Overestimating Self-Control: Evidence from the Health Club Industry*

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Abstract

Experimental evidence suggests that people make time-inconsistent choices and display overconfidence about positive personal attributes. Do these features affect consumer behavior in the market? To address this question we use a new panel data set from three US health clubs with information on the contract choices and the day-to-day attendance decisions of 7,978 health club members over three years. Members who choose a contract with a flat monthly fee of over $70 attend on average 4.8 times per month. They pay a price per expected visit of more than $17, even though a $10-per-visit fee is also available. On average, these users forgo savings of $700 during their membership. We review many aspects of the consumer behavior, including the interval between last attendance and contract termination, the survival probability, and the correlation between different consumption choices. The empirical results are difficult to reconcile with the standard assumption of time-consistent preferences and rational expectations. A model of time-inconsistent agents with overconfidence about future time inconsistency explains the findings. The agents overestimate the future attendance and delay contract cancellation whenever renewal is automatic.

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"Saturday 31 December. New Year's Resolutions. I WILL [...] go to the gym three times a week not merely to buy sandwich." (Fielding, 1999. *Bridget Jones' Diary: A Novel*)

A few months later: "Monday 28 April. [...] Gym visits 0, no. of gym visits so far this year 1, cost of gym membership per year £370; cost of single gym visit £123 (v. bad economy)." (Fielding, 2001. *Bridget Jones: The Edge of Reason*)

1 Introduction

Experimental methods are a relative novelty in economics. In psychology, instead, there is a long tradition of testing theories in the laboratory. Some of these laboratory studies are directly relevant to economics, notably the experiments on intertemporal preferences and on beliefs.

The experiments on time preferences call into question the assumption of time consistency, commonplace in economics since Samuelson (1937) and Koopmans (1960). According to the experimental evidence, the average discount rate for adjacent periods is higher in the near future than in the more distant future.[1] Individuals who display this discounting pattern in all periods have time-inconsistent preferences. Their actual decisions may conflict with their previously formulated long-run plans.

The experiments on beliefs have tested the hypothesis of rational expectations. One of the stable findings of these laboratory studies is that consumers tend to overestimate their positive personal attributes. Most individuals rate their driving ability as above average (Larwood and Whittaker, 1977; Svenson, 1981). Subjects also underestimate the probability of hospitalization (Weinstein, 1980) and the time needed to finish a project (Buehler, Griffin, and Ross 1994).

Economists have started to incorporate these experimental findings. Laibson (1997) and O'Donoghue and Rabin (1999) have formalized a parsimonious model of time-inconsistent references. Applications of this model include addiction (Gruber and Koszegi, 2001), consumption (Laibson, 1997), and tax policy (Krusell, Kuruscu, and Smith 2000). Other authors have integrated overconfidence in theoretical (Roll, 1986; Benabou and Tirole, 2002) and in experimental work (Camerer and Lovallo, 2001) with emphasis on takeovers and market entry.

Given the importance of the economic implications, it is crucial to know whether time inconsistency and overconfidence, as displayed in laboratory settings, affect consumer behavior in the market. Recent empirical studies point to market evidence of these phenomena in the fields of consumption (Angeletos et al., 2001), addiction (Gruber and Mullainathan, 2002), job search (DellaVigna and Paserman, 2001), retirement (Madrian and Shea, 2001; Choi et al., forthcoming), and corporate investment (Malmendier and Tate, 2002).[2] In such complex

[1] Benzion, Rapoport and Yagil, 1989; Kirby, 1997; Kirby and Herrnstein, 1995; Loewenstein and Prelec, 1992; Thaler, 1981.

[2] Fang and Silverman (2001) and Gruber and Koszegi (2001) use field data to test for time consistency as

economic settings, however, alternative interpretations of the empirical findings are possible. For example, limited cognitive abilities may explain anomalous lifecycle savings choices.

In this paper we study a simple yet economically significant decision, enrollment and attendance in a health club. We employ a new panel data set from three US health clubs with 7,978 members over three years. Unlike most data sets on consumption behavior, this data set documents both the purchase of a commodity—enrollment in the health club and membership renewal—and the actual consumption—health club attendance.[3] We use the two decisions over time to provide evidence on time inconsistency and overconfidence. We focus on one type of overconfidence, overestimation of future self-control.[4]

After introducing the health club industry (Section 2), we present a simple model of consumer behavior in a health club (Section 3). We assume that attendance to the club entails an immediate effort cost and yields future health benefits. We consider the standard case of time-consistent preferences and rational expectations, but we also allow for time-inconsistent preferences and overconfidence. The agents have a hyperbolic discount function (Strotz, 1956; Phelps and Pollak, 1968; Laibson, 1997; O'Donoghue and Rabin, 1999), with a higher discount rate between the present and the next period than between any adjacent future periods. Moreover, they may underestimate their time inconsistency. The latter assumption is motivated by the general evidence on overconfidence, as well as specific evidence showing that agents underestimate the value of commitment devices (Ariely and Wertenbroch, 2002). Following the literature, we refer to these overconfident agents as partially naive hyperbolic agents (O'Donoghue and Rabin 2001).

Time inconsistency and overconfidence affect health club attendance. At the moment of joining a club, time-inconsistent consumers make plans about future attendance using the low discount rate that applies between future periods. Once the moment of attending has arrived, however, the future health benefits are heavily discounted and the consumers attend less than they intended to. Since the long-run plans conflict with the actual decisions, these individuals have self-control problems. In addition, overconfidence induces them to overestimate their future attendance.

In Section 4 we introduce the data set and test the predictions of the model. A key feature of the data is the variation in price structure and in renewal procedures among the contracts in the menu. Consumers can choose between two flat-rate contracts—a monthly contract and an annual contract—and a pay-per-visit option for $10. The monthly contract is automatically renewed from month to month until the consumer cancels. The annual contract, instead, expires after twelve months and the consumer has to explicitly renew it. We use the

well.

[3]Gourville and Soman (1998) use swipe data from a health club to test for mental accounting.

[4]In Section 4.6 we discuss alternative forms of overconfidence, such as overconfidence about benefits of health club attendance.

contractual differences in pricing and renewal to identify consumer preferences.

We establish seven stylized facts, as summarized in Table 1. The first fact exploits the variation in per-usage pricing. Health club members who choose a monthly contract with flat fee of over \$70 attend on average 4.8 times per month in the first six months. They pay a price per expected visit in excess of \$17, even though a \$10-per-visit fee is also available. In addition, only 20 percent of the users in the monthly contract pay less than \$10 per visit ex post (Stylized Fact 1). Comparable findings hold for the first year of the annual contract.

Second, members with the monthly contract accumulate an average gap of 2.29 full consecutive months between the last attendance and contract termination. (Stylized Fact 2). The monetary cost of this period with no attendance (\$185) is an order of magnitude larger than the transaction costs of cancellation (in the order of \$10-\$20).

The next two stylized facts exploit the contractual variation in cancellation procedure. The share of agents enrolled after one year under the monthly contract is 12.5 percent higher than under the annual contract (Stylized Fact 3). Surprisingly, the contract that allows *more* freedom to cancel has a *higher* share of agents renewing the contract. This occurs despite the fact that long-term enrollment is cheaper under the annual contact. This difference is particularly high for low-attenders. The share of agents that remain enrolled is twice as high under the monthly than under the annual contract for agents with low attendance in the first 12 months (Stylized Fact 4). Stylized Facts 3 and 4 do not seem to be explained by sorting of high-attenders into the monthly contract. To the contrary, initial attendance is 9.5 percent higher under the annual contract.

We also consider the dynamics of average attendance for agents initially enrolled in the annual contract. Average monthly attendance in the first year is 46 percent lower than the attendance of stayers in the second year (Stylized Fact 5). The pattern is reversed for users initially enrolled in the monthly contract. Average monthly attendance in the first six months is significantly higher than in any of the subsequent six-month periods (Stylized Fact 6). Finally, users who pay a high price per attendance in the monthly contract display a longer gap between last attendance and contract termination (Stylized Fact 7).

Stylized Facts 1 through 7 are hard to reconcile with a standard model of time-consistent decision-makers with rational expectations. A model with time inconsistency and overconfidence about future time inconsistency, however, can organize all the empirical findings. Agents with these features may pay more than \$10 per expected visit (Stylized Fact 1) for two reasons. First, the more expensive flat-rate contracts helps them to commit to higher future attendance, and therefore partially solve the time inconsistency problem. Second, the overconfidence leads the agents to overestimate attendance under the flat-rate contract.

Agents with overoptimistic expectations display a status quo effect (Samuelson and Zeckhauser, 1988) and delay membership cancellation under the monthly contract (Stylized Fact 2). Since they expect to be more patient in the near future, they delegate cancellation to later selves, in the (irrational) belief that these later selves will cancel (Akerlof, 1991; O'Donoghue and Rabin, 2001). The delay of cancellation does not occur under the annual contract, since contract expiration after 12 month is the default. As a result, the share of agents enrolled after 12 months should be higher under the monthly contract than under the annual contract (Stylized Fact 3). In addition, the difference in cancellation behavior should be highest for individuals who intend to cancel, i.e. for low levels of past attendance (Stylized Fact 4).

Under the annual contract, users with low attendance quit at expiration. Given this selective exit, average attendance for stayers is higher than for the initial group (Stylized Fact 5). Under the monthly contract, instead, low-attenders delay contract cancellation. As negative shocks accumulate over time, the average attendance decreases (Stylized Fact 6). Finally, if time-inconsistency and overconfidence are driving the above results, individuals who pay a higher price per attendance should also have a longer cancellation gap (Stylized Fact 7).

We discuss several alternative interpretations of the stylized facts, including risk aversion, transaction costs, awareness about contracts, imperfect memory, and overconfidence about benefits from exercise. While some of these explanations fit some of the facts, we argue that a model of time-inconsistent partially naive agents provides the most parsimonious unifying model. In addition, this model is consistent with the available experimental evidence.

Overall, this paper provides evidence that consumers display time inconsistency and overconfidence in the market even when stakes are high. In the health clubs of our sample, the average non-subsidized user chooses the monthly contract, and by doing so forgoes savings of about \$700 per membership, out of a total amount of about \$1,500 paid to the health club. The results of this study are likely to generalize to the 32.8m Americans who exercise in one of the 16,983 US health clubs. Therefore, both in terms of monetary magnitude and in terms of population involved, time inconsistency and overconfidence have a significant economic impact in the health club industry.

While the significant impact of time inconsistency and overconfidence on market outcomes is the core result of the paper, we would like to emphasize three other themes. First, despite biased expectations, partially naive individuals are responsive to standard economic forces. We find strong evidence that individuals learn over time, and that they switch toward the contract that is more appropriate given their type. High attendance is a strong predictor of the probability of renewing a flat-rate contract with another flat-rate contract as opposed to cancelling (Stylized Fact 5). In addition, the observed initial sorting between the monthly and annual contract conforms to the standard predictions for agents with heterogeneous attendance costs.

Second, while the paper focuses on the consumer side of the market, we would like to stress the implications for the industrial organization of flat-rate pricing and of automatic renewal. The previous studies on flat-rate and pay-per-visit pricing had focused almost exclusively on the telecommunication industry (Miravete, forthcoming). For contracts with automatic renewal, we show that a small cancellation cost can induce substantially higher survival rates. Arguably, this finding can explain the frequency of contracts with automatic renewal in other industries such as the newspaper, credit card, and mail order industry. In DellaVigna and Malmendier (2001) we explore the general implications of time inconsistency and naiveté for firm pricing.

Third, at a methodological level, we use a range of data sources to test the robustness of the results. In addition to the data set on individual contract choice and attendance, we present results from a survey of health club members, a survey of health club companies, and a field experiment. The additional data sets help us to distinguish the proposed explanation from alternative interpretations.

The remainder of the paper is organized as follows. In Section 2 we introduce the main features of the health club industry. In Section 3 we outline a simple model of contract and attendance choices. In Section 4 we take the predictions of the model to the data. Section 5 concludes. All the proofs are in Appendix A.

2 The health club industry

Exercising is an activity which challenges self-control. People would like to exercise regularly in order to lose weight, get fit, stay healthy, and develop new social contacts. These future benefits, however, come at the expense of current costs: the logistic cost of getting to the gym and the physical (and psychic) cost of exercising. Because the costs are immediate and the benefits delayed, individuals with time-inconsistent preferences fail to exercise as much as they wish to. Anecdotal evidence is consistent with this statement. According to a survey conducted by American Sports Data, 62 percent of the US population acknowledges the benefits of exercise, knows it should exercise more, but never does so.[5]

Nevertheless, US health clubs have been increasingly successful in convincing Americans to overcome inertia and join a health club. As of January 2001, 16,983 clubs were operating in the US. The industry revenues for the year 2000 totalled \$11.6bn, and the memberships in this same period summed to 32.8m, up from 17.4m in 1987. Fifty-one percent of the users were members in commercial health clubs, while thirty-four percent were members in non-profit facilities.[6] The upper part of Table 2 presents the top 10 commercial health clubs in the US. Only one company, the market leader Bally Total Fitness with \$1,007m revenues and 4m members, is publicly traded. Few companies operate in more than 10 states. The lower part of Table 2 shows the Herfindahl and Concentration Ratio indices for the industry.[7] Ownership

[5] www.americansportsdata.com/pr3.htm.

[6] The remaining fifteen percent are members of miscellaneous for-profit facilities (corporate fitness centers, aerobics studios, resorts, spas, hotels, and country clubs.) Source: International Health, Racquet and Sportsclub Association (IHRSA), www.ihrsa.org.

[7] The Herfindahl index is computed using data on the 100 largest firms. Since the 100-th firm has a share of only .00031 of the industry revenue, the bias from neglecting the smaller firms is at most $.00031^2 * 16,883$ (the

concentration is in the 10th percentile of US industries.

In order to document the contract design in the industry, we conducted a survey of health clubs in the metropolitan area of Boston.[8] This survey provides also a benchmark for the contract design of the health clubs in our sample. Health clubs offer three options to attend. 85 clubs out of 100 offer a monthly contract. This contract entails a monthly fee and no fee per visit. The monthly fee is automatically debited each month to a credit card or bank account until the user cancels the membership. 90 clubs offer an annual contract that involves the payment of an annual fee and no fee per visit. Both monthly and annual contracts have an initiation fee. Finally, 82 clubs offer a pay-per-visit option, often in the form of a 10-visit pass.

The health clubs in our sample offer these three types of contract with the following additional features (Section 4.1 provides additional detail).

1. The monthly contract has a standard fee of $85 that is charged every month until the users cancel. Cancellation can be done in person at the club or by sending a written note.[9] If cancellation takes place before the 10th of the month, no further fees are due, and the users can attend until the end of the month. Members who cancel after the 10th have to pay the fee for the next month and can attend until the end of the following month.

2. The annual contract has a standard yearly fee of $850. Users thus get a discount of 2 months out of 12 in exchange for a yearly commitment. At the end of the year, the contract expires and members who wish to stay enrolled have to sign up again, either for an annual or for a monthly contract. In order to encourage renewal, the club sends out a reminder card one month before the contract expires.

3. The pay-per-visit system is twofold. Users can either pay $12 per visit or purchase a 10-visit pass for $100. Transaction costs for the 10-visit pass are small. Users provide basic demographic information and receive a card for ten visits.

Under these three membership types, the users hand in their card at each visit and a health club employee swipes it (marks the visit for the 10-visit pass) while the users are exercising. The three contracts give right to the same services, i.e., a temporary locker, towels, and access to the equipment. Also, both the monthly and the annual contract allow members to "freeze" (suspend) their membership for three months per year[10]. Users with a monthly contract do not have to pay their monthly fee during the freezing period. Annual members get additional usage time after the twelve months of the original membership.

number of health clubs - 100) = .00162.

[8]For details on the survey, see DellaVigna and Malmendier (2001).

[9]Some users cancel by telling their bank or credit card company to discontinue the payments to the health club.

[10]Monthly users can also quit for up to three additional months without repaying the initiation fee.

The cancellation policy of the monthly contract deserves further attention. While the policy involves a monthly deadline for cancellation (the 10th of the month), the members may not know this deadline, or simply assume that they can cancel "at any time." We investigate this issue that proves to be important (Section 3.4.1). Since it was not feasible to survey members of the three clubs in our sample, we collected data from random consumers in a mall in California. 48 consumers who stated that they attended a health club completed a survey (Appendix D). Out of these, the 32 individuals who indicated a monthly membership were then asked by which day they have to cancel 'in order to avoid paying the next monthly fee.' Only one provided a date. The others stated that they did not know the answer or reported "cancellation any time (30 days in advance)." A follow-up with the health clubs revealed that for 20 out of 27 individuals (whom we could match to a health club), the clubs had a cancellation policy with monthly deadlines. Therefore, out of 20 individuals enrolled in 15 different clubs with monthly deadlines, only one knew the relevant date. Building on this evidence, we will assume that the typical individual is uncertain about the monthly deadline for cancellation.

3 A model

3.1 Setup

In this Section we provide a simple model of health club usage. We assume that the consumers have the same contractual choices as in the three clubs in the sample. We consider both the attendance decisions and the contractual choices over time. This Section highlights six testable predictions with a minimal use of formalism. A detailed formalization of consumer behavior is presented in Appendix A.

Contractual menu. We assume that the firm (health club) offers the choice between flat-fee contracts and pay-per-visit contracts. We define a contract as a 4-tuple (T', L', p', k'). T' is the contractual duration in days. L' is a lump-sum fee that the user pays for the contractual length T'. The parameter p' is the price per health club attendance. Finally, k' is a transaction cost that the agent pays if, at the end of the T' periods, she switches to a pay-per-visit contract.

Under a flat-fee contract consumers pay a fee $L' = L > 0$ to sign up for T' periods, and can then attend at no additional price in each of the T' periods ($p' = 0$). We call a contract with T' equal to 30 days a *monthly contract*, and a contract with T' equal to 360 an *annual contract*. Under a *pay-per-visit contract*, consumers pay no flat fee ($L' = 0$) and a price $p' = p > 0$ for each attendance during the T' periods. After the T' days of enrollment, consumers choose again from the contractual menu.[11] We assume that consumers pay a transaction cost $k' = k > 0$ to switch from the monthly contract to the pay-per-visit contract. All other transitions are

[11] We model the cancellation of a flat-rate membership as switching to a pay-per-visit contract, since the agents can always attend at price p.

costless. This captures the observed difference in the renewal default between the monthly and the annual contract.[12]

The timing is as in Figure 1. At time 0, the consumers choose between a flat-rate (monthly or annual) and a pay-per-visit contract. They pay the lump-sum fee L' at $t = 1$ and have the option at $t = 1, ..., T'$ to attend the health club or to pursue her best alternative activity. If they attend at time t, they pay the fee p' at time t. At $t = T'$, the agents choose again between the different contracts, with the lump-sum fee L' due at $T' + 1$, and so on.

Payoffs of attendance. If the agents attend the health club at time t they incur an immediate cost c at time t and reap benefits $b > 0$ at time $t + 1$. If the agents do not attend, they receive payoffs from the best alternative activity which, without loss of generality, we normalize to 0. We interpret c as the effort cost and b as the net present value of all the future benefits from better health and improved fitness. We assume that health club attendance is an experience good with ex-ante uncertain attendance costs c. The costs of attendance have distribution G, and the value of c is realized after sign-up and is constant thereafter. In Appendix A we solve a more general model where we allow for both transitory shocks, such as a busy work schedule or family engagements, and for persistent differences in the cost of attendance, such as a different value of time. In the generalization we also allow for heterogeneity across agents at sign-up.

Intertemporal preferences. We assume that agents have quasi-hyperbolic preferences (Phelps and Pollak 1968, Laibson 1997, O'Donoghue and Rabin 1999). The discount function for time s, when evaluated at period t, equals 1 for $s = t$ and equals $\beta\delta^{s-t}$ for $s = t+1, t+2, ...$ with $\beta \leq 1$. The present value of a flow of future utilities $(u_s)_{s \geq t}$ as of time t is

$$u_t + \beta \sum_{s=t+1}^{\infty} \delta^{s-t} u_s. \tag{1}$$

We can interpret β as the parameter of short-run discounting and δ as the parameter of long-run discounting. The standard *time-consistent exponential* model corresponds to the case where β is equal to 1. If β is smaller than 1, the individual exhibits time-varying discounting. The discount factor between the present period and the next period is $\beta\delta$, while the discount factor between any two periods in the future is simply δ. The difference between the short-run and the long-run discount factors generates *time inconsistency.*

We allow for consumers who overestimate their time consistency. A *partially naive hyperbolic* agent with parameters $(\beta, \hat{\beta}, \delta)$ (O'Donoghue and Rabin, 2001) expects (erroneously) to have the discount function $1, \hat{\beta}\delta, \hat{\beta}\delta^2, ...$ with $\beta \leq \hat{\beta} \leq 1$ in all future periods. The individual

[12] For simplicity, we neglect the small transition cost of switching from an annual contract to another flat-rate contract, or from a monthly contract to an annual contract, that is, the cost of writing a check or providing a credit card number to a staff member. Predictions 1 to 6 are essentially unaffected by the introduction of these additional costs.

therefore correctly anticipates that she will have hyperbolic preferences in the future, but she overestimates the future parameter of short-run discounting if $\beta < \hat{\beta}$. The difference between the perceived and actual future short-run discount factor $\hat{\beta} - \beta$ reflects the *overconfidence* about future self-control.

Three special cases deserve mention. An *exponential* agent has time-consistent preferences ($\beta = 1$) and is aware of it ($\hat{\beta} = 1$). A *sophisticated* agent has time-inconsistent preferences ($\beta < 1$) and is aware of it ($\hat{\beta} = \beta$). A fully *naive* agent has time-inconsistent preferences ($\beta < 1$), but is completely unaware of it ($\hat{\beta} = 1$). She believes that she will behave like a time-consistent agent in the future.

The time-consistent agent is clearly the agent most often encountered in economic models, so we take her to be the null. Given the experimental evidence on time preferences and overconfidence, we consider a partially naive hyperbolic agent to be the most plausible alternative to test against the null. Therefore we will go into some detail about the predicted behavior if consumers are partially naive hyperbolics with time preferences $(\beta, \hat{\beta}, \delta)$.

3.2 Attendance decision

When the agent enrolls in the health club at $t = 0$, she assigns discounted net utility $\beta\delta^t(\delta b - p - c)$ to attendance at time t, and utility 0 to the best alternative activity. Thus, she would like to attend in a future period t, upon learning c, whenever $c \leq \delta b - p$.

A *time-inconsistent* agent, though, will attend less often than she wishes. At the moment of deciding whether to attend, the discounted payoff of attendance is $\beta\delta b - p - c$. Therefore, at each t she attends only if $c \leq \beta\delta b - p$, i.e., with probability $G(\beta\delta b - p)$. The smaller is β, the larger is the difference between desired and actual attendance probability $G(\delta b - p) - G(\beta\delta b - p)$ and the more serious is the time inconsistency. This difference is zero for individuals with time-consistent preferences ($\beta = 1$).

A partially naive hyperbolic individual with $\beta < \hat{\beta}$ is not fully aware of her time inconsistency. At time 0 she overestimates the probability with which she will attend in future periods. She expects to attend if $c \leq \hat{\beta}\delta b - p$, i.e., with probability $G(\hat{\beta}\delta b - p)$. The larger is the difference $\hat{\beta} - \beta$, the large is the overestimation of the future attendance probability $G(\hat{\beta}\delta b - p) - G(\beta\delta b - p) \geq 0$. Time-consistent ($\beta = \hat{\beta} = 1$) and sophisticated agents ($\beta = \hat{\beta} < 1$) have rational expectations about their future time preferences and therefore do not overestimate future attendance.

