.01*
civil servant	-0.08*	-0.01*	-0.09*	-0.01*	-0.15***	-0.02***
retiree	0.04	0.01	0.03	0.00	-0.09	-0.01
doctor	-0.51***	-0.08***	-0.50***	-0.08***	-0.54***	-0.08***
student/ apprentice/ pupil	-0.23***	-0.04***	-0.23***	-0.04***	-0.14***	-0.02***
pensionary	-0.01	-0.00	-0.02	-0.00	0.04	0.01
other	0.48***	0.07***	0.48***	0.07***	0.35***	0.05***
age (ref.: < 18)						
18 – 24	0.23***	0.04***	0.23***	0.03***	0.35***	0.05***
25 – 44	0.02	0.00	0.01	0.00	0.23***	0.03***
45 – 65	0.22***	0.03***	0.22***	0.03***	0.49***	0.07***
> 65	0.58***	0.09***	0.58***	0.09***	0.96***	0.13***
employer benefits	-0.51***	-0.08***	-0.51***	-0.08***	-0.48***	-0.07***
economic conditions						
market deposit interest	0.02	0.00	0.02	0.00	0.17	0.02
market loan interest	-1.46*	-0.22**	-1.45*	-0.22**	-1.44**	-0.20**
stock index	0.00	0.00	0.00	0.00	0.00	0.00
GDP	-0.44***	-0.07***	-0.44***	-0.07***	-0.48***	-0.07***
ending during crises	0.42	0.06	0.42	0.06	0.45	0.06
constant	59.04***	-0.39***	58.47***	-0.39***	57.58***	
Pseudo R <sup>2</sup>	0.28		0.28		0.31	
N	2,182,743		2,182,743		1,759,410	

*Notes:*

This table presents logit estimates on the probability of saving duration being **less than 7 years** ('default'). The dependent variable in each model is as '1' if the duration is less than 7 years and '0' otherwise. For a complete variable description see appendix 1. Since wop subsidy is lost within this saving period the wop-coefficient is thought to be negative. We estimate three different models: The first one without interactions terms, the second interacts wop eligibility with different contract-volume classes. For the last model all contracts having interest bonus clauses are dropped. Negative coefficients are expected for interest bonus and wop. For each model the coefficient as well as the average marginal effects are reported (or discrete effects for the categorical variables Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start (see Petersen, 2009). We report Pseudo-R<sup>2</sup>. 'N' is the number of observations. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

**Table 7: OLS and quantile regression results for cash flow volatility**

	OLS			
	quantile regressions			
	model (1)	model (2)	model (3)	model (4)
	coef	10% coef	50% coef	90% coef
interest bonus	-0.237***	-0.043***	-0.210***	-0.271***
wop subsidy	-0.054***	-0.002***	-0.030***	-0.125***
return optimized contract	0.258***	0.047***	0.230***	0.299***
contract volume (ref.: < 5,000)				
5,000 – 10,000	-0.021***	-0.003***	-0.017***	-0.039***
10,000 – 20,000	-0.021***	-0.004***	-0.023***	-0.041***
20,000 – 30,000	-0.008*	-0.004***	-0.020***	-0.001
30,000 – 40,000	0.015*	-0.001***	-0.007***	0.049***
40,000 – 50,000	0.023**	-0.003***	-0.001	0.065***
50,000 – 100,000	0.018**	-0.001***	-0.001	0.051***
> 100,000	0.051***	0.001	0.029***	0.108***
deposit rate	-0.047***	-0.007***	-0.036***	-0.072***
agreed loan rate	-0.025***	-0.008***	-0.023***	-0.041***
takes loan	0.004	0.004***	0.018***	0.006***
recommended savings rate	-0.617***	-0.100***	-0.547***	-0.674***
waiting period	-0.001	0.001***	-0.001**	0.008***
occupation (ref.: b.c. worker)				
self-employed	-0.001	0.000	0.002***	0.007***
white collar worker	-0.002*	0.000	-0.001***	-0.000
civil servant	-0.016***	-0.003***	-0.009***	-0.019***
retiree	-0.008***	-0.002***	-0.002***	-0.013***
doctor	-0.012***	-0.001	-0.005**	-0.028***
student/ apprentice/ pupil	0.001	0.001***	-0.000	-0.000
pensionary	-0.010**	-0.002**	-0.002	-0.009
other	0.006**	0.001***	0.004***	0.014***
age (ref.: < 18)				
18 – 24	0.015***	-0.000	0.007***	0.032***
25 – 44	-0.005**	-0.008***	-0.008***	0.009***
45 – 65	-0.010***	-0.009***	-0.010***	0.004***
> 65	-0.009**	-0.010***	-0.013***	0.015***
employer benefits	-0.030***	0.006***	-0.007***	-0.067***
economic conditions				
market deposit rate vola	-0.089***	-0.004***	-0.059***	-0.170***
market deposit interest	0.035	0.002***	0.044***	0.095***
market loan interest	-0.093*	-0.010***	-0.108***	-0.230***
stock index	-0.000	-0.000***	-0.000***	-0.000***
GDP	-0.000	-0.001***	-0.005***	0.003***
ending during crises	-0.008	0.002***	0.001***	-0.017***
constant	3.158**	0.376***	3.137***	7.000***
Adj. R <sup>2</sup>	0.22	0.09	0.20	0.22
N	1,841,555	1,841,555	1,841,555	1,841,555

