Do Customers Learn from Experience? Evidence from Retail Banking*

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We study customers’ adoption and subsequent switching decisions, with regard to a menu of three-part tariff plans offered by a commercial bank. Using a rich panel data set covering 70,000 fee-based checking accounts over 30 months, before and after the introduction of the plans, we find that most customers adopt non-cost-minimizing plans, preferring plans with large monthly allowances and high fixed payments. Furthermore, after adoption, customers who exceed their allowances and consequently pay overage fees are more likely to switch to plans with larger allowances than customers who do not experience such fees. Notably, after switching, these overage-paying customers pay higher monthly payments than before. In contrast, switchers who did not pay overage payments before switching pay less after switching. Our findings, unlike those of previous research on experience-based learning, suggest that the behavior of experienced customers does not converge to the predictions of neoclassical models. We propose that ‘overage aversion’, which is closely related to loss aversion and mental accounting, is the most plausible explanation for our findings.

Key words: tariff choice; non-linear pricing; switching; learning;

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I. Introduction

Economic models of rational behavior assume that individuals attempt to make optimal choices, i.e., choices that maximize their utility. When choices involve uncertainty or are computationally difficult, economists typically consider learning through experience to be an important driver of such optimization behavior (e.g., Roth and Erev 1995). The interest of researchers in the sources and the consequences of customer experience has increased in recent years, as a large body of literature has shown that individuals exhibit various types of biases when making decisions, and that firms exploit these biases when setting prices or designing customer contracts (e.g., DellaVigna 2009; DellaVigna and Malmendier 2004, 2006; Lacetera et al. 2012). If customer experience can mitigate initial customer biases, it is likely to limit the effectiveness of firms’ attempts to take advantage of such biases. Hence, a central question in the behavioral economics literature is to what extent customers learn from experience with contracts that are likely to exploit behavioral biases and subsequently improve upon their initial choices. In their review of the behavioral economics literature, Levitt and List (2008) write that “exploring how markets and market experience influence behavior represents an important line of future inquiry.”

Nevertheless, only a few studies have used micro-level field data to explore the consequences of customer experience (List 2003, 2004; Miravete 2003; Agarwal et al. 2006; Agarwal et al. 2011; Miravete and Palacios-Huerta 2011; Haselhuhn et al. 2012; Ketcham et al. 2012). The scarcity of such analyses is probably due to the unique nature of the data they require. A main insight that has emerged thus far in these studies is that, as predicted by the neoclassical economic theory (e.g. Becker 1976), experience does lead to better outcomes and can ameliorate initial biases. In this paper we provide novel evidence that, in contrast to what the existing literature would suggest, a specific type of customer experience—namely, overage payments—can systematically result in worse, rather than better, economic outcomes for customers. We use the term ‘overage aversion’ to refer to this unique role of overage payments in customers’ decision making.

Our research setting is the retail banking industry, and we focus specifically on customer choice from a menu of three-part tariff plans. A three-part tariff plan consists of a fixed fee, an included allowance of units for which the marginal price is zero, and a positive marginal price for additional usage beyond this allowance. The additional expense for this additional usage is termed overage payment. Prime examples of this pricing method are subscription plans in the cellular, Internet, car leasing, and banking industries. Such pricing schemes have become common in recent years, as advances in technology have enabled both firms and customers to track usage levels over billing periods.

Our empirical analysis makes use of a rich data set obtained from a large commercial bank operating in a Western OECD member country. The data comprise detailed monthly information on
about 70,000 checking accounts. The data span 30 months, starting 6 months before the bank introduced a menu of three-part tariff plans. Bank customers could select a plan from the new menu or continue to be charged according to the existing pay-per-use pricing scheme.

We begin our empirical analysis by examining customers’ plan adoption decisions. We first document strong evidence for flat-rate bias, i.e., customers typically chose plans with allowances that were larger than the allowances of their cost-minimizing plans (DellaVigna and Malmendier 2006; Goettler and Clay 2012; Lambrecht et al. 2007; Lambrecht and Skiera 2006; Train et al. 1987). We also find that only 17% to 18% of account-holders adopted their cost-minimizing plans, based on their account usage before and after the adoption of the plans, respectively. Had all plan adopters chosen their cost-minimizing plans, their monthly payments would have been 30% lower, on average, than the actual monthly charges they incurred following adoption. However, in fact, our panel data estimates, controlling for account usage, indicate that customers who adopted plans experienced an average increase of 9% in their monthly payments to the bank (as compared with their payments prior to plan introduction).

Having shown that the average customer’s initial plan choice is not the cost-minimizing choice, we next examine customers’ switching decisions. Specifically, we investigate whether plan adopters who later switched to a new plan improved upon their initial choices. Because we follow customers over a period of more than two years, and since customers did not face any contractual or monetary switching costs, our data provide a unique opportunity to evaluate the sources for and the implications of these switching decisions.

Our first finding with regard to switching decisions is that only a small fraction of customers actually switched plans, while the vast majority of customers retained their initial plan choices. Our analysis also indicates that, at the aggregate level, customers who did switch plans paid less after switching. Notably, however, the outcome of the switching decision was heterogeneous across plan switchers. In particular, we find that customers who paid overage payments before switching tended to switch to plans with larger allowances, and their subsequent monthly payments ended up exceeding their average monthly charges before switching. In contrast, plan switchers who did not pay overage payments prior to switching were more likely to choose plans with smaller allowances and consequently reduce their overall costs.

We suggest that these phenomena are driven by overage aversion; that is, customers incur excess disutility from paying overage payments, leading them to replace overage payments with higher monthly fixed payments. To provide a quantifiable measure for the non-monetary cost created by overage payments, we estimate a discrete choice model that allows us to evaluate customers’ relative sensitivity to fixed payments as compared to overage payments. Our estimates suggest that customers’ disutility from paying $1 as overage payment equals that of roughly $3.5 in fixed monthly payments.

We propose that loss aversion coupled with mental accounting (Tversky and Kahenman 1991; Thaler 1985, 1999) constitute a plausible explanation for our findings. Loss aversion means that
individuals have a propensity to prefer avoiding losses to obtaining gains. Koszegi and Rabin (2006, 2007) further develop the concept of loss aversion and suggest that customers construct reference points based on their rational expectations about outcomes, and that gains and losses are constructed around these reference points. In the context of three-part tariff plan choice, we propose that customers distinguish between expected ‘within-budget’ payments (fixed monthly fees) and other ‘unexpected’ payments (overage payments). Loss aversion occurs only with respect to the uncertain overage payments, which accrue only if the customer exceeds the plan’s allowance. We thus postulate that a customer subscribes in advance to a three-part tariff plan with an allowance that is likely to exceed his or her needs, thereby reducing the likelihood of experiencing the psychological costs associated with exceeding the allowance of the chosen plan. In other words, customers who choose among three-part tariff plans treat fixed fee payments and overage payments as separate mental accounts, and they associate different levels of disutility with paying from these different accounts.

Our study is also related to the literature on non-linear pricing, and specifically on three-part tariffs. Despite the prevalence of three-part tariff plans in practice, little research has been done on customer choice from a menu of such pricing schemes. The few existing studies on customer choice from a menu of three-part tariff plans investigated customer plan choice for new services, where customers’ knowledge about the services and their benefits was preliminary and limited. These studies focused, for example, on Internet and cellular services, using data collected at a time when such services were relatively new (Ascarza et al. 2010; Grubb 2009; Grubb and Osborne 2012; Lambrecht et al. 2007; Lambrecht and Skiera 2006). Accordingly, customer choice biases in these studies were typically attributed to customer uncertainty regarding the benefits of the new service and customers’ biased beliefs about their future usage. In contrast, in our setting of retail banking we expect that customers will have lower uncertainty regarding the benefits of the service and their levels of usage. We expect low uncertainty among the bank customers in our data set both because, in general, customers are likely to be familiar with checking accounts, and because, specifically, we analyze customers’ decisions with regard to accounts that they have been using for some time, with average account tenure of 14 years. Furthermore, due to data limitations, previous studies did not thoroughly examine how customers’ behavior changed as they gained experience with the new services and the new pricing plans. Our unique data enable us to focus on customers’ switching decisions and directly explore how the experience gained while being subscribed to a three-part plan affects customer choices and consequent payoffs.

II. Data and Industry Background

II.1. Data

II.1.1. Three-part Tariff Plans. We use data on the introduction of three-part tariff plans by a large commercial bank to its active customers. The new pricing plans provided an alternative to an ‘old’ pricing scheme that had previously been the only system used in the banking industry of the analyzed
market at the time of introduction. The ‘old’ pricing scheme calculated customers’ commission payments according to the number and types of their transactions. The cost for a specific transaction could range from a few cents to as much as $7. When the new three-part tariff plans were introduced, each of the bank’s customers had the option of continuing to use the ‘old’ pricing scheme, or choosing one of the new plans. Continuing with the ‘old’ pricing scheme was the default option and required no active choice on the customer’s part. After choosing one of the new service plans, customers could switch to a different plan or go back to the ‘old’ scheme (we refer to this as ‘quitting’) at any time. A customer could join a plan, switch to a different plan, or go back to the ‘old’ scheme by calling his or her bank branch or the bank’s call center. The customer was not required to arrive in person, sign documents, or pay any switching fees.

Customers who chose to adopt three-part tariff plans were no longer charged according to the type and number of their transactions, but were instead given monthly allowances for three types of transactions. These three transaction types included check deposits, transactions through direct channels (e.g., Internet or using a touch-tone telephone), and transactions that involve interaction with a clerk at a bank’s branch or through a call center. Any transaction above one’s allowance entailed overage payment above the basic plan cost. The overage payments depended on the channel used for the extra transaction ($0.3 for the check and direct channels and $1.2 for the channel involving human interaction) but were the same across different plans. In Table 1, we present the details of two three-part tariff plans: the least expensive plan (plan 1) — the plan with the lowest allowance; and the second most expensive plan (plan 5) — the plan with the next to the highest allowance. In the month when the new plans were introduced, bank customers could choose from a menu of four three-part tariff plans. Nine months after the first four plans were introduced, two new plans were added to the existing set of plans. After plans had been offered to customers, they remained available throughout the investigated timeframe, with two exceptions: One plan from the set of the four initial plans was removed from the choice set nine months after its introduction, and another plan was altered such that its allowance for direct channels was reduced. (Customers who chose these plans before these changes could still use them afterwards.) Throughout the analysis, the number of the plan is an indication of the size of the allowance (e.g., plan 2 has a larger allowance than plan 1 and entails a higher fixed payment).