3.3 Contractual choice at enrollment

Consider a consumer with preferences $(\beta, \hat{\beta}, \delta)$ who signs a contract (T', L', p', k') at $t = 0$. To simplify, assume that all transaction costs are zero. Over the next T'periods, the agent expects to attain the net benefit

$$\beta\delta\left[-L' + \frac{1-\delta^{T'}}{1-\delta}\int_{-\infty}^{\hat{\beta}\delta b - p'}(\delta b - p' - c)dG(c)\right]. \tag{2}$$

The agent pays a fee L', independently of attendance, and she attains utility $\beta\delta^t(\delta b - p' - c)$ from attending at time t, with $1 \leq t \leq T'$. As of time 0, the agent expects to attend whenever $c \leq \hat{\beta}\delta b - p'$, hence the integral.

Using expression (2) it is easy to show that at $t = 0$ an agent with time preferences $(\beta, \hat{\beta}, \delta)$ prefers a flat-rate contract $(T', L, 0, 0)$ to a pay-per-visit contract $(T', 0, p, 0)$ if

$$L \leq \frac{1-\delta^{T'}}{1-\delta}\left[\int_{-\infty}^{\hat{\beta}\delta b - p} pdG(c) + \int_{\hat{\beta}\delta b - p}^{\hat{\beta}\delta b}(\delta b - c)dG(c) + \int_{\hat{\beta}\delta b}^{\infty} 0dG(c)\right]. \tag{3}$$

In absence of transaction costs, the dynamic maximization collapses to a simple contractual comparison over the T' periods of contractual duration. The flat fee L—left-hand side of (3)—must be smaller than the willingness to pay for the flat-fee contract—right-hand side of (3). The latter willingness to pay for contract can be decomposed in three parts. First, whenever the net value per visit is high ($c \leq \hat{\beta}\delta b - p$), the consumer expects to attend regardless of whether she has to pay a price p (in the pay-per-visit contract) or not (in the flat-rare contract). In this case she is willing to pay $\min(\delta b - c, p) = p$, the price of one visit under the pay-per-visit scheme. Second, whenever the value of the visits is positive but lower ($\hat{\beta}\delta b - p \leq c < \hat{\beta}\delta b$), the user attends only if $p = 0$, i.e., under the flat-rate contract. In this case she is willing to pay up to the net long-run value ($\delta b - c$), since the pay-per-visit contract would not guarantee any such visit. Finally, for low value of visits ($c > \hat{\beta}\delta b$), the user attends under neither contract, and her willingness to pay is zero.

Using (3) and inequality $\int_{\hat{\beta}\delta b - p}^{\hat{\beta}\delta b}(\delta b - c)dG(c) \leq \left[(1-\hat{\beta})\delta b + p\right] \cdot \left[G(\hat{\beta}\delta b) - G(\hat{\beta}\delta b - p)\right]$, we prove the following Proposition.

Proposition 1. *Assume that an agent with time preferences $(\beta, \hat{\beta}, \delta)$ prefers a flat-rate contract over a pay-per-visit contract at $t = 0$. Then the fee L for the flat-rate contract must satisfy*

$$\begin{aligned}\frac{(1-\delta)\,T'}{1-\delta^{T'}}L \quad &\leq \quad p \cdot T'G(\beta\delta b) \\ &\quad +(1-\hat{\beta})\delta b \cdot T'\left[G(\hat{\beta}\delta b) - G(\hat{\beta}\delta b - p)\right] \\ &\quad +p \cdot T'\left[G(\hat{\beta}\delta b) - G(\beta\delta b)\right]\end{aligned} \tag{4}$$

For an agent with standard *time-consistent* preferences ($\beta = \hat{\beta} = 1$) expression (4) reduces to $\frac{(1-\delta)T'}{1-\delta^{T'}}L \leq p \cdot T'G(\beta\delta b)$. The time-consistent agent chooses the flat-fee contract at $t = 0$ only if the fee L, adjusted for discounting, is smaller than p times the expected number of attendances under the flat-rate contract, $T'G(\beta\delta b)$. In other words, a time-consistent agent is willing to pay per expected attendance at most p, the price she would pay under the pay-per-visit contract. The adjustment term $\frac{(1-\delta)T'}{1-\delta^{T'}}$ derives from the fact that the fee L is paid up-front at $t = 1$, while the price p is paid between periods 1 and T'.

A time-inconsistent agent may instead pay more than p for two distinct reasons. To the extent that she is *sophisticated* ($\hat{\beta} < 1$), she values the flat-rate contract as a commitment device to overcome her short-run impatience. The second term in (4) is the price that the consumer is willing to pay for this commitment: $(1 - \hat{\beta})\delta b$ is the additional utility of each extra attendance on top of the utility for the future impatient self. This term multiplies the expected increase in attendance $T'[G(\hat{\beta}\delta b) - G(\hat{\beta}\delta b - p)]$ induced by the zero per-visit price.

Second, to the extent that the agent is *naive* about the future time preferences ($\beta < \hat{\beta}$), she believes that she will attend more than she actually does. She overestimates the number of attendances under the flat-rate contract by the amount $T'[G(\hat{\beta}\delta b) - G(\beta\delta b)]$. Therefore, her additional willingness to pay (relative to a time-consistent agent) equals the overestimation of attendance times the willingness to pay for an attendance, p.

Proposition 1 implies the following testable prediction.

Prediction 1. (Price per expected attendance at enrollment) *If the agents have time-consistent preferences ($\beta = \hat{\beta} = 1$), the ratio of the flat rate adjusted for discounting, $\frac{(1-\delta)T'}{1-\delta^{T'}}L$, and of the expected attendance under the flat-rate contract, $T'G(\beta\delta b)$, is smaller than the price of a visit p under the pay-per-visit contract. The opposite is true for time-inconsistent agents if $(1 - \beta)$ is sufficiently large.*

Prediction 1 allows us to test the null hypothesis of time-consistent preferences against the alternative hypothesis of time-inconsistent preferences. The fees L and p are observable and the expected attendance can be estimated by the sample average attendance for users enrolled in a flat-rate contract. In Appendix A we generalize Prediction 1 to allow for initiation fees, transaction costs, and heterogeneity in costs among agents. Since initiation fees and cancellation costs make a flat-rate contract less attractive, neglecting them as in Prediction 1 biases the test in favor of the null hypothesis.

This test of time consistency is conservative for two reasons. First, expression (4) is only a necessary condition for the agent to choose the flat-rate contract over the payment per visit. The original necessary and sufficient condition (3) implies that with some probability the net benefit of attendance $\delta b - c$ is smaller than p, and in these cases the agent is only willing to pay $\delta b - c < p$ per attendance. Because of the low value of these attendances, the price per expected attendance should be strictly smaller than p for time-consistent agents.

Second, inequality (3) specifies only a threshold for the choice of a flat-rate contract. For most individuals this threshold is not binding. For example, health club addicts attend so frequently that the threshold for them is trivially satisfied, even if they overestimate attendance or would like to commit to attend (even) more. Ideally, we would like to test Prediction 1 on the marginal individual for which (3) is satisfied with (almost) strict inequality. Therefore, in the empirical test we will focus on unsubsidized users that pay a higher fee L.

3.4 Contractual choice over time

3.4.1 Switching decision

In Prediction 1, we use the initial contractual choice to distinguish between time-consistent and time-inconsistent preferences. We now use the contractual choice over time to distinguish the assumption of rational expectations about the time preferences (exponential or sophisticated agents) from the assumption of overconfidence (naiveté). This section builds on Akerlof (1991) and O'Donoghue and Rabin (2001).[13]

We rely on the difference in cancellation defaults between the two flat-rate contracts in the health clubs of our study. The monthly contract requires a small effort—sending a letter, cancelling in person—in order to discontinue the membership (formally, to switch to payment per visit). We model this as positive transaction costs for cancellation, $k' = k > 0$. The annual contract, instead, automatically expires, and cancellation requires no effort ($k' = 0$). As the following calibrations show, the small difference in cancellation cost can have a sizeable impact.

Consider an agent enrolled in a monthly contract who would save s dollars per day by switching to the pay-per-visit contract. Assume a cancellation cost k of \$15 (the time cost of writing a cancellation letter), a daily δ of .9998 (corresponding to a yearly discount factor of .93) and a short-term discount factor β equal to .7.[14] A time-consistent agent switches immediately if the present transaction costs are smaller than the future discounted gain from switching, i.e., if $k < \delta s/(1-\delta)$. For the calibrated values, switching occurs if $s > (1-\delta)k/\delta \approx .3$ cents per day or 9 cents per month. The very low threshold value reflects the fact that the costs of switching are born only once while the benefits are received forever.

A sophisticated agent may delay switching for a finite period of time. Each self would like to delegate quitting to a later self, but prefers immediate quitting if cancellation would otherwise be postponed for too long. Proposition A.1 in Appendix A gives an upper bound t_C on the delay in switching. Using the approximation $\left(1-\delta^{t_C}\right)/(1-\delta) \approx t_C$, we obtain $t_C \lessapprox k(1-\beta\delta^{t_C})/\beta\delta s \approx 6.6/s$. A sophisticated agent who is losing 20 cents per day ($s = .2$) or \$6 per month (one tenth of the average monthly fee) by not switching is willing to wait at most 33 days to cancel. An agent who loses more is even less willing to wait. Sophisticated

[13] O'Donoghue and Rabin (2001) show that partially naive agents are similar to fully naive agents in their delaying behavior. We omit this case for brevity.

[14] Angeletos et al. (2001) and Paserman (2001) calibrate the hyperbolic model on field data and find values of β between .5 and .9. The results of the calibrations are similar for the ranges $k \in [\$5, \$20]$, $\delta^{365} \in [.90, .98]$, $\beta \in [.5, .9]$.

agents, even if they have time-inconsistent preferences, recognize the presence of very large long-term gains from switching, and therefore switch almost immediately.

A naive agent may delay switching forever in presence of even small cancellation costs. She believes that her future selves will be exponential. She incorrectly expects that the future self in T periods will switch if $k < \delta s/(1-\delta)$. If this inequality holds, the agent compares switching immediately to switching in T periods. She prefers switching immediately if $k < \beta\delta^T k + \beta\delta s(1-\delta^T)/(1-\delta)$, or $k \lessapprox \beta\delta T s/(1-\beta\delta^T)$.[15] If the latter condition does not hold, the naive agent postpones switching for T periods. Once the T periods are over, however, the agent goes through the same reasoning, and postpones the decision for T more periods, and so on every T periods. To calibrate the likelihood of delay for a naive agent, we build on the survey evidence presented in Section 2 and assume $T = 1$, i.e., that the user has a uniform prior over the monthly deadline.[16] The naive agent switches if $s \gtrapprox k(1-\beta\delta^T)/\beta\delta T \approx \$6.6$ or, equivalently, if the monthly gain from switching is at least \$192. A naive agent enrolled under the monthly contract therefore delays cancellation forever for all plausible levels of s. Under the annual contract, instead, the naive agent does not delay, since switching is costless ($k = 0$).

The following prediction on the delay of cancellation summarizes the discussion in this Section.

Prediction 2. (Cancellation lags) *If the agents have rational expectations about their time preferences ($\beta = \hat{\beta}$), non-attenders cancel the monthly contract (almost) immediately. If the agents have naive expectations ($\beta < \hat{\beta}$), we should observe sizeable periods of enrollment with no attendance under the monthly contract*

3.4.2 Survival probability

An alternative way to test for naiveté is the comparison of the renewal behavior for agents enrolled under the annual and under the monthly contract. Since the two contracts have different contractual durations, we measure renewal at a time when both contracts are up for renewal, i.e., after 12 or 24 months. We define the survival probability $S_{j,t}$ as the share of consumers who initially enrolled in contract j and are still enrolled with a flat-rate contract after t months rather than switching to paying per visit.

Consider first the case of rational expectations. If the users were initially randomly assigned to either the monthly or the annual contract, we would expect essentially the same survival probability under the two contracts. Given that learning over time is presumably similar under the monthly and annual contract, the same percentage of users should be choosing to continue

[15] Once again, we used the approximation $\left(1-\delta^T\right)/\left(1-\delta\right) \approx T$.

[16] If the agent knows the monthly deadline ($T = 30$), delay occurs if the monthly gain from switching is at most \$6.6. We therefore predict that agents with small gains from cancellation would delay, even if they know the monthly deadline.

with a flat-rate contract. The different renewal defaults should have only a small impact.

In reality, however, individuals are not randomly assigned to the annual and monthly contract. Rather, agents are heterogeneous in their expectations about their own future attendance and sort into the monthly and the annual contract accordingly. Users who anticipate a high likelihood of not attending the health club in the future prefer the monthly contract. These users value highly the option to switch sooner to payment per visit. Users who, instead, believe that they will be high-attenders prefer the annual contract. These users value the reduced price of this membership and do not mind the yearly commitment. Sorting therefore implies that the users selected into the annual contract are ex-post more likely to be frequent users, and therefore more likely to renew with a flat-rate contract. The survival probability at t months should be higher for the annual than for the monthly contract: $S_{A,t} > S_{M,t}$ for $t = 12, 24$. (Proposition A.3 in Appendix A formalizes the sorting result).

Consider now the case of partial naiveté. If the agents overestimate their future patience, an additional force determines the two survival probabilities. As we saw in Section 3.4, naive users delay switching to the pay-per-visit contract from the monthly contract, but not from the annual contract. If the delay is strong enough to override sorting effects, the survival probability should be higher for the monthly contract: $S_{M,t} > S_{A,t}$ for $t = 12, 24$.

Prediction 3. (Survival probability) *If agents have rational expectations ($\beta = \hat{\beta} \leq 1$), the survival probability after one and after two years is higher for agents who initially chose the annual membership than for agents who initially chose the monthly membership: $S_{A,t} > S_{M,t}$, for $t = 12,\ 24$. If agents are naive ($\beta < \hat{\beta} = 1$) and if $1 - \beta$ is sufficiently large, the reverse holds: $S_{A,t} < S_{M,t}$ for $t = 12,\ 24$.*

Prediction 3 concerns the aggregate survival probability. In order to make the prediction on survival probability more precise, we would need to control for consumer heterogeneity and condition the survival probability on the cost of attendance c. While c is unobservable, attendance in the months previous to the 12^{th} month is a noisy proxy for the cost of attendance c.[17] Denote by $S_{j,t}(v)$ the survival probability of contract j at time t conditional on attendance v.

Prediction 4. (Survival probability as a function of attendance) *If the agents have rational expectations ($\beta = \hat{\beta} \leq 1$), the survival probability after one and after two years is higher for agents who initially chose the annual membership than for agents who initially chose the monthly membership at all levels of past visits v: $S_{A,t}(v) > S_{M,t}(v)$ for all v, $t = 12$,*

[17] Formally, we are assuming that the distribution of the past visits conditional on the costs c does not depend on the contract chosen. This condition is likely to be satisfied, since the monthly and the annual contract have the same (zero) per-visit price.

24. *If the agents are naive* ($\beta < \hat{\beta} = 1$) *and if* $1 - \beta$ *is sufficiently large, the reverse holds,* : $S_{A,t}(v) < S_{M,t}(v)$ *for all* v, $t = 12$, 24.

For agents with rational expectations, sorting is the key to Prediction 4 (Figure 2a). Users with low expected cost sort into the annual contract. Therefore, given that v is only a noisy proxy for the cost c, annual users are more likely to be low-cost types than monthly user with the same attendance v. Therefore, the survival probability is uniformly higher for the monthly contract than for the annual contract.

For naive agents, delay in cancellation drives the results (Figure 2b). Naive agents delay cancellation under the monthly but not under the annual contract. Therefore the survival probability for the monthly contract is higher. In addition, to the extent that the survival probability for the annual contract is increasing in past attendance v, the difference between $S_{M,12}(v)$ and $S_{A,12}(v)$ is maximal for low values of v.

Consider now a setting where a fraction of the agents is naive and a fraction is not (Figure 2c). The survival probability for the heterogeneous population is a convex combination of the survival probabilities for agents with rational expectations (Figure 2a) and for naive agents (Figure 2b). In this case, the sorting and the delay effect combine to determine the survival probability. If the proportion of naives is sufficiently large, we expect $S_{M,t}(v) \geq S_{A,t}(v)$ at least for low levels of attendance v. At these levels, the delay effect is stronger since more users have high costs of attendance and intend to quit. At high levels of attendance, few agents want to switch to the pay-per-visit contract and the sorting effect is likely to dominate.

In sum, the null hypothesis of rational expectations implies $S_{A,t}(v) \geq S_{M,t}(v)$ for all levels of past attendance v. The alternative hypothesis that naive agents are a large portion of the population implies $S_{A,t}(v) < S_{M,t}(v)$ at least for low levels of past attendance v.

3.4.3 Attendance over time

In this Section we present a third testable implication of overconfidence (naiveté) on consumer choices over time. We consider the dynamics of attendance for individuals enrolled in flat-rate contracts.

So far, we have assumed that consumers are initially uncertain about their (effort) cost of attendance, and that they learn it immediately after sign-up. In Appendix A, we make the more realistic assumption that people learn their type slowly over time. In either case, these assumptions are capturing the fact that, as time goes by, users learn about the effort of commuting to the club and the enjoyment of exercising. This learning effect implies a certain pattern for renewal. Only the users who have experienced a low cost of exercising attend frequently enough to justify the renewal with a flat-rate contract. The others find it preferable to switch to a pay-per-visit contract. Learning therefore generates selective exit of individuals with ex-post low attendance patterns.

Consider the implications for individuals initially enrolled in an annual contract. Define as stayers agents who do not switch to a pay-per-visit contract. The expected attendance for stayers in the second year should be higher than for the initial group in the first year, since the low-attenders have switched to paying per visit.[18] Since exit from the annual contract into a pay-per-visit contract requires no cost, we expect the same pattern for both agents with rational expectations and naive agents.

Prediction 5. (Expected attendance over time for annual contract) *Among users initially enrolled in the annual contract, the expected attendance in the second year among stayers is higher than the expected attendance in the first year for the initial group.*

While the dynamics of attendance in the annual contract does not depend on naiveté, the dynamics in the monthly contract does. Agents with rational expectations behave as under the annual contract. As low-attenders quit, the average attendance for stayers increases over time. The only difference relative to the annual contract is that the average attendance increases from month to month since users are allowed to quit in any month. Naive agents, instead, delay cancellation in the monthly contract. Since there is no selective exit, expected attendance among stayers need not increase over time. In fact, if negative shocks are more common than positive shocks[19], average attendance decreases over time.

Prediction 6. (Expected attendance over time for monthly contract) *Consider users initially enrolled in a monthly contract. If agents have rational expectations ($\beta = \hat{\beta} \leq 1$), expected attendance among stayers should increase from month to month. If agents are partially naive ($\beta < \hat{\beta}$), expected attendance should not increase over time.*

3.5 Summary

The model outlined in this Section enabled us to formulate six predictions. Prediction 1 provides a test of time consistency. If the price per expected attendance in the early periods is higher than the price under the per-visit scheme, we reject the null hypothesis of time consistency in favor of the alternative hypothesis of time inconsistency. Time-inconsistent individuals are either purchasing a commitment device that increases their attendance, or are paying for the overconfidence about their future attendance. Predictions 2, 3, 4 and 6 allow us to distinguish between these two interpretations. If the members in the monthly contract accumulate a substantial gap between last attendance and cancellation (Prediction 2), if the survival probability is higher for the monthly contract than for the annual contract

[18]The pattern of average attendance within each year, instead, depends on the type of shocks.

[19]This is the case if the process for the cost of attendance is mean reverting. The agents select into the flat-rate contract when they have a very low realization of costs which then reverts to the mean.

(Predictions 3 and 4), and if expected attendance does not increase over time for the monthly contract (Prediction 6), we are lead to reject the assumption of sophistication in favor of the assumption of partial overconfidence (naiveté). The above predictions, therefore, allow us to test for both time inconsistency and sophistication about the time inconsistency. Finally, Prediction 5 allows us to test the hypothesis that agents learn over time.

4 Empirical test

In this section, we introduce the health club data set and test Predictions 1 to 6. Additional information on the data set construction is available in Appendix B.

4.1 The data set

We collected a new panel data set from three health clubs located in New England, which we label clubs 1, 2, and 3. The data set contains information on the contractual choices and the day-to-day attendance of users that enrolled after April 1, 1997. The sample period lasts until August 24, 2000 for club 1 and until March 13, 2001 for clubs 2 and 3. The day-to-day record of usage is made available by the technology regulating the access to these health clubs. Users have to deposit their membership cards in a basket at the front desk when they enter. While they are exercising, a health club employee swipes the cards, and users pick them up when they exit. This method guarantees a high recording precision even during peak hours. We construct the panel of contractual choices from the billing records. Each entry in the accounting data specifies the price paid for the transaction and a 4-letter code. This code allows us to track the membership type—standard, student, family, corporate—as well as details like the subsidizing company (if any).

In these clubs corporate employees account for a substantial part of the members. Several companies located near the clubs subsidize the attendance of their employees. The health club receives part of the membership payments directly from the firms, with the remainder being paid by the members. The health club informs the companies periodically about the number of employees enrolled and their attendance. This creates incentives for the health club to record attendances accurately or, possibly, to overrecord them.

Contractual menu. Consumers in clubs 1 and 2 choose between monthly, annual, and pay-per-visit contracts, with the features presented in Section 2.[20] In the monthly contract, non-corporate users pay an initiation fee ranging from \$0 (in promotional periods) to \$150 and a monthly fee between \$55 and \$85, depending on the applicability of a discount. Corporate

[20]Contracts for one to six months with automatic expiration are also available. We do not include them in our analysis, since they are typically targeted towards occasional summer users. We also remove from the sample free limited-time memberships that are occasionally given to employees of the subsidizing companies.

users generally pay no initiation fee and an out-of-pocket monthly fee ranging between $19 and $65, as a function of the subsidy paid by their company. Users who choose the annual contract pay up-front 10 times the applicable monthly fee. The initiation fee is the same as under the corresponding monthly contract. Finally, users can pay $12 per visit or purchase a 10-visit pass for $100. Unfortunately, attendance is not tracked for the pay-per-visit users.

In club 3 users face the same menu of contracts with lower prices and slightly different services. The monthly fee ranges from $13 to $52, and the initiation fee is at most $50. The annual fee in the annual contract equals 10 times the corresponding monthly fee. The pay-per-visit options are a $10 fee per visit, and a $80 pass for 10 visits. Finally, the enrollment in a monthly or an annual contract does not include the provision of towels.

Sample construction. We match the information on attendance and on contract choice in the three clubs to form a longitudinal data set with monthly observations, covering the period from April 1997 to August 2000 (club 1) and to March 2001 (clubs 2 and 3). Our analysis focuses on *enrollment spells*. A spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits. We define spells to be censored if either the enrollment is ongoing at the end of the sample period, or the individual switches to a short-term contract or receives a promotional membership. Individuals have multiple spells if they quit the club and re-enroll at some later date.

The initial sample includes 11,605 individuals. We drop individuals who were never enrolled in either a monthly or an annual contract (2,978 individuals). We eliminate spells with serious inconsistency in the billing data (132 spells). We also exclude users with a family membership to avoid issues regarding the joint consumption of the services (295 spells).[21] Finally, in order to match the theoretical model for inexperienced users, we drop users who had a free or a seasonal membership before they chose a monthly or an annual contract (293 individuals).

Enrollment spells. This leaves us with a sample of 7,978 individuals and 8,615 enrollment spells. In the paper, we use the sample 'First Spell', which includes only the first enrollment spell for each individual. As the Columns 1 to 3 of Table 3 show, Club 1 has 19 percent more members than club 2, and more than twice as many members as club 3. The percentage of completed spells (above 60 percent) and the number of switches between flat-rate contracts with different prices (around 20 percent) is similar across the clubs. Health club members rarely change the type of contract they initially enroll in. The mean duration of a spell, including censored spells, is higher in club 1 than in the other clubs. Of the 7,978 individuals enrolled in any club, 7,079 choose a monthly membership (Column 5) and 899 choose an annual membership (Column 6) as their first contract.

