Are loyalty-rewarding pricing schemes anti-competitive?☆

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Abstract

Many economists and policy analysts seem to believe that loyalty-rewarding pricing schemes, like frequent flyer programs, tend to reinforce firms’ market power and hence are detrimental to consumer welfare. The existing academic literature has supported this view to some extent. In contrast, we argue that these programs are business stealing devices that tend to enhance competition, in the sense of generating lower average transaction prices and higher consumer surplus. In highly competitive environments this result is robust to alternative specifications of the firm’s commitment power and demand structures. However, it could be reversed if the number of firms is sufficiently small and if firms are restricted to use program designs with sufficiently weak commitment capacity.

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1. Introduction

In some markets sellers discriminate between first time and repeat buyers using a variety of instruments. For instance, manufacturers have been offering repeat-purchase coupons for a long...
time. That is, they provide a coupon along with the product purchased, which consumers can use to obtain a discount in their next purchase of the same product. Recently, firms have designed more sophisticated pricing schemes to reward loyalty. For example, most airlines have set up frequent-flyer programs (FFPs) that offer registered travelers free tickets or free class upgrades after a certain number of miles have been accumulated. Similar programs are also run by car rental companies, supermarket chains, hotels, and other retailers.

What are the efficiency and distributional effects of these loyalty-rewarding programs? Do they enhance firms’ market power? Should organizations that aim at protecting consumer interests be concerned about the proliferation of those schemes? The goal of this paper is to contribute to our understanding of these issues by analyzing firms’ incentives to introduce loyalty rewards in highly competitive environments. In this context we can focus on how alternative designs of loyalty programs are able to cope with firms’ time inconsistency problem. Although some of our results are not directly applicable to any arbitrary market structure, our model puts in the right perspective some of the results of the literature, typically derived in the context of duopoly models. In contrast to many economists and policy analysts who believe that loyalty programs are anti-competitive (higher profits, lower consumer surplus), our model suggests that these programs tend to be pro-competitive, except in cases where the number of competing firms is sufficiently small and firms are restricted to use program designs with sufficiently weak commitment capacity.

Loyalty programs can perhaps be interpreted as a form of price discrimination analogous to quantity and bundled discounts. However, such an analogy is, at best, only part of the story. In all the above examples the time dimension seems crucial. In particular, these programs involve some commitment capacity (sellers restrict their future ability to set prices) and they affect the pattern of repeat purchases (current demand depends on past sales). It is precisely this dynamic aspect which is the main focus of this paper. In other words, our aim is not to undertake a complete analysis of loyalty rewards. Instead, we restrict attention to single product markets (excluding bundled discounts) where each consumer buys one unit (excluding static non-linear pricing). Moreover, we focus on markets for final consumption goods, and hence neglect all the issues associated with vertical relations.

Unfortunately, the empirical evidence currently available is scarce. In the marketing literature one can find somewhat weak evidence on the influence of loyalty programs on the pattern of repeat purchases. In some cases the evidence is about industries (for instance, grocery retailing) where loyalty programs have an important bundling component.

Some of the recent evidence refers to the air transport industry. FFPs were first introduced by major US airlines immediately after deregulation and they were interpreted as an attempt to isolate themselves from competition. In fact, Lederman (2003) reported significant effects of FFPs on market shares. In particular, she showed that enhancements to an airline’s FFP, in the form of improved partner earning and redemption opportunities, are associated with increases in the airline’s market share. Moreover, those effects are larger on routes that depart from airports at

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1 Frequent flyer programs seem to be more popular than ever. In fact, according to The Economist (January 8th, 2005, page 14) “the total stock of unredeemed frequent-flyer miles is now worth more than all the dollar bills in circulation around the world”. The same article also mentions that unredeemed frequent flyer miles are a non-negligible item in some divorce settlements!

2 In particular, in the context of vertical relations, it has been recognized that loyalty discounts offered by manufacturers when selling to retailers, which are very often buyer-specific, may serve the same purpose as other vertical control practices, such as tying and exclusive dealing. See, for instance, Kobayashi (2005).

3 See, for instance, Sharp and Sharp (1997) and Lal and Bell (2003). The introduction of a loyalty program by a particular firm tends to increase its market share, although its effect on profitability is less clear.
which the airline is more dominant. She interprets these results as indicating that FFP reinforces firms’ market power. Our analysis challenges this interpretation.