II.1.2. Sample and Data. Our data consist of information on a sample of 70,510 checking accounts out of a list of about one million accounts that the bank identified as potential candidates for the service. This initial list of potential accounts was reduced to include only accounts that were active for at least six months at the time that the new service was introduced and that were considered the

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1 Note that three-part tariff plans for cellular service also typically include three types of allowances: voice, text and data.
2 A scale of 1 to10. Higher values indicate a higher socio-demographic status for the address of the customer.
3 Due to confidentiality concerns we are not allowed to reveal the summary statistics for the following variables: salary,
primary accounts of the account holders. In addition, accounts held by very young customers and accounts for which certain indicators, such as the age or the address of the customer, were missing, were also excluded. To construct the actual sample of accounts we used a layer sampling procedure based on the plan adoption time. That is, all accounts were ordered according to the date on which the account holder adopted a three-part tariff plan. Non-adopting customers were randomly ordered. We then selected every tenth account for the final sample. The data were collected over the course of 30 months (from 6 months before service introduction until 24 months after introduction). In our sample, 32,394 customers adopted one of the six investigated three-part tariff plans. Of those customers, 2,268 eventually switched to one of the other three-part tariff plans, while 2,160 opted to return to the ‘old’ payment system.

The account-level data include information on the plans used in each month, as well as additional detailed monthly-level information for every account. In particular, we have monthly information on the three types of transactions: check deposits, transactions through direct channels, and transactions through personalized clerk-assisted channels. The data also cover each customer’s monthly volume of information inquiries and information regarding other characteristics associated with the account, including general characteristics (e.g., account tenure and social security payments made to the account), financial characteristics (e.g., income and the monthly levels of savings and loans), and demographic characteristics (e.g., customer age and socio-demographic index). Another unique characteristic of our data is the inclusion of the number of direct marketing calls directed at each customer to introduce the possibility of choosing from the menu of new plans. To protect customers’ privacy, each account number was encrypted in a way that still enabled us to track that account through the entire research data set (see Landsman and Givon (2010) for a further discussion of the data).

Table 2 presents the summary statistics for plan adopters and non-adopters for the data variables. On average, adopters pay higher monthly bank commission charges than non-adopters do ($7.30 vs. $3.69), and show more active involvement in managing their accounts (e.g. 3.33 vs. 1.7 direct transactions). Non-adopters are typically older, which probably explains why they have higher savings and smaller loans. Finally, adopters received, on average, four times more marketing calls per month than did non-adopters. Overall, these summary statistics suggest that customers engage in a sorting behavior. A customer with high usage volume (measured by pre-adoption payments) is likely to adopt one of the new plans. In contrast, low-volume customers tend to prefer the ‘old’ pricing plan, which does not require a high fixed monthly bank payment.

2 A scale of 1 to 10. Higher values indicate a higher socio-demographic status for the address of the customer.
3 Due to confidentiality concerns we are not allowed to reveal the summary statistics for the following variables: salary, loans, savings, monthly mean positive balance, and monthly mean negative balance. We use these variables in the regression analysis.
II.2. Economic Environment

The data we use come from a large commercial bank that operates in a developed OECD member country. The banking industry in the country we analyze is highly concentrated. In the analyzed time period, there were three large banks that controlled about 85% of the analyzed banking industry. Furthermore, over the years of data collection, relatively few bank customers switched between banks. The introduction of the new pricing scheme that we study followed a public outcry over the complexity of banks’ payment schemes. The bank from which we obtained the data is a leading bank in the country and was the first to offer the new pricing scheme to its customers. Throughout the paper, we convert the local monetary unit into nominal dollars.

III. Analysis

In this section we first examine whether customers tend to choose their cost-minimizing plans. We then explore whether, as found by previous studies using data on a menu of plans, customers exhibit a flat-rate bias when choosing among a menu of pricing plans. Next, we examine whether customer learning ameliorates these initial biases, as predicted by the neoclassical theory. In particular, we investigate the factors that trigger plan switching among customers, and then analyze the nature and consequences of these switching decisions.

III.1. Initial Plan Choice

III.1.1. Optimality of Initial Plan Adoption Choices. We start by computing the percentage of account holders whose plan choices were the cost-minimizing plans, given their account usage before or after adopting a plan. Tables 3A and 3B present the distribution of optimal pricing plans against the chosen pricing plans (including the ‘old’ pricing scheme) for each of the available plans, based on account usage three months before (i.e. ex-ante approach) or three-months after (ex-post approach) adoption, respectively. For example, the number in the second column of row 5 in Table 3A indicates that the optimal plan for 4.6% of the adopters of plan 5 is plan 2. The diagonals in Tables 3A and 3B represent the percentage of customers who chose their cost-minimizing (optimal) plans. As can be easily observed in the tables, the vast majority of non-optimal plan choices were for plans with larger allowances than the allowance offered by the cost-minimizing plan (i.e., there is a large concentration of choices below the diagonal of Tables 3A and 3B). As already mentioned, the tendency to choose

4 In online Appendix A we provide more details on the calculations used for the optimality assessment.
5 When we performed the same calculation, considering only three-part tariff plans in the optimality analysis (i.e., we did not consider the possibility of non-adoption in this analysis), we find that 29% of plan adopters chose the plans that minimized their payments to the bank (based either on their ex-ante or ex-post approach). Once we expand the calculation time window
plans with allowances larger than the allowances of the cost-minimizing plans, known as flat-rate bias, has been documented in various industries. If we aggregate over adopting customers, we find that only 17% to 18% of plan adopters actually chose the plans that minimized their payments to the bank, based on the usage patterns three months before and after the adoption of the plan, respectively. Comparing customers’ actual payments to the payments that they would have paid had they chosen the cost-minimizing plan (based on pre-adoption usage), we find that, on average, plan adopters could have reduced their monthly payments by nearly 30% had they chosen their optimal plans.

We carried out a logit regression analyses to further explore the characteristics of adopting customers and of customers who are likely to experience a flat-rate bias. Our results show that age and savings correlate negatively with plan adoption, whereas the account holder’s mean commission payment under the ‘old’ payment system, the number of children below the age of 18, and the number of marketing calls correlate positively with plan adoption. We also find that account holders who are characterized by higher socio-demographic indices or longer account tenure and who perform more information inquiries are less likely to experience flat-rate bias. Interestingly, the number of marketing calls, which has a strong effect on the initial adoption decision, has no effect on the tendency to experience a flat-rate bias (see online Appendix B for a full report of the logit regression estimation results).

**III.1.2. Panel-data Analysis of Customer Adoption Decision.** The analysis above focused on the comparison between the chosen plan and the cost-minimizing plan. To provide direct evidence on the consequences of the adoption decision we estimate the following panel data fixed effect regression:

\[
\text{Log(Payment)}_{it} = \beta_0 + \beta_D D_{Adoption,it} + \beta_A \text{Log(Activity +1)}_{it} + \beta_X \text{Log(X +1)}_{it} + \alpha_i + \eta_t + \epsilon_{it}
\]

where the dummy variable \(D_{Adoption,it}\) equals one if customer \(i\) has adopted a three-part tariff plan by time \(t\), and zero otherwise. \(Activity_{it}\) is a matrix that includes for each account \(i\) the number of clerk-assisted and direct transactions, and the number of checks deposited in month \(t\). \(X_{it}\) includes account-level characteristics that can vary over time, such as salary, number of account owners, number of salaries, social insurance payments, loans and savings. We implement log-transformation for all the variables that are not binary variables. Finally, we also include account \((\alpha_i)\) and time \((\eta_t)\) fixed effects to control for unobserved differences across customers and unobserved time trends. We also cluster our standard errors at the individual account level. The regression results, reported in column 1 in Table 4, indicate that following plan adoption the monthly payment by adopting customers increased by 9.1%.

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for optimality calculation (see online Appendix A), the range of optimality percentages is between 14% and 19%, corresponding to a 6-month window before and after plan choice, respectively. Furthermore, these qualitative results do not change once we focus on late adopters and hence are able to extend the timeframe to 12 and 18 months before these customers adopted a three-part tariff plan.
In the next section we turn to the main analysis and focus on switching decisions, which we consider as an indication of learning. This analysis allows us to test whether customer learning leads to lower customer payments, as the traditional theory predicts.

III.2. Switching

Most customers who adopted a three-part tariff kept their initial choice. Only 2,268 customers switched to other three-part tariff plans after initially adopting a plan. This pattern may have been driven by inertia or non-pecuniary switching costs, or it might simply indicate that customers were satisfied with their initial choices, even if the chosen plan was not the cost-minimizing plan. In this section we focus on the group of customers who did switch plans and show that customers who exceeded the allowance of their three-part tariff plan and consequently paid overage payments were likely to switch to another three-part tariff plan. In particular, we show that customers who experienced overage payments were more likely to switch upward, i.e., to plans with higher allowances. We then assess the optimality of these switching decisions, conditional on whether a switching customer paid or did not pay overage payments before switching.

III.2.1. The Effect of Overage Payments on Switching.

Customers who switched to other plans paid, on average, the highest overage payments under their initial plans compared with all other plan adopters ($1.06 per month for plan switchers, compared with $0.62 and $0.3 for plan quitters and plan adopters who kept their initial plans, respectively). Consistent with this finding, while using their initial plans, switchers exceeded their plans’ allowances for clerk-assisted and check transactions more frequently than did other plan adopters (29% and 15% of months with excess clerk-assisted transactions and check transactions, respectively, for switchers, compared to only 9% and 6% of months with excess clerk-assisted and check transactions, respectively, for non-switchers).

Figure 1 presents the relationship between switching decision and overage payments from another angle, classifying customers in terms of the nature of their initial plan choices: initial downward bias (customers who initially adopted a plan with too small an allowance), initial optimal choice, and initial upward bias (customers who initially adopted a plan with too large an allowance). Clearly, in all cases, customers who eventually switched paid higher overage payments under their initial plans than did customers who did not switch. As expected, the mean overage payment of customers with a downward bias is higher than that of all other plan adopters.

To further substantiate our claim that overage payments are a strong trigger for switching, we performed a proportional hazard regression for the duration between the time of plan adoption and the time of plan switching. We estimated this regression using a semi-parametric estimation procedure that allows for time-varying independent variables (Cox 1972). A proportional hazard model (PHM) is a commonly used framework to model the duration until an event occurs (e.g., Seetharaman and Chintagunta 2003). According to the PHM, the hazard function is decomposed into two multiplicative components: \( h_u = h_{0u} \psi(X_{it}) \), where \( h_{0u} \) represents the baseline hazard function, which reflects the
dynamics of the hazard rate over time, and $\psi(X_u)$ represents the effect of the variables composing $X_u$ on the hazard rate. $\psi(X_u)$ adjusts $h_{0u}$ up or down proportionally to reflect the effect of the covariates.\(^6\)

In the first result column of Table 5, we summarize the estimation results of the switching hazard model. We find that the hazard of switching to another plan significantly increases with the cumulative amount of overage payment paid by that time. The estimated odds ratio for overage payment is 1.01. That is, an additional dollar in the cumulative overage payments increases the hazard of switching by one percent. We do not find, however, that the optimality of the initial choice is associated with a change in the likelihood to switch to another plan. In other words, customers who did not initially choose their cost-minimizing plans are not more likely to switch than customers whose initial plan choices were optimal. The second result column of Table 5 presents the estimation results of a similar hazard model for the duration between the time of initial plan adoption and the time of switching to a plan with a higher allowance (‘upward switching’). We find that the choice to switch to a higher plan is strongly associated with overage payments (with an odds ratio of 1.02).\(^7\) This association is even stronger than that for switching in general. We also find, as expected, that an initial downward bias raises the hazard of switching to a plan with a larger allowance.