In Columns 7 to 8 we present the same summary statistics for the sample 'First spell and no subsidy.' This sample is a restriction of the sample 'First Spell' to unsubsidized memberships. We consider a membership to be unsubsidized if, over the whole spell, the average out-of-pocket

[21]The empirical results in this paper replicate in the (small) sample of family memberships.

fee exceeds \$70 per month for enrollment in a monthly membership and \$700 per year (\$58 per month) for enrollment in an annual membership. The 1,120 spells in this sample (14.03 percent of the full sample) exhibit a longer average duration than spells in the larger sample.

Descriptive statistics. The top part of Table 4 summarizes additional descriptive statistics. In clubs 1 and 2, the average amount of money spent per spell is about \$550, and the average fee per month ranges between \$43 and \$53. For corporate users, these are the out-of-pocket payments for the individuals and do not include the subsidies paid by the sponsoring firms. In club 3 these amounts are substantially lower, since the contracts are cheaper. In the sample of individuals with no subsidy (Columns 7 and 8), these amounts are twenty to sixty percent higher. The initiation fee averages \$4 in the sample 'First spell' and \$14 in the sample 'First Spell and no subsidy' since a large majority of users pay no initiation fee (86 percent in the unsubsidized sample). In the 'First Spell' sample, individuals who enroll in a monthly contract attend on average 4 times per month, and individuals who enroll in an annual contract attend on average 4.3 times per month. Attendance in club 1 (Column 1) is somewhat higher than in the other clubs. Freezing of a contract is rare in all the clubs. The bottom part of Table 4 displays the available demographic controls for all the clubs. Users are somewhat more likely to be male than female and are on average in the early thirties. Corporate memberships account for 50 percent of the sample, while student memberships account for only 2 percent.

4.2 Contract choice at enrollment

We test Prediction 1 using the sample of users enrolled in an unsubsidized flat-rate membership in clubs 1 and 2. We analyze separately users in club 3 given the lower fee per visit. If users are time-consistent, the price per expected attendance should be smaller than the per-visit price p (Section 3.3). We consider the 10-visit pass to be the empirical counterpart of the pay-per-visit contract, so $p = \$10$.[22]

Monthly contract. For users initially enrolled in a monthly contract, we compute the price per expected attendance separately for each month. We limit the analysis to the first six months of tenure to target inexperienced users. We use the sample 'First spell and no subsidy' to ensure comparability to standard health clubs with no corporate subsidy and to maximize the power of the test.[23] The sample consists of 912 spells, 12.9 percent of the spells starting with a monthly contract.

The first Column in Table 5 reports the average monthly fee in the t^{th} month of tenure, with standards errors in parentheses. The sample for month t consists of users who initially enrolled

[22] Given the distribution of attendance for users enrolled with the monthly and the annual contract, the average price per average attendance from using the 10-visit pass is \$10.86. The benefits of a lower price relative to the \$12 per-visit fee outweigh the losses from unused coupons.

[23] Given the high monthly fee, the users who choose the monthly contract are more likely to be close to the threshold in (3).

in a monthly contract and have had a continuous history of membership under either a monthly or an annual contract until month t included. Consumers who cancel or are censored drop out of the sample. For users who switch to an annual contract, the monthly fee is the monthly share of the annual fee. We find that the average monthly fee exceeds \$80 in all months, except in the joining month which is typically pro-rated, and in month 3, a promotional free month for 18.6 percent of the sample. The average number of visits for users in the t^{th} month of tenure (Column 2) declines from 5.45 in month 2 to 4.32 in month 6 (again, month 1 covers only part of a month).

The third Column in Table 5 presents the ratio of the average fee in month t (Column 1) and the average attendance in month t (Column 2). This ratio is the estimated price per expected attendance for month t. The estimate ranges between \$14 and \$16 in the first three months and is higher than \$17 in the subsequent three months. In each of the six months we reject the hypothesis that the measure is smaller than \$10. As a summary measure, we compute the ratio of average monthly payment (Column 1) and average monthly attendance (Column 2) in the first six months across all individuals.[24] The resulting price per average attendance in the first six months of enrollment equals \$17.13, well above \$10.

In addition to averages, we consider also the distribution of these measures in the first six months (Table 6). We measure the price per attendance as the ratio of total attendance over total payment in the first six months of membership in a monthly contract. In this sample, only 20 percent of the individuals pay less than \$10 per visit. The remaining 80 percent would have saved money choosing the pay-per-visit contract.

Annual contract. We apply Prediction 1 also to the users that chose an annual contract at enrollment. We restrict the sample 'First spell and no subsidy' to users who joined the club at least 14 month before the end of the sample period. This ensures that we observe the annual contract in its entirety.[25] The final sample consists of 145 spells, 16.12 percent of the sample of spells starting with an annual contract.

The bottom row of Table 5 presents the estimation results. The sample average of the monthly share of the annual fee for the first year (Column 1), adjusted for discounting, is \$71.02.[26] The average number of monthly visits in the first year (Column 2) is 4.68. The resulting price per average attendance (Column 3), \$15.15, is somewhat lower than for the monthly contract but still substantially higher than \$10. The lower estimate is presumably due to the selection of users with high expected attendance into the annual contract, and the

[24]For each individual, we compute the average over all available months until the sixth, with the exception of miscoded months and months with freezing. When averaging across individuals, we weigh all individuals equally, independent of tenure.

[25]We exclude 3 annual contracts that are terminated before the 12th month. Health clubs are required to accept cancellations for medical reasons or for relocation more than 25 miles away from the clubs.

[26]Given a daily discount factor δ of .9998, the adjustment term $T(1-\delta)/\left(1-\delta^{T}\right)$ equals 1.037, reflecting the forgone interest from paying the fee at sign-up instead of continuously throughout the year.

lower fee of the annual contract. Table 6 shows the distribution across users of attendance and of the price per attendance in the first year of an annual membership. Only 24 percent pays less than \$10 per visit.

Stylized fact 1. (Price per expected attendance at enrollment) *Users who choose an unsubsidized flat-rate contract pay a price per average attendance of over \$17 in the monthly contract and over \$15 in the annual contract. The share of users who pay ex post less than \$10 per visit is 20 percent in the monthly contract and 24 percent in the annual contract.*

Robustness. So far we have restricted attention to the unsubsidized sample and pooled the results across clubs. We now consider subsidized users as well and disaggregate the results by club.

We compute the average attendance as a function of the individual price. We consider users initially enrolled with a monthly contract within the sample 'First spell.' For each individual, we take the average monthly fee and the average monthly attendance in the first 6 months as measures of the individual price and attendance. For each club, we then do a separate kernel regression of attendance on price using an Epanechnikov kernel. We use cross-validation club-by-club with a grid search to compute the optimal bandwidth for the price.[27]

Figure 3a show the results for club 1. The average monthly attendance from the kernel regression lies between 3 and 5 and is increasing in price, although the estimates are not very smooth given the small bandwidth suggested by the cross-validation. We use the average attendance from the kernel regression to compute the ratio of price and average attendance for each level of price. Figure 3b plots the price per average attendance with 95 percent confidence intervals. The price per average attendance is significantly higher than \$10 for users paying a monthly fee in excess of \$53. The estimates for club 2 are comparable (Figures 3c and 3d) and somewhat smoother given the larger optimal bandwidth. In club 3 the price per average attendance is higher than \$8 for users paying a fee in excess of \$46 (Figure 3f).

Summary. Overall, we observe a robust deviation from the predictions of a model of time-consistent agents. Non-subsidized users enrolled in contracts with flat fees pay a price per average attendance that is significantly higher than the per-visit price available as an alternative contract. The result is robust to the type of contract (monthly or annual), the sample (the amount of subsidy), and the club considered. The deviations from the predictions for time-consistent agents are large in size: unsubsidized members of a monthly contract pay 70 percent in excess of the \$10 fee.

The model in Section 3.3 suggests two possible explanations for this deviation. First, sophisticated time-inconsistent users ($\beta = \hat{\beta} < 1$) may purchase the monthly contract as a commitment device to increase attendance. Under this interpretation, the inequality (4) and the empirical results imply a lower bound for $(1 - \beta)\delta b \cdot [G(\beta\delta b) - G(\beta\delta b - p)] / G(\beta\delta b)$ of

[27] Pagan and Ullah (1999), pp. 110–120.

$\$17 - \$10 = \$7$. In turn, this implies $(1 - \beta)\delta b \geq \$7$. Second, users may be naive about their time inconsistency ($\beta < \hat{\beta} = 1$). Inequality (4) then implies that they overestimate the probability of attending the health club by at least seventy percent. An average attendance of two visits a week, while far from the actual number of visits, is a plausible estimate of the *desired* number of visits: the health club staff encourages members to attend two to three times per week.

Alternative interpretations. Before attempting to tease out these two explanations in the next Section, we consider six alternative interpretations of the empirical findings above.

1. *Transaction costs.* Large transaction costs associated with payment per visit could explain why inexperienced users choose a flat-rate contract even if they expect to attend little. The actual transaction costs, however, appear to be small. Users can purchase a ten-visit pass by filling out a simple form, and can then enter the club for ten visits with the same procedure as users with a monthly or annual contract. A transaction-cost-based explanation requires a time cost of over \$70 for the few minutes necessary to fill out the form. A high distaste for payment per visit (Thaler, 1999; Loewenstein and Prelec, 1998) could explain the findings.

2. *Risk aversion.* Assume a utility function that is additively separable in income and health club net benefits. Users that are risk averse in income may prefer a flat-rate contract to the pay-per-visit contract because the former contract minimizes the variance of the payments.[28] This effect, however, should be small for the monthly contract. Over the small amounts of money required for a monthly contract, the agent is locally risk neutral (Rabin, 2001). The price per average attendance, instead, is particularly high for users in the monthly contract.

3. *Underrecording of attendance.* The high price per attendance may reflect underrecording of attendance because of a faulty computer system or moral hazard problems with the staff. Alternatively, the health club employees may simply seek to avoid queues of users waiting to swipe. While these phenomena are common in the industry, they are less likely to occur at the three health clubs in our sample. These clubs, presumably in order to report attendances to the subsidizing corporations, put in place one of the most advanced and reliable systems to track attendance in the industry.[29] Unlike in most clubs, a front-desk employee collects the cards from the members and then does the swiping in a quiet moment. Therefore, card swiping does not generate queues. Nevertheless, to assess the importance of occasional computer lapses or staff laziness, we construct a test of accuracy of the attendance records. For each day we construct the fraction of members of club 1 attending. We regress this measure on a set of controls: 6 day-of-the-week dummies, 11 month dummies, 3 year dummies, and 15 holiday

[28] The result is not robust to the specification of the utility function. Under the assumption that the utility function is a concave function of the sum of income and health club net benefits, the predictions are reversed: more risk-averse agents are more likely to choose the pay-per-visit contract.

[29] In fact, we selected these clubs in part because of the data quality. A dozen of other clubs with which we established preliminary contacts had software or hardware problems in the recording of attendance.

dummies. If these measures predict accurately the share of attendance, computer lapses are unlikely to be significant. Column 1 of Appendix Table 1 shows the results.[30] The R square of the regression is .8785, suggesting that idiosyncratic factors such as computer crashes or staff laziness are unlikely to be large enough to explain the above results. Column 2 shows that the results for clubs 2 and 3 yield an even higher R square.

4. *Additional benefits.* The monthly and annual contracts provide the same benefits as the pay-per-visit system except for the option to rent an overnight locker at an extra fee.[31] If users value this option highly, they may be willing to forgo the monetary savings of paying per visit. In the three clubs, however, only 5.52 percent of the users ever rent a locker. If we exclude these users, the results on price per average attendance for the monthly contract do not vary (first row of Appendix Table 2).

5. *Awareness of pay-per-visit contract.* Another concern is the information of health club users about the pay-per-visit contract. Health club salespeople may emphasize the monthly and annual contract. In order to investigate this possibility, we set up a small experiment. We provided subjects with incentives to choose the appropriate contract similar to those of a median user of health clubs. Each of the subjects had a budget of $90 and had to choose the cheaper option to attend a club under the assumption that he/she would go on average 4 (3 for some)[32] times per month. The subjects could keep whatever they saved out of the $90, in addition to a fixed payment of $15. In order to insure no communication with other subjects, we met each subject individually and at different times. We instructed them to visit club 1 in person, and met them again individually afterwards. The complete instructions are in Appendix C. Of the 11 subjects participating, 7 chose a pay-per-visit option (which was the pay-maximizing choice), while 4 picked the monthly contract. While the majority of subjects did not find it difficult to find out about the pay-per-visit option, it appears that some salespeople were reluctant to mention the pay-per-visit contract. As an alternative test, we consider the contractual choices of a special subgroup of users that are likely to be informed about all the contractual options. Members of an HMO that we label HMO1 can choose between a 20% discount on the flat-rate contracts, or a $6 payment per visit. Presumably, users claiming this discount are aware of both options, since both are explicitly listed on the HMO 1 website. The second row of Appendix Table 2 shows the price data net of the discount for these members. The price per expected attendance over months 1 to 6 for users enrolling with a monthly contract equals $10, well above the $6 price per visit.

[30]The sample includes the days starting from April 1, 1998. We do not use the initial period in which very few individuals are enrolled and therefore the dependent variable is very noisy.

[31]In particular, a 10-visit card gives the same rights to get a towel and a temporary locker, hire a personal trainer, take the (free) aerobic classes and attend in clubs belonging to the same company.

[32]Interestingly, club 1 increased the price of a vist to $20 and the price of a $10-visit-coupon to $150 after this paper was written. To make the choices of subjects comparable to the choices in our sample, we lowered the attendance to 3 visits per month.

6. *Ex-post subsidies.* Some HMOs reimburse members partially for health club expenses upon presentation of a receipt. To the extent that these reimbursements make the annual and the monthly contract cheaper relative to the pay-per-visit contract, they induce users to choose flat-rate contracts. Appendix Table 3 summarizes a survey of the fitness discounts for all the HMOs in the state where the three clubs operate.[33] The reimbursement schemes do not seem to justify the high price per attendance for flat-rate contracts. An additional confirmation comes from the finding in point 5 above for members of HMO 1.

4.3 Contract choice over time

As Section 3.4 suggests, we can use the dynamics of consumer choices to distinguish the two interpretations of the previous findings based on sophistication or on naiveté. We test Prediction 2 on cancellation lags, Prediction 3 and 4 on the survival probability, and Predictions 5 and 6 on attendance over time.

4.3.1 Lags in cancellation

As Prediction 2 suggests, agents with rational expectations who do not attend the club should cancel the membership, given the moderate transaction costs. We compute the number of full months between the last attendance and contract termination for users who hold a monthly contract at the time of termination. For example, if an agent attends the last time on March 10 and cancels on April 5, we count the 51 days between last attendance (March 10) and membership termination (April 30) as *one* full month. We restrict the sample to users who paid no initiation fee.[34]

Stylized fact 2. (Cancellation lags) *On average, 2.29 full months elapse between the last attendance and contract termination for monthly members, with associated membership payments of $185. The gap is at least 4 months for 20 percent of the users.*

Users spend on average $185 in membership fees after their last attendance, even though the transaction costs of cancellation are likely lower than $20 (time cost of sending a letter or visiting the club). While option value calculations may account for this discrepancy, delay of cancellation by naive agents is a more plausible interpretation. Another interpretation is that individuals are overconfident about their future attendance prospects.

[33] We thank Nancy Beaulieu for providing the list of HMOs.

[34] We include users with an unsubsidized membership (monthly fee higher than $70 or annual fee higher than $700) who joined the club before the month of April 1998.

4.3.2 Survival probability

Prediction 3 suggests a formal way to test the hypothesis that individuals delay cancellation under the monthly contract due to naiveté about their time inconsistency. This procedure controls for expectations about future attendance.

Consider first the null hypothesis of rational expectations about the time preferences. The survival probability at months 12 and 24 for agents initially enrolled in a flat-rate contract should be higher for the annual than for the monthly contract: $S_{A,t} > S_{M,t}$, $t = 12, 24$. As discussed in Section 3.4.2, ex-ante sorting drives this result. Individuals who are willing to commit for a year are also more likely to renew the membership ex post.

Under the alternative hypothesis of naiveté about the future time preferences, individuals delay cancellation under the monthly contract which is automatically renewed, but not under the annual contract, which requires explicit renewal. Therefore, if the delay effect is stronger than the sorting effect, the survival probability should be lower for the annual than for the monthly contract, or $S_{A,t} < S_{M,t}$, $t = 12, 24$.

Finally, Prediction 4 suggests that we can refine these predictions using health club attendance as a proxy of the realized cost of attendance.

Sorting. To document the ex ante sorting into the monthly and the annual contract we compare the average number of visits in months 2, 3 and 4 of tenure for individuals initially enrolled in the monthly and in the annual contract.[35] Given that the price per visit p is zero for both contracts, differences in attendance should reflect differences in the expected attendance cost. Column 1 of Table 7 reports the aggregate results for the sample 'First spell.' In each month, expected attendance is higher under the annual than under the monthly contract, and significantly so in months 3 and 4. The difference has the sign predicted by the sorting hypothesis and is rather large: the average attendance in months 2 to 4 is 5.51 under the annual contract and 5.03 under the monthly contract, a difference of 9.5 percent. The magnitude of this difference is comparable to variation in average attendance by age groups and by gender (Table 7). Columns 2 to 9 in Table 7 present the results for age-gender-month cells. In 20 cells out of 24 the average attendance is higher under the annual contract. Thus, even after controlling for some heterogeneity, individuals with lower cost of attendance are more likely to choose the annual contract at enrollment.

Specification. We construct the survival measure s_i as follows. For spells starting with an annual contract, s_i equals 1 if no more than one calendar month elapses between the expiration of the first annual contract[36] and the enrollment of a new monthly or annual contract; s_i

[35] We exclude the first month because attendance is pro-rated over the number of effective days of membership, and the pro-rating procedure is slightly different for the annual and the monthly contract. We do not extend the comparison to months after the fourth since users who experience a high cost can quit under the monthly contract but not under the annual contract.

[36] In 11.5 percent of the cases, the first annual contracts lasts more than 12 months due to promotional months

equals 0 otherwise. For spells starting with a monthly contract, no equally natural definition is available. We err on the side of overstating cancellation in the monthly contract, and set s_i to 1 if the individual is enrolled on the 14th month of active, paid membership, and 0 otherwise.[37] We assume the following simple empirical specification to test Predictions 4 and 5:

$$s_i = 1 \text{ if } s_i^* = \alpha + \gamma M_i + \Phi V_i + \Pi(V_i * M_i) + BX_i + \varepsilon_i \geq 0, \tag{5}$$

where ε_i is normally distributed and M_i is a dummy variably that equals 1 if the first contract for the individual was a monthly contract, and 0 otherwise. The measure of attendance $V_i = [v_i, v_i^2, v_i^3, v_i^4]$ is a quartic in the average monthly attendance over all the available months until the 13th active month. Finally, the vector of controls X includes gender, a quadratic function of age, a dummy for corporate membership, a dummy for student membership, 11 dummies for the month and 4 dummies for the year of enrollment. We use the sample 'First spell' restricted to users who joined the club at least 14 active months before the end of the sample period. We also drop users with missing values of a control variable, as well as spells that are censored before the 14th active month.

Average survival probability. First, to test Prediction 4 we employ a probit specification as in (5) with the coefficients Φ and Π constrained to be zero. Within this specification, the coefficient γ captures the average difference in survival probability between users initially enrolled in a monthly contract and users initially enrolled in an annual contract.

The coefficients in Table 8 are the marginal change in a coefficient in response to an infinitesimal change in the continuous independent variables, and a discrete change for the independent dummy variables. In Column 1 of Table 8 we restrict B to equal zero (no controls). The coefficient γ is positive (Column 1 in Table 8). Enrollment in a monthly contract increases survival by 3.18 percentage point relative to the baseline rate of 39.93 percent survival with the annual contract. The introduction of demographic controls in Column 2 of Table 8 increases the coefficient γ from .0318 to .0509 and to .0514 with dummies for the time of enrollment (Column 3). Despite the fact that the demographic controls available are poor measures of ex-ante expected attendance, controlling for some of the unobserved heterogeneity reduces the downward bias on the coefficient due to sorting and makes the coefficient significantly positive. For example, individuals enrolled with a monthly contract are significantly younger than users with an annual contract (Table 4), and young people are less likely to renew (Columns 2 and 3 of Table 8). Failing to control for age biases downward the coefficient γ.

Stylized fact 3 (Survival probability). *The survival probability after 13 months for the monthly contract is 12.5 percent higher than for the annual contract.*

Survival probability as a function of attendance. We can also analyze the survival

and freezing periods.

[37] We exclude from the count of active months promotional periods, months in which the contract was frozen, and months (up to 3 in a row) in which the agent has temporarily quit the club.

probability as a function of past attendance (Prediction 4) using the full specification in (5) with unrestricted coefficients.[38] The parameter γ now captures the difference in survival probability between monthly and annual contract for low past attendance, i.e., for $v_i = 0$. Under the null of rational expectations we expect $\gamma < 0$ (sorting), while under the alternative hypothesis of naiveté we expect $\gamma > 0$ (delay of cancellation).

In Column 4 of Table 8 we present the results without controls. The coefficient γ on the monthly dummy is positive and very large, .1650. Automatic renewal doubles the survival probability for low levels of attendance from the baseline level of 15.98 percent for the annual contract to 32.48 for the monthly contract. Once we include the controls (Column 5), the coefficient γ on the monthly dummy increases to .1803. The coefficient on v indicates that one additional visit per month is associated with a 6.4 percent higher survival probability for users enrolled in an annual contract. The responsiveness of the survival probability to attendance for users under the monthly contract is about half the size.

We can relax partly the functional form restrictions and introduce a quartic polynomial in past attendance (Columns 6 and 7). We plot the predicted survival probability in Figure 5a for the estimates in Column 6. For low levels of past attendance the monthly contract has a substantially higher survival probability. For higher levels of attendance, instead, the annual contract has a higher survival. The patterns of Figure 5a are broadly consistent with the implications of naiveté. The effect of cancellation delay is particularly strong for low levels of attendance for which the individual is mostly likely to be planning to cancel. For higher levels of past attendance, the sorting effect dominates.

Stylized fact 4 (Survival probability as a function of attendance). *For low levels of past attendance, the survival probability under the monthly contract is twice as high as under the annual contract. For high past attendance, the annual contract has a higher survival.*

Robustness. In Table 9, we check the robustness of the findings in several directions. First, we replicate the results of Columns 4 and 5 of Table 8 using, as a proxy for attendance costs, the average monthly attendance in months 9 to 12, if available, or else in the last 4 months of membership[39]. The estimates are essentially unchanged. Figure 5b displays the predicted survival probability for a model with a quartic in attendance, with qualitative

[38] In order to use past attendance as a proxy of the value of staying enrolled in the club, two conditions are necessary. First, past attendance should predict future attendance. Second, attendance should not depend on the contract chosen, conditional on the type of the agent. The first condition depends on the autocorrelation of the cost of attendance. We can check it on the first year of tenure for users in an annual contract, for whom selective exit is not an issue. A regression of attendance in the 12th month on attendance in each of the first 6 months gives an R square of .4024. The second condition is also met since the marginal cost of a visit is the same under both the monthly and the annual contract. Notice that Prediction 3 allows for an *indirect* sorting effect of the contract chosen on attendance: for given past attendance, a user with an annual contract is more likely to be a low cost type (and therefore to renew) than a user with a monthly contract.