*Notes:*

This table presents OLS and quantile regression estimates for cash flow volatility of each contract ('vola'). The dependent variable is the standard deviation of cash inflows per contract. For a complete variable description see appendix 1. Model (1) presents OLS results. Models (2) – (4) present quantile regression results. We choose the 10%, 50% and 90% quantile for estimation. Negative coefficients are expected for interest bonus and wop. We report coefficients and adj. R<sup>2</sup>. Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start (see Petersen, 2009). 'N' is the number of observations. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

**Table 8: Logit and OLS results on additivity and the value of interest bonuses**

	additivity of rewards			value of interest bonus		
	model (1)		model (2)	model (3)		model (4)
	saving persistence		vola	saving persistence		vola
	coef	$\Delta$ prob (%)	coef	coef	$\Delta$ prob (%)	coef
interest bonus and wop (ref.: no reward)						
1 0	-2.51***	-0.38***	-0.10***	(-)	(-)	(-)
0 1	-2.33***	-0.36***	-0.05***	(-)	(-)	(-)
1 1	-4.92***	-0.52***	-0.15***	(-)	(-)	(-)
value of interest bonus (ref.: 0%)						
0.50%	(-)	(-)	(-)	-1.45**	-0.16***	-0.05***
1.50%	(-)	(-)	(-)	-5.56***	-0.39***	-0.15***
2.00%	(-)	(-)	(-)	-6.86***	-0.43***	-0.16***
2.50%	(-)	(-)	(-)	-6.04***	-0.41***	-0.14**
wop subsidy	(-)	(-)	(-)	-2.32***	-0.32***	-0.05***
return optimized contract	1.47***	0.19***	0.06***	1.48***	0.19***	0.05***
contract volume (ref.: < 5,000)						
5,000 – 10,000	-0.19*	-0.03*	-0.02***	-0.18*	-0.03*	-0.02***
10,000 – 20,000	-0.18	-0.03	-0.03***	-0.16	-0.02	-0.02***
20,000 – 30,000	-0.16	-0.02	-0.01***	-0.17	-0.02	-0.01***
30,000 – 40,000	-0.21	-0.03	0.01	-0.22*	-0.03*	0.01
40,000 – 50,000	-0.34**	-0.05**	0.02*	-0.37***	-0.05***	0.02**
50,000 – 100,000	-0.57***	-0.08***	0.01	-0.59***	-0.08***	0.01*
> 100,000	-0.64***	-0.09***	0.04***	-0.74***	-0.10***	0.04***
deposit rate	-2.29***	-0.33***	-0.08***	-4.18***	-0.59***	-0.11***
agreed loan rate	-0.14	-0.02	-0.01	1.11**	0.16***	0.01
takes loan	-0.77***	-0.11***	0.01**	-0.70***	-0.10***	0.01**
recommended savings rate	-2.63***	-0.38***	-0.10***	-2.28**	-0.32**	-0.08**
waiting period	0.30***	0.04***	0.02***	1.05***	0.15***	0.04***
occupation (ref.: b.c. worker)						
self employed	0.42***	0.06***	0.00	0.36***	0.05***	0.00
white collar worker	0.03	0.00	-0.00*	0.01	0.00	-0.00**
civil servant	-0.05	-0.01	-0.02***	-0.10***	-0.01***	-0.02***
retiree	-0.10**	-0.01**	-0.01***	-0.15***	-0.02***	-0.01***
doctor	-0.53***	-0.07***	-0.01***	-0.55***	-0.07***	-0.01***
student /apprentice / pupil	-0.12***	-0.02***	0.00	-0.09*	-0.01*	0.00
pensionary	0.50	0.07	-0.01**	0.30	0.04	-0.01**
other	0.72***	0.11***	0.01***	0.65***	0.10***	0.01***
age (ref.: < 18)						
18 – 24	0.49***	0.07***	0.02***	0.56***	0.08***	0.02***
25 – 44	0.20***	0.03***	-0.01**	0.32***	0.04***	-0.00*
45 – 65	0.16**	0.02**	-0.01***	0.26***	0.04***	-0.01***
> 65	0.58***	0.09***	-0.01***	0.66***	0.09***	-0.01***
employer benefits	-0.67***	-0.10***	-0.03***	-0.71***	-0.10***	-0.03***
economic conditions						
market deposit rate vola	(-)	(-)	-0.09***	(-)	(-)	-0.09***
market deposit interest	0.11	0.02	0.04*	0.12	0.02	0.04*
market loan interest	-1.21	-0.18	-0.11**	-0.99	-0.14	-0.10*
stock index	0.00	0.00	-0.00	0.00	0.00	-0.00
GDP	-0.37*	-0.05*	-0.01	-0.40	-0.06*	-0.01
ending during crises	-0.22	-0.03	-0.01	-0.21	-0.03	-0.01
constant	47.58*		3.36**	45.80		3.22**
Pseudo R <sup>2</sup> / Adjusted R <sup>2</sup>	0.31		0.19	0.32		0.19
N	2,182,743		1,841,555	2,182,743		1,841,555