III.2.2. Optimality of Switching. Tables 6A and 6B present results of the analyses evaluating the optimality of switching decisions based on switching customers’ account usage before and after switching, respectively. In both cases, aggregating over all switchers, we find that only 14% of the switchers made the optimal cost-minimizing switching choice. The percentage of optimal choices is even smaller than that in the initial choice analysis.

To illustrate the impact of pre-switch overage payments on the nature of the switching decision, Figures 2 and 3 present the percentage of customers who switched to plans with larger allowances (‘upward switchers’) and the percentage of customers who switched to plans with smaller allowances (‘downward switchers’) according to the nature of their consecutive plan choices. Figure 2 focuses on customers who paid overage fees before the switching decision, and Figure 3 focuses on customers who did not pay overage fees before switching to other plans. The contrast between the two figures is striking. Upward switching decisions were common only among switchers who previously paid overage payments. From Figure 2 we also learn that 36% of the customers who switched after paying an overage payment had initially chosen their cost-minimizing plans. Nevertheless, these customers

\(^6\) The two important advantages of this method, over panel data techniques and over standard regression methods such as ordinary least-squares or logistic regression, are, first, its ability to account for right censoring (i.e., some events may occur beyond the end of the observation window), and second, its ability to use both time-invariant control variables (e.g., demography) and time-varying independent variables (e.g., monthly usage level). The semi-parametric estimation procedure we use allows the parameters of interest to be assessed without specifying the baseline hazard $h_{0u}$. In large samples (as in this study), the estimates produced by this approach are consistent and asymptotically normal (Allison 1995). We estimate the PHM on a balanced panel of plan users that have adopted a three-part tariff plan by the 10th time period. On each customer in this panel we observe 15 post adoption periods starting from the adoption month for that customer. We control for the customer’s time of adoption by including this information in $X_u$. The use of a balanced panel allows us to overcome the uneven post adoption observations in our data for customers that have adopted the plans in different time periods.

\(^7\) Overage payments in this regression are specified as the cumulative amount paid as overage by time $t$. Our estimation results are also robust to an alternative specification using the mean overage payment at time $t$.  

10
switched to more expensive plans. In fact, 91% of these customers switched to plans with larger allowances. In contrast, as shown in Figure 3, switchers who had not paid overage payments prior to their switching decisions were more likely to switch to plans with smaller allowances, and nearly 25% of them switched to their cost-minimizing plans.

Figures 2 and 3 and the results of the hazard model suggest that customers undergo an overage-dependent learning process. Customers who experience paying overage fees show a higher tendency to switch, in particular to plans with higher fixed payments, which are, in most cases, not their cost-minimizing plans. In contrast, customers who do not experience paying overage fees are less likely to switch, but those who do switch are more likely to choose a plan with a lower fixed payment and reduce their monthly bank payments. In what follows we use panel data analysis to further substantiate this learning pattern and quantify its effect.

III.2.3. Panel Data Analysis of Switching Decisions. The panel data analysis exploits the longitudinal nature of our data and focuses on bank customers who adopted one of the three-part tariff plans and subsequently switched to another plan. We estimate the following panel data fixed-effect regressions, similar to Equation (1) above:

\[
\text{Log(Payment)}_{it} = \beta_0 + \beta_D \text{D}_{\text{adoption},it} + \beta_x \text{Log(Activity + 1)}_{it} + \beta_X \text{Log(X + 1)}_{it} + \alpha_i + \eta_t + \varepsilon_{it}
\]

(2)

\[
\text{Log(Payment)}_{it} = \beta_0 + \beta_D \text{D}_{\text{Switching},it} + \beta_x \text{Log(Activity + 1)}_{it} + \beta_X \text{Log(X + 1)}_{it} + \alpha_i + \eta_t + \varepsilon_{it}
\]

(3)

The dummy variable \(D_{\text{adoption},it}\) in Equation (2) equals one if customer \(i\) has adopted a three-part tariff plan by time \(t\), and zero otherwise. Similarly, \(D_{\text{Switching},it}\) in Equation (3) is a dummy variable that equals one if customer \(i\) has switched plans by time \(t\) and zero otherwise. All other variables are similar to those presented in Equation (1).

The regression results are reported in columns 2-7 in Table 4. In column 2, we report the results of a regression analysis for Equation (2). The sample in this regression includes all plan switchers for all time periods before plan switching (including pre-adoption months). The coefficient on the adoption variable suggests that, on average, switching customers paid 5.3% more after adopting a three-part tariff plan than they did before plan adoption. In columns 3 and 4 of Table 4, we report the estimation results for Equation (2) for switching customers who paid overage payments at least once, and for switching customers who did not pay any overage payments prior to switching plans, respectively. The regression results suggest that, in the months after adoption and before switching, ‘overage switchers’ did not pay more to the bank than they had prior to plan adoption. In contrast, ‘non-overage switchers’ paid nearly 19% more following adoption and before switching. These findings suggest that non-overage switchers had initially chosen plans with excessively large allowances, and consequently did not pay overage payments.

In columns 5-7 we report the estimation results of Equation (3). In these analyses we again investigate only switching customers yet only analyze post-adoption months. Our aim here is to
identify the effect of switching on customer payments. In column 5 we report the estimation results for the entire sample of switching customers. In columns 6 and 7 we report the estimation results for overage and for non-overage switchers, respectively. The results presented in column 5 indicate that, on average, customers’ monthly bank payments decreased by 3.2% after plan switching. This result indicates that, on average, plan adopters who decided to alter their initial plan choices did reduce their monthly payments. Importantly, we find evidence for heterogeneity among switchers in terms of the change in their payments following the switching decision. Overage payers who switched plans increased their monthly payments by 6.5% on average (see column 6). In contrast, non-overage payers who switched plans reduced their monthly payments by 25.6%.

The panel data estimation results, together with the hazard analysis, lead to interesting insights regarding the experience-based learning process in three-part tariff plan choice. Our findings imply that customers’ experience with new three-part tariff plans can result in lower payments if these customers have not previously paid overage fees. If, on the other hand, customers do experience overage payments, then although they are more likely to switch plans, they are also more likely to choose new plans that increase their overall payments to the bank. Our analysis thus suggests that customers who have experienced overage payments seek to avoid paying such payments and, in order to achieve this goal, end up paying excessively-high fixed fees. In the next section, we aim to quantify the sensitivity of customers to overage payments relative to fixed payments.

IV. Modeling Customers’ Choice Process

In this section we provide a quantifiable measure for overage aversion. We do so by modeling customers’ choice process and by integrating the separate effects of plan payment and overage payments into the plan choice. We define the utility \( U \) perceived by customer \( i \) from choosing a given plan \( j \) at time \( t \) as:

\[
U_{ijt} = V_{ijt} + \epsilon_{ijt}
\]

\( V_{ijt} \) in Equation (4) represents the deterministic part of the utility obtained from choosing alternative \( j \). We specify \( V_{ijt} \) to be a function of four main elements, as follows:

\[
V_{ijt} = \beta_{i0} + \beta_{i1}FP_j + \beta_{i2}OP_{ijt} + \beta_{i3}PB_j + \beta_{i4}C_{ijt}
\]

\( \beta_{i1} \) and \( \beta_{i2} \) in Equation (5) are payment sensitivity coefficients that capture, respectively, the differential effects of the fixed payment associated with plan \( j \), \( FP_j \), and of the overage fees, \( OP_{ijt} \), that customer \( i \) would incur by using plan \( j \) at time \( t \). The latter variable is calculated individually for each customer according to his or her activity level in each time period and for every available plan at that time, and, therefore, is customer–plan–time specific. We define the two price sensitivity effects to be customer-specific. That is, we assume that each customer’s sensitivity towards both payments is
‘drawn’ from the distribution of these parameters across our population of customers. If indeed a customer is ‘overage averse’, we expect the customer’s sensitivity to overage payments to be larger than his or her sensitivity to fixed fee payments (i.e., \( \beta_1 < \beta_2 \)).

\( \beta_{ij} \) is a customer–plan-specific effect, capturing the inherent tendency of customer \( i \) to choose plan \( j \). \( PB_j \) in Equation (5) stands for the additional plan benefits provided for the two most expensive plans.\(^8\) Here, too, we define the effect of these benefits, \( \beta_3 \), to be customer-specific. Finally, the last component in Equation (5), \( \beta_4 \), represents possible state dependence affecting customers’ choice (Seetharaman 2004; Seetharaman and Chintagunta 1999). This state dependence can be viewed as ‘inertia’, ‘stickiness’, or a ‘status quo bias’ effect (Rivot and Baron 1992; Samuelson and Zeckhauser 1988) that hypothetically raises the probability that the customer remains in the current state during the next time period. The state dependence is integrated into the model using a brand choice indicator variable:

\[
C_{ijt} = \begin{cases} 
1 & \text{if plan } j \text{ is chosen by customer } i \text{ at time } t, \forall j = 1, \ldots, J \\
0 & \text{otherwise}
\end{cases}
\]

Next, we decompose the individual parameters \( (\beta_1, \beta_2, \beta_3, \beta_4) \) in Equation (5) according to customer characteristics, in the following manner (variable notations are defined in Table 7):

\[
\beta_{ik} = \left( \begin{array}{c} 
\alpha_{k0} + \alpha_{k1}Num\_owners_i + \alpha_{k2}Inf\_trans_i + \alpha_{k3}Age_i + \alpha_{k4}Social\_old_i + \alpha_{k5}Loans_i \\
+ \alpha_{k6}Salary_i + \alpha_{k7}Num\_salaries_i + \alpha_{k8}Social\_kids_i \\
+ \alpha_{k9}Savings_i + \alpha_{k10}negative\_balance_i \\
+ \alpha_{k11}Socio_i + \alpha_{k12}Adopt\_month_i \\
\end{array} \right) + \nu_{ki}
\]

With \( k = 1,2,3,4. \)

\[
\nu_{ki} \sim MVN(0, \Sigma_p)
\]

Assuming an i.i.d. extreme value distribution for \( \epsilon_{ijt} \) in Equation (4) allows us to use the standard logit formula for plan choice probabilities. Thus, conditional on customer \( i \)'s adoption of a three-part tariff plan, the choice probability \( (P_{ijt}) \) that customer \( i \) chooses plan \( j \) at time \( t \) is specified as a multinomial logit model:

\[
P_{ijt} = \frac{e^\epsilon_{ijt}}{\sum_{j=1}^{J} e^\epsilon_{ijt}}
\]

The likelihood function is therefore:

\[
l([B,\mathbf{A}]) = \prod_{i,j,t} [P_{ijt}|B,\mathbf{A}]
\]

---

\(^8\) For plans 5 and 6 the bank offered an additional benefit that could amount to a yearly gain of up to $10.
Where B represents the matrix of first-layer parameters \((\beta_0, \beta_1, \beta_2, \beta_3, \beta_4)\), and A represents the parameters in the second layers \((a_{01,06})\). For the estimation, we used the Hierarchical Bayes Markov Chain Monte Carlo (HB MCMC) estimation procedure. Further details regarding the estimation are presented in online Appendix C.