[39] For users with spells shorter than four months, we use the attendance data for all the available months.

patterns resembling the ones in Figure 5a.

Second, we use alternative measures of survival. While the original measure captures best the renewal of the annual contract, the measure of renewal for the monthly contract is somewhat arbitrary, and probably downward biased. The new measures are the probability of enrollment in a monthly or annual contract at the 15th and at the 16th month after the joining date.[40] Users initially enrolled in the monthly contract are 5.43 percent more likely to be enrolled at the 15th month (Column 3 of Table 9), and 3.76 percent more likely to be enrolled at the 16th month (Column 5) than users initially enrolled under the annual contract. The coefficients are about 2 percentage points larger when the controls are introduced. These estimates confirm that the benchmark measure of renewal, if anything, understates the size of γ. Finally, we measure the survival after two years as the probability of enrollment at the 27th and 28th month after the joining date. In the specifications with controls, the estimate of γ is positive, although not significantly different from 0.

Third, we generalize the results to unsubsidized users. We replicate the results of Columns 1 and 2 of Table 8 for the sample "First spell and no subsidy" (Columns 11 and 12 of Table 9) and for the larger sample "First spell" restricted to users who pay at least \$60 per month in the monthly contract or \$600 per year in the annual contract (Columns 13 and 14).[41] In the first, smaller sample the estimated γ has a similar magnitude as in the benchmark specification, but the estimates are imprecise. In the second, wider sample, the coefficient is positive and very large (.0925 with controls), as well as precisely estimated. Overall, the previous results extend to non-subsidized users.

Summary. After one year, more individuals are enrolled in the monthly contract, which allows more freedom to cancel, than under the annual contract (Stylized Fact 3). The result is economically and statistically significant, robust across specifications, and highest for users with low attendance (Stylized Fact 4). This finding is puzzling for standard theory. Further, it does not seem to arise because of sorting but despite sorting. Since the monthly contract is more expensive than the annual contract, the only reason to choose it is the availability of the option to switch early.

In light of the model in Section 3, these facts support the case of partially naive, time-inconsistent agents. The combination of time inconsistency and naiveté generates a status-quo bias. The members are substantially more likely to renew if renewal is automatic than if renewal requires a minimal effort. The hypothesis best supported by the data is that the population includes, along with a significant share of naive, time-inconsistent agents, a share

[40] Measures of survival at earlier months are inappropriate. First, given the pro-rating of the first and last month of an annual contract, an annual contract always extends until at least the 13th month. Second, about 10 percent of the annual spells lasts until the 14th month due to a free promotional month.

[41] In both cases, we drop individuals who have missing values for a control or who joined the club later than 14 active months before the end of the sample period.

of agents with rational expectations, exponential or sophisticated (Stylized Fact 4; Figures 5a, 5b and 2c).

4.3.3 Attendance over time

As a third approach to investigate contractual choices over time, we now analyze the dynamics of average attendance and test Predictions 5 and 6.

Annual contract. We first consider spells starting with an annual contract in the sample 'First spell and no subsidy.' As suggested by Prediction 5, we compare average attendance for the baseline group in the first year with average attendance for stayers in the second year. We define as stayers the users who renew with either an annual or a monthly contract at the end of the first year, and that have a spell lasting at least two years.[42] We display the results in columns 1 to 3 of the bottom part of Table 10.

Stylized fact 5 (Average attendance over time in annual contract). *In the annual contract, average monthly attendance in the first year for the initial group, 4.69, is significantly lower than in the second year for stayers, 6.85.*

The difference in attendance between the two groups is large: the baseline group in the first year attends on average 46 percent less than the stayers. Consequently, the price per average attendance in the first year, \$15.15, is significantly higher than in the first year, \$10.77. Comparable results obtain for the larger sample 'First spell' that includes all the subsidized memberships (Columns 4 to 6 of Table 10).

Figure 4a provides information on the within-year dynamics of the price per average attendance. The sample at month t is given by the users in 'First spell and no subsidy' who have joined with an annual membership and are still enrolled with a flat-rate contract after t months of tenure. Over the first 12 months the price per average attendance increases from 12.5 to 18, as negative shocks accumulate. At renewal (months 12 and 13), the price per attendance is halved.

This evidence supports Prediction 5 on the effects of learning. Users hit by negative shocks are unlikely to renew their flat-rate membership. As a consequence, average attendance among stayers increase over time, and the price per attendance decreases. The magnitude of the effects also suggests that the uncertainty is substantial, and that the learning effect is large.

Monthly contract. We now consider spells starting with a monthly contract. The sample for average attendance at month t is given by the users in 'First spell and no subsidy' who have joined with a monthly membership and are still enrolled with a flat-rate contract after t months of tenure. Columns 1 to 3 of the top part of Table 10 show the results by six-month groups.

[42]The results remain unchanged if we consider a narrower sample which includes only users who renew with an annual contract after 12 months.

Stylized fact 6 (Average attendance over time in monthly contract). *Average monthly attendance in the first six months of a monthly contract, 4.85, is 26 percent higher than in the next six months and is significantly higher than in any of the later six-month periods among stayers.*

The price per average attendance for the first six months, \$17.13, is significantly lower than in any of the later six-month periods.[43] Figure 4b provides information on the month-by-month dynamics. The price per average attendance increases over the first 10 months up from about \$15 to about \$20, and remains constant thereafter. The results extend to the sample 'First spell' including all the memberships starting with a monthly contract (Columns 4 to 6).

Summary. We observe a large difference in the contractual dynamics for the two flat-rate contracts. Average attendance increases by 46 percent between the first and the second year of the annual contract (Stylized Fact 5), but it decreases by 26 percent between the first six months and the next six months in the monthly contract (Stylized Fact 6).

Once again, the findings support the case of partially naive, time-inconsistent agents. Under the annual contract, learning induces selective exit over time of low-attenders. Naiveté does not affect the selective exit since contract cancellation requires no effort. Under the monthly contract, instead, contract cancellation requires a costly action. The different default induces naive agents to delay cancellation and to stay enrolled even if they attend little. This interpretation is consistent with the findings on the dynamics of attendance and on cancellation lags.

4.4 Size of deviation

The behavior of the average health club user deviates systematically from the predictions of the standard theory. In this Section, we provide a coarse measure of the monetary size of this deviation. For monthly and annual memberships, we compute the difference between actual expenses over the whole enrollment spell and imputed expenses for the same number of attendances with 10-visit passes.[44] A positive value of this 'Average Loss' measure indicates that the user would have saved money purchasing 10-visit passes, and a negative value indicates that the user would have lost money with these passes. We construct the Average Loss measure for the sample 'First spell and no subsidy'. To reduce the likelihood of censoring, we consider only spells that start before October 1997.

The average loss per spell (Column 1 of Table 11) is \$698 for agents initially enrolled with a monthly contract. This amount corresponds to 47.87 percent of the \$1,517 spent on the health

[43] The results remain unchanged if we consider a narrower sample which includes only users who have had a monthly contract at all times until month t.

[44] We neglect the fact that attendance would be lower under a pay-per-visit contract than under a flat-rate contract. Therefore, for a time-consistent agent, the measure we adopt understates the savings from paying per visit.

club membership during the whole spell. For agents initially enrolled in an annual contract, there is a small but insignificant gain of $61 (Column 4). Columns 2 to 3 and 5 to 6 present the same variables for samples that include later spells. The estimates of the loss for the monthly contract are somewhat lower, given the higher percentage of spells censored. The estimates of loss for the annual contract are higher (a loss of about $200) but still imprecise.

Overall, the deviation from the standard model observed in the data appear to have large monetary consequences specially for users in the monthly contract. Our interpretation of the results is that in the monthly contract the delay in cancellation amplifies over time the effects of the initial overestimation of attendance.

4.5 Correlation

The assumption best supported by the data is that a significant fraction of the users has time-inconsistent preferences and naive expectations. Heterogeneity in naiveté further predicts a positive correlation between different correlates of naiveté. Members with a long cancellation lag in the monthly contract should be more likely to pay a high price per attendance in the period before the last attendance.

We test this prediction for users enrolled in the monthly contract. As a measure of cancellation lags, we use the number of consecutive full months between the last attendance and the expiration (as in Section 4.3.1). As a measure of price per attendance, we take the ratio of the payments to the health club over the attendance for the period between sign-up and n months before the last attendance, with n equal to 1, 2, 3 and 4. We limit the time frame in order to avoid a spurious correlation between the price per attendance and months of delay due to low attendance in the final months. Finally, we take the log of 1 plus the measures in order to reduce the skewness of both variables. The correlation in Table 12 between the delay and the price per attendance is positive and highly significant for all the values of n. Longer lags n between the two measures do not affect the estimate, suggesting that the correlation is not likely to be spurious.

Stylized fact 7 (Correlations). *Users who pay a high price per attendance in the monthly contract display a longer gap between last attendance and contract termination.*

Similarly, we predict that individuals who accumulate a long delay in cancellation should also be less likely to freeze a contract if they face a temporary period of non-attendance. We take as a raw measure of freezing a dummy variable which equals 1 if the individual ever froze before the last attendance and 0 otherwise, and we correct it to control for periods of non-attendance.[45] The bottom row of Table 12 shows that there is a highly significant correlation

[45] We run a probit of this dummy on the longest consecutive number of months with no attendance before the last attendance, and the number of periods longer than 2 months with no attendance. We take the residual of this regression as the final measure of freezing.

of -.1035 between this freezing proxy and the cancellation delay. As predicted by the naive hypothesis, individuals who delay freezing delay cancellation as well.

The correlations between the behaviors are in the range of the typical within-individual correlations across behaviors in the social sciences (Glaeser et al., 2000). Even though other interpretations are possible, these results are consistent with the idea that time inconsistency and naive expectations drive both the results on the high price per attendance for flat-rate memberships (Section 4.2) and the results on renewal behavior (Section 4.3).

4.6 Alternative Interpretations and Survey Results

The evidence on contract and attendance choice is consistent with two deviations from the standard model: time inconsistency and overconfidence (naiveté) about the time inconsistency. Alternative interpretations of this evidence fall in two classes: rational expectations models and models with overconfidence.

Leading examples of the first class of models are rational models of self-control, including the temptation model by Gul and Pesendorfer (2001), and models with distaste for payment per visit (Loewenstein and Prelec, 1998; Thaler, 1999). These models explain Stylized Fact 1 with preference for commitment or aversion to per-usage payment. To match Stylized Facts 2, 3, 4, and 6 on contract choice over time, however, one needs to posit additional deviations from the standard model. Agents may have limited memory (Mullainathan, 2002)[46] and forget to cancel the health club membership under the monthly contract. Or they may regard discontinuing the health club membership as a personal failure.[47] Models with rational expectations predict that individuals choose a flat-rate contract even though they are aware that on average it will be more expensive than a pay-per-visit contract.

We attempt to test this prediction with survey data. The sample is 48 randomly chosen health club users in California (details in Section 2). First, we elicit expectations of their own attendance in the next month, September.[48] Under rational expectations, the expected future attendance should be indistinguishable from actual attendance. Although we do not observe actual attendance in this sample, it is unlikely to differ substantially from attendance in our health club data set. If we split the sample into 24 (gender)*(club)*(age) cells, the average monthly attendance over the membership is lower than 4.75 visits for 23 out of 24 cells, with a global average of 4.17 monthly visits.

[46] Models of bounded memory with rational expectations implies that individuals should be very wary of contracts with automatic renewal. In our data, instead, 90 percent of the flat-rate memberships are monthly contracts.

[47] The self-signalling hypothesis, however, presumably predicts an equally high survival probability for the monthly and for the annual contract, contrary to Stylized Facts 3 and 4. Moreover, this story implies that users like to switch from the monthly to the annual contract to signal a strong commitment to themselves. This switch instead happens for only 1.5 percent of the 7,079 spells initiated with a monthly contract (Table 3).

[48] In our data attendance in September is five percent lower than the yearly average.

Second, we present the subjects with the following scenario: 'Suppose that, based on your previous experience you expect to attend on average 5 times per month (about once a week), if you enroll in a monthly membership. You plan to attend the health club throughout the next year. Would you choose a monthly contract with a monthly fee of $70 per month or 10-visit passes for $100 (each visit costs $10)?' If the alternative models with rational expectations are the correct explanation for Stylized Fact 1, health club users should choose the monthly contract in this hypothetical scenario.

Table 13 shows the result of the survey. The average number of expected monthly visits is 9.50 with a standard error of 0.66. The expected average attendance, therefore, is about twice as high as the actual attendance in the data set of this paper. In the hypothetical scenario, 18 consumers out of 48 prefer the monthly contract, and 30 prefer the 10-visit pass. With realistic expectations about attendance, therefore, the majority of people prefers to pay per visit. These two results suggest that overestimation of future attendance is an important component of the empirical results.

Alternative interpretations that allow for overconfidence are consistent with the results of the survey. Consumers may overestimate the benefits (or underestimate the costs) of health club attendance, perhaps because of salesmen or because of projection bias (Loewenstein, O'Donoghue, and Rabin, 2002). These models predict Stylized Facts 1 and 2, but are inconsistent with Stylized Facts 3, 4, and 6, since they do not generate a status quo effect. Alternatively, health club members may be overconfident about their efficiency in the future. These members overestimate future attendance (they expect to have more free time in the future) and delay cancellation (they expect to have lower costs of cancellation tomorrow). This model predicts Stylized Facts 1 to 7 for essentially the same reasons as the naive hyperbolic model.

We are sympathetic to the latter alternative interpretation of the data. However, we prefer the formalization in this paper for two reasons. First, partially naive individuals look for commitment devices, while agents that overestimate their efficiency do not. Arguably, the high demand for personal trainers in health clubs indicates a demand for commitment. Second, while there is experimental evidence supporting time inconsistency, there is no specific evidence of overestimation of future efficiency. In addition, Ariely and Wertenbroch (2002) show that students prefer to set deadlines for problem sets, a behavior inconsistent with overestimation of efficiency.

5 Conclusion

Do consumers display time inconsistency and overconfidence in the market? In this paper we have used a new panel data set from three US health clubs to provide an answer to these questions. Members who choose a contract with a flat monthly fee of over $70 attend on average 4.8 times per month. They pay a price per expected visit of more than \$17, even though a \$10-per-visit fee is also available. On average, these users forego savings of \$700 during their membership. We present additional results on the interval between last attendance and contract termination, the survival probability, average attendance over time, and the correlation between different behaviors. The empirical results are difficult to reconcile with the standard assumptions of time-consistent preferences and rational expectations. We have presented a model of agents with time inconsistency and overconfidence about self-control that explains the findings. The agents overestimate the future attendance and delay contract cancellation whenever renewal is automatic.

A central finding of this paper is the evidence on consumer overconfidence about the future time inconsistency. While this deviation from rational expectations is not isolated (Camerer, 1999; Malmendier and Tate, 2002), it is still hard to believe that individuals remain naive about their own preferences and ability after a lifetime of experiences. In work in progress, we identify two reasons that would slow down learning about the overconfidence. First, in a noisy environment the consumers may misattribute the past outcomes to the environment rather than to self-control. Second, firms have limited incentives to educate naive consumers.

The results in the paper have implications for the contract design by firms. Rational, profit-maximizing health clubs can easily learn the features of consumer behavior using data sets like the one analyzed in this paper. We therefore expect them to offer contracts that are designed to maximize profits given the time inconsistency and overconfidence of the consumers. In a related paper (DellaVigna and Malmendier, 2001), we characterize the features of the profit-maximizing contract for goods that challenge the self-control of consumers with time-inconsistent preferences. For goods with immediate costs and delayed benefits—such as health club attendance—the profit-maximizing contract involves below marginal cost pricing of attendance and automatic renewal with a cancellation cost. The typical contract of health clubs in the Boston area indeed has these features. The evidence on contractual design confirms the conclusions of the analysis of consumer behavior.

A Appendix A: Mathematical Appendix

In this Appendix we allow for less restrictive assumptions about the contract space and about the payoffs from attendance. We provide a closed-form solution for the contractual choices over time.

Contractual menu. We define a contract as a 5-tuple (T', L_0', L', p', k'), where T', L', p', k' are as in the text and L_0' is the lump-sum initiation fee that the agent pays once at sign-up. We denote a flat-rate contract as F, with the monthly contract being F_M and the annual contract F_A. For the monthly contract F_M, let $L' = L_M$. For the annual contract F_A let $L' = 10 * L_M$. The monthly and the annual contract have no price per visit, $p' = 0$, but both have an initiation fee $L_0' = L_0$. The initiation fee L_0' is due only at $t = 1$ except if the agent switches from the pay-per-visit contract P to F_M or F_A. For the pay-per-visit contract P, $L_0' = L' = 0$ and $p' = p > 0$.

Payoffs of attendance. We suppose that the stochastic effort cost of attendance c_t is the sum of a quasi-permanent and a transitory component: $c_t = \overline{c}_t + \varepsilon_t$, with $\varepsilon_t \sim G$ i.i.d. across periods, and $E(\varepsilon_t) = 0$, $E(\varepsilon_t^2) < +\infty$. We further assume that G has a strictly positive density g over the support. The quasi-permanent component $\overline{c}_t$ is initially noisy, but then it stabilizes. New members find out the costs of attendance after some experience. More precisely, between periods 1 and d, with $d \geq 1$, $\overline{c}_t$ follows an i.i.d. process, with distribution

$$\overline{c}_t = \begin{cases} \overline{c}_L & \text{with probability } \lambda_L \\ \overline{c}_H & \text{with probability } \lambda_H = 1 - \lambda_L \end{cases} \tag{6}$$

with $\overline{c}_L < \overline{c}_H$. From period d on, for $t > s \geq d$ we have $\overline{c}_t = \overline{c}_s = \overline{c}_L$ with probability λ_L and $\overline{c}_t = \overline{c}_s = \overline{c}_H$ otherwise. The period d is uncertain with d distributed according to a Poisson process, with $P(d = d_0 | d > d_0 - 1) = p_d > 0$ independent of d_0.

We assume that at time 0 the agent knows the deterministic benefits b and the distribution of the stochastic process for c, including the parameter λ_L. At time $t \geq 1$, the agent observes the realization of c_t before making the attendance decision. In period d the agent experiences the permanent realization of $\overline{c}_d$. We allow for heterogeneity in the ex-ante probability λ_L of being a low-cost type. We assume a continuum of λ_L in the population with distribution Λ, support $[0, 1]$ and $E[\lambda_L] = \bar{\lambda}_L$.

Contractual choice. Consider a consumer with preferences $(\beta, \hat{\beta}, \delta)$ and cost parameter λ_L who signs contract (T', L_0', L', p', k') at $t = 0$. Except for the possible transaction cost payment, she expects to attain the net benefit $\beta\delta\widehat{U}^{\hat{\beta},\delta}(T', L_0', L', p', k'; \lambda_L)$ for the next T' periods:

$$\widehat{U}^{\hat{\beta},\delta}(T', L_0', L', p', k'; \lambda_L) \equiv -L_0' - L' + \frac{1 - \delta^{T'}}{1 - \delta} \sum_{i \in \{L,H\}} \lambda_i \int_{-\infty}^{\hat{\beta}\delta b - p'} (\delta b - p' - c) dG(c - \overline{c}_i). \tag{7}$$

Expression (7) does not depend on whether the consumer learns the permanent type $\overline{c}$ during the T' periods of contractual duration. We make the following three assumptions.

Assumption 1. (Discount rate) $(1 - \delta^{360})/(1 - \delta^{30}) > 10$.

Assumption 2. (Choice with low cost)
$-\left(1-\delta^{360}\right)L_0+\widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;1)-\widehat{U}^{\hat{\beta},\delta}(360,0,0,p,0;1)>0.$

Assumption 3. (Choice with high cost) $\widehat{U}^{\hat{\beta},\delta}(360,0,0,p,0;0)-\widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;0)\geq \frac{1-\delta^{360}}{\delta}k\left[1-\frac{1-\delta^{30}}{1-\delta^{30}(1-p_d)^{30}}\right]/\left[\frac{1-\delta^{360}}{1-\delta^{360}(1-p_d)^{360}}-\frac{1-\delta^{30}}{1-\delta^{30}(1-p_d)^{30}}\right]>0.$

Assumption 1 requires that the yearly discount factor δ^{360} be higher than .669. It implies that users who have learned their cost type $\bar{c}$ strictly prefer being enrolled in F_A forever to being enrolled in F_M forever, since they are patient enough to appreciate the discount implicit in the annual contract. Assumptions 2 and 3 imply that individuals with type $\bar{c}_L$ ($\lambda_L=1$) strictly prefer contract F_A to P, and individuals with type $\bar{c}_H$ ($\lambda_L=0$) strictly prefer P to F_A regardless of the contract they are enrolled in when they learn their type. In addition, Assumption 3 imposes the additional condition (used in Proposition A.3) that users with type $\bar{c}_H$ have a strong enough preference for P over F_A.

We now prove the equivalent of Proposition 1 for the more general model with initiation fee and switching cost. We work backwards and solve first for the optimal renewal and switching decision.

Switching decision. Define the per-period perceived net gain in utility from switching from F to P for type $\bar{c}_H$ as $U_C^{\hat{\beta},\delta}\equiv\frac{1-\delta}{1-\delta^T}[\widehat{U}^{\hat{\beta},\delta}(T,0,0,p,0;\lambda_L=0)-\widehat{U}^{\hat{\beta},\delta}(T,0,L,0,0;\lambda_L=0)]$, with $U_C^{\hat{\beta},\delta}>0$ by Assumption 3. Notice $L_0=0$ since the initiation fee is sunk. Denote with $t_C^{\beta,\hat{\beta},\delta}$ the time at which an agent with preferences $(\beta,\hat{\beta},\delta)$ and cost $\bar{c}_H$ performs the one-time cancellation activity C. If the agent ever cancels, the cancellation time $t_C^{\beta,\hat{\beta},\delta}$ equals T_0+nT for some $n\in I\!N$, where T_0 is the first occasion for contract choice after time d, and T is the interval to the next contract choice. Define $t_C^{\beta,\hat{\beta},\delta}=\infty$ if the agent never cancels. Proposition A.1 (adapted from O'Donoghue and Rabin, 2001) characterizes the time of cancellation $t_C^{\beta,\hat{\beta},\delta}$ for time-consistent, sophisticated and naive individuals. We omit the case of partially naive agents for brevity (cfr. O'Donoghue and Rabin, 2001).

Proposition A.1 *(***Quitting decision***) (i) For a time-consistent agent ($\beta=\hat{\beta}=1$), $t_C^{1,1,\delta}=T_0$ if $U_C^{1,\delta}>(1-\delta)k/\delta$, and $t_C^{1,1,\delta}=\infty$ otherwise. (ii) For a sophisticated agent ($\beta=\hat{\beta}<1$), $t_C^{\beta,\beta,\delta}\leq T_0+T_C$ where $T_C\geq 0$ is the largest integer multiple of T satisfying $\beta\delta\left[-\frac{1-\delta^{T_C}}{1-\delta}U_C^{\beta,\delta}-\delta^{T_C-1}k\right]>-k$ if $U_C^{\beta,\delta}>(1-\delta)k/\beta\delta$ and $t_C^{\beta,\beta,\delta}=\infty$ otherwise. (iii) For a naive agent ($\beta<\hat{\beta}=1$) $t_C^{\beta,1,\delta}=T_0$ if $U_C^{1,\delta}>(1-\delta)\left(1-\beta\delta^T\right)k/\left(1-\delta^T\right)\beta\delta$ and $t_C^{\beta,1,\delta}=\infty$ otherwise. (iv) For given L, p and k, $t_C^{1,1,\delta}\leq t_C^{\beta,1,\delta}$.*

Proof of Proposition A.1. (i) Given the stationary setting after T_0, a time-consistent agent quits either immediately or never. The solution is $t_C^{1,1,\delta}=T_0$ if quitting is better than renewing forever: $-k>-\frac{\delta}{1-\delta}U_C^{1,\delta}$ or $U_C^{1,\delta}>(1-\delta)k/\delta$. (ii) A sophisticated hyperbolic agent cancels at time T_0 if the next self that will cancel is too far off into the future. The agent is willing to wait at most T' periods, where T' is the highest multiple of T such that $\beta\delta\left[-\frac{1-\delta^{T'}}{1-\delta}U_C^{\beta,\delta}-\delta^{T'-1}k\right]>-k$. Existence of a finite T' is guaranteed if $U_C^{\beta,\delta}>(1-\delta)k/\beta\delta$.