*Notes:*

This table presents logit and OLS estimates on the additivity of both contractual rewards as well as the influence of different values of interest bonus on customer behavior. For the logit model we estimate the probability of saving duration being **less than 4 years** ('default'). For a complete variable description see appendix 1.

Models (1) and (2) classify the contracts according to the existence of either interest bonus or wop or both. Model (1) presents logit coefficients as well as average marginal effects. The dependent variable of model (2) is the standard deviation of cash flows per contract ('vola'). For this OLS model we present estimated coefficients.

Models (3) and (4) include indicator variables classifying the interest bonus contracts by the absolute amount of the contractual reward. Model (3) presents logit coefficients as well as average marginal effects. The dependent variable of model (4) is the standard deviation of cash flow per contract ('vola'). For this OLS model we present estimated coefficients. Negative coefficients are expected for interest bonus and wop. Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start (see Petersen, 2009). We report Pseudo-R<sup>2</sup> and adjusted R<sup>2</sup>. 'N' is the number of observations. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

**Table 9: Robustness check based on panel-OLS/ panel-logit results**

	saving persistence							vola
	model (1) (FE)	model (2) (logit)		model (3) (logit)		model (4) (logit)		Model (5) (FE)
	coef	coef	$\Delta$ prob (%)	coef	$\Delta$ prob (%)	coef	$\Delta$ prob (%)	coef
interest bonus	3.88***	-6.56***	-0.69***	-4.73***	-0.46***	-4.67***	-0.45***	-0.22***
wop subsidy	1.97***	-1.56***	-0.17***	-1.75***	-0.17***	-1.28***	-0.16***	-0.04***
return optimized contract	-1.04***	0.68***	0.06***	0.72***	0.06***	0.72***	0.06***	0.24***
contract volume (ref.: 5,000)								
5,000 – 10,000	0.04**	0.10***	-0.01***	-0.23***	-0.01***	-0.17***	-0.02***	-0.02***
10,000 – 20,000	0.11***	-0.03	-0.04***	-0.30***	-0.02***	-0.15***	-0.03***	-0.03***
20,000 – 30,000	0.01	0.08*	-0.04***	-0.17***	-0.01**	-0.02	-0.02***	-0.02***
30,000 – 40,000	0.06***	0.09	-0.04***	-0.18***	-0.01**	-0.06	-0.02***	-0.00*
40,000 – 50,000	0.18***	-0.15**	-0.05***	-0.31***	-0.02***	-0.14**	-0.04***	-0.00
50,000 – 100,000	0.36***	-0.35***	-0.07***	-0.49***	-0.04***	-0.34***	-0.05***	-0.01***
> 100,000	0.15***	-0.15	-0.05***	-0.35***	-0.02**	-0.24**	-0.03***	0.02***
bonus * contract volume								
5,000 – 10,000	(-)	(-)	(-)	0.56***	-0.47	0.52***	-0.47***	(-)
10,000 – 20,000	(-)	(-)	(-)	0.73***	-0.45	0.66***	-0.44***	(-)
20,000 – 30,000	(-)	(-)	(-)	0.65***	-0.45	0.57***	-0.44***	(-)
30,000 – 40,000	(-)	(-)	(-)	0.48***	-0.47	0.42**	-0.47***	(-)