Table 7 presents the estimation results for the choice model. We find that the mean price sensitivity coefficient for the plan’s fixed payment is more than three times smaller than that for overage payment \((\beta_1 = -0.13, \text{ std.} = 0.02; \beta_2 = -0.46, \text{ std.} = 0.02)\). These findings imply that for the average customer, $1 paid as overage payment has the same weight as $3.5 paid as part of a fixed plan payment, i.e., customers overweigh payments outside the allowance. This finding is consistent with our notion of ‘overage aversion’, whereby customers prefer plans with large allowances and high fixed payments and further switch to such plans after paying overage payments. This measure is higher than the loss aversion factor proposed by Tversky and Kahneman (1992), estimated to be 2.25.

Our second-layer estimates indicate that customers’ price sensitivity to a plan’s fixed fee increases with customer age, but also decreases with the number of children below the age of 18 as captured by the amount of social security parental benefits. We further find that accounts with higher levels of savings, loans, or positive or negative balances are less sensitive to fixed fee payments. Interestingly, we find that customers who adopted three-part tariff plans later after their introduction were more ‘overage averse’ (i.e., more sensitive to overage payments and less sensitive to price) compared with customers who adopted earlier. We also find that there is a strong stickiness effect leading customers to remain with their previously chosen plans \((\beta_4 = 3.84, \text{ std.} = 0.02)\). In line with our hazard model estimation results, we find that customers who are later adopters are less likely to stick with their chosen plans.

V. Possible Explanations

Previous studies that documented a flat-rate bias have offered several possible explanations for this bias (e.g. Lambrecht and Skiera 2006). Below we discuss these explanations and argue why we think that mental accounting coupled with loss aversion provide the most plausible explanation for our empirical findings.

V.1. Mental Accounting and Loss Aversion

Mental accounting theory implies that individuals conceptually group expenditures into categories (‘mental accounts’) and do not treat money as fungible across categories. In the context of this paper, we suggest that customers who choose among three-part tariff plans treat fixed fee payments and overage payments as separate mental accounts, and that they associate different levels of disutility with paying from different accounts. In particular, our findings imply that customers are less sensitive to payments from the ‘fixed fee account’ than they are to payments from the ‘overage payments account’. We further propose that this higher sensitivity is related to the theory on loss aversion,
which is an essential element of mental accounting (Thaler 1999). Loss aversion refers to individuals’ propensity to prefer avoiding losses to obtaining gains. Koszegi and Rabin (2006, 2007) suggest that customers construct reference points based on their rational expectations about outcomes, and that gains and losses come into play when there is uncertainty. Accordingly, we propose that customers distinguish between expected ‘within-budget’ payments (fixed monthly fees) and ‘unexpected’ payments occurring when customers exceed their plan allowance (overage payments). Due to the unique, non-linear structure of three-part tariff plans, loss aversion occurs only with respect to the uncertain overage payments. We further assume that customers incur greater psychological costs when paying overage payments compared with the psychological costs associated with the old ‘pay-per-use’ pricing scheme. This distinction is attributed to the strong role of the fixed plan fees in forming customers’ expectations regarding payments. The fixed plan fees are expected to serve as a natural reference point in the minds of customers, and deviations from these expectations are psychologically costly. Therefore, adopting customers try to avoid such ‘unexpected’ psychologically costly payments by choosing plans with higher expected monthly payments.

V.2. Overestimation of Demand

An alternative explanation for our findings is that customers overestimate their usage levels at the time of plan adoption and consequently adopt plans with large allowances. In addition, customers further interpret experiencing overage payments as a signal of increased usage and subsequently switch to plans with even larger allowances. Previous studies on choice among three-part tariff plans that focused on new services have suggested demand overestimation as a main explanation for flat-rate bias.

Unlike previous papers, we focus on a well-established service whose customers are less likely to overestimate their usage. Moreover, our data allow us to further investigate the explanation of demand overestimation by focusing on the behavior of quitting customers. If indeed customers view overage payments as signals for increased usage, then we expect them to view the ‘old’ pay-per-use system as an inferior alternative to a more expensive three-part tariff plan. This is because the ‘old’ payment system implies a linear increase in payment with usage, while a more expensive plan entails a ‘flat’ range in which costs do not increase with higher levels of usage. Thus, under demand overestimation we would expect overage payments to have a negative effect on quitting. Conversely, under the ‘overage aversion’ explanation both switching upward and quitting might be an optimal response because they lower the possibility of incurring unexpected overage payments.

---

9 We assume that customers incur greater psychological costs from overage payments than from payments within the old ‘pay-per-use’ pricing scheme. These higher psychological costs stem from the strong effect of the fixed plan fee on customers’ expectations, and its natural role as a reference for the ‘losses’ associated with overage payments.
Furthermore, among customers who decide to switch plans after experiencing overage payments, the customers in plans with higher allowances have fewer options to choose from compared with customers subscribed to plans with lower allowances. Thus, under the overage aversion explanation we can expect that the larger the allowance of a customer’s initial plan, the greater the likelihood that the customer will quit after experiencing overage payments. Table 8 presents the estimation results of two hazard models for quitting. The first model includes overage payments and the current plan number (1 for plan 1, 2 for plan 2 etc.) as explanatory variables. In the second model, we further include an interaction term between the amount paid as overage payment and the customer’s current plan number. We find that the hazard of quitting increases with the amount paid as overage payment. Moreover, the effect of the interaction between the amount paid as overage payment and the current plan of the customer is positive and significant. This positive interaction suggests that the larger the allowance of a customer’s initial chosen plan, the more likely the customer is to quit following overage payments. This behavior contradicts our expectations under the demand overestimation explanation, yet is consistent with the ‘overage aversion’ explanation for the behavior revealed in our data.

V.3. Pain of Paying

Prelec and Loewenstein (1998) propose that customers experience a ‘pain of paying’ (also referred to as the taxi-meter effect) that can undermine the utility they derive from consumption. Paying per use lessens the joy from consumption because at the time of usage, users often experience an immediate ‘pain of paying’. Prelec and Loewenstein (1998) emphasize the distinction between payments before versus after consumption and argue that consumption that has been paid for in advance can be enjoyed as if it were free (Prelec and Loewenstein 1998; Thaler 1999). Accordingly, they predict that customers will prefer pre-paid fixed pricing plans over pay-per-use pricing schemes.

Although the explanation based on mental accounting and loss aversion (V.1) and the explanation based on the concept of pain of paying are closely related, we believe that these concepts are not exactly identical. First, Prelec and Loewenstein (1998) emphasize the timing of payment, before or after consumption, as a main reason why customers prefer fixed payments to pay-per-use schemes. However, the timing of payment in relation to usage is not likely to have influenced our results, because in our setting, as in many other subscription services that offer menus of three-part tariff plans, fixed payments and overage payments are made at the same time. A second difference concerns the variability in payments. According to the theory of Prelec and Loewenstein (1998), customers should experience a similar pain of paying when subscribed to the ‘old’ pay-per-use scheme. We argue, however (see V.1), that the psychological costs associated with paying arise only for usage above a certain reference point, which we assume is the allowance of a particular plan.

Thus, if indeed customers try to avoid the disutility associated with per-usage payments, we would expect them to also avoid the ‘old’ pay-per-use payment system. Yet, as shown above (see
Table 8), overage payments trigger not only switches to plans with larger allowances but also quitting behavior, i.e., reversion to the ‘old’ pay-per-use option. Thus, unless customers do not associate the ‘old’ payment system with per-usage payments, this behavior likely contradicts the pain of paying explanation and is more consistent with the loss aversion explanation we propose.

V.4. Plan Benefits

Subscribing to a service plan, and in particular to a plan with a large allowance, can in some cases serve as a social signal, enhancing a customer’s image by impressing other individuals. However, in the context we analyze, the particular three-part tariff plan chosen by the customer is typically not observed by others. Hence, we believe that the social benefits that customers derive from choosing larger plans are negligible. In addition, there are no other, non-social, benefits such as better customer service for customers who choose higher plans. Moreover, an enhanced self-image cannot explain the role of overage payments in triggering switching to plans with larger allowances, or quitting the new three-part tariff plans altogether.

V.5. Persuasion and the Role of Sales Agents

Customers’ tendency to choose plans with larger allowances can also be attributed to the marketing campaign that accompanied the introduction of the new plans. Also, sales agents could potentially persuade customers who incurred overages to switch to larger plans. Indeed, marketing calls had a large impact on the adoption of three-part tariff plans. Yet, as we also show in online Appendix B, these marketing calls are not statistically associated with subscribing to larger-than-optimal plans. In fact, discussions with bank officials reveal that the bank’s objective in introducing the new plans was to induce account-holders to switch to direct (e.g., Internet) channels in order to cut back on the workload for clerks employed in the bank. Thus, if anything, the marketing efforts were aimed at encouraging customers to choose plans with low allowances of clerk-assisted activities. Furthermore, persuasion cannot explain why customers who incurred overage payments were likely to return to the old pricing plan. With respect to switching, we also find that marketing calls are unlikely to have affected switching decisions, because marketing calls were performed to encourage plan adoption, i.e., they were targeted at customers who had not yet adopted a plan.

VI. Discussion and Concluding Remarks

Several recent studies that empirically utilize real-world data have documented a wide variety of choice biases. Yet the practical importance of such choice biases can be questioned if customer experience leads to the reduction or even the elimination of these systematic biases. Previous field studies on the role of experience have indeed provided evidence that individuals overcome initial bias after gaining experience. In this paper, we aim to contribute to this debate by investigating whether
customers who initially choose non-optimal three-part tariff plans improve upon their initial choices after gaining experience with these plans.

We rely on a unique and rich individual-monthly-level data set spanning 30 months, before and after a commercial bank introduced a menu of three-part tariff plans. In line with prior research, our analysis indicates that customers ‘leave money on the table’ and do not choose their cost-minimizing plans. We also document strong evidence for a flat-rate bias, implying that consumers choose plans that offer larger allowances, and consequently entail higher monthly fixed payments, as compared with the plans that would have minimized costs. More importantly, our analysis of switching decisions indicates that the choice anomalies we document do not disappear as customers gain experience with the new plans. To the best of our knowledge, ours is the first study that uses field data and finds that specific types of experiences can systematically lead customers to make worse economic outcomes.

In particular, our findings suggest that customers are sensitive to the specific experience of paying overage fees. We suggest that this ‘overage aversion’ is the source of both the initial flat-rate bias and the bias observed in customer switching decisions. Our estimation results for a logit choice model suggest that, on average, customers are 3.5 times more sensitive to overage payments than they are to fixed plan fee payments.