If instead $U_C^{\beta,\delta} \leq (1-\delta)k/\beta\delta$ holds, the agent prefers renewing forever to cancelling, and therefore, $t_C^{\beta,\beta,\delta} = \infty$. (iii) A naive hyperbolic agent believes that the future self in T periods will undertake the cancellation activity at $T_0 + T$ if $U_C^{1,\delta} > (1-\delta)k/\delta$, and never otherwise (see part (i) of this Proposition). If $U_C^{1,\delta} \leq (1-\delta)k/\delta$, the future self never cancels and the present self (that discounts the future more heavily) does not cancel either: $t_C^{\beta,1,\delta} = \infty$. Under the opposite inequality, the agent chooses between canceling at T_0 and at $T_0 + T$. She prefers canceling at $T_0 + T$ if $\beta\delta\left[-\frac{1-\delta^T}{1-\delta}U_C^{1,\delta} - \delta^{T-1}k\right] \geq -k$ or equivalently if $U_C^{1,\delta} \leq \frac{(1-\delta)\left(1-\beta\delta^T\right)}{\beta\delta(1-\delta^T)}k$. Therefore, if $\frac{(1-\delta)\left(1-\beta\delta^T\right)}{\beta\delta(1-\delta^T)}k \geq U_C^{1,\delta} > (1-\delta)k/\delta$, then $t_C^{\beta,1,\delta} = \infty$. If $U_C^{1,\delta} > \frac{(1-\delta)\left(1-\beta\delta^T\right)}{\beta\delta(1-\delta^T)}k$, then $t_C^{\beta,1,\delta} = T_0$. (iv) Both time-consistent and naive agents have a threshold cancellation policy, with $t_C = \infty$ for $U_C \leq \bar{U}$ and $t_C = T_0$ for $U_C > \bar{U}$. The inequality $t_C^{1,1,\delta} \leq t_C^{\beta,1,\delta}$ follows since the agents have the same $U_C^{1,\delta}$ for a given c and the threshold for time-consistent agents, $(1-\delta)k/\delta$, is lower than the threshold for naive agents, $\frac{(1-\delta)\left(1-\beta\delta^T\right)}{\beta\delta(1-\delta^T)}k$. **Q.E.D.**

Assumption 4. We assume $(1-\delta)k/\delta \leq U_C^{1,\delta} \leq (1-\beta\delta)k/\beta\delta$ and $T = 1$. Therefore, $t_C^{1,1,\delta} = T_0$ and $t_C^{\beta,1,\delta} = \infty$. We also assume $U_C^{\beta,\delta} > (1-\delta)k/\beta\delta$ and solve the multiplicity of equilibria for the sophisticated agent as follows: $t_C^{\beta,\beta,\delta} = T_0$.

Assumption 4 implies that time-consistent and sophisticated agents with cost $\overline{c}_H$ switch to the pay-per-visit contract P at time T_0, while naive agents with cost $\overline{c}_H$ never do so. Assumption 4 formalizes the calibration result (Section 3.4.1) that naive agents are much more likely to accumulate a substantial cancellation delay than agents with rational expectations.

Contractual choice at enrollment. Denote by $\tilde{G}(z|\lambda_L) \equiv \sum_{i\in\{L,H\}} \lambda_i G(z - \overline{c}_i)$ the ex ante expected probability distribution of cost, conditional on parameter λ_L. We prove the following Proposition, which is analogous to Proposition 1 in the text.

Proposition A.2 *Assume that an agent with cost parameter λ_L and time preferences $(\beta, \hat{\beta}, \delta)$ prefers a flat-rate contract F over a pay-per-visit contract P at $t = 0$. Then the fee L for contract F at $t = 0$ satisfies*

$$\begin{aligned} \frac{(1-\delta)\,T}{1-\delta^T}(L + \alpha_0 L_0 + \alpha_1 \frac{k}{\delta}) \quad \leq \quad & p \cdot T\tilde{G}(\beta\delta b|\lambda_L) \\ & +(1-\hat{\beta})\delta b \cdot T\left[\tilde{G}(\hat{\beta}\delta b|\lambda_L) - \tilde{G}(\hat{\beta}\delta b - p|\lambda_L)\right] \\ & +p \cdot T\left[\tilde{G}(\hat{\beta}\delta b|\lambda_L) - \tilde{G}(\beta\delta b|\lambda_L)\right] \end{aligned} \tag{8}$$

where $\alpha_0 \equiv \left[1 - \delta^T(1-p_d)^T\right] - \delta^T\bar{\lambda}_{L,F}(1-(1-p_d)^T)$ and $\alpha_1 \equiv \delta^T(1-\bar{\lambda}_{L,F})(1-(1-p_d)^T)$, with $\alpha_0 \in (0,1)$ and $\alpha_1 \in (0,1)$.

Proof of Proposition A.2. At time 0, the perceived utility of contract F for a type λ_L is

$\beta\delta U_F(\lambda_L)$, with

$$U_F(\lambda_L) \equiv -L_0 + \frac{1}{1-\delta^{T'}(1-p_d)^{T'}} \left\{ \begin{array}{c} \widehat{U}^{\hat{\beta},\delta}(T',0,L',0,k';\lambda_L) + \delta^{T'} \frac{1-(1-p_d)^{T'}}{1-\delta^{360}} * \\ \left[\begin{array}{c} \lambda_L \widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;1) + \\ (1-\lambda_L)\left[\widehat{U}^{\hat{\beta},\delta}(360,0,0,p,0;0) - k'\left(1-\delta^{360}\right)/\delta\right] \end{array} \right] \end{array} \right\}$$

where $L' = L_A, T' = 360, k' = 0$ for contract F_A and $L' = L_M, T' = 30, k' = k > 0$ for contract F_M. The agent pays L_0 at the start and then attains utility $\widehat{U}^{\hat{\beta},\delta}(T',0,L',0,k';\lambda_L)$ as long as she does not learn her type, i.e., with probability $(1-p_d)^{T'}$. With probability $1-(1-p_d)^{T'}$ the agent learns her type within T' periods. Then, with probability λ_L she faces $\overline{c}_L$ and chooses contract F_A, and with probability $1-\lambda_L$ she faces $\overline{c}_H$ and she picks contract P, where the two contract choices depend on Assumptions 1, 2, and 3. Similarly, the perceived utility of contract P for a type λ_L is $\beta\delta U_P(\lambda_L)$, with

$$U_P(\lambda_L) \equiv \frac{1}{1-\delta^{T'}(1-p_d)^{T'}} \left\{ \begin{array}{c} \widehat{U}^{\hat{\beta},\delta}(T',0,0,p,0;\lambda_L) + \delta^{T'} \frac{1-(1-p_d)^{T'}}{1-\delta^{360}} * \\ \left[\begin{array}{c} \lambda_L \left[\widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;1) - L_0\left(1-\delta^{360}\right)\right] \\ +(1-\lambda_L)\widehat{U}^{\hat{\beta},\delta}(360,0,0,p,0;0) \end{array} \right] \end{array} \right\}$$

where the main difference from $U_F(\lambda_L)$ is that the agent does not pay an initiation fee at $t=0$, but only if she learns that her type is $\overline{c}_L$. Notice that we are comparing the contract F with a contract P of equal duration T'. Assumption 2 implies that an agent with cost $\overline{c}_L$ prefers to switch to F_A even if she has to pay the initiation fee L_0. An agent with type λ_L prefers F to P if and only if

$$\begin{aligned} \widehat{U}^{\hat{\beta},\delta}(T',0,L',0,k';\lambda_L) - \widehat{U}^{\hat{\beta},\delta}(T',0,0,p,0;\lambda_L) \quad &\geq \quad \left[1-\delta^{T'}(1-p_d)^{T'} - \delta^{T'}\lambda_L(1-(1-p_d)^{T'})\right] L_0 \\ &+\delta^{T}(1-\lambda_L)\left[1-(1-p_d)^{T'}\right]\frac{k'}{\delta}. \end{aligned} \tag{9}$$

Notice that $1-\delta^{T'}(1-p_d)^{T'} - \delta^{T'}\lambda_L\left[1-(1-p_d)^{T'}\right] \geq 1-\delta^{T'}(1-p_d)^{T'} - \delta^{T'}\left[1-(1-p_d)^{T'}\right] \geq 0$. Using expression (7) for $\widehat{U}^{\hat{\beta},\delta}$, we can rewrite inequality (9) as

$$\begin{aligned} L' + \alpha_0 L_0 + \alpha_1 \frac{k}{\delta} \quad &\leq \quad \frac{1-\delta^{T'}}{1-\delta} \sum_{i\in\{L,H\}} \lambda_i \left[\int_{-\infty}^{\hat{\beta}\delta b - p} p dG(c-\overline{c}_i) + \int_{\hat{\beta}\delta b - p}^{\hat{\beta}\delta b} (\delta b - c) dG(c-\overline{c}_i)\right] \\ &\leq \quad \frac{1-\delta^{T}}{1-\delta} \sum_{i\in\{L,H\}} \lambda_i \left\{ \begin{array}{c} G(\hat{\beta}\delta b - \overline{c}_i)\left[\phi_i p + (1-\phi_i) z_i\right] + \\ (1-\hat{\beta})[\delta b G(\hat{\beta}\delta b - \overline{c}_i) - G(\hat{\beta}\delta b - p - \overline{c}_i)] \end{array} \right\} \end{aligned} \tag{10}$$

with $0 \leq \phi_i \equiv G(\hat{\beta}\delta b - p - \overline{c}_i)/G(\hat{\beta}\delta b - \overline{c}_i) \leq 1$ and $0 \leq z_i \equiv \int_0^p y dG(\hat{\beta}\delta b - y - \overline{c}_i)/[G(\hat{\beta}\delta b - \overline{c}_i) - G(\hat{\beta}\delta b - p - \overline{c}_i)] \leq p$. Using the inequality $z_i \leq p$ in expression (10) and multiplying both sides of the inequality by $T(1-\delta)/\left(1-\delta^{T}\right)$, we obtain (8) as desired. **Q.E.D.**

Denote the set of all agents that choose contract F as $C_F \equiv \{\lambda_L | F \succeq_{\lambda_L} P\}$. Define $\tilde{L} \equiv L' + \alpha_0 L_0 + \alpha_1 \frac{k}{\delta} \geq L'$. The following Corollary follows from aggregation of inequality (8) over all $\lambda_L \in C_F$ and division on both sides by $P(\lambda_L \in C_F)$.

Corollary 1. *The fee L for the flat-rate contract F at $t = 0$ satisfies*

$$\begin{aligned}\frac{(1-\delta)T}{1-\delta^T}\tilde{L} \quad\leq\quad & p\cdot T\int_{\lambda_L\in C_F}\tilde{G}(\beta\delta b|\lambda_L)d\Lambda(\lambda_L)/P(\lambda_L\in C_F)\\ &+(1-\hat{\beta})\delta b\cdot T\int_{\lambda_L\in C_F}\left[\tilde{G}(\hat{\beta}\delta b|\lambda_L)-\tilde{G}(\hat{\beta}\delta b-p|\lambda_L)\right]d\Lambda(\lambda_L)/P(\lambda_L\in C_F)\\ &+p\cdot T\int_{\lambda_L\in C_F}\left[\tilde{G}(\hat{\beta}\delta b|\lambda_L)-\tilde{G}(\beta\delta b|\lambda_L)\right]d\Lambda(\lambda_L)/P(\lambda_L\in C_F).\end{aligned}$$

Corollary 1 enables us to generalize Prediction 1 in the text in two ways. First, we allow for cancellation costs as well as initiation fees. Second, we allow for heterogeneity in the cost parameter λ.

Prediction 1'. *If the agents have time-consistent preferences ($\beta = \hat{\beta} = 1$),*

$$\frac{(1-\delta)T}{1-\delta^T}\tilde{L}/\left[\frac{T\int_{\lambda_L\in C_F}\tilde{G}(\beta\delta b|\lambda_L)d\Lambda(\lambda_L)}{P(\lambda_L\in C_F)}\right]\leq p. \tag{11}$$

Survival probability. We prove first a sorting result. We show that at $t = 0$, as long as cancellation costs are moderate[49], agents with a high probability of being a low-cost type prefer the annual contract F_A over the monthly contract F_M.

Proposition A.3 (Sorting into monthly and annual contract) *There exists a $\bar{\lambda}$ with $0 \leq \bar{\lambda} < 1$ such that at $t = 0$ agents with $\lambda_L \geq \bar{\lambda}$ prefer contract F_A to F_M and agents with $\lambda_L < \bar{\lambda}$ prefer contract F_M to F_A.*

Proof of Proposition A.3. The expression for the perceived utility of contract F, $U_F(\lambda_L)$, is in the Proof of Proposition A.2. The derivative of $U_F(\lambda_L)$ with respect to λ_L is

$$\frac{\partial U_F(\lambda_L)}{\partial\lambda_L}=\frac{1}{1-\delta^{T'}(1-p_d)^{T'}}\left\{\begin{array}{c}\frac{1-\delta^{T'}}{1-\delta}\left[\int_{-\infty}^{\hat{\beta}\delta b}(\delta b-c)dG(c-\overline{c}_L)-\int_{-\infty}^{\hat{\beta}\delta b}(\delta b-c)dG(c-\overline{c}_H)\right]+\\ \delta^{T'}\frac{1-(1-p_d)^{T'}}{1-\delta^{360}}\left[\begin{array}{c}\widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;1)\\ -\widehat{U}^{\hat{\beta},\delta}(360,0,0,p,0;0)+k\left(1-\delta^{360}\right)/\delta\end{array}\right]\end{array}\right\}.$$

We now set out to show that this derivative is higher for contract F_A than for contract F_M. This implies that, if an agent with parameter λ_L chooses F_A, also all agents with higher λ_L choose F_A. We do so in three steps.

[49] If the transaction cost k is high, the opposite sorting could take place. For higher levels of λ_L, contract M becomes more appealing, as the probability of incurring k falls. Assumption 3 guarantees that this second effect does not dominate. In the health club case, Assumption 3 is likely to be satisfied. Assume $\delta = .9998$, $k = \$15$ and $p_d = .005$, implying a .14 probability of learning the permanent type in each month. Assumption 3 is satisfied if the annual gain in utility from choosing contract V instead of A when $\overline{c} = \overline{c}_H$ is at least \$25, a small sum compared to the average annual fee of \$500.

Step 1. The difference between the derivatives for F_A and F_M is

$$\frac{\partial U_A(\lambda_L)}{\partial \lambda_L}-\frac{\partial U_M(\lambda_L)}{\partial \lambda_L}=$$

$$\frac{1}{1-\delta}\left[\frac{1-\delta^{360}}{1-\delta^{360}\left(1-p_d\right)^{360}}-\frac{1-\delta^{30}}{1-\delta^{30}\left(1-p_d\right)^{30}}\right]\left[\begin{array}{c}\int_{-\infty}^{\hat{\beta}\delta b}(\delta b-c)dG(c-\overline{c}_L)\\ -\int_{-\infty}^{\hat{\beta}\delta b}(\delta b-c)dG(c-\overline{c}_H)\end{array}\right]+$$

$$\frac{1}{1-\delta^{360}}\left[1-\frac{1-\delta^{360}}{1-\delta^{360}\left(1-p_d\right)^{360}}-\left(1-\frac{1-\delta^{30}}{1-\delta^{30}\left(1-p_d\right)^{30}}\right)\right]\left[\begin{array}{c}\widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;1)\\ -\widehat{U}^{\hat{\beta},\delta}(360,0,0,p,0;0)\end{array}\right]$$

$$-\left(1-\frac{1-\delta^{30}}{1-\delta^{30}\left(1-p_d\right)^{30}}\right)\frac{k}{\delta}$$

$$=\frac{1}{1-\delta}\left[\frac{1-\delta^{360}}{1-\delta^{360}\left(1-p_d\right)^{360}}-\frac{1-\delta^{30}}{1-\delta^{30}\left(1-p_d\right)^{30}}\right]*$$

$$\left[\begin{array}{c}\int_{-\infty}^{\hat{\beta}\delta b-p}(\delta b-c-p)dF(c-\overline{c}_H)\\ -\left(\int_{-\infty}^{\hat{\beta}\delta b}(\delta b-c)dF(c-\overline{c}_H)-\frac{1-\delta}{1-\delta^{360}}L_A\right)\end{array}\right]-\left(1-\frac{1-\delta^{30}}{1-\delta^{30}\left(1-p_d\right)^{30}}\right)\frac{k}{\delta}.$$

Step 2. We prove $\left[\frac{1-\delta^{360}}{1-\delta^{360}(1-p_d)^{360}}-\frac{1-\delta^{30}}{1-\delta^{30}(1-p_d)^{30}}\right]>0$. Rewrite this inequality as $\frac{1-\delta^{360}}{1-\delta^{30}}>\frac{1-\delta^{360}(1-p_d)^{360}}{1-\delta^{30}(1-p_d)^{30}}$. We set out to prove that $\partial\left(\frac{1-(\delta m)^{360}}{1-(\delta m)^{30}}\right)/\partial m>0$, which would imply the desired conclusion. The derivative $\partial\left(\frac{1-(\delta m)^{360}}{1-(\delta m)^{30}}\right)/\partial m$ is equal up to a positive constant term to $\frac{30}{360}\left(\delta m\right)^{29}+\frac{330}{360}\left(\delta m\right)^{389}-\left(\delta m\right)^{359}$. For $0<\delta m<1$, $(\delta m)^p$ is a strictly convex function of p. We can use a strict version of Jensen's inequality—$\alpha f\left(p\right)+\left(1-\alpha\right)f\left(y\right)>f(\alpha p+\left(1-\alpha\right)y)$ for $\alpha\in(0,1)$ and f strictly convex—to infer $\frac{30}{360}\left(\delta m\right)^{29}+\frac{330}{360}\left(\delta m\right)^{389}>\left(\delta m\right)^{\frac{30*29+330*389}{360}}=\left(\delta m\right)^{359}$.

Step 3. Using Assumption 3, the desired conclusion $\frac{\partial U_A(\lambda_L)}{\partial \lambda_L}-\frac{\partial U_M(\lambda_L)}{\partial \lambda_L}>0$ follows.

After proving the existence of a threshold value $\bar{\lambda}$ in λ_L for the choice of F_A, we prove that for $\lambda_L=1$ the agent strictly prefers F_A to F_M. This implies $\bar{\lambda}<1$ and completes the proof. For $\lambda_L=1$,

$$\begin{aligned}U_F(1) &\equiv -L_0+\frac{1}{1-\delta^{T'}\left(1-p_d\right)^{T'}}\left\{\begin{array}{c}\widehat{U}^{\hat{\beta},\delta}(T',0,L',0,k';1)\\ +\delta^{T}\frac{1-(1-p_d)^{T}}{1-\delta^{360}}\widehat{U}^{\hat{\beta},\delta}(360,0,L_A,0,0;1)\end{array}\right\}=\\ &= -L_0+\frac{1}{1-\delta}\int_{-\infty}^{\hat{\beta}\delta b-p}(\delta b-p-c)dF(c-\overline{c}_L)-\left[\alpha\frac{L'}{1-\delta^{T}}+(1-\alpha)\frac{L_A}{1-\delta^{360}}\right]\end{aligned}$$

where $\alpha\equiv\frac{1-\delta^{T'}}{1-\delta^{T'}(1-p_d)^{T'}}$, $\alpha\in(0,1)$. Using $L_A=10L_M$ and Assumption 1 we get $\frac{L_A}{1-\delta^{360}}<\frac{L_M}{1-\delta^{30}}$. It follows that the expression $U_F(1)$ is higher for $L'=L_A$, $T'=360$ than for $L'=L_M$, $T'=30$, and therefore $\bar{\lambda}\leq 1$. A standard continuity argument implies $\bar{\lambda}<1$. **Q.E.D.**

We introduce the following definitions in order to prove Prediction 3', a formalized version of Prediction 3 in the text. Consider an agent with cost parameter λ_L who has chosen at time 0 contract F_j, with $j \in \{A, M\}$. Define the survival probability $S_{j,t}(\lambda_L)$ as the probability that this agent is enrolled under a flat-rate contract F at time t. Define as $T_A = \{t | t = 360 * n \text{ for some } n \in I\!N\}$ and $T_M = \{t | t = 30 * n \text{ for some } n \in I\!N\}$ the time periods at which contract renewal takes place for contracts F_A and F_M. Denote by $C_A \equiv \{\lambda_L | F_A \succeq_{\lambda_L} F_M \text{ and } F_A \succeq_{\lambda_L} P \text{ at } t = 0\}$ the set of all values of λ_L such that the agent chooses F_A at time 0 and by $\bar{\lambda}_{L,A} \equiv E[\lambda_L | \lambda_L \in C_A]$ the average level of λ_L across agents who choose F_A at $t = 0$. Similarly, define $C_M \equiv \{\lambda_L | F_M \succeq_{\lambda_L} F_A \text{ and } F_M \succeq_{\lambda_L} P \text{ at } t = 0\}$ and $\bar{\lambda}_{L,M} \equiv E[\lambda_L | \lambda_L \in C_M]$. Finally, denote by $S_{j,t}$ the survival probability averaged across all agents that chose contract j at time 0.

Prediction 3'. *For agents with rational expectations about the time preferences ($\beta = \hat{\beta} < 1$), the expected survival probability is higher for the annual than for the monthly contract: $S_{A,t} > S_{M,t}$ for any $t \in T_A$. For naive agents ($\beta < \hat{\beta} = 1$), the opposite holds: $S_{A,t} < S_{M,t} = 1$ for any $t \in T_A$.*

Proof of Prediction 3'. An agent with rational expectations about the future time preferences ($\beta = \hat{\beta}$) is enrolled under contract F at time t if she still has not learned the type, i.e., with probability $(1 - p_d)^t$, or, conditional on having learned the type, if $\bar{c} = \bar{c}_L$. Therefore,

$$S_{j,t}(\lambda_L) = (1 - p_d)^t + \left[1 - (1 - p_d)^t\right] \lambda_L \tag{12}$$

with $t \in T_j$ and $j \in \{A, M\}$. We can then integrate the survival probabilities $S_{j,t}(\lambda_L)$ in (12) over all the types λ_L that chose contract j at $t = 0$, that is, for $\lambda_L \in C_j$. The result then follows since $\bar{\lambda}_{L,A} > \bar{\lambda}_{L,M}$ by Proposition A.3. Consider now naive agents ($\beta < \hat{\beta} = 1$). Expression (12) holds also for a naive agent enrolled under contract F_A, while under contract F_M, equality $S_{M,t}(\lambda_L) = 1$ holds. The result $S_{A,t} < S_{M,t} = 1$ then follows once again by aggregation over λ. **Q.E.D.**

We now introduce Prediction 4', a formalized version of Prediction 4. Assume that we cannot observe $\bar{c}$, but that we observe a noisy proxy, the number of past visits v, with $v \in R$, and density function $h(v|\bar{c})$. We assume that the density h does not depend on the contract chosen. Denote by $S_{j,t}(v)$ the survival probability conditional on attendance v.