40,000 – 50,000	(-)	(-)	(-)	0.32	-0.50	0.23	-0.49***	(-)
50,000 – 100,000	(-)	(-)	(-)	0.39*	-0.50	0.31	-0.49***	(-)
> 100,000	(-)	(-)	(-)	0.72	-0.45	0.63	-0.45***	(-)
wop subsidy * contract volume								
5,000 – 10,000	(-)	-0.27***	-0.14***	(-)	(-)	-0.23***	-0.13***	(-)
10,000 – 20,000	(-)	-0.54***	-0.18***	(-)	(-)	-0.61***	-0.18***	(-)
20,000 – 30,000	(-)	-0.73***	-0.19***	(-)	(-)	-0.61***	-0.17***	(-)
30,000 – 40,000	(-)	-0.72***	-0.19***	(-)	(-)	-0.48***	-0.15***	(-)
40,000 – 50,000	(-)	-0.66***	-0.21***	(-)	(-)	-0.63***	-0.18***	(-)
50,000 – 100,000	(-)	-0.66***	-0.23***	(-)	(-)	-0.60***	-0.19***	(-)
> 100,000	(-)	-0.57***	-0.19***	(-)	(-)	-0.38*	-0.15***	(-)
deposit rate	2.42***	-3.35***	-0.28***	-2.38***	-0.20***	-2.38***	-0.19***	-0.05***
agreed loan rate	-0.36***	1.41***	0.12***	0.55***	0.05***	0.55***	0.04***	-0.03***
takes loan	-0.28***	0.74***	0.06***	-0.10***	-0.01***	-0.09***	-0.01***	0.01***
recommended savings rate	2.21***	0.17	0.01	0.02	0.00	-0.04	-0.00	-0.65***
waiting period	-0.49***	0.88***	0.07***	0.49***	0.04***	0.49***	0.04***	-0.00***
occupation (ref.: b.c. worker)								
self-employed	-1.61***	1.53***	0.06***	2.22***	0.12***	2.22***	0.11***	-0.00
white collar worker	-0.05	0.11	0.01	-0.02	-0.00	-0.02	-0.00	-0.01
civil servant	0.30	-0.92	-0.07	-0.40	-0.04	-0.39	-0.04	0.01
retiree	0.10*	-2.59***	-0.29***	-0.71***	-0.07***	-0.72***	-0.07***	-0.02***
doctor	0.40	0.52	0.03	-0.20	-0.02	-0.24	-0.02	-0.06
student/apprentice/ pupil	-0.78***	1.27***	0.05***	0.58**	0.05***	0.58**	0.04***	0.02
pensionary	0.90	-11.38	-0.91	-13.89	-0.85***	-14.92	-0.86***	-0.04
other	-2.57***	2.55***	0.07***	3.15***	0.14***	3.13***	0.13***	-0.01***
age (ref.: < 18)								
18 – 24	-0.99***	0.96***	0.12***	1.15***	0.17***	1.15***	0.17***	0.03***
25 – 44	-2.05***	2.01***	0.23***	2.47***	0.34***	2.46***	0.33***	0.05***
45 – 65	-3.03***	2.79***	0.30***	3.57***	0.43***	3.56***	0.42***	0.06***
> 65	-4.09***	3.55***	0.34***	4.60***	0.48***	4.59***	0.47***	0.07***
employer benefits	0.66***	-0.67***	-0.06***	-0.86***	-0.07***	-0.86***	-0.07***	-0.03***
economic conditions								
market deposit rate vola								-0.07***
market deposit interest	0.60***	-0.47***	-0.04***	-0.32***	-0.03***	-0.32***	-0.03***	0.06***
market loan interest	-0.71***	0.75***	0.06***	0.45***	0.04***	0.45***	0.04***	-0.04***
stock index	-0.00***	-0.00***	-0.00***	0.00***	0.00***	0.00***	0.00***	-0.00***
GDP	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
ending during crises	-0.00	0.16***	0.01***	-0.21***	-0.02***	-0.21***	-0.02***	-0.01***
constant	6.30***							0.85***
Overall R <sup>2</sup> / Pseudo R <sup>2</sup>	0.45	0.44		0.48		0.48		0.15
N - obs	1,503,738	292,346		300,044		300,044		1,272,909
N - id	1,097,022	117,853		114,454		114,454		965,956