This paper also provides insight regarding the impact of three-part tariff plans on firms’ profits, and can explain why firms choose to offer these types of plans. Because customers consistently choose plans with too-large allowances, offering a menu of three-part tariff plans substantially increases the revenue of the firm. In other words, overage aversion that leads to a flat-rate bias can serve as an additional explanation for the increasingly common use of three-part tariffs in a variety of industries (Grubb 2012). In addition, our findings relate to the recent debate on the FCC bill-shock agreement with U.S. cellular carriers. This agreement, expected to become effective in April 2013, requires cellular carriers to notify subscribers as they near their allowance limit. One potential implication of such notifications is a further increase in the salience of overage payments that can affect not only customers’ cellular usage but also their plan choice behavior.

Our paper is also related to theoretical papers on the saliency of information (e.g., Bordalo et al. 2012). These papers offer a conceptual framework that seeks to explain violations of expected utility theory by emphasizing the role of salient information available to the decision-maker. In the context of our study, if customers attach greater salience to information on actual overage payments than to information on fixed payments, they are more likely to react to overage payments by switching to new plans, specifically, plans that are less likely to involve making such payments (i.e., plans with larger allowances). Similarly, customers may initially adopt plans with large allowances in order to avoid paying these salient overage payments.

Our findings that customers who paid overage payments updated their initial plan choice by switching to a larger plan could suggest that customers learn about their own overage aversion. The
idea that individuals can learn about their own preferences is different from the more common assumption in learning models that preferences are fixed and that individuals learn about their usage or about the quality of the chosen good. We believe that customers learn both about their usage level and about their sensitivity to the features of the new plan, and, specifically in our setting, about their sensitivity to overage payments. While all plan adopters undergo a learning process regarding usage, the learning process regarding one’s overage aversion is likely to be more pronounced among customers who experience overage payments. An open question is whether customers eventually learn about their true overage aversion (Ali 2011). Future research can formalize customers’ learning patterns regarding overage aversion, and investigate how these learning patterns are affected by overage payments and by customer characteristics.

This study is among the first to use panel field data to investigate the role of experience in mitigating initial choice biases. Therefore, several future research opportunities arise. First, future studies can verify whether our findings can be generalized to other industries in which firms offer three-part tariff plans. Given that several other studies, investigating a variety of other industries, have also documented the existence of flat-rate biases in customer choice, we believe that our findings will indeed be generalizable. Second, although the relative magnitude of the estimated effect of overage aversion on customers’ payments is large, both for the initial choices and for the subsequent switching decisions, its per-customer manifestation in absolute monetary monthly values is quite low (as compared to the average income and savings in our data set). Future research in similar settings that involve larger payments in absolute values can shed more light on the magnitude of the effect.

References


### Table 1 – Example of Three-Part Tariff Plans

<table>
<thead>
<tr>
<th>Plan #</th>
<th>Monthly payment</th>
<th>Overage payment</th>
<th>Allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clerk-assisted activities</td>
<td>Direct activities/Check deposits</td>
</tr>
<tr>
<td>1</td>
<td>$4.75</td>
<td>$1.2</td>
<td>$0.30</td>
</tr>
<tr>
<td>5</td>
<td>$9.50</td>
<td>$1.2</td>
<td>$0.30</td>
</tr>
</tbody>
</table>

### Table 2 – Descriptive Statistics: Adopters vs. Non-adopters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-adopters Mean (Std. Dev.)</th>
<th>Adopters Mean (Std. Dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account tenure (years)</td>
<td>14.7 (10.4)</td>
<td>13.21 (9.33)</td>
</tr>
<tr>
<td>Age of account holder</td>
<td>51.5 (17.7)</td>
<td>43.94 (13.87)</td>
</tr>
<tr>
<td>Number of owners</td>
<td>1.48 (0.58)</td>
<td>1.44 (0.51)</td>
</tr>
<tr>
<td>Parental Social Security benefits (for children below age of 18) in thousand U.S. dollars</td>
<td>0.01 (0.05)</td>
<td>0.04 (0.09)</td>
</tr>
<tr>
<td>Elderly Social Security benefits in thousands of US dollars</td>
<td>0.16 (0.25)</td>
<td>0.08 (0.22)</td>
</tr>
<tr>
<td>Number of salaries</td>
<td>0.7 (0.73)</td>
<td>0.75 (0.77)</td>
</tr>
<tr>
<td>Socio-economic measure of residence of account holder (scale of 1–10)</td>
<td>5.73 (2.25)</td>
<td>5.17 (2.23)</td>
</tr>
<tr>
<td>Monthly mean number of account information inquiries*</td>
<td>4.81 (10.24)</td>
<td>6.59 (11.48)</td>
</tr>
<tr>
<td>Monthly mean number of clerk-assisted transactions*</td>
<td>0.57 (0.87)</td>
<td>0.94 (1.22)</td>
</tr>
<tr>
<td>Monthly mean number of transactions through direct channels*</td>
<td>1.70 (2.40)</td>
<td>3.33 (3.66)</td>
</tr>
<tr>
<td>Monthly mean number of check transactions*</td>
<td>1.66 (3.16)</td>
<td>3.56 (5.07)</td>
</tr>
<tr>
<td>Mean monthly number of marketing calls*</td>
<td>0.03 (0.05)</td>
<td>0.08 (0.077)</td>
</tr>
<tr>
<td>Pre-adoption commission charges</td>
<td>3.69 (2.74)</td>
<td>7.30 (3.42)</td>
</tr>
<tr>
<td>Mean monthly overspending compared to minimum payment * ($)</td>
<td>0.62 (1.58)</td>
<td>2.24 (2.15)</td>
</tr>
</tbody>
</table>

**Customers**

<table>
<thead>
<tr>
<th></th>
<th>Non-adopters</th>
<th>Adopters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38116</td>
<td>32394</td>
</tr>
</tbody>
</table>

* For adopters this variable is calculated based on 3 months before adoption; for non-adopters this variable is based on the 3 months before the introduction of the new plans.

For adopters this variable is calculated based on all months before adoption; for non-adopters this variable is based on all observations.

Due to confidentiality concerns we are not allowed to reveal the summary statistics for the following variables: Salary, loans, savings, monthly mean positive balance, monthly mean negative balance and monthly mean of bank commission payments. We use these variables in the regression analysis.
### Table 3A – Choice Optimality Ex-ante for All Customers

<table>
<thead>
<tr>
<th>Optimal Chosen</th>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>Plan 5</th>
<th>Plan 6</th>
<th>No Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan 1</td>
<td>51.6%</td>
<td>0.3%</td>
<td>2.8%</td>
<td>0.3%</td>
<td>0.1%</td>
<td>0.0%</td>
<td>44.8%</td>
</tr>
<tr>
<td>Plan 2</td>
<td>55.8%</td>
<td>2.5%</td>
<td>0.0%</td>
<td>1.1%</td>
<td>0.1%</td>
<td>0.0%</td>
<td>40.5%</td>
</tr>
<tr>
<td>Plan 3</td>
<td>55.5%</td>
<td>0.0%</td>
<td>16.3%</td>
<td>0.0%</td>
<td>1.0%</td>
<td>0.0%</td>
<td>27.1%</td>
</tr>
<tr>
<td>Plan 4</td>
<td>51.3%</td>
<td>2.2%</td>
<td>0.0%</td>
<td>4.2%</td>
<td>0.7%</td>
<td>0.0%</td>
<td>41.7%</td>
</tr>
<tr>
<td>Plan 5</td>
<td>67.0%</td>
<td>4.6%</td>
<td>2.8%</td>
<td>9.6%</td>
<td>3.7%</td>
<td>0.1%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Plan 6</td>
<td>62.7%</td>
<td>7.0%</td>
<td>1.2%</td>
<td>11.4%</td>
<td>6.8%</td>
<td>1.9%</td>
<td>9.1%</td>
</tr>
<tr>
<td>No Plan</td>
<td>24.6%</td>
<td>0.0%</td>
<td>4.4%</td>
<td>0.0%</td>
<td>0.5%</td>
<td>0.1%</td>
<td>70.3%</td>
</tr>
</tbody>
</table>

The numbers represent the distribution of optimal plans across plan adopters for each of the available plans. Each row presents the distribution of optimal plans for the customers who chose the particular plan represented in that row. For adopters, optimality is calculated based on 3 months before adoption; for non-adopters this variable is based on 3 months before the introduction of the new plans. When we aggregate over all adopting customers we find that 17% chose their cost-minimizing plan. Further details are provided in online Appendix A.

### Table 3B – Choice Optimality Ex-post for All Customers

<table>
<thead>
<tr>
<th>Optimal Chosen</th>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>Plan 5</th>
<th>Plan 6</th>
<th>No Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan 1</td>
<td>56.3%</td>
<td>0.3%</td>
<td>2.2%</td>
<td>0.3%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>40.8%</td>
</tr>
<tr>
<td>Plan 2</td>
<td>59.5%</td>
<td>3.9%</td>
<td>0.0%</td>
<td>1.4%</td>
<td>0.1%</td>
<td>0.0%</td>
<td>35.2%</td>
</tr>
<tr>
<td>Plan 3</td>
<td>62.3%</td>
<td>0.0%</td>
<td>13.0%</td>
<td>0.0%</td>
<td>0.7%</td>
<td>0.0%</td>
<td>24.0%</td>
</tr>
<tr>
<td>Plan 4</td>
<td>54.6%</td>
<td>3.0%</td>
<td>0.0%</td>
<td>4.3%</td>
<td>0.7%</td>
<td>0.0%</td>
<td>37.4%</td>
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<tr>
<td>Plan 5</td>
<td>69.7%</td>
<td>5.1%</td>
<td>2.9%</td>
<td>8.9%</td>
<td>3.0%</td>
<td>0.2%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Plan 6</td>
<td>64.3%</td>
<td>7.7%</td>
<td>1.0%</td>
<td>10.4%</td>
<td>5.9%</td>
<td>2.3%</td>
<td>8.3%</td>
</tr>
<tr>
<td>No Plan</td>
<td>24.8%</td>
<td>0.0%</td>
<td>4.8%</td>
<td>0.0%</td>
<td>0.5%</td>
<td>0.1%</td>
<td>69.8%</td>
</tr>
</tbody>
</table>

The numbers represent the distribution of optimal plans across plan adopters for each of the available plans. Each row presents the distribution of optimal plans for the customers who chose the particular plan represented in that row. For adopters, optimality is calculated based on 3 months after adoption; for non-adopters this variable is based on 3 months before the introduction of the new plans. When we aggregate over all adopting customers we find that 18% chose their cost-minimizing plan. Further details are provided in online Appendix A.
Table 4—Customer Payment Regression