From a theoretical point of view, some of these issues have been approached by Cairns and Galbraith (1990), Banerjee and Summers (1987) and Caminal and Matutes (1990) (CM, hereafter). Cairns and Galbraith (1990) showed that, under certain circumstances, FFP-type policies could be an effective barrier to entry. We believe that this insight is essentially correct, but this is only one dimension of the problem. The last two papers focused on symmetric, multiperiod duopoly models. Banerjee and Summers (1987) did show that lump-sum coupons are likely to be a collusive device and hence consumers would be better off if coupons were forbidden. CM introduced product differentiation and consumers that are uncertain about their future preferences. They argued that the specific form of the loyalty program might be crucial. In particular, if firms are able to commit to the price they will charge to repeat buyers, then competition is enhanced and prices are reduced. However, in their model lump-sum coupons tend to relax price competition, a result very much in line with those of Banerjee and Summers (1987). Hence, the desirability of such programs from the point of view of consumer welfare seemed to depend on the specific details, which in practice may be hard to interpret. Moreover, the emphasis on symmetric duopoly and on restricting the analysis to an arbitrary subset of commitment devices was probably misleading.

In this paper we try to make progress by introducing several innovations. Firstly, we use an extension of the standard Hotelling model to allow for a large number of monopolistically competitive firms. Market structure affects the dynamic consequences of loyalty-rewards. In oligopoly, a firm’s commitment to the price for repeat purchases influences future profits through two different channels: (i) consumer demand (lock-in effect) and (ii) future prices set by rivals (strategic effect). The size of the strategic effect is maximized in a symmetric duopoly, but it is negligible if the number of firms is large. In order to understand the relative role of these two channels, it is convenient to study the limiting case (monopolistic competition) where the strategic effect has been shut down completely. Thus, most of the literature has focused on one extreme case (duopoly) and instead we emphasize the other extreme (monopolistic competition). In Section 7 we discuss more systematically the role of the number of firms.

Our second innovation has to do with the set of commitment devices. Firms may not be able to commit to future prices or, even if they are, they might prefer not to do it, perhaps because of uncertainty about future demand or costs. In this case, instead of restricting attention to lump-sum coupons, we allow firms to choose the discounting rule. It turns out that the equilibrium discounting rule is simple but quite different from lump-sum discounts.

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4 In the real world different loyalty programs involve different degrees of commitment to the actual transaction price. For instance, in the case of FFPs, frequent travelers may gain the right to “buy” a ticket at zero price, but they can also use these miles to upgrade the ticket, in which case the actual price is left undetermined ex-ante. In the case of repeat-purchase coupons, discounts can take various forms (proportional, lump-sum, or even more complex), but repeat buyers do not know in advance the net price.

5 Fudenberg and Tirole (2000) study a similar two-period duopoly model, although they emphasize the case where consumer preferences are fixed over time. In this case, commitment to future prices prevent inefficient switching. In Section 6 they also consider the case where consumer preferences change over time and extend some of CM’s results to a general distribution of consumer preferences.

6 More recently, Kim et al. (2001) have also studied a duopoly model where firms can offer lump-sum discounts. The novelty is that firms can choose the nature of those discounts (cash versus non-cash). They show that firms may have incentives to offer ‘inefficient’ cash rewards (higher unit reward cost for the firm than a free product of the firm). In either case reward programs weaken price competition.

7 There is also recent literature on the effect of bundled loyalty discounts. See, for example, Gans and King (2006) and Greenlee and Reitman (2005). These models are static.
Thirdly, we extend the analysis beyond the two-period framework (where firms actually compete for a single generation of consumers), and also consider an overlapping generation set up. The crucial difference is not the time horizon. What matters is that the demand structure is quite different if more than one generation is present at a point in time, provided firms are unable to discriminate between former customers of rival firms and new consumers.

Finally, the paper also discusses entry barriers, firms’ relative sizes and partnerships.

The analysis provides an unambiguous message: loyalty-rewarding pricing schemes are essentially business-stealing devices that tend to enhance competition, in the sense of lower average transaction prices and higher consumer surplus. The introduction of a loyalty program is a dominant strategy for each firm (provided these programs involve sufficiently small administrative costs) but in equilibrium all firms lose (prisoner’s dilemma). This result is robust, in particular, to different specifications of the firms’ commitment power, and to alternative demand structures. Clearly, the pro-competitive effect of loyalty programs may cease to hold if the number of firms is small. We know this at least since Banerjee and Summers (1987) and CM. However, in the last section we argue that loyalty programs will be anti-competitive only if the following two conditions hold simultaneously: the number of firms is sufficiently small and firms are restricted to use specific designs which involve low commitment value for consumers.