Notes:

This table presents panel-OLS and panel-logit estimates for saving persistence and panel-OLS for cash flow volatility (vola). The dependent variable in model (1) is the savings duration. The dependent variable of model (2) is '1' if the contract's duration is less than seven years and '0' otherwise. The dependent variable of models (3) and (4) is '1' if the duration is less than 4 years and '0' otherwise. The dependent variable of model (5) is vola for each contract. For a complete variable description see appendix 1. For model (1) the panel model uses 1.5 million contracts that have been negotiated by 1.1 million customers. The panel-logit models (2)-(4) additionally require that the customers save in one contract, e.g., less than 4 years and with the next contract more than 4 years. Therefore N decreases for the panel-logit models. For model (1) estimating OLS fixed effects (FE) we report coefficients and overall R<sup>2</sup>. For the panel-logit models the coefficients as well as the average marginal effects are reported (or discrete effects for the categorical variables). In the logit models negative coefficients are expected for interest bonus and wop, positive ones in the OLS model. We report Pseudo-R<sup>2</sup>. All models are estimated using fixed-effects on the customer-level. Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start (see Petersen, 2009). 'N-obs' is the number of contracts. 'N-id' is the number of customers. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

**Table 10: Robustness check based on OLS results using matching algorithms**

	1:1 matching, without replacement				1:3 matching, with replacement			
			model (1)	model (2)			model (3)	model (4)
	frequency (%)		saving persis- tence OLS coef	vola OLS coef	frequency (%)		saving persistence OLS coef	vola OLS coef
	treated	untreated			treated	untreated		
interest bonus	(-)	(-)	<b>2.34***</b>	<b>-0.222***</b>	(-)	(-)	<b>2.30***</b>	<b>-0.219***</b>
wop subsidy	43.21	39.91	1.95***	-0.048***	43.21	43.20	1.81***	-0.048***
return optimized contract	(-)	(-)	-1.27***	0.212***	(-)	(-)	-1.02***	0.221***
contract volume in € (ref.: < 5,000)	2.82	3.46			2.82	2.80		
5,000 – 10,000	32.89	32.81	0.00	-0.015***	32.89	32.89	0.17*	-0.028***
10,000 – 20,000	50.86	49.62	0.28*	-0.020***	50.86	50.87	0.41***	-0.020***
20,000 – 30,000	10.64	11.23	0.37*	-0.005	10.64	10.65	0.46**	-0.002
30,000 – 40,000	1.56	1.63	0.21	0.039**	1.56	1.56	0.25	0.015
40,000 – 50,000	0.46	0.48	0.11	0.077***	0.46	0.47	0.28	0.049***
50,000 – 100,000	0.68	0.69	0.42*	0.064***	0.68	0.69	0.61***	0.046***
> 100,000	0.08	0.08	0.18	0.098***	0.08	0.08	0.36*	0.085***
deposit rate	(-)	(-)	2.35***	-0.028***	(-)	(-)	2.19***	-0.035***
agreed loan rate	(-)	(-)	-0.36*	-0.000	(-)	(-)	-0.41***	-0.013