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>All adopting customers (over all months)</th>
<th>All switchers (over pre-switch months)</th>
<th>‘Overage payment’ switchers (over pre-switch months)</th>
<th>‘Non-overage payment’ switchers (over pre-switch months)</th>
<th>All switchers (over post-adoption months)</th>
<th>‘Overage payment’ switchers (over post-adoption months)</th>
<th>‘Non-overage payment’ switchers (over post-adoption months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post adoption month</td>
<td>0.091***</td>
<td>0.053***</td>
<td>-0.001</td>
<td>0.189***</td>
<td>-0.032***</td>
<td>0.065***</td>
<td>-0.256***</td>
</tr>
<tr>
<td>Post switching month</td>
<td><strong>0.129</strong>*</td>
<td><strong>0.156</strong>*</td>
<td><strong>0.189</strong>*</td>
<td><strong>0.094</strong>*</td>
<td><strong>0.138</strong>*</td>
<td><strong>0.156</strong>*</td>
<td><strong>0.076</strong>*</td>
</tr>
<tr>
<td>Monthly number of clerk-assisted transactions</td>
<td><strong>0.038</strong>*</td>
<td><strong>0.038</strong>*</td>
<td><strong>0.044</strong>*</td>
<td><strong>0.036</strong>*</td>
<td><strong>0.010</strong>*</td>
<td><strong>0.013</strong>*</td>
<td><strong>0.005</strong></td>
</tr>
<tr>
<td>Monthly number of direct transactions</td>
<td><strong>0.064</strong>*</td>
<td><strong>0.079</strong>*</td>
<td><strong>0.092</strong>*</td>
<td><strong>0.059</strong>*</td>
<td><strong>0.056</strong>*</td>
<td><strong>0.067</strong>*</td>
<td><strong>0.016</strong>*</td>
</tr>
<tr>
<td>Monthly number of check deposits</td>
<td><strong>0.054</strong>*</td>
<td><strong>0.055</strong></td>
<td><strong>0.095</strong></td>
<td><strong>0.006</strong></td>
<td><strong>0.074</strong>*</td>
<td><strong>0.036</strong></td>
<td><strong>0.063</strong></td>
</tr>
<tr>
<td>Number of owners</td>
<td>0.34***</td>
<td>0.299***</td>
<td>0.310***</td>
<td>0.250**</td>
<td>0.022</td>
<td>0.063</td>
<td>-0.256***</td>
</tr>
<tr>
<td>Parental Social Security benefits (for children below the age of 18)</td>
<td><strong>0.041</strong>*</td>
<td>-0.034</td>
<td>-0.036</td>
<td>0.011</td>
<td>0.089***</td>
<td>0.038</td>
<td>0.235*</td>
</tr>
<tr>
<td>Elderly Social</td>
<td>0.00</td>
<td>0.009***</td>
<td>0.008**</td>
<td>0.008**</td>
<td>0.008***</td>
<td>0.007**</td>
<td>0.005**</td>
</tr>
<tr>
<td>Monthly mean number of account status inquiries</td>
<td>0.00</td>
<td>0.003***</td>
<td>0.004**</td>
<td>0.004**</td>
<td>0.002***</td>
<td>0.003**</td>
<td>0.005**</td>
</tr>
<tr>
<td>Salary</td>
<td>-0.001</td>
<td>0.008</td>
<td>-0.004</td>
<td>0.032**</td>
<td>0.008</td>
<td>0.011</td>
<td>-0.010**</td>
</tr>
<tr>
<td>Number of salaries</td>
<td>-0.012***</td>
<td>-0.032***</td>
<td>-0.010</td>
<td>-0.062***</td>
<td>0.013</td>
<td>0.012</td>
<td>0.010**</td>
</tr>
<tr>
<td>Mean level of positive account balance</td>
<td>0.001</td>
<td>0.002</td>
<td>0.008</td>
<td>0.120**</td>
<td>0.001</td>
<td>0.006</td>
<td>0.108*</td>
</tr>
<tr>
<td>Mean level of negative account balances</td>
<td>0.019***</td>
<td>0.021***</td>
<td>0.042***</td>
<td>-0.011</td>
<td>0.011</td>
<td>0.006</td>
<td>0.012**</td>
</tr>
<tr>
<td>Loans</td>
<td>0.165***</td>
<td>0.023***</td>
<td>0.026**</td>
<td>0.025**</td>
<td>0.021***</td>
<td>0.008</td>
<td>0.031**</td>
</tr>
<tr>
<td>Savings</td>
<td>0.13***</td>
<td>0.023***</td>
<td>0.027***</td>
<td>0.013</td>
<td>0.016***</td>
<td>0.016**</td>
<td>0.017**</td>
</tr>
<tr>
<td>Constant</td>
<td>1.83***</td>
<td>1.648***</td>
<td>1.730***</td>
<td>1.948***</td>
<td>1.860***</td>
<td>1.834***</td>
<td>2.045***</td>
</tr>
<tr>
<td>Observations</td>
<td>923673</td>
<td>47371</td>
<td>31,874</td>
<td>15,497</td>
<td>36,006</td>
<td>25,368</td>
<td>10,638</td>
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<tr>
<td>R-squared</td>
<td>0.36</td>
<td>0.135</td>
<td>0.242</td>
<td>0.228</td>
<td>0.197</td>
<td>0.317</td>
<td>0.422</td>
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<tr>
<td>Number of customers</td>
<td>32394</td>
<td>2268</td>
<td>1,509</td>
<td>759</td>
<td>2,268</td>
<td>1,509</td>
<td>759</td>
</tr>
</tbody>
</table>

The dependent variable in all regressions is the (log) monthly payment to the bank. An observation is an account/month. All regressions include individual account and month fixed effects. The regression results in column 1 refer to Equation (1) in the text, and the sample includes all adopting customers. The estimation results shown in columns 2-4 include only the months before plan switching (including pre-adoption months, Equation (2) in the text), whereas columns 5-7 refer only to the months after plan adoption (Equation (3) in the text). The sample of customers shown in columns 2 and 5 includes all switching customers. In columns 3 and 6 we focus on customers who paid overage payments at least once before plan switching, while in columns 4 and 7 we focus on customers who did not pay overage payments before plan switching.

*** p<0.01, ** p<0.05, * p<0.1, standard errors in parentheses are clustered at the account level.
Table 5 – Hazard Regression Analysis for Switching Decision

<table>
<thead>
<tr>
<th>Variable</th>
<th>Switching Hazard Regression</th>
<th></th>
<th>Upward Switching Hazard Regression</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly cumulative average payment&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.01***</td>
<td>1.01</td>
<td>0.02***</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.03</td>
<td></td>
<td>-0.19***</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upward initial choice bias&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.06</td>
<td>1.06</td>
<td>0.02</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>(0.15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downward initial choice bias&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.12***</td>
<td>1.13</td>
<td>0.12***</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adoption month&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.17**</td>
<td>1.19</td>
<td>0.04</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of owners&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.74E-04</td>
<td>1.00</td>
<td>1.00E-03*</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(4.80E-04)</td>
<td></td>
<td>(5.86E-04)</td>
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</tr>
<tr>
<td>Monthly mean number of account status inquiries&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.03**</td>
<td>1.04</td>
<td>0.03*</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-9.23E-04</td>
<td>1.00</td>
<td>2.18E-03</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(3.95E-03)</td>
<td></td>
<td>(4.73E-03)</td>
<td></td>
</tr>
<tr>
<td>Account tenure&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-4.04E-03</td>
<td>1.00</td>
<td>-9.37E-03**</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(3.00E-03)</td>
<td></td>
<td>(3.50E-03)</td>
<td></td>
</tr>
<tr>
<td>Parental Social Security benefits (for children below the age of 18)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-7.63E-04**</td>
<td>1.00</td>
<td>-6.73E-04</td>
<td>1.00</td>
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<tr>
<td></td>
<td>(3.27E-04)</td>
<td></td>
<td>(4.17E-04)</td>
<td></td>
</tr>
<tr>
<td>Elderly Social Security benefits&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-7.71E-05</td>
<td>1.00</td>
<td>8.69E-05</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(1.36E-04)</td>
<td></td>
<td>(1.65E-04)</td>
<td></td>
</tr>
<tr>
<td>Mean level of positive account balance&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.35E-05**</td>
<td>1.00</td>
<td>8.93E-05***</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(2.71E-05)</td>
<td></td>
<td>(3.10E-05)</td>
<td></td>
</tr>
<tr>
<td>Mean level of negative account balance&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-1.42E-05</td>
<td>1.00</td>
<td>3.93E-05</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(2.69E-05)</td>
<td></td>
<td>(3.05E-05)</td>
<td></td>
</tr>
<tr>
<td>Loans&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.5S6E-03*</td>
<td>1.01</td>
<td>4.24E-03</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(4.59E-03)</td>
<td></td>
<td>(5.17E-03)</td>
<td></td>
</tr>
<tr>
<td>Savings&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-2.12E-04</td>
<td>1.00</td>
<td>2.46E-04</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(3.99E-04)</td>
<td></td>
<td>(4.50E-04)</td>
<td></td>
</tr>
<tr>
<td>Socio-economic indicator&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.02</td>
<td>1.02</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial choice - Plan 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.10</td>
<td>1.11</td>
<td>-0.32***</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial choice - Plan 3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.42***</td>
<td>1.52</td>
<td>-1.04***</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial choice - Plan 4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.46**</td>
<td>1.58</td>
<td>-13.61</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td></td>
<td>(175.06)</td>
<td></td>
</tr>
<tr>
<td>Initial choice - Plan 5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.08</td>
<td>1.09</td>
<td>-0.21</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td></td>
<td>(0.21)</td>
<td></td>
</tr>
<tr>
<td>Initial choice - Plan 6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.38</td>
<td>1.46</td>
<td>-0.17</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td></td>
<td>(0.22)</td>
<td></td>
</tr>
</tbody>
</table>

| Number of customers<sup>c</sup>              | 8,809                        | 8,809  |                                   |        |

<sup>a</sup> Time-varying variable

<sup>b</sup> Non-time-varying variable

<sup>c</sup> Balanced panel of plan adopters by t=10 (i.e., first 15 months of post adoption observations). The panel does not include eventual quitters.

*** p<0.01, ** p<0.05, * p<0.1
### Table 6A – Switching Choice Optimality Ex-Ante

<table>
<thead>
<tr>
<th>Optimal Final plan</th>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>Plan 5</th>
<th>Plan 6</th>
<th>No plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan 1</td>
<td>61.8%</td>
<td>0.0%</td>
<td>0.4%</td>
<td>2.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>35.3%</td>
</tr>
<tr>
<td>Plan 2</td>
<td>74.6%</td>
<td>2.5%</td>
<td>2.1%</td>
<td>1.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Plan 3</td>
<td>60.5%</td>
<td>0.0%</td>
<td>15.8%</td>
<td>0.0%</td>
<td>2.6%</td>
<td>0.0%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Plan 4</td>
<td>48.2%</td>
<td>2.0%</td>
<td>5.7%</td>
<td>5.0%</td>
<td>0.8%</td>
<td>0.0%</td>
<td>38.2%</td>
</tr>
<tr>
<td>Plan 5</td>
<td>39.7%</td>
<td>2.6%</td>
<td>13.7%</td>
<td>12.0%</td>
<td>9.8%</td>
<td>0.4%</td>
<td>21.8%</td>
</tr>
<tr>
<td>Plan 6</td>
<td>32.9%</td>
<td>2.7%</td>
<td>2.7%</td>
<td>19.2%</td>
<td>21.9%</td>
<td>5.5%</td>
<td>15.1%</td>
</tr>
</tbody>
</table>

The numbers represent the distribution of optimal plans across plan users for each of the available plans. Each row presents the distribution of optimal plans for the customers who switched to the particular plan represented in that row. Optimality is calculated based on 3 months before switching. When we aggregate over all switching customers we find that 14% of them switched to the cost-minimizing plan. Further details are provided in online Appendix A.