Prediction 4'. *For agents with rational expectations about the time preferences ($\beta = \hat{\beta} < 1$), the survival probabilities conditional on attendance satisfy $S_{A,t}(v) > S_{M,t}(v)$ for all v and $t \in T_A$. For naive agents ($\beta < \hat{\beta} = 1$), $S_{A,t}(v) < S_{M,t}(v) = 1$ for all v and $t \in T_A$.*

Proof of Prediction 4'. In order to derive an expression for $S_{j,t}(v)$, notice that the density of v unconditional on $\bar{c}$ is the same for $t \leq d$ and $t > d$. Therefore the number of visits v does not bring any information as to whether the agent already knows the cost type. For time-consistent and sophisticated agents ($\beta = \hat{\beta} \leq 1$), we can use Bayes rule for the probability $P(\bar{c} = \bar{c}_L | v)$ and write the survival probability $S_{j,t}(v)$ as

$$S_{j,t}(v) = (1 - p_d)^t + \left[1 - (1 - p_d)^t\right] \frac{h(v|\bar{c}_L)\bar{\lambda}_{L,j}}{h(v|\bar{c}_L)\bar{\lambda}_{L,j} + h(v|\bar{c}_H)\left[1 - \bar{\lambda}_{L,j}\right]} \tag{13}$$

for $j \in \{A, M\}$. The inequality $S_{A,t}(v) > S_{M,t}(v)$ follows from $\bar{\lambda}_{L,A} > \bar{\lambda}_{L,M}$ (Proposition A.3) and from the observation that the fraction in (13) is increasing in $\bar{\lambda}_{L,j}$. For naive agents ($\beta < \hat{\beta} \leq 1$), expression (13) holds for enrollment under the annual contract F_A; under the annual contract F_A, $S_{A,t}(v)$ equals one, since the agents never cancels. Expression $S_{A,t}(v) < S_{M,t}(v)$ follows since $S_{M,t}(v) = 1$ by Assumption 4 and $S_{A,t}(v)$ equals the expression for non-naive agents. **Q.E.D.**

Attendance over time. Define $a_{j,t}$ the expected attendance at time t for agents who initially chose contract F_j, $j = A, M$, and are enrolled in a flat-rate contract at time t. We introduce and prove the following formalizations of Prediction 5 and 6.

Prediction 5'. *Expected attendance in the annual contract $a_{A,t}$ is increasing over time: $a_{A,u} > a_{A,v}$ with $0 \leq u < \tilde{T} \leq v$, where $\tilde{T}$ is a period where the agent chooses between F and P.*

Proof of Prediction 5'. The expected attendance $a_{A,t}$ equals

$$T(1-p_d)^{T(t)} \frac{\int_{\lambda_L \in C_F} \tilde{G}(\beta\delta b|\lambda_L) d\Lambda(\lambda_L)/P(\lambda_L \in C_F)}{(1-p_d)^{T(t)} + \left[1-(1-p_d)^{T(t)}\right] \bar{\lambda}_{L,F}} + \tag{14}$$

$$T\left[1-(1-p_d)^{T(t)}\right] \bar{\lambda}_{L,F} \frac{G(\beta\delta b - \overline{c}_L)}{(1-p_d)^{T(t)} + \left[1-(1-p_d)^{T(t)}\right] \bar{\lambda}_{L,F}} \tag{15}$$

with $\bar{\lambda}_{L,F} = E[\lambda_L|\lambda_L \in C_F]$, and $T(t)$ being the last time period before t in which the agent could choose between flat-rate and pay-per-visit contracts. To see this, consider that agents remain enrolled in the flat-rate contract if either: (i) with probability $(1-p_d)^{T(t)}$ they have not yet learned their type by the last time they could switch contract; or (ii) they have learned by time $T(t)$ that they are a low-cost type (Assumptions 2 and 3). In case (i), the probability of attendance equals the one at time 0. Using $G(\beta\delta b - \overline{c}_L) > \int_{\lambda_L \in C_F} \tilde{G}(\beta\delta b|\lambda_L) d\Lambda(\lambda_L)/P(\lambda_L \in C_F)$, it follows that expression (14) is increasing in $T(t)$, which is what we wanted to prove. **Q.E.D.**

Prediction 6'. *For agents with rational expectations about the time preferences ($\beta = \hat{\beta} < 1$), expected attendance in the monthly contract $a_{M,t}$ is increasing over time: $a_{M,u} > a_{M,v}$ with $0 \leq u < \tilde{T} \leq v$, where $\tilde{T}$ is a period where the agent chooses between F and P. For naive agents ($\beta < \hat{\beta} = 1$), $a_{M,t}$ is constant over time: $a_{M,u} = a_{M,v}$ with $0 \leq u < v$.*

Proof of Prediction 6'. For $\beta = \hat{\beta}$, the proof follows along the lines of the proof of Prediction 5', since agents that experience $\overline{c}_H$ choose the flat-rate contract. For $\beta < \hat{\beta} = 1$, by Assumption 4 all the agents that choose a flat-rate contract at time 0 renew the choice of the flat-rate contract at later periods. Therefore, the average attendance is constant over time. **Q.E.D.**

B Appendix B: Data Appendix

The data on consumer behavior come from two different sources, the attendance panel and the billing records. In these two data sets, a 7-digit identification number allows us to link multiple spells of the same individual. We are told that the staff in the clubs always tries to assign to returning members the previous id.

Attendance panel. Each time a health club user with a flat-rate contract exercises, a health club staff member swipes the electronic card of the user, and therefore creates an attendance record. Each line of the attendance panel consists of the individual id, the date of the visit, basic demographic information (birthday, gender), a code for short-term memberships, the enrollment and the expiration date (for members that terminated the membership). All the information but the date of the visits is constant for an individual.

Billing records. The health clubs keep an official record of the customer payments. These billing data provide detailed and accurate information about the category of users—retail (the default), student, family, corporate—as well as the type of transaction. Each line of the billing panel consists of the individual id, the date of the contractual transaction, the 4-digit code that identifies the transaction, and the price paid (if any). For example, line "1234567 1/1/98 R564 55" indicates that user 1234567 on Jan. 1, 1998 paid an out-of-pocket monthly fee of $55 that applies to employees of company XYW. For the monthly contract, typical transactions are the payment of the initiation fee, of the monthly fee, or of additional items such as an overnight locker or a personal trainer. Other common codes involve monthly freezes of a membership, bounced payments, and termination of a membership for delinquency in the payments. For the annual contract, typical transactions are the payment of the initiation fee and of the annual fee, as well as for overnight lockers and personal trainer.

We use the price stated in the records as a measure of the monetary payments to the clubs. We could alternatively use the 4-digit code and a conversion table (based on the prices as of August 2000) to recover an imputed price. The correlation between the two measures of price is .9668. None of the results in the paper changes if we use the imputed price instead of the actual price.

Monthly panel. We merge the attendance and the billing panel into a unique data set, and we then transform the data into a balanced panel with monthly observations. Each observation consists of a variable defining the membership (not enrolled/enrolled in a monthly contract/enrolled in an annual contract/in a freeze), the total number of attendances in the month, and the price paid for the month. For an annual contract, the monthly price is 1/12th of the original price. In order to deal with monthly and annual contracts that start in the middle of a month, we pro-rate the fees for the first month. For the final month of an annual contract, we also pro-rate the fees. Monthly contracts always terminate on the last day of the month, so no pro-rating is needed for the last month.

Enrollment spells. We adopt the following rules regarding the definition of a period of enrollment. An *enrollment spell* is defined as a continuous temporal sequence of monthly or annual contracts, including possible freezes of the membership. If no more than one calendar month of non-enrollment separates two contracts, we still include them in one spell. For example, this is the case if an annual contract expiring on 15/1/98 is renewed on 17/3/98. The missing monthly payment may be due to an (unrecorded) one-month promotional offer, a delay in payment, or missing data for a monthly payment.

We consider an enrollment spell *censored* if either the spell is ongoing at the end of the panel or if the spell is followed by a short-term contract. One-month, two-month, three-month, and four-month contracts with automatic expiration are available, mostly for summer users. We do not analyze these relatively uncommon contracts, and therefore consider censored a spell that is followed by one of these contracts. We also consider a spell censored if it is followed by a sequence of months with no contract and attendance in at least half of the months. We assume that in these periods health club members are using a free temporary membership[50], which the clubs grant in various promotional or charitable initiatives.

C Appendix C: Experimental Instructions

Instructions for participation into the experiment follow. We report the version with 3 attendances per month. Other subjects had a version equal in all ways except that it was formulated with 4 attendances per month.

"The experiment you will participate in is part of a research project on health clubs. Today we will spend about 15 minutes going through the instructions and at the end of today we will pay you $5 immediately for showing up. The instructions are simple. If you follow them carefully, by the end of the experiment (approximately one week from now), you could earn a considerable amount of money.

The experiment you will participate in consists of one main task. In one of the next days you will visit one conveniently located health club in [location of the club], and you will find out the opportunities to attend that club. After your visit, you will meet us again and report to us. At this second meeting, you will be paid a fixed sum of $15 for participation in the experiment and an additional compensation depending on your report.

You task will be as follows. You are interested in attending health club *** for the next year or so. Based on your past experiences, you anticipate that on average you will attend the club 3 times a month, that is, you expect to go about once a week, except that you have business travel once a month. You want to find out what is the cheapest way to attend 3 times per month. Your task will be to visit health club *** in the next week, to find out the options to attend this club, and to compute the cheapest one. After your visit, you will meet with us again, and report to us the option that is cheapest if you attend 3 times a month for the next year or so.

In order to make the task more realistic, we will give you incentives similar to those of people who shop around to find the cheapest option to exercise. You will earn a substantial reward for choosing an option that saves money. Here is how we determine how much we pay you. We allocate to you a budget of $90 per month for gym attendance. This is equivalent to a budget of $30 for each attendance ($30 * 3 = $90). For each option, you should calculate how much you pay for the three visits in a month out of the monthly budget of $90. You should find the option in health club *** that minimizes the overall expense for the three visits. Next week, you will report to us this option, and you will keep the amount that you saved out of $90. Your earnings are guaranteed to be positive.

Consider an example (both the type of contract and the numbers are made up). Suppose that the three visits to the club in a month cost you $60 overall. In addition, you need to pay a one-time $120 initiation fee. Since you expect to attend for about a year, we count 1/12th of the initiation fee, i.e., $10. Therefore, next week, in addition to the fixed payment, you will receive $90 - $60 - $10 = $20. You will receive the $20 earned in this imaginary example and

[50] Unfortunately, no code characterizes contracts that involve no monetary payments, like a free membership.

the fixed payment of $15, in addition to today's $5 show-up fee.

Remember: these figures are imaginary, you should not use them to estimate your earnings from the experiment, nor the options that club *** offers. They are just meant to illustrate your payment scheme.

There are some important details of the experiment that you should remember:

1. It is crucial for our experiment that you visit the club in person. You are not allowed to obtain information over the phone. To prove that you actually visit the club, you will bring to our next meeting the brochure that they hand to you at the club.

2. Once you are at the club, act as naturally as you can. Remember, you are interested in attending their club, and you expect to attend once a week in most weeks (3 times a month). Your task is to inquire about the best (cheapest) way to do so. You should not tell them that this is part of an experiment. You are just one of the many people that inquire about joining their gym. Do not show them these instructions.

3. Because we are interested in the offers that they make to a typical member, you are NOT allowed to make use of any reduction. In particular, you should not claim a student reduction, or a reduction due to your health insurance. You should not mention your student status, if you are a student. We are interested in the price that a normal user would pay. Given that the typical member in this club is a young professional, you should wear business casual clothing when visiting the club.

4. You should NOT actually sign up, or pay any amount to the club as part of this experiment. You should only collect information. We will not be able to pay any amount to the club for you.

5. If they ask you information about yourself, feel free to say that you wanted to check out their gym before you signed up. You should sound genuinely interested in their gym, but you do not have to provide them with information about yourself.

6. The experimenters know the prices of the contracts that are available at the club you are sent to. Therefore, it is in your interest to truthfully report the contracts that the club offers.

Do you have any questions? If everything is clear, we would like to provide you with directions to the health club.

We would also like you to sign the consent form below, and schedule an interview time for next week. Today, we will pay you $5 immediately. Next week, you will report to us the cheapest option, bring us the brochure from the health club, briefly answer a debriefing questionnaire, and then we will pay you $15 plus the incentive payment we mentioned above.

Remember, you can drop out of this experiment at any time. You will still be paid the $5 show-up fee for today, but you will not receive the final payments, unless you report to us the information on the cheapest contract."

D Appendix D: Survey of health club members

On three days in August 2002, a research assistant randomly selected by-passers at a mall in Walnut Creek, California, and asked them is they attended a health club. If the answer was positive, he administered the following survey.

"We would like to ask you five questions related to health club attendance. We really appreciate your time.

1. In which health club are you enrolled?

    Name of the health club:

    Address of the health club: Street and City

2. What type of membership do you have? [Circle one.]

- Monthly contract.
- Annual contract.
- Other [please fill in your membership type] ______________________

3. How often do you expect to attend your health club next month?

Next month, I expect to attend [circle one]

- 0-1 times per month
- 2-3 times per month
- 4-5 times per month (1 visit per week)
- 6-7 times per month
- 8-9 times per month (2 visits per week)
- 10-11 times per month
- 12-13 times per month (3 visits per week)
- more than 13 times per month

4. (Please answer Question 4 only if you have a monthly membership. Otherwise go to Question 5.) How is the cancellation policy of your health club? In particular, when do you have to cancel to avoid paying the next monthly fee?

- I don't know.
- I have to cancel by [fill in day of the month] ______________________

5. Consider the following hypothetical scenario.

Suppose that, based on your previous experience you expect to attend on average 5 times per month (about once a week), if you enroll in a monthly membership.

You plan to attend the health club throughout the next year. Would you choose ...

[Circle one.]

- ... a monthly contract with a monthly fee of $70 per month?
- ... 10-visit passes for $100 (each visit costs $10)?

THANK YOU AND HAVE A GREAT DAY!"

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Figure 1. Contractual Menu

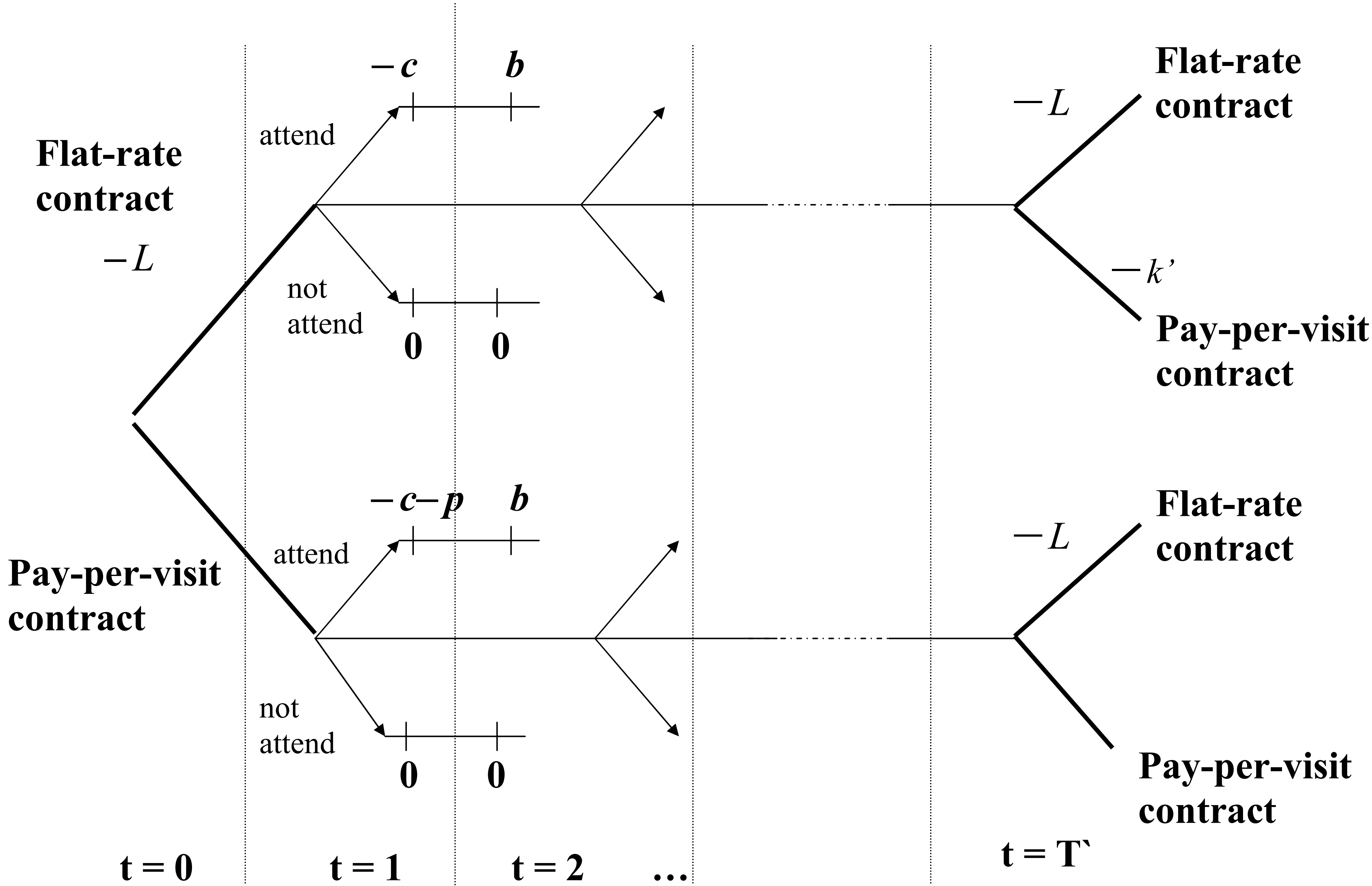


Figure 2. Survival probability (as a function of attendance)

Figure 2.a.
Time-consistent or
sophisticated agents

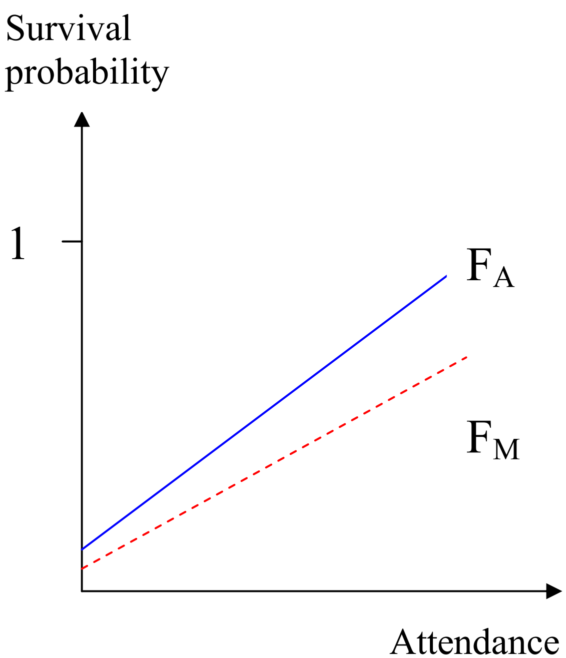


Figure 2.b.
Naïve agents

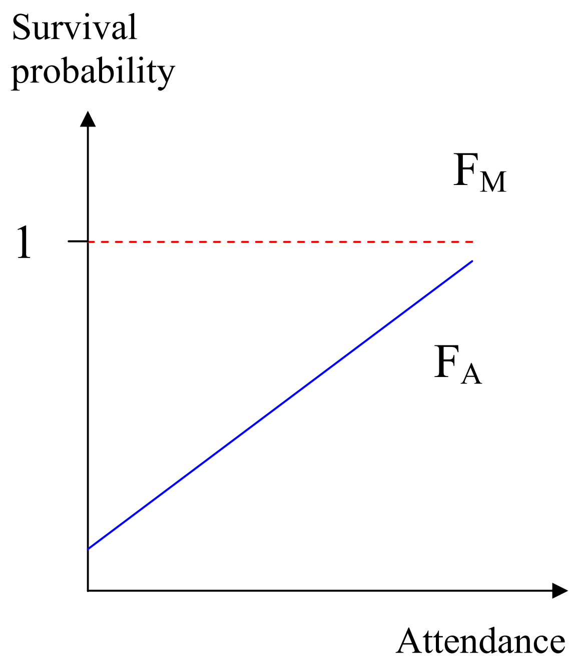


Figure 2.c.
Heterogeneity (time-cons./soph.
and naïve agents)

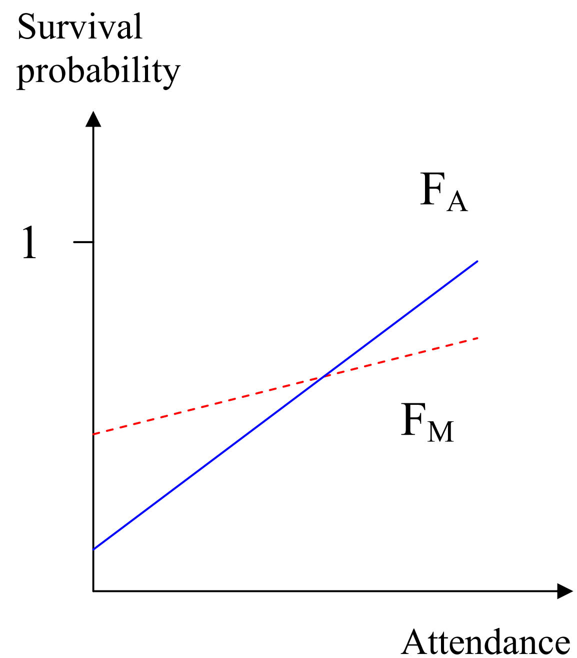


Figure 3. Average attendance and price per average attendance (Kernel regressions)

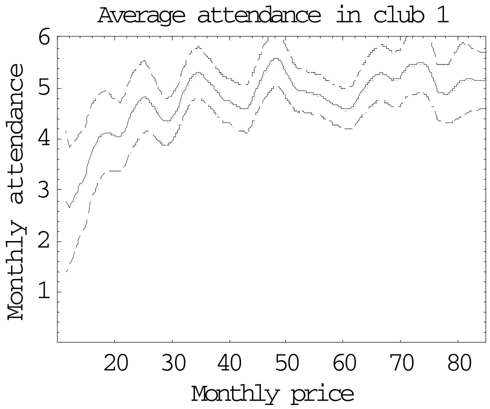


Figure 3a. Kernel regression of attendance on price (club 1, bandwidth 4).

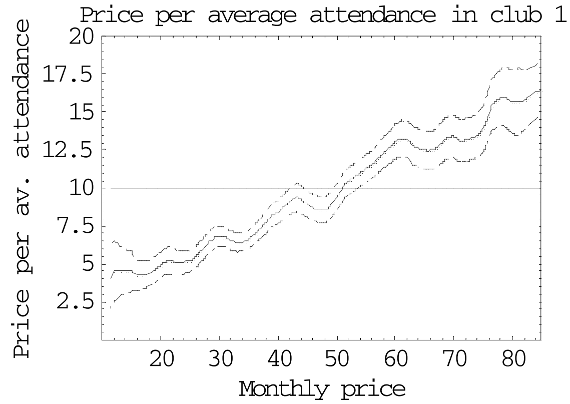


Figure 3b. Price per average attendance as a function of the monthly price (club 1, bandwidth 4).

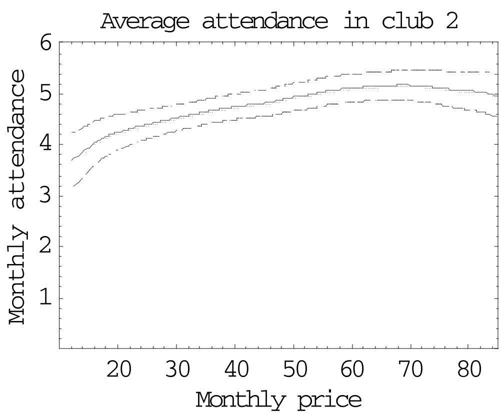


Figure 3c. Kernel regression of attendance on monthly price (club 2, bandwidth 16).