The predictions of our theory are compatible with the empirical evidence reported by Lederman (2003). As mentioned above, she shows that the introduction (or an enhancement) of an airline’s FFP raises its market share. Such a link is also present in our model. Lederman goes on and argues that this empirical fact is the result of the FFP enhancing the firm’s market power. Our theory challenges this interpretation and claims that the use of FFPs may actually signal fiercer competition among airlines. Lederman (2003) also shows that the positive effect of the firm’s FFP on its market share is relatively larger for large firms. The predictions of the asymmetric version of our model are also consistent with these results. Large firms are relatively protected from the pro-competitive effects of FFP (the reduction in profits is relatively smaller for larger firms), but nevertheless all firms would prefer that loyalty rewards were forbidden.

In the next section we introduce the benchmark model. Sections 3 and 4 provide the main results of the benchmark model under alternative commitment capacities. In Section 5 we extend and solve the model with overlapping generations. Section 6 contains an informal discussion of various additional issues and Section 7 contrasts our results with those obtained in duopoly models. Some of the analytical details are provided in the Appendix.

2. The benchmark model

This is essentially a two-period Hotelling model extended to accommodate an arbitrary number of firms and, at the limit, it can be interpreted as a monopolistic competition model.

There are \( n \) firms (we must think of \( n \) as a large number), each one produces a variety of a non-durable good. Both firms and varieties are indexed by \( i, i=1,...,n \). Firms are located in the extremes of \( n \) spokes of length \( \frac{1}{2} \), which start from the same central point. Demand is perfectly symmetric. There is a continuum of consumers with mass \( \frac{a}{2} \). Each consumer has a taste for two varieties only and the pair of selected varieties differ across consumers. In fact, consumers are

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8 To the best of our knowledge there is no systematic evidence on the effect of FFPs on firm profitability. Lederman (2003) constructs an index of the average fare charged by each airline. These indices do not seem to include the zero price tickets used by frequent flyers. She shows that an enhancement of the airline’s FFP raises its own average fare, which is again compatible with the predictions of our model.
uniformly distributed over the \( \frac{n(n-1)}{2} \) possible pairs. Thus, the mass of consumers who have a taste for an arbitrary pair is \( \frac{1}{n-1} \) and, since there are \( (n-1) \) pairs that contain a particular variety, the mass of consumers who demand a particular variety is 1.

Each consumer demands one unit of the good per period. Consumer location represents the relative valuation of the two varieties. In particular, those consumers who have a taste for varieties \( i \) and \( j \) are uniformly distributed over spokes \( i \) and \( j \) (a continuous line of length equal to one). If a consumer located at \( x \in [0, \frac{1}{2}] \) of the \( i \)th spoke chooses to consume one unit of variety \( i \) then she obtains a utility equal to \( R - tx \). Alternatively, if she chooses to consume one unit of variety \( j \) then she obtains \( R - t(1-x) \). As usual, we assume that \( R \) is sufficiently large, so that all the market is served in equilibrium.

If \( n=2 \) then this is the classic Hotelling model. If \( n \geq 2 \) firm \( i \) competes symmetrically with the other \( n-1 \) firms. If \( n \) is very large the model resembles monopolistic competition, in the sense that each firm: (i) enjoys some market power, and (ii) is small with respect to the market, even in the strong sense that if one firm is ejected from the market then no other firm is significantly affected.

In practice this model works exactly the same as the standard, two-firm Hotelling model, although interpretation is different. In the current model, a representative firm is located at one extreme of the \([0, 1]\) interval and ‘the market’ at the other. Consumers with a preference for the variety supplied by the representative firm are uniformly distributed over the interval, although in each location consumers are heterogeneous with respect to the name of the alternative brand. At the same time these consumers represent a very small fraction of the potential customer base of any rival firm. As a result, the representative firm correctly anticipates that its current actions have a negligible effect on its rivals’ market shares and hence they will not have a significant effect on their future actions.