### Table 6B – Switching Choice Optimality Ex-Post

<table>
<thead>
<tr>
<th>Optimal Final plan</th>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>Plan 5</th>
<th>Plan 6</th>
<th>No plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan 1</td>
<td>63.4%</td>
<td>0.4%</td>
<td>0.8%</td>
<td>1.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Plan 2</td>
<td>79.8%</td>
<td>3.9%</td>
<td>0.8%</td>
<td>1.2%</td>
<td>0.4%</td>
<td>0.0%</td>
<td>14.0%</td>
</tr>
<tr>
<td>Plan 3</td>
<td>65.5%</td>
<td>0.0%</td>
<td>13.8%</td>
<td>0.0%</td>
<td>2.3%</td>
<td>0.0%</td>
<td>18.4%</td>
</tr>
<tr>
<td>Plan 4</td>
<td>57.5%</td>
<td>2.8%</td>
<td>3.7%</td>
<td>3.8%</td>
<td>1.3%</td>
<td>0.0%</td>
<td>31.0%</td>
</tr>
<tr>
<td>Plan 5</td>
<td>55.9%</td>
<td>3.9%</td>
<td>9.0%</td>
<td>8.2%</td>
<td>6.6%</td>
<td>0.0%</td>
<td>16.4%</td>
</tr>
<tr>
<td>Plan 6</td>
<td>42.3%</td>
<td>5.1%</td>
<td>5.1%</td>
<td>11.5%</td>
<td>20.5%</td>
<td>7.7%</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

The numbers represent the distribution of optimal plans across plan users for each of the available plans. Each row presents the distribution of optimal plans for the customers who switched to the particular plan represented in that row. Optimality is calculated based on 3 months after switching. When we aggregate over all switching customers we find that 14% of them switched to the cost-minimizing plan. Further details are provided in online Appendix A.
<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta_1$ - Fixed plan price</th>
<th>$\beta_2$ - Overage payment</th>
<th>$\beta_3$ - Other benefits</th>
<th>$\beta_4$ - Stickiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-5.54E-01</td>
<td>-3.69E-01</td>
<td>-7.86E-01</td>
<td>3.84</td>
</tr>
<tr>
<td>Number of Owners</td>
<td>1.01E-02</td>
<td>-2.37E-03</td>
<td>2.32E-02</td>
<td>9.93E-03</td>
</tr>
<tr>
<td>Salary in US $</td>
<td>4.45E-07</td>
<td>-8.40E-08</td>
<td>6.54E-07</td>
<td>9.95E-07</td>
</tr>
<tr>
<td>Number of Salaries</td>
<td>-2.22E-03</td>
<td>5.07E-05</td>
<td>6.25E-03</td>
<td>4.75E-03</td>
</tr>
<tr>
<td>Information Transactions</td>
<td>3.34E-05</td>
<td>-1.49E-05</td>
<td>-1.30E-05</td>
<td>4.45E-05</td>
</tr>
<tr>
<td>Age</td>
<td>-9.42E-04</td>
<td>2.08E-04</td>
<td>-1.19E-03</td>
<td>-6.27E-04</td>
</tr>
<tr>
<td>Account Tenure</td>
<td>2.68E-04</td>
<td>-5.04E-06</td>
<td>2.02E-03</td>
<td>2.46E-04</td>
</tr>
<tr>
<td>Parental Social Security benefits (for children below the age of 18) in US $</td>
<td>5.08E-05</td>
<td>-9.15E-06</td>
<td>5.15E-05</td>
<td>1.17E-05</td>
</tr>
<tr>
<td>Elderly Social Security benefits in US $</td>
<td>7.40E-07</td>
<td>3.94E-07</td>
<td>-1.09E-07</td>
<td>-7.69E-06</td>
</tr>
<tr>
<td>Loans in US $</td>
<td>9.66E-08</td>
<td>-1.72E-08</td>
<td>9.23E-08</td>
<td>3.76E-08</td>
</tr>
<tr>
<td>Savings in US $</td>
<td>7.74E-08</td>
<td>-1.67E-08</td>
<td>6.00E-08</td>
<td>2.11E-08</td>
</tr>
<tr>
<td>Mean level of positive account balance in US $</td>
<td>1.88E-06</td>
<td>-6.64E-07</td>
<td>-1.40E-06</td>
<td>1.84E-06</td>
</tr>
<tr>
<td>Mean level of negative account balance in US $</td>
<td>1.38E-05</td>
<td>-3.02E-06</td>
<td>1.16E-05</td>
<td>5.79E-06</td>
</tr>
<tr>
<td>Socio-economic indicator (scale of 1 to 10)</td>
<td>-1.35E-03</td>
<td>-1.12E-03</td>
<td>-3.19E-03</td>
<td>7.21E-03</td>
</tr>
<tr>
<td>Adoption month</td>
<td>3.50E-02</td>
<td>-6.39E-03</td>
<td>3.59E-02</td>
<td>-2.38E-02</td>
</tr>
</tbody>
</table>

* Bold numbers indicate that 0 lies outside the 95% highest posterior density interval of the estimate for the population mean.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Quitting Hazard Regression Parameter Estimate</th>
<th>Hazard ratio</th>
<th>Quitting Hazard Regression Parameter Estimate</th>
<th>Hazard ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Standard Error)</td>
<td></td>
<td>(Standard Error)</td>
<td></td>
</tr>
<tr>
<td>Monthly cumulative average payment*</td>
<td>0.02***</td>
<td>1.02</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td></td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Initial plan - ordered</td>
<td>-0.13***</td>
<td>0.88</td>
<td>-0.16***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td></td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>Average payment *Initial plan choice</td>
<td>0.18***</td>
<td>1.67</td>
<td>0.61***</td>
<td>1.36</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td></td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Upward initial choice bias</td>
<td>0.29***</td>
<td>1.34</td>
<td>0.31***</td>
<td>1.36</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td></td>
<td>(0.09)</td>
<td></td>
</tr>
<tr>
<td>Downward initial choice bias</td>
<td>0.03***</td>
<td>1.03</td>
<td>0.03***</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td></td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Adoption month</td>
<td>0.04</td>
<td>1.04</td>
<td>0.04</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td></td>
<td>(0.07)</td>
<td></td>
</tr>
<tr>
<td>Monthly mean number of account status inquiries*</td>
<td>-9.84E-04</td>
<td>1.00</td>
<td>-1.07E-03</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(9.26E-04)</td>
<td></td>
<td>(9.62E-04)</td>
<td></td>
</tr>
<tr>
<td>Salary*</td>
<td>-0.10***</td>
<td>0.91</td>
<td>-0.10**</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td></td>
<td>(0.05)</td>
<td></td>
</tr>
<tr>
<td>Number of owners</td>
<td>-0.26***</td>
<td>0.78</td>
<td>-0.25***</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td></td>
<td>(0.06)</td>
<td></td>
</tr>
<tr>
<td>Account tenure</td>
<td>3.27E-03</td>
<td>1.00</td>
<td>3.41E-03</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(3.84E-03)</td>
<td></td>
<td>(3.85E-03)</td>
<td></td>
</tr>
<tr>
<td>Customer age</td>
<td>6.39E-03**</td>
<td>1.01</td>
<td>0.01**</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>(2.84E-03)</td>
<td></td>
<td>(2.84E-03)</td>
<td></td>
</tr>
<tr>
<td>Parental Social Security benefits (for children below the age of 18)**</td>
<td>-1.51E-03***</td>
<td>1.00</td>
<td>-1.48E-03***</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(5.20E-04)</td>
<td></td>
<td>(5.18E-04)</td>
<td></td>
</tr>
<tr>
<td>Elderly Social Security benefits</td>
<td>5.65E-04***</td>
<td>1.00</td>
<td>5.76E-04***</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(1.7E-04)</td>
<td></td>
<td>(1.16E-04)</td>
<td></td>
</tr>
<tr>
<td>Mean level of positive account balance*</td>
<td>1.04E-04***</td>
<td>1.00</td>
<td>1.02E-04***</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(1.63E-05)</td>
<td></td>
<td>(1.66E-05)</td>
<td></td>
</tr>
<tr>
<td>Mean level of negative account balance*</td>
<td>-3.24E-04***</td>
<td>1.00</td>
<td>-3.24E-04***</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(5.83E-05)</td>
<td></td>
<td>(5.89E-05)</td>
<td></td>
</tr>
<tr>
<td>Loans*</td>
<td>-0.01</td>
<td>0.99</td>
<td>-1.22E-02</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(1.09E-02)</td>
<td></td>
<td>(1.10E-02)</td>
<td></td>
</tr>
<tr>
<td>Savings*</td>
<td>1.41E-03***</td>
<td>1.00</td>
<td>1.45E-03***</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(3.25E-04)</td>
<td></td>
<td>(3.25E-04)</td>
<td></td>
</tr>
<tr>
<td>Socio-economic indicator*</td>
<td>0.02</td>
<td>1.03</td>
<td>0.02</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td></td>
<td>(0.02)</td>
<td></td>
</tr>
</tbody>
</table>

* Time-varying variable  
† Non-time-varying variable  
* The number of the plan, ordered according to the size of the allowance and fixed monthly fee. Plan 1 has the smallest allowance and lowest fixed monthly fee, and plan 6 has the highest allowance and the largest fixed monthly fee  
*** p<0.01, ** p<0.05, * p<0.1
Figure 1. Average monthly average payments among adopters, classified according to switching and initial bias type.
**Figure 2. Nature of Switch for Overage Payers**

**Figure 3. Nature of Switch for Non-Overage Payers**
Online Appendix A – Optimality Calculation Schemes

A customer might calculate the cost of a plan in a given three-part tariff plan menu in several ways. For example, customers might consider only their activity in the month of choice while evaluating the plans. Alternatively, they might take into account a longer period of time spanning several months of activity. Moreover, customers might compare the overall payments over the entire time period across all plans based on their activity in each month, or alternatively calculate the payment associated with each plan according to their mean monthly activity level. Because we are not aware of the actual methods used by customers to calculate and compare payments across different plans, we employed several payment calculation approaches to evaluate choice optimality. First, we considered different time periods for the optimality calculation, ranging from one month to six months. Second, we used two calculation schemes to calculate the payment associated with each plan. The first scheme was based on the monthly mean number of transactions (according to each of the transaction types) over the relevant timeframe. The second was based on the overall payment for each plan based on the customer’s actual usage over the relevant timeframe. While the latter approach is more accurate in terms of plan optimality, it is more complex to compute. Take, for example, a customer who uses the account heavily only once a year. This customer might do best by choosing a cheap plan with a small allowance and just paying the overage payments during the month of heavy usage. But if that same customer calculates her average monthly activity (taking that month into account), she might conclude that she needs a larger allowance, and she will end up buying a more expensive plan and paying larger amounts each month. Third, a customer might choose a plan that is not optimal for his or her past usage behavior, and yet can be optimal given a behavioral change. We therefore assessed the optimality of customers’ plan choices using both an ex-ante approach (i.e., by evaluating pre-adoption usage behavior) and an ex-post approach (i.e., evaluating post-adoption usage behavior). The ex-post criterion might be a more accurate criterion for assessing optimality if, at the time of adoption, customers take into account their expected changes in usage behavior. We find that our optimality assessments are rather similar under the different schemes. Therefore, in the paper we present our analysis results based on evaluation of the monthly mean number of transactions over three months (i.e., not the overall payment), either ex-ante or ex-post, depending on the analysis. Notably, in the various calculations, we use the month of introduction as a reference month to calculate the choice optimality among non-adopters.