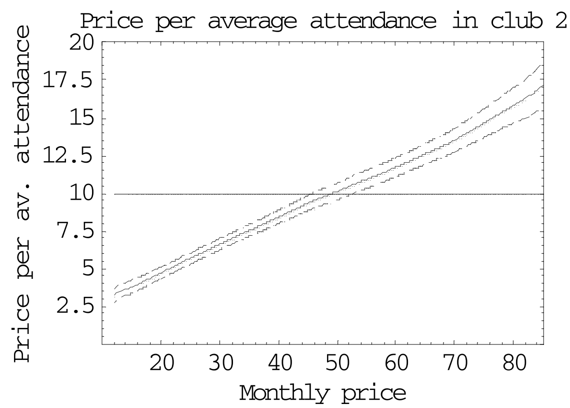


Figure 3d. Price per average attendance as a function of the monthly price (club 2, bandwidth 16).

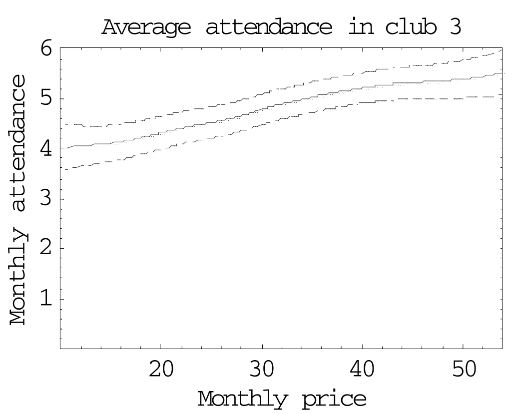


Figure 3e. Kernel regression of attendance on price (club 3, bandwidth 16)

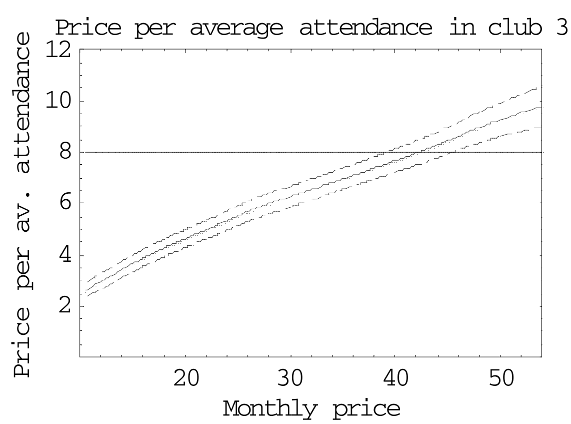


Figure 3f. Price per average attendance as a function of the monthly price (club 3, bandwidth 16).

Notes: Point estimates and 95 percent confidence intervals plotted. The sample is 'First spell' for individuals initially enrolled with a monthly contract. The individual price variable is the average price over the first six months. The individual attendance variable is the average attendance over the first six months. Figures 3a, 3c, and 3e show a kernel regression of attendance on price using an Epanechnikov kernel. The bandwidth is determined by cross-validation with a grid search separately for each club. Figures 3b, 3d, and 3f show the ratio of the price and the expected attendance predicted for that price using the kernel regression. Confidence intervals are derived using the Delta method.

Figure 4. Price per average attendance over time

Figure 4a. Price per average attendance
Annual contracts with annual fee >=$700

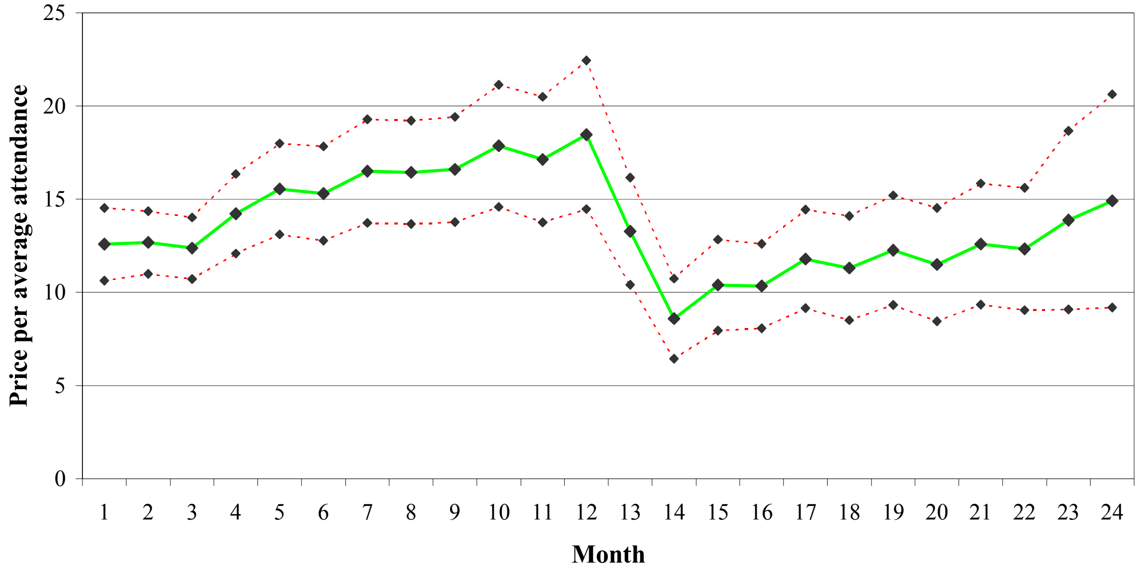
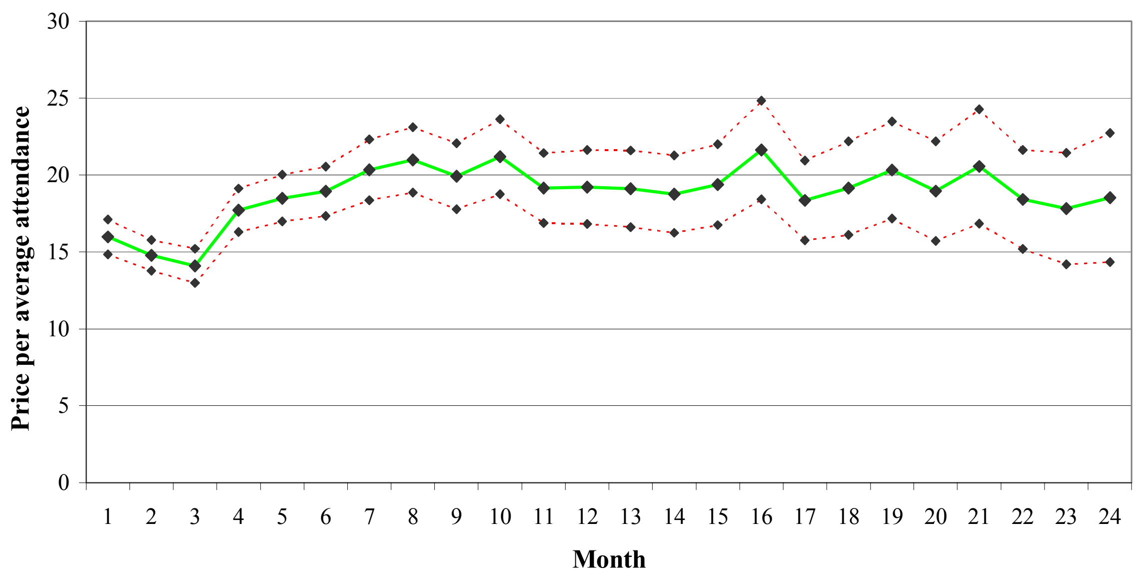


Figure 4b. Price per average attendance
Monthly contracts with monthly fee>=$70



Notes: Point estimates and 95 percent confidence intervals plotted. Figure 4a plots the ratio of average price and average attendance at month *n* of tenure. The sample is 'First spell and no subsidy, all clubs' for individuals initially enrolled in the annual contract and still enrolled at month *n* of tenure. Figure 4b plots the ratio of average price and average attendance at month *n* of tenure. The sample is 'First spell and no subsidy, all clubs' for individuals initially enrolled in the monthly contract and still enrolled at month *n* of tenure. Standard errors for the ratio of average price and average attendance computed using the bivariate Delta method.

<u>Figure 5. Predicted survival probability.</u>
Probit specification with quartic polynomial in past attendance

Figure 5a.

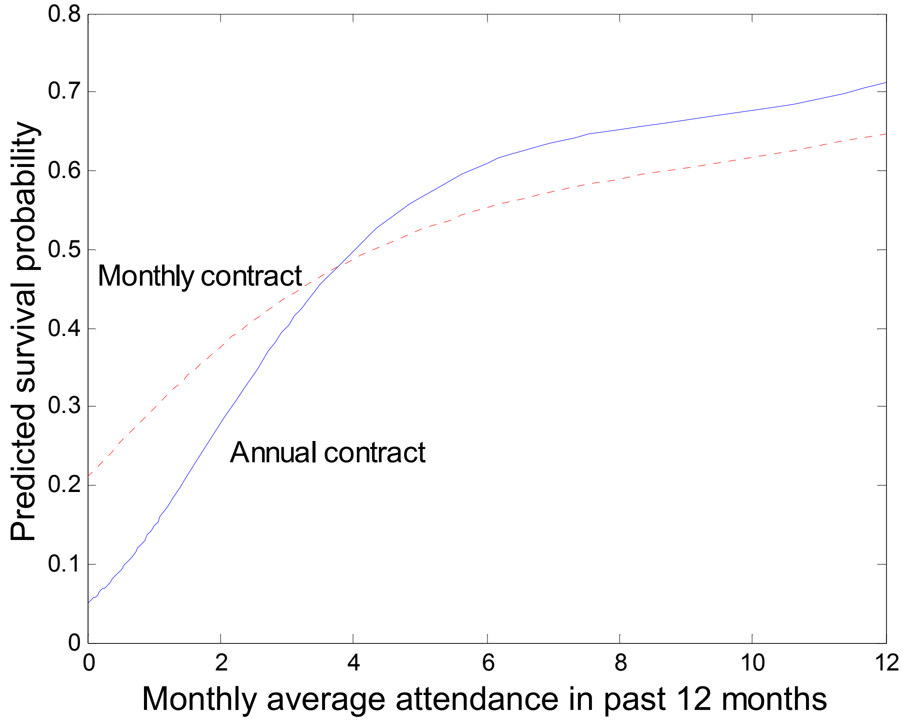
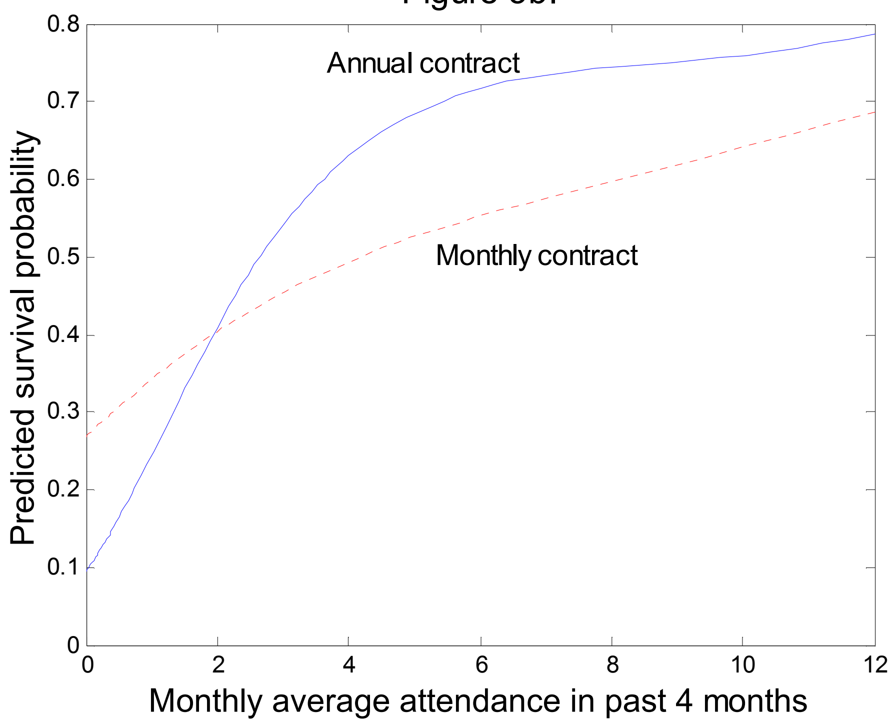


Figure 5b.



Notes: Figure 5a and Figure 5b plot the predicted probability of membership at the 14th active month after enrollment as a function of a quartic polynomial in past attendance. Figure 5a follows the probit specification of Column 6 in Table 8. Figure 5b follows the probit specification of Column 1 in Table 9 with a quartic polynomial in attendance as an additional control.

Table 1: Stylized Facts and Explanations

	Time-consistent agents (1)	Sophisticated time-inconsistent agents (2)	Partially naive time-inconsistent agents (3)	Distaste for payment per usage (4)	Overconfidence about future attendance (5)
Stylized fact 1. Price per average attendance > $10		commitment	commitment, overestimation of attendance	distaste	overestimation of attendance
Stylized fact 2. Interval between last attendance and termination 2.29 full months			delay in cancellation		overestimation of attendance
Stylized fact 3. Survival probability at 14th month 12.5 percent higher for monthly than for annual contract			delay in cancellation		
Stylized fact 4. Survival probability at 14th month double for monthly than for annual contract for low past attendance			delay in cancellation		
Stylized fact 5. Average attendance 46 percent higher in second year for annual contract	learning	learning	learning	learning	learning
Stylized fact 6. Decreasing average attendance over time in monthly contract			delay in cancellation		
Stylized fact 7. Positive correlation of price per average attendance and interval between attendance and termination			heterogeneity in naiveté		

Table 2: US Health Club Industry †

Top 10 Clubs for Revenue, year 2000

	Corporate Revenue in 2000 (in m$)	Number of Clubs in 2000[1]	Number of Employees in 2000	Number of States Operates in	Year Founded
	(1)	(2)	(3)	(4)	(5)
1. Bally Total Fitness Chicago, IL	1,007	380(O), 5(F)	20,000	28 (and Canada)	1962
2. 24 Hour Fitness Worldwide San Francisco, CA	943	430(O)	26,300	15 (and 10 countries)	1983
3. Town Sports International New York, NY	225	1(O), 4(M), 104(L)	6,400	9	1973
4. Wellbridge Denver, CO	175	23(O), 14(M), 10(L)	5,000	12	1983
5. Life Time Fitness Inc. Eden Prairie, MN	101	20(O)	3,000	6 (MN,MI,OH,IN,VA,IL)	1992
6. TCA Club Management Chicago, IL	85	24(O), 22(M)	2,200	16 (and Canada)	1969
7. The Sports Club Co. Inc. Los Angeles, CA	77	7(O)	2,400	4 (CA,NY,NV,D.C.)	1978
8. Crunch Fitness International New York, NY	73	19(L), 1(LS)	2,200	5 (NY,CA,FL,IL,GA)	1989
9. Western Athletic Clubs San Francisco, CA	70	4(O), 5(L)	1,600	2 (CA,WA)	1977
10. Sport &Health Clubs McLean, VA	61.5	24(O), 1(M)	1,850	3 (VA,MD,D.C.)	1973

Concentration Indexes for year 2000

Herfindahl Index (*10,000)	152.65
Concentration Ratio 4 (%)	20.25
Concentration Ratio 8 (%)	23.15
Concentration Ratio 20 (%)	27.84
Concentration Ratio 50 (%)	32.55

† **Notes:** Source: "Understanding the Top 100", Jerry Janda, Club Industry. The Corporate Revenue includes also revenue from international clubs, whenever applicable. Information comes from a survey of the companies. Since all of the companies but one are private, accuracy of the information is not guaranteed. The Concentration Indexes are from calculations of the authors using data from the industry publication *Club Industry*. The Herfindahl Index is the sum of the squared shares of company revenues over total industry revenue, summed across the biggest 100 companies (the contribution to the Herfindahl index of the companies past the 100^{th} is bounded above by .00162). The Concentration Ratio n is the ratio of the revenues by the n biggest companies over industry revenues.

[1] (O)=Owned, (M)=Managed, (L)=Leased, (LS)=Licensed, (F)=Franchised.

Table 3: Enrollment Spells, Descriptive Statistics

	Sample: First spell				Sample: First spell		Sample: First spell and no subsidy	
	Club 1	Club 2	Club 3	All clubs	All clubs		All clubs	
	All contracts				First contract Monthly	First contract Annual	First contract Monthly	First contract Annual
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of spells	3548	2984	1446	7978	7079	899	912	208
Number of completed spells	2440	1850	994	5284	4775	509	588	111
Fraction of total spells	0.688	0.620	0.687	0.662	0.675	0.566	0.645	0.534
Switching btw. flat-rate contracts[1]								
Number of contract switches per spell	0.227	0.201	0.162	0.205	0.207	0.196	0.240	0.260
Ever switch to annual contract					0.015		0.008	
Ever switch to monthly contract						0.102		0.111
Measures of duration (months)								
Mean duration	12.22	11.71	10.95	11.80	11.38	15.07	13.19	16.77
Standard deviation of duration	(8.75)	(9.70)	(9.14)	(9.20)	(9.28)	(7.80)	(9.72)	(8.30)
10th percentile	3	2	2	3	3	6	3	9
25th percentile	6	4	4	5	5	13	6	13
Median	10	9	8	9	8	13	10	13
75th percentile	16	16	14	15	15	16	18	23
90th percentile	25	26	24	25	25	26	28	29

Notes: An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "First spell" consists of the first enrollment spell. The sample "First spell and no subsidy" restricts the sample "First spell" to those spells in which the average adjusted monthly fee is at least $70 if the spell starts with a monthly contract and at least $58 if the spell starts with an annual contract. The spells in column "First Contract Monthly" start with a monthly contract. The spells in column "First Contract Annual" start with an annual contract. The measures of duration include censored spells.

[1] A switch is a change from a monthly to an annual contract or viceversa, or a change from a contract code to another (such as from employee of company A to employee of company B).

Table 4: Demographic controls, Descriptive Statistics

	Sample: First spell				**Sample:** First spell		**Sample:** First spell and no subsidy	
	Club 1	Club 2	Club 3	All clubs	All clubs		All clubs	
	All Contr.	All Contr.	All Contr.	All Contr.	First Contract Monthly	First Contract Annual	First Contract Monthly	First Contract Annual
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total Amount in $	569.05	548.97	312.24	515.00	501.28	622.97	920.51	1041.80
	(509.94)	(559.85)	(307.50)	(509.07)	(513.41)	(459.66)	(713.68)	(543.94)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208
Initiation fee	6.32	1.99	2.85	4.07	3.87	5.62	14.46	17.07
	(26.64)	(12.16)	(12.88)	(20.13)	(19.45)	(24.82)	(41.66)	(45.15)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208
Average fee per month								
monthly contract	52.40	49.37	31.36	47.42	47.31	56.50	78.52	74.82
	(18.34)	(18.93)	(10.91)	(19.10)	(19.05)	(20.51)	(5.07)	(15.33)
	N = 3185	N = 2663	N = 1314	N = 7162	N = 7079	N = 83	N = 912	N = 22
annual contract	48.33	43.76	24.15	42.83	45.94	42.48	69.89	66.26
	(18.35)	(17.34)	(8.62)	(17.50)	(15.77)	(17.66)	(4.19)	(4.21)
	N = 445	N = 405	N = 151	N = 1001	N = 102	N = 899	N = 7	N = 208
Average attendance per month								
monthly contract	4.06	4.02	3.75	3.99	3.98	4.62	3.96	5.45
	(3.85)	(3.82)	(3.67)	(3.81)	(3.81)	(3.79)	(3.77)	(4.15)
	N = 3185	N = 2663	N = 1314	N = 7162	N = 7079	N = 83	N = 912	N = 22
annual contract	4.45	4.22	4.16	4.31	5.76	4.15	6.07	4.26
	(3.90)	(4.06)	(3.98)	(3.97)	(4.20)	(3.92)	(4.04)	(3.87)
	N = 445	N = 405	N = 151	N = 1001	N = 102	N = 899	N = 7	N = 208
Contract choice per spell								
months with monthly contract	9.18	8.91	8.86	9.02	10.11	0.44	11.70	0.55
	(8.42)	(9.14)	(8.91)	(8.78)	(8.70)	(2.12)	(9.06)	(2.35)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208
months with annual contract	1.58	1.95	1.41	1.69	0.15	13.76	0.08	15.16
	(4.75)	(5.79)	(4.84)	(5.18)	(1.52)	(7.47)	(1.08)	(7.97)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208
freezing	0.28	0.30	0.18	0.27	0.30	0.05	0.37	0.04
	(0.97)	(1.12)	(0.73)	(1.00)	(1.05)	(0.37)	(1.22)	(0.32)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208
Female	0.44	0.49	0.47	0.46	0.48	0.34	0.38	0.35
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.47)	(0.49)	(0.48)
	N = 3539	N = 2984	N = 1446	N = 7969	N = 7071	N = 898	N = 912	N = 208
Age at sign-up	30.71	31.54	35.05	31.81	31.52	34.04	33.14	34.40
	(8.43)	(8.94)	(9.27)	(8.92)	(8.78)	(9.65)	(9.70)	(10.78)
	N = 3343	N = 2855	N = 1363	N = 7561	N = 6710	N = 851	N = 855	N = 197
Corporate member	0.43	0.61	0.43	0.50	0.50	0.53	0.16	0.16
	(0.50)	(0.49)	(0.50)	(0.50)	(0.50)	(0.50)	(0.37)	(0.37)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208
Student	0.05	0.00	0.00	0.02	0.02	0.01	0.00	0.00
	(0.22)	(0.04)	(0.06)	(0.15)	(0.15)	(0.12)	(0.06)	(0.07)
	N = 3548	N = 2984	N = 1446	N = 7978	N = 7079	N = 899	N = 912	N = 208

Notes: Standard deviation in parentheses. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "First spell" consists of the first enrollment spell. The sample "First spell and no subsidy" restricts the sample "First spell" to those spells in which the average adjusted monthly fee is at least $70 if the spell starts with a monthly contract and at least $58 if the spell starts with an annual contract. The spells in column "First Contract Monthly" start with a monthly contract. The spells in column "First Contract Annual" start with an annual contract. "Average price per month" refers to the out-of-pocket fee in the case of corporate users.

Table 5: Price per Average Attendance at Enrollment

	Sample: First spell and no subsidy, all clubs		
	Average price per month	Average attendance per month	Average price per average attendance
	(1)	(2)	(3)
	Users initially enrolled with a monthly contract		
Month 1	55.09	3.45	15.98
	(0.78)	(0.13)	(0.57)
	N = 873	*N* = 873	*N* = 873
Month 2	80.53	5.45	14.78
	(0.44)	(0.18)	(0.51)
	N = 797	*N* = 797	*N* = 797
Month 3	70.02	4.97	14.09
	(1.04)	(0.18)	(0.57)
	N = 780	*N* = 780	*N* = 780
Month 4	81.72	4.61	17.71
	(0.26)	(0.19)	(0.72)
	N = 766	*N* = 766	*N* = 766
Month 5	81.87	4.43	18.50
	(0.25)	(0.18)	(0.78)
	N = 701	*N* = 701	*N* = 701
Month 6	81.88	4.32	18.94
	(0.28)	(0.19)	(0.82)
	N = 639	*N* = 639	*N* = 639
Months 1 to 6	83.00	4.85	17.13
	(0.40)	(0.14)	(0.52)
	N = 912	*N* = 912	*N* = 912
	Users initially enrolled with an annual contract, join 14 month before the end of sample period.		
Year 1	71.02	4.69	15.15
	0.50	0.38	1.24
	N = 145	*N* = 145	*N* = 145

Notes: Standard errors in parentheses. Standard errors for “Average price per average attendance” measure computed using the bivariate Delta method. The number of observations is denoted by N. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample “First spell” consists of the first enrollment spell. The sample “First spell and no subsidy” restricts the sample “First spell” to those spells in which the average adjusted monthly fee is at least \$70 if the spell starts with a monthly contract and at least \$58 if the spell starts with an annual contract. The sample for the *t*-th month includes spells that are ongoing, not frozen, and not miscoded at month *t*. For the 6-month period, the sample includes spells that are ongoing, not frozen, and not miscoded in at least one month in the period. For the 1-year period in the annual contract, the sample includes only spells that started at least 14 months before the end of the sample period, and that were not prematurely terminated because of medical reasons or relocation.