takes loan	(-)	(-)	-0.16	0.008	(-)	(-)	-0.33*	0.030***
recommended savings rate	(-)	(-)	0.92	-0.422***	(-)	(-)	0.40	-0.480***
waiting period	(-)	(-)	0.08	-0.008	(-)	(-)	-0.12	0.002
occupation (ref.: b.c. worker)	16.79	17.09			16.79	17.09		
self-employed	3.10	3.12	-0.46***	0.008*	3.10	3.08	-0.06	-0.009*
white collar worker	10.04	10.39	-0.28**	0.000	10.04	10.04	-0.34**	-0.007
civil servant	0.31	0.50	-0.11	-0.010***	0.31	0.30	-0.18	-0.023***
retiree	16.54	15.64	-0.01	-0.008*	16.54	16.56	0.01	-0.011
doctor	0.04	0.07	0.14	0.004	0.04	0.03	-0.20	0.007
student/ apprentice/ pupil	16.88	16.39	0.22**	0.001	16.88	16.89	0.39***	-0.007
pensionary	0.06	0.19	-0.79***	-0.010**	0.06	0.05	-0.13	-0.006
other	36.24	36.61	-0.41***	0.007***	36.24	36.26	-0.19***	-0.002
age (ref.: < 18)	4.54	3.54			4.54	4.51		
18 – 24	13.73	12.77	-0.32***	0.008***	13.73	13.73	-0.39***	0.013*
25 – 44	31.31	33.43	-0.23***	-0.009***	31.31	31.34	-0.26***	-0.015**
45 – 65	33.14	35.98	-0.27***	-0.016***	33.14	33.17	-0.33***	-0.020**
> 65	17.28	14.28	-0.49***	-0.018***	17.28	17.24	-0.47***	-0.016
employer benefits	46.12	46.56	0.57***	-0.024***	46.12	46.13	0.70***	-0.028***
economic conditions								
market deposit rate vola	(-)	(-)	(-)	-0.103***	(-)	(-)	(-)	-0.103***
market deposit interest	(-)	(-)	1.79*	-0.021	(-)	(-)	2.13**	-0.156*
market loan interest	(-)	(-)	-1.39	0.021	(-)	(-)	-1.71	0.186**
stock index	(-)	(-)	-0.00	-0.000	(-)	(-)	-0.00	0.000
GDP	(-)	(-)	0.23	0.020	(-)	(-)	0.22	-0.003
ending during crises	(-)	(-)	-0.39	-0.004	(-)	(-)	-0.57*	0.028
constant	(-)	(-)	-18.58	0.892	(-)	(-)	-15.53	-4.068**
adjusted R <sup>2</sup>	(-)	(-)	0.45	0.190	(-)	(-)	0.48	0.250
N	(-)	(-)	846,666	762,676	(-)	(-)	1,693,332	1,511,589
N – treated	423,333	(-)	423,333	402,564	423,333	(-)	423,333	402,564
N – untreated	(-)	423,333	423,333	360,112	(-)	1,269,999	1,269,999	1,109,025

*Notes:*

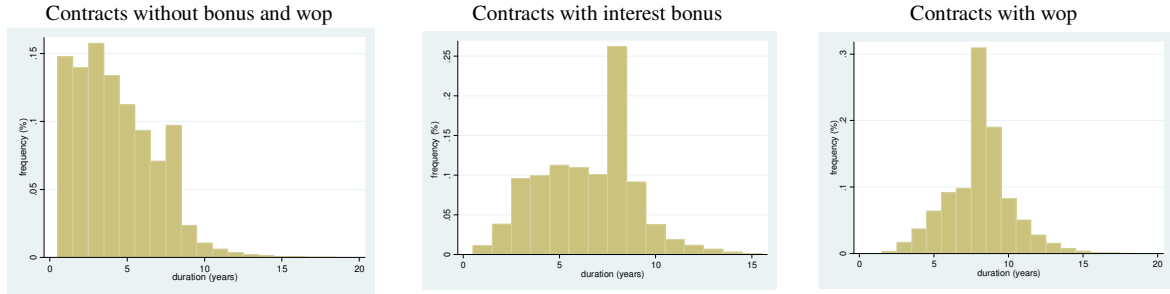
This table presents summary statistics on the variables used to match treated contracts, i.e., with interest bonus, to untreated contracts, i.e., without interest bonus. We report the frequency of variables for treated and untreated contracts in columns 1, 2 and 5, 6. Frequencies are reported for those variables used to match an untreated to a treated contract. Models (1) and (3) present OLS regressions estimated of saving persistence. The dependent variable of each model is the observed saving duration of each contract measured in years. Positive coefficients are expected for interest bonus and wop. Models (2) and (4) present OLS regressions results for cash flow volatility. The dependent variable of those models is the observed cash flow volatility for each contract. Negative coefficients are expected for interest bonus and wop.