In Table A1 we present 24 different optimality calculation schemes used in our plan choice optimality assessment. The optimality calculation schemes differ on three levels: (1) the length of the timeframe investigated in order to assess optimality, (2) the basis for optimality calculation (i.e., overall payment or mean monthly activity level), and (3) the ex-post or ex-ante assessment.
For optimality assessments based on a 1-month period there is no difference in calculated plan payments between the two calculation bases (overall payment and mean activity level).

Next, we provide an example to illustrate the difference between the optimality calculation schemes. Take, for example, a customer who performed the following numbers of transactions in each of the three transaction types over three months (Table A2):

**Table A2 – Activity Description**

<table>
<thead>
<tr>
<th>Month</th>
<th>Clerk-assisted transactions</th>
<th>Direct transactions</th>
<th>Check transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month 1</td>
<td>0</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Month 2</td>
<td>17</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Month 3</td>
<td>1</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Mean activity</td>
<td>6</td>
<td>6.66</td>
<td>9.66</td>
</tr>
</tbody>
</table>

Table A3 presents the calculation of the plan payment using the overall payment calculation basis for the four plans that were available in those three months, and for the ‘old’ pay-per-use payment system. According to Table A3, Plan 1 is the optimal plan because the overall payment for this plan is the lowest.
Table A3 – Payment Calculation Using Overall Payment as the Calculation Basis

<table>
<thead>
<tr>
<th></th>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>‘old’ system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month: 1</td>
<td>$5.65</td>
<td>$6.25</td>
<td>$7.65</td>
<td>$14.00</td>
<td>$13.51</td>
</tr>
<tr>
<td>Month: 2</td>
<td>$26.60</td>
<td>$27.50</td>
<td>$24.55</td>
<td>$14.00</td>
<td>$ 6.16</td>
</tr>
<tr>
<td>Month: 3</td>
<td>$7.20</td>
<td>$7.80</td>
<td>$7.95</td>
<td>$14.00</td>
<td>$4.78</td>
</tr>
<tr>
<td>Sum</td>
<td>$39.45</td>
<td>$41.55</td>
<td>$40.15</td>
<td>$42.00</td>
<td>$24.45</td>
</tr>
</tbody>
</table>

Table A4 presents the calculation of the plan payment using the mean monthly activity level calculation scheme. According to this calculation scheme the optimal plan is Plan 3.

Table A4 – Payment Calculation Using Mean Activity Level as the Calculation Basis

<table>
<thead>
<tr>
<th>Payment according to mean activity level</th>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>No plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>$13.05</td>
<td>$13.75</td>
<td>$11.30</td>
<td>$11.50</td>
<td>$13.51</td>
<td></td>
</tr>
</tbody>
</table>
Online Appendix B – Adoption and Flat-Rate Bias Regression Analysis

**Table B1 – Logit Regressions for Adoption Decision**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account tenure</td>
<td>-0.002***</td>
<td>-0.006***</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.008***</td>
<td>0.006***</td>
<td>-0.008*</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Number of owners</td>
<td>-0.125***</td>
<td>-0.061*</td>
<td>-0.22*</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.033)</td>
<td>(0.119)</td>
</tr>
<tr>
<td>Parental Social Security benefits (for children below the age of 18) in US $</td>
<td>0.516***</td>
<td>0.444***</td>
<td>1.593***</td>
</tr>
<tr>
<td></td>
<td>(0.154)</td>
<td>(0.196)</td>
<td>(0.482)</td>
</tr>
<tr>
<td>Elderly Social Security benefits in US $</td>
<td>-0.200***</td>
<td>0.1</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(0.052)</td>
<td>(0.083)</td>
<td>(0.279)</td>
</tr>
<tr>
<td>Salary in US $</td>
<td>0.028*</td>
<td>0.017</td>
<td>-0.153</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.022)</td>
<td>(0.102)</td>
</tr>
<tr>
<td>Number of salaries</td>
<td>0.211***</td>
<td>-0.018</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.032)</td>
<td>(0.127)</td>
</tr>
<tr>
<td>Socio-economic indicator (scale of 1 to 10)</td>
<td>-0.075***</td>
<td>-0.06***</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Loans in US $</td>
<td>0.003**</td>
<td>-0.001</td>
<td>-0.004</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Savings in US $</td>
<td>-0.001***</td>
<td>0.002***</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Monthly mean number of account status inquiries</td>
<td>-0.009***</td>
<td>-0.009***</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Monthly mean number of clerk-assisted transactions</td>
<td>0.098***</td>
<td>-0.085***</td>
<td>0.352***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Monthly mean number of direct transactions</td>
<td>0.041***</td>
<td>-0.005</td>
<td>0.044***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Monthly mean number of check transactions</td>
<td>-0.053***</td>
<td>0.005</td>
<td>-0.081***</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Mean level of positive account balance in US $</td>
<td>-0.183***</td>
<td>-0.028*</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.015)</td>
<td>(0.053)</td>
</tr>
<tr>
<td>Mean level of negative account balance in US $</td>
<td>-0.020*</td>
<td>0.046***</td>
<td>-0.055</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.015)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>Mean monthly number of marketing calls</td>
<td>11.314***</td>
<td>-0.1</td>
<td>-0.779</td>
</tr>
<tr>
<td></td>
<td>(0.184)</td>
<td>(0.18)</td>
<td>(0.644)</td>
</tr>
<tr>
<td>Monthly mean of bank commission payments based on the ‘old’ payment system in US $</td>
<td>0.456***</td>
<td>0.001</td>
<td>0.073***</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.009)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Adoption month</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.137***</td>
<td>-0.027***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.011)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-2.044***</td>
<td>-0.043</td>
<td>-2.33***</td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.103)</td>
<td>(0.337)</td>
</tr>
<tr>
<td>Customers</td>
<td>70510</td>
<td>32394</td>
<td>32394</td>
</tr>
</tbody>
</table>

* Column 1 shows the results of a logit adoption regression, in which the dependent variable equals one if the customer adopted a three-part tariff plan and zero otherwise. For adopters the control variables are calculated based on 3 months before adoption; for non-adopters this variable is based on 3 months before the introduction of the new plans.

* Columns 2 and 3 present the estimation results of a multinomial logit regression in which the choice of a cost-minimizing (‘optimal’) plan is the base category. The dependent variables upward bias choice and downward bias choice are determined relative to the allowance of the optimal plan.

*** p<0.01, ** p<0.05, * p<0.1
In column 1 in Table B1 we present the results of a logit regression for plan adoption. An observation in this regression is a customer, and the dependent variable equals one if the customer chose a three-part tariff plan during the investigated timeframe and zero otherwise. In general, the regression results are consistent with the summary statistics presented in Table 2. For example, age and savings correlate negatively with plan adoption, whereas the account holder’s mean commission payment under the ‘old’ payment system, salary, number of children below the age of 18 (implied by the amount received in parental Social Security benefits), and the number of marketing calls correlate positively with plan adoption. In addition, the number of account owners, the customer socio-demographic index and the number of account information inquiries are each negatively associated with adoption.

In columns 2 and 3 we present the results of a multinomial logit regression for customers who chose their cost-minimizing plans (the base category), plans with allowances that exceeded customers’ needs (defined as ‘upward choice bias’, column 2), and plans with allowances that fell below customers’ needs (defined as ‘downward choice bias’, column 3). The estimates suggest that account holders who are characterized by higher socio-demographic indices and longer account tenure and who perform more information inquiries are less likely to experience flat-rate bias. In addition, customers with fewer young children (inferred from the level of parental Social Security benefits) or whose accounts have a larger number of owners are significantly more likely to choose the cost-minimizing plan. Interestingly, our results also suggest that the number of marketing calls, which had a strong effect on the initial adoption decision, had no effect on the tendency to experience a flat-rate bias.
Online Appendix C: HB MCMC Estimation Procedure

For the estimation, we used the Hierarchical Bayes Markov Chain Monte Carlo (HB MCMC) algorithm (Train 2003).

Let \{A\} denote the parameters in the second layer of the utility equation (for \(V_{ijt}\)), and let \{B\} denote the population vectors of \(K\) random parameters that enter the utility equation. For the random parameters, we assumed a multivariate normal distribution with diffuse priors for the population parameters. Specifically, we used a normal prior distribution with a high variance for the population means and a diffuse inverted Wishart prior distribution for the population variance \([IW(K, I)]\), where \(I\) is the identity matrix. The draws from the conditional posteriors for the Gibbs sampling are as follows.

First, we drew from \(f(B|\beta, \Sigma_u, A) \propto \prod_{i,j} [p_t(C_{ij}, B, A)] \cdot \Pi(B|\beta, \Sigma_u)\) using the Metropolis-Hastings algorithm. The first element on the right-hand side is the logit probability for plan choice. The second element is the normal density. Second, we drew \(\bar{B}\) and \(\Sigma_B\) from \(f(\bar{B}|B, \Sigma_u) \sim N \left( \frac{\sum_i B_i}{NI}, \frac{\Sigma_B}{NI} \right)\) where \(NI\) is the number of customers, and from \(f(\Sigma_u|B, \bar{B}) \sim IW \left( K + NP, \frac{(KI + \bar{S})}{K + NI} \right) \) where \(\bar{S} = \sum_i (B_i - \bar{B})(B_i - \bar{B})\).

Third, we drew from the posterior distribution of the second-level parameters in \{A\}, using the closed-form solution to the standard linear regression coefficients.

We let the chain run for 200,000 iterations and discarded the first 180,000 as burn-in. We then used every tenth iteration to sample from the posterior distribution.