An important feature of the model is that consumers are uncertain about their future preferences. More specifically, each consumer derives utility from the same pair of varieties in both periods, although her location is randomly and independently chosen in each period. Thus, consumers’ uncertainty refers only to their future relative valuations of the two varieties.\(^9\)

Marginal production cost is \( c \geq 0 \). In this class of models, in equilibrium the absolute margin, \( p-c \) is independent of \( c \). Hence, typically there is no loss of generality in normalizing \( c=0 \). In fact, setting \( c=0 \) does not make any difference in most of this paper. The exception is Section 4, where we analyze discounts. If we set \( c=0 \) then a proportional coupon of 100% would be equivalent to a commitment to marginal cost pricing. However, if we allow for \( c>0 \) then a proportional coupon alone is generally not sufficient to implement marginal cost pricing.

In the second period firms are able to discriminate between first time and repeat buyers. In particular, repeat buyers can prove their previous transaction with the same supplier. In the language of Fudenberg and Tirole (1998) the market is semianonymous.

Both firms and consumers are risk neutral and neither of them discount the future. Thus, their total expected payoff at the beginning of the game is just the sum of the expected payoffs in each period.

The spokes set up was taken from Chen and Riordan (2004). The main difference is that in that paper consumers have a taste for all varieties. In particular, a consumer located at \( x \), \( x \in [0, \frac{1}{2}] \) of the \( i \)th spoke pays transportation cost \( tx \) if she purchases from firm \( i \) and \( t(1-x) \) if she buys from any firm \( j \neq i \). In the process of revising the current paper we learned the existence of a new paper

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\(^9\) At given prices, a consumer may prefer today to travel with a particular airline, given her destination and available schedules. However, the following week the same consumer may prefer to fly a different airline as travel plans change.
by the same authors (Chen and Riordan, 2006) where consumers only have a taste for two possible varieties. The focus of the latter piece is completely different from the current paper.

3. Commitment to the price of repeat purchases

3.1. The full commitment game

Let us start with a natural benchmark. Suppose that firms can commit in the first period to the second period price that applies to repeat buyers, \( p^r_2 \), and also to the second period price that applies to newcomers, \( p^n_2 \). Thus, if we let \( p_1 \) denote the first period price, each firm sets the three prices \( (p_1, p^r_2, p^n_2) \) simultaneously at the beginning of the game.\(^{10}\) The firm’s commitment is an option for consumers, who can always choose to buy from rival firms in the second period. Thus, \( p_1 \) is actually the price of a bundle, one unit of the good in the first period plus the option to repeat trade with the same supplier at a predetermined price.

If we denote the average prices set by rival firms with bars, then second period market shares among repeat buyers and newcomers, \( x^r_2, x^n_2 \) are given respectively by:

\[
\begin{align*}
x^r_2 &= \frac{t + \bar{p}^n_2 - p^r_2}{2t} \\
x^n_2 &= \frac{t + \bar{p}^r_2 - p^n_2}{2t}
\end{align*}
\]

Finally, the first period market share, \( x_1 \), is given by:

\[
p_1 + tx_1 + x^r_2 \left( p^r_2 + \frac{tx^r_2}{2} \right) + (1-x^r_2) \left( \bar{p}^n_2 + \frac{t(1-x^r_2)}{2} \right) = \bar{p}_1 + t(1-x_1) + x^n_2 \left( p^n_2 + \frac{tx^n_2}{2} \right) + (1-x^n_2) \left( \bar{p}^r_2 + \frac{t(1-x^n_2)}{2} \right)
\]

A firm’s optimization problem consists of choosing \( (p_1, p^r_2, p^n_2) \) in order to maximize the present value of profits:

\[
\pi = (p_1-c) x_1 + x_1 x^r_2 (p^r_2-c) + (1-x_1) x^n_2 (p^n_2-c)
\]

The next proposition summarizes the result (some computational details are given in Appendix A.1):

**Proposition 1.** There is a unique symmetric Nash equilibrium of the full commitment game, which is described in the second column of Table 1.

The first column of Table 1 shows the equilibrium of the game in which firms cannot discriminate between repeat buyers and newcomers. In this case all prices in both periods are

\(^{10}\) In this case, the game is static and the characteristics of the equilibrium are independent of the number of firms.
equal to \( c + t \), all market shares are equal to \( \frac{1}{2} \) and hence total surplus is maximized (the allocation of consumers is ex-post efficient). If we compare the first two columns we note that:

Remark 1. In the equilibrium under full commitment consumers are better off and firms are worse off than in the absence of commitment. Total surplus is lower because of the higher transportation costs induced by the endogenously created switching costs.