The dataset contains 423,333 contracts with interest bonuses. The 1:1 propensity score matching uses for each contract with interest bonus one similar contract without interest bonus. Every contract without interest bonus can only be used once. The 1:3 matching procedure employs three contract without interest bonus. Here replacements are allowed, i.e., a contract without interest bonus may be matched several times to different interest bonus contracts.

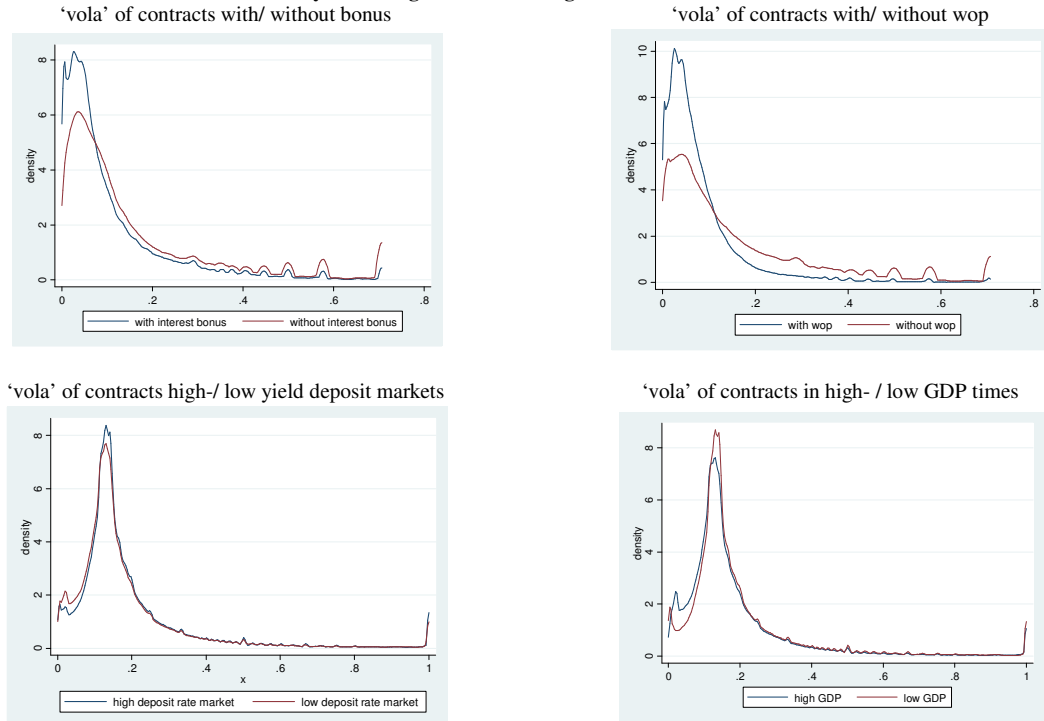
For a complete variable description see appendix 1. Significance is calculated using robust (Huber/White) standard errors clustered by the time dimension, i.e., contract start (see Petersen, 2009). We report adjusted R<sup>2</sup>. ‘N’ is the number of observations. \*, \*\*, \*\*\* indicate that the coefficient differs from zero at the 10%, 5%, and 1% level (using a two-sided test), respectively.