The “Average price” in period t is the average fee across people enrolled in period t. The “Average attendance” in period t is the average number of visits across people enrolled in period t. The measure in Column (3) is the ratio of the measure in Column (1) and the measure in Column (2).

Table 6: Distribution of Attendance and Price per Attendance at Enrollment

	Sample: First spell and no subsidy, all clubs			
	First contract monthly, Months 1-6 (monthly fee >= $70)		First contract annual, Year 1 (annual fee >= $700)	
	Average attendance per month (1)	Price per attendance (2)	Average attendance per month (3)	Price per attendance (4)
Distribution of measures				
10th percentile	0.33	7.59	0.23	6.05
20th percentile	1.00	10.17	0.86	8.67
25th percentile	1.50	11.39	1.23	10.65
Median	3.91	20.89	3.58	20.34
75th percentile	7.00	58.39	6.58	59.82
90th percentile	10.75	107.50	11.00	119.64
95th percentile	12.83	170.00	13.25	239.28
	N = 912	N = 912	N = 145	N = 145

Notes: The number of observations is denoted by N. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample “First spell” consists of the first enrollment spell. The sample “First spell and no subsidy” restricts the sample “First spell” to those spells in which the average adjusted monthly fee is at least $70 if the spell starts with a monthly contract and at least $58 if the spell starts with an annual contract. The spells in column “First Contract Monthly, months 1-6” start with a monthly contract. The spells in column “First Contract Annual, year 1” start with an annual contract. The variable "Price per attendance" is defined as the ratio of the average price over the average attendance over the firsy period (6 months for the monthly contract, one year for the annual contract).

Table 7: Average Attendance in Monthly and Annual Contracts (Sorting)

	Average attendance during the *n*-th month since enrollment								
	Sample: First spell, all clubs								
	Whole sample	Male sample				Female sample			
		Age<=25	Age >25, Age<=30	Age >30, Age<=40	Age >40	Age<=25	Age >25, Age<=30	Age >30, Age<=40	Age >40
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Month 2									
Monthly contract	5.500	5.809	5.769	5.261	5.651	5.974	5.553	4.453	5.442
	0.066	(0.2071)	(0.1706)	(0.1655)	(0.2090)	(0.1808)	(0.1684)	(0.1732)	(0.2326)
	N = 6380	*N* = 732	*N* = 944	*N* = 941	*N* = 702	*N* = 927	*N* = 859	*N* = 757	*N* = 514
Annual contract	5.797	7.277	5.652	5.764	5.644	6.638	5.316	4.825	5.672
	0.187	(0.6454)	(0.4351)	(0.4114)	(0.4690)	(0.6703)	(0.5595)	(0.5081)	(0.6405)
	N = 874	*N* = 83	*N* = 132	*N* = 203	*N* =163	*N* = 69	*N* = 79	*N* = 80	*N* = 64
Month 3									
Monthly contract	4.998	5.427	5.074	4.771	5.248	5.539	4.949	4.214	4.655
	0.069	(0.2185)	(0.1707)	(0.1751)	(0.2214)	(0.1925)	(0.1803)	(0.1837)	(0.2368)
	N = 5783	*N* = 662	*N* = 873	*N* = 878	*N* = 656	*N* = 796	*N* = 788	*N* =673	*N* = 452
Annual contract	5.583	6.366	5.813	5.747	5.644	5.613	5.300	4.593	5.111
	0.191	(0.6920)	(0.4949)	(0.3896)	(0.5001)	(0.6138)	(0.5914)	(0.5638)	(0.5525)
	N = 858	*N* = 82	*N* = 128	*N* = 198	*N* = 163	*N* = 62	*N* = 80	*N* = 81	*N* = 63
Month 4									
Monthly contract	4.592	4.990	4.907	4.528	4.781	4.904	4.549	3.724	4.254
	0.070	(0.2205)	(0.1759)	(0.1756)	(0.2195)	(0.2013)	(0.1805)	(0.1780)	(0.2477)
	N = 5390	*N* = 586	*N* = 810	*N* = 851	*N* = 604	*N* = 711	*N* = 742	*N* = 660	*N* = 421
Annual contract	5.151	5.813	5.613	4.922	5.727	5.491	4.372	4.012	4.871
	0.188	(0.6924)	(0.4802)	(0.3746)	(0.4816)	(0.7041)	(0.5370)	(0.5075)	(0.6571)
	N = 839	*N* = 80	*N* = 124	*N* = 193	*N* = 161	*N* = 57	*N* = 78	*N* = 83	*N* = 62

Notes: Standard errors in parentheses. The number of observations is denoted by N. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "First spell" consists of the first enrollment spell. The spells in row "Monthly Contract" start with a monthly contract. The spells in row "Annual Contract" start with an annual contract. The sample in month n includes spells that are ongoing, not frozen, and not miscoded.

Table 8: Probit of Renewal Decision I

	Dependent variable: Enrollment at 14th active month **Sample:** First spell with non-missing controls, all clubs						
Controls:	no controls	controls	controls + time dummies	no controls	controls + time dummies	no controls	controls + time dummies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy for enrollment with monthly contract	0.0318	0.0509	0.0514	0.1650	0.1803	0.2858	0.2943
	(0.0217)	(0.0217)	(0.0218)	(0.0321)	(0.0317)	(0.0508)	(0.0502)
Average monthly attendance in the first 13 active months							
Attendance				0.0641	0.0656	0.2643	0.2742
				(0.0060)	(0.0061)	(0.0635)	(0.0654)
$(\text{Attendance})^2$						-0.0322	-0.0339
						(0.0163)	(0.0170)
$(\text{Attendance})^3$						0.0017	0.0018
						(0.0015)	(0.0016)
$(\text{Attendance})^4$						-0.00003	-0.00003
						-0.00004	-0.00005
Monthly contract* (Average monthly attendance in the first 13 active months)							
Monthly*Attendance				-0.0292	-0.0291	-0.1429	-0.1363
				(0.0063)	(0.0065)	(0.0654)	(0.0673)
Monthly*$(\text{Attendance})^2$						0.0176	0.0163
						(0.0167)	(0.0174)
Monthly*$(\text{Attendance})^3$						-0.0008	-0.0007
						(0.0015)	(0.0016)
Monthly*$(\text{Attendance})^4$						0.00001	0.00001
						-0.00004	-0.00005
Female		-0.0576	-0.0566		-0.0453		-0.0458
		(0.0143)	(0.0144)		(0.0148)		(0.0149)
Age		0.0202	0.0204		0.0270		0.0280
		(0.0047)	(0.0047)		(0.0050)		(0.0050)
Age square		-0.0002	-0.0002		-0.0003		-0.0003
		(0.0001)	(0.0001)		(0.0001)		(0.0001)
Corporate member		0.0911	0.0816		0.1105		0.1089
		(0.0143)	(0.0144)		(0.0147)		(0.0149)
Student member		-0.1342	-0.1370		-0.1071		-0.0907
		(0.0500)	(0.0498)		(0.0530)		(0.0545)
Month and year of enrollment			X		X		X
Baseline renewal probability for monthly=0	0.3993	0.4033	0.4161				
Baseline renewal probability for monthly=0 and attendance=0				0.1598	0.1679	0.0497	0.0497
Number of observations	*N* =4905	*N* =4905	*N* =4905	*N* =4905	*N* =4905	*N* =4905	*N* =4905

Notes: Standard errors in parentheses. The number of observations is denoted by N. Entries in the Table represent the marginal coefficients of the probit in response to an infinitesimal change in the continuous variables, and a discrete change for the dummy variables. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample “First spell with non-missing controls” consists of the first enrollment spell for individuals for whom the demographic controls “age” and “female” are available. The sample is further restricted to individuals who join at least 14 active months before the end of the sample period. See the text for a definition of Enrollment at the 14th active month. The controls "Month and year of enrollment" indicate that the probit contains 11 dummies for the month of enrollment and 4 dummies for year of enrollment.

Table 9: Probit of Renewal Decision II. Robustness

Sample:	First spell with non-missing controls, all clubs										No subsidy I, all clubs		No subsidy II, all clubs	
Dependent variable:	Enrollment at 14th active month		Enrollment at the 15th month		Enrollment at the 16th month		Enrollment at the 27th month		Enrollment at the 28th month		Enrollment at 14th active month		Enrollment at 14th active month	
Controls:	No Controls	Controls + Time Dummies	No Controls	Controls + Time Dummies	No Controls	Controls + Time Dummies	No Controls	Controls + Time Dummies	No Controls	Controls + Time Dummies	No Controls	Controls + Time Dummies	No Controls	Controls + Time Dummies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Dummy for enrollment with monthly contract	0.1545	0.1698	0.0543	0.0719	0.0376	0.0582	-0.0009	0.0262	-0.0016	0.0294	0.0527	0.0465	0.0812	0.0925
	(0.0287)	(0.0286)	(0.0217)	(0.0219)	(0.0221)	(0.0222)	(0.0261)	(0.0252)	(0.0264)	(0.0252)	(0.0479)	(0.0501)	(0.0370)	(0.0378)
Average attendance in last 4 months	0.0728	0.0736												
	(0.0062)	(0.0063)												
Monthly contract* (Average attendance in last 4 months)	-0.0384	-0.0379												
	(0.0065)	(0.0066)												
Female		-0.0462		-0.0405		-0.0405		-0.0759		-0.0811		-0.0443		-0.0306
		(0.0149)		(0.0143)		(0.0144)		(0.0166)		(0.0167)		(0.0398)		(0.0280)
Age		0.0256		0.0145		0.0164		0.0239		0.0265		0.0312		0.0253
		(0.0050)		(0.0046)		(0.0047)		(0.0054)		(0.0054)		(0.0115)		(0.0083)
Age square		-0.0003		-0.0001		-0.0002		-0.0002		-0.0003		-0.0004		-0.0003
		(0.0001)		(0.0001)		(0.0001)		(0.0001)		(0.0001)		(0.0001)		(0.0001)
Corporate member		0.1004		0.0747		0.0700		0.0713		0.0705		0.2071		0.0043
		(0.0149)		(0.0144)		(0.0145)		(0.0168)		(0.0169)		(0.0484)		(0.0319)
Student member		-0.1147		-0.1151		-0.0953		-0.0916		-0.0767		0.1527		-0.1616
		(0.0525)		(0.0503)		(0.0516)		(0.0591)		(0.0604)		(0.2722)		(0.0669)
Month and year of enrollment		X		X		X		X		X		X		X
Renewal probability for monthly=0			0.3983	0.4162	0.3925	0.4077	0.2677	0.2853	0.2589	0.2730	0.4701	0.5426	0.4366	0.4373
Renewal probability for monthly=0 & attend.=0	0.1823	0.1832												
Number of observations	N=4905	N=4905	N=4990	N=4990	N=4860	N=4860	N=2874	N=2874	N=2777	N=2777	N=704	N=704	N=1362	N=1362

Notes: Standard errors in parentheses. The number of observations is denoted by N. Entries in the Table represent the marginal coefficients of the probit in response to an infinitesimal change in the continuous variables, and a discrete change for the dummy variables. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "First spell with non-missing controls" consists of the first enrollment spell for individuals for whom the demographic controls "age" and "female" are available. The sample is further restricted to individuals who join at least 14 active months before the end of the sample period. The sample "No Subsidy I" is a restriction of the sample "First spell with non-missing controls" to individuals paying on average a per-month fee of at least \$70. The sample "No Subsidy I" is a restriction of the sample "First spell with non-missing controls" to individuals paying on average a per-month fee of at least \$60. See the text for a definition of Enrollment after 13 active months. The controls "Month and year of enrollment" indicate that the probit contains 11 dummies for the month of enrollment and 4 dummies for year of enrollment.

Table 10: Attendance and Price per Average Attendance Over Time

	Sample: First spell and no subsidy, all clubs			**Sample:** First spell, all clubs		
	Average price per month	Average attendance per month	Average price per average attendance	Average price per month	Average attendance per month	Average price per average attendance
	(1)	(2)	(3)	(4)	(5)	(6)
	Users initially enrolled with a monthly contract					
Months 1-6	83.00	4.85	17.13	50.44	4.87	10.36
	(0.40)	(0.14)	(0.52)	(0.25)	(0.05)	(0.12)
	N = 912	*N* = 912	*N* = 912	*N* = 7079	*N* = 7079	*N* = 7079
Months 7-12	82.04	3.59	22.87	53.03	3.91	13.56
	(0.24)	(0.16)	(1.05)	(0.31)	(0.07)	(0.25)
	N = 606	*N* = 606	*N* = 606	*N* = 3961	*N* = 3961	*N* = 3961
Months 13-18	81.47	3.93	20.74	53.03	4.39	12.07
	(0.35)	(0.23)	(1.24)	(0.41)	(0.10)	(0.29)
	N = 339	*N* = 339	*N* = 339	*N* = 2192	*N* = 2192	*N* = 2192
Months 19-24	81.67	3.87	21.10	54.18	4.39	12.35
	(0.37)	(0.29)	(1.61)	(0.58)	(0.13)	(0.39)
	N = 200	*N* = 200	*N* = 200	*N* = 1181	*N* = 1181	*N* = 1181
	Users initially enrolled with an annual contract					
Year 1	71.02	4.69	15.15	47.57	4.48	10.62
	(0.50)	(0.38)	(1.24)	(0.75)	(0.17)	(0.44)
	N = 145	*N* = 145	*N* = 145	*N* = 598	*N* = 598	*N* = 598
Year 2	73.78	6.85	10.77	50.09	6.59	7.60
	(1.06)	(1.00)	(1.57)	(1.81)	(0.49)	(0.60)
	N = 36	*N* = 36	*N* = 36	*N* = 112	*N* = 112	*N* = 112

Notes: Standard errors in parentheses. Standard errors for "Average price per average attendance" measure computed using the bivariate Delta method. The number of observations is denoted by N. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "First spell" consists of the first enrollment spell. The sample "First spell and no subsidy" restricts the sample "First spell" to those spells in which the average adjusted monthly fee is at least $70 if the spell starts with a monthly contract and at least $58 if the spell starts with an annual contract.

For the 6-month periods, the sample includes spells that are ongoing, not frozen, and not miscoded in at least one month in the period. For year 1 in the annual contract, the sample includes only spells that started at least 14 months before the end of the sample period, and that were not prematurely terminated because of medical reasons or relocation. For year 2, the sample includes only spells that started with an annual contract at least 26 months before the end of the sample period, and that lasted at least 25 months. The spells in row "First contract monthly" start with a monthly contract. The spells in row "First contract annual" start with an annual contract. The "Average price" in period t is the average fee across people enrolled in period t. The "Average attendance" in period t is the average number of visits across people enrolled in period t. The measure in Column (3) is the ratio of the measure in Column (1) and the measure in Column (2).

Table 11: Loss from choice of flat-rate contracts

	Sample: First spell and no subsidy, first contract monthly, all clubs			Sample: First spell and no subsidy, first contract annual, all clubs		
	Join before October 1997 (1)	Join before April 1998 (2)	Join before October 1998 (3)	Join before October 1997 (4)	Join before April 1998 (5)	Join before October 1998 (6)
Loss from choice of flat-rate contract in $	698.16	607.35	595.00	-61.65	220.17	230.01
	(106.05)	(53.33)	(41.40)	(424.22)	(193.95)	(146.08)
Total money spent per spell in $	1516.88	1309.07	1256.48	1832.34	1562.73	1445.00
	(114.96)	(59.73)	(46.15)	(169.77)	(101.25)	(76.47)
Percentage of loss over money spent	47.87%	51.28%	51.83%	6.01%	28.45%	27.18%
	(4.78)	(2.93)	(2.60)	(17.62)	(9.66)	(8.63)
Number of observations *N*	*N* = 70	*N* = 238	*N* = 345	*N* = 15	*N* = 43	*N* = 68

Notes: Standard errors in parentheses. The number of observations is denoted by *N*. An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "First spell" consists of the first enrollment spell. The sample "First spell and no subsidy" further restricts the sample "First spell" to those spells in which the average adjusted monthly fee is at least $70 if the spell starts with a monthly contract and at least $58 if the spell starts with an annual contract. The spells in Column "First contract monthly" start with a monthly contract. The spells in Column "First contract annual" start with an annual contract. The measure "Loss from choice of contract with flat fee in $" is the average saving in $ that a user who chose a contract would have attained if she had purchased a 10-visit pass for $100 and attended the same number of times. A negative value denotes that the user would have lost money by purchasing the pass.

Table 12: Correlations †

	Sample: Last contract Monthly, join before April 1998, all clubs
Correlation for *n* = 1	ρ(price per average attendance with 1 month distance, cancellation gap) = .2131 (.0000, N = 2186)
Correlation for *n* = 2	ρ(price per average attendance with 2 months distance, cancellation gap) = .2185 (.0000, N = 1873)
Correlation for *n* = 3	ρ(price per average attendance with 3 months distance, cancellation gap) = .2110 (.0000, N = 1586)
Correlation for *n* = 4	ρ(price per average attendance with 4 months distance, cancellation gap) = .2041 (.0000, N = 1358)
Correlation between cancellation gap and freezing measure	ρ(freezing measure, cancellation gap) = -.1042 (.0000, N = 4323)

† **Notes:** Entries are the simple correlation between the variables. In parenthesis the p-value for the hypothesis of zero correlation and the number of observation over which correlation are calculated. The cancellation gap is measured as log(1 + number of consecutive full months between last attendance and contract expiration). The price per average attendance is measured as log(1 + [payments to health club / attendance from enrollment until *n* months before last attendance]). An enrollment spell starts whenever an individual enrolls (or re-enrolls) in the club and ends whenever the individual quits or is censored. The sample "Last contract Monthly, Join before April 1998" consists of all spells that start before April 1998, and end with a monthly contract. The spells cannot be ongoing, and have to have at least two months of paid contract preceding the *n* months before the last attendance. See the Text for details on the freezing measure.

Table 13: Survey of Health Club Members in California

	Full Sample	Members with Annual Contracts	Members with Monthly Contracts	Members with Monthly Contracts matched with a club with a deadline
	(1)	(2)	(3)	(4)
Average expected attendance in the next month[1]	9.50 (0.66)	9.84 (1.06)	9.35 (0.98)	9.85 (1.01)
Number of people who know the cancellation policy of their health club (monthly contract only)				1 5%
Number of people who would choose the 10-visit pass (hypothetical scenario)	30 63%	9 50%	19 76%	13 65%
Number of subjects	48	18	25	20

Notes: Standard errors in parentheses. The survey was run in a mall in California at the end of August 2002. Subjects were randomly chosen among the people walking by. The text of the survey is in Appendix D. The sample "Members with Monthly Contracts matched with a club with a deadline" includes subjects that stated that they had a monthly contract, and whom we were able to match to a health club that actually had a deadline for cancellation of the monthly contract.

[1] An indicated frequency of "*n* to *n + 1* times per month" is coded as *n + 1/2* monthly visits. An indicated frequency of "more than 13 times per month" is coded as 14 monthly visits.

Appendix Table 1: Predictability of aggregate day-to-day attendance

	Dependent variable: (Total attendance) / (Total no. of members) in a given day (*100)	
	Club 1 (1)	Clubs 2 and 3 (2)
Constant	23.9503 (0.3742)	25.7922 (0.4585)
Tuesday dummy	0.3607 (0.2958)	-0.4523 (0.3326)
Wednesday dummy	-1.0491 (0.2921)	-1.8951 (0.3274)
Thursday dummy	-3.0415 (0.2931)	-4.3115 (0.3284)
Friday dummy	-6.9622 (0.2933)	-7.1911 (0.3278)
Saturday dummy	-12.0147 (0.2926)	-17.4992 (0.3267)
Sunday dummy	-14.2534 (0.2921)	-19.8135 (0.3275)
11 Month dummies	X	X
3 Year dummies	X	X
Dummy for 2001		X
15 Holiday dummies		X
Observations	N = 876	N = 1079
R-squared	0.8785	0.8915

Notes: Standard errors in parentheses. The sample includes all the days between April 1, 1998 and August 24, 2001 for club 1 and all the days between April 1, 1998 and March 15, 2001 for clubs 2 and 3. The dependent variable is the ratio of total attendance over total number of members in a given day multiplied by 100. The set of 15 Holiday dummies includes a separate dummy for each of the federal holidays, plus dummies for the Christmas week, the Thanksgiving week, and the day after NewYear.

Appendix Table 2: Price per average attendance in subsamples

	Average price per month (1)	Average attendance per month (2)	Average price per average attendance (3)
Subsample 1: First spell and no subsidy, no locker use, users initially enrolled in a monthly contract, all clubs			
Months 1 to 6	83.03	4.87	17.05
	(0.42)	(0.15)	(0.53)
	N = 835	*N* = 835	*N* = 835
Subsample 2: First spell, members of HMO 1, users initially enrolled in a monthly contract, all clubs			
Months 1 to 6	53.08	4.98	10.65
	(0.36)	(0.12)	(0.25)
	N = 1342	*N* = 1342	*N* = 1342

Notes: Standard errors in parentheses. Subsample 1 includes users in the sample "First Spell and no Subsidy" who enroll with a monthly contract and never rent an overnight locker. Subsample 2 includes users in the sample "First Spell" who enroll with a monthly contract as a member of HMO 1. The price shown is net of the HMO reduction. The alternative contract for members of HMO 1 is the payment of a per-visit fee of $6.

Appendix Table 3: HMO reimbursement of health club expenses

	Monthly contract (1)	Annual contract (2)	Pay-per-visit (3)	Applicable clubs (4)
HMO 1	20% reduction	20% reduction	6$ copayment	Selected clubs
HMO 2	No Plan	No Plan	No Plan	
HMO 3	No Plan	No Plan	No Plan	
HMO 4	25-60% reduction	No Plan	No Plan	Gyms in Globalfit Network (Do not include Clubs 1, 2, and 3)
HMO 5	No Plan	10% reduction	No Plan	Planet Fitness, Metropolitan, Gold's, Mike's Gym
HMO 6	$25 reimbursement	$25 reimbursement	No Plan	All clubs
HMO 7	Up to $150 reimbursement	Up to $150 reimbursement	Up to $150 reimbursement	All clubs
HMO 8	Up to $150 reimbursement	Up to $150 reimbursement	Up to $150 reimbursement	All clubs
HMO 9	Discount on initiation fee	Discount on initiation fee		
HMO 10	Typically, 50% off initiation fee	Typically, 50% off initiation fee		Selected clubs
HMO 11	No plan	No plan	No plan	
HMO 12	No plan	No plan	No plan	

Notes: Fitness programs for health clubs located in the state home to the three clubs in the sample. Information from HMOs websites and telephone calls by the authors. The discount on HMO 7 is only active since September 1999; previously it was only a $20 discount. The health clubs in our sample are not part of the Globalfit Network.