Note that in equilibrium both firms commit to a price equal to marginal costs for repeat buyers. In fact, this is a dominant strategy for all firms. The intuition is identical to that provided by Crémer (1984) in a monopoly model.\(^{11}\) First, we can ask what is the value of \( p_2^r \) that maximizes the joint payoffs of a single firm and its first period customers. The answer is \( p_2^r = c \). By setting the price for repeat buyers equal to marginal costs, consumers will revisit the firm every time their willingness to pay in the second period is higher than the firm’s opportunity cost. Thus, \( p_2^r = c \) is “efficient” from the point of view of the coalition between the firm and its customers, but not from a social point of view. In fact, such a pricing policy creates rents for the coalition by stealing customers from their rival firms. Moreover, in the current game, firms have incentives to commit to such a “coalition-efficient” price because they are able to appropriate all the rents created through a higher first period price.\(^{12}\)

In contrast to Crémer’s results, the seller’s commitment to marginal cost pricing for repeat buyers does not make any consumer worse off. Whether or not firms compete among themselves is crucial.

\(^{11}\) See also Bulkley (1992) and Caminal (2004) for the same result in very different set ups.

\(^{12}\) In fact, firms would like to sell the option to buy in the second period at a price equal to marginal costs, separately from the first period purchase. In practice, this is quite difficult to implement.
Since rival firms set the price for repeat buyers equal to marginal cost, it is very hard to attract newcomers in the second period, which induces firms to set a relatively low $p_2^r$. Firms make zero profits from repeat purchases but also low profits out of second period newcomers, and hence their fight for first period customers is only slightly more relaxed than in the static game. The other side of the coin is that consumers’ valuation of the option included in the first period purchase is relatively low. All this is reflected in first period prices which are only slightly above the equilibrium level of the static game.

It is important to note that $p_2^r$ is above the level that maximizes profits from newcomers in the second period (see below). The reason is that by committing to a higher $p_2^r$ the firm makes the offer of their rivals less attractive, i.e., from Eq. (3) we have that $\frac{dx_1}{dp_2^r}>0$.

3.2. The partial commitment game

In the real world firms sometimes sign (implicit or explicit) contracts with their customers, which include the prices prevailing in their future transactions. However, it is more difficult to find examples in which firms are able to commit to future prices that apply to new customers.

In this subsection we consider the game in which firms choose $(p_1, p_2^r)$in the first period, and $p_2^n$ is selected in the second period after observing $x_1$ and $\bar{p}_2^r$.

The next result shows that the equilibrium strategies of Proposition 1 are not time consistent (intermediate steps are specified in Appendix A.2).

**Proposition 2.** There is a unique subgame perfect and symmetric Nash equilibrium of the partial commitment game, which is described in the third column of Table 1.

The equilibrium of the partial commitment game also features marginal cost pricing for repeat buyers, since the same logic applies. However, the equilibrium value of $p_2^r$ is now lower than that of the full commitment game. The reason is that $p_2^r$ is chosen in the second period in order to maximize profits from second period newcomers. Hence, firms disregard the effect of $p_2^r$ on the first period market share. In this case, since firms obtain higher profits from newcomers, competition for first period customers decreases, which is reflected in higher first period prices. As a result:

**Remark 2.** In the equilibrium of the partial commitment game consumers are better off and firms are worse off than in the absence of commitment.

**Remark 3.** Both consumers and firms are better off under partial commitment than under full commitment.

Thus, the time inconsistency problem has only a minor effect on the properties of the equilibrium. Moreover, the payoff of a particular firm increases with its own commitment capacity but decreases with the commitment capacity of its rivals.

Our model can be easily compared with the duopoly model analyzed in CM. In fact, the only difference is that in the current model firms cannot influence the future behavior of their rivals. In other words, the strategic commitment effect is missing. As a result, firms wish to commit to marginal cost pricing for repeat buyers since this is the best deal it can offer their customers. On the other hand, in the equilibrium of the duopoly game, firms commit to a price below marginal cost for repeat buyers. The reason is that if a duopolist cuts $p_2^r$ below marginal costs this has a second order (negative) effect on profits, but it also induces its rival to set a lower $\bar{p}_2^n$ in the second period, which has a first order (positive) effect on profits, since $\frac{dx_1}{dp_2^r}<0$. 
4. Commitment to a linear discount

There might be many reasons why firms may not be able to commit to a fixed price for repeat buyers. Even if they can, they may choose not to do so perhaps because of uncertainty about future cost or demand parameters. In fact, in some real world examples we do observe firms committing to discounts for repeat buyers while leaving the net price undetermined. In this section we consider the same deterministic benchmark model