## Figure 1: Contract duration of savers and cash flow volatility

### Panel A: Distribution of contract durations according to contract design



### Panel B: Distribution of cash flow volatility according to contract design and market conditions



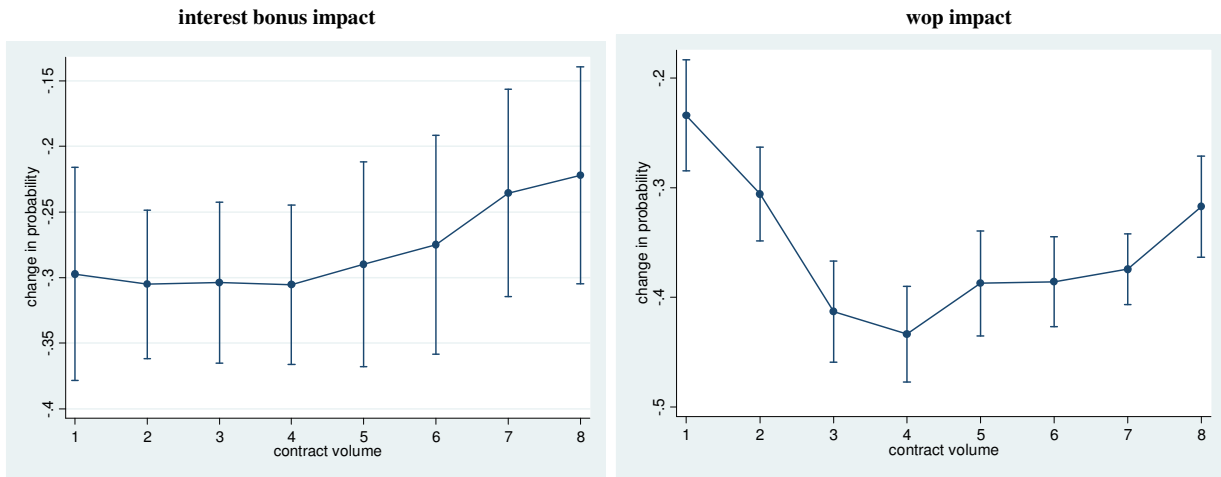
**Notes:**

Panel A shows the discrete, empirical distribution of all contractual savings durations for contracts that have neither interest bonus nor wop eligibility, contracts with interest bonus clauses as well as contracts with wop. All durations in years.

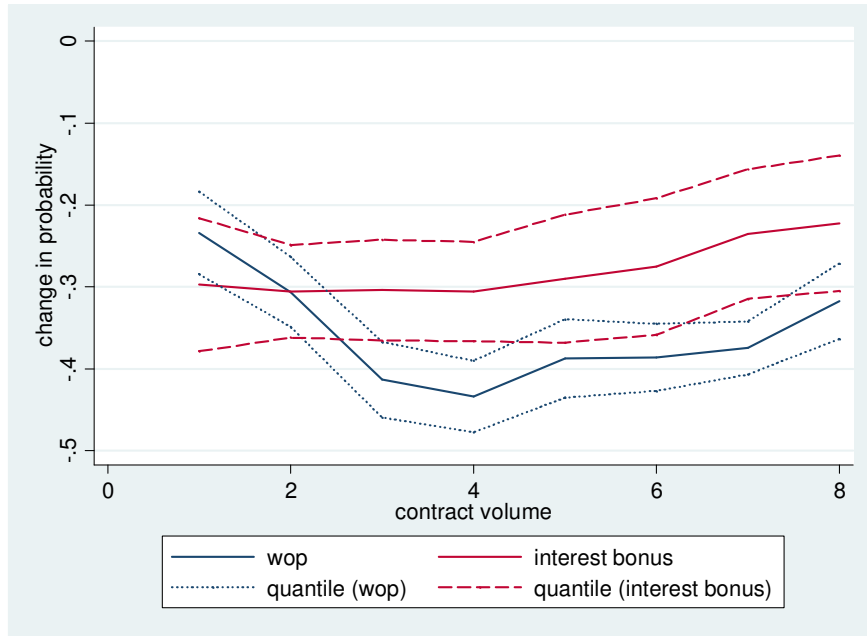
Panel B presents the continuous distribution of cash flow volatility per contract ('vola'). Contracts with interest bonus or wop exhibit lower 'vola' than those without bonus or wop respectively. 'vola' does not seem to differ largely when the contracts' lifetime is during high- and low deposit markets or high- and low GDP market times. Graphs are qualitatively equal if plotted for unemployment or loan rate levels.

**Figure 2: Impact of bonus and wop**

**Panel A: interest bonus- and wop impact**



**Panel B: relative impact**



*Notes:*

The first column of Panel A presents the average marginal effects from Table 4, model (2). The change in probability of early contract termination is shown for different contract volume classes if interest bonuses are employed and sanction early contract termination within 4 years. Column 2 of Panel A presents the change in probability for a contract termination within 7 years if the contract is wop eligible (see Table 5, model (2)). The solid lines are estimated average marginal effects, the vertical line present the 95% confidence interval. Panel B presents the change in probability for Table 4, model (4), if interest bonus as well as wop are interacted with contract volume. The dashed lines present the 95% confidence interval. The contract volume classes are defined in € as followed: '1': <5,000, '2': 5,000-10,000, '3': 10,000-20,000, '4': 20,000-30,000, '5': 30,000-40,000, '6': 40,000-50,000, '7': 50,000-100,000, '8': >100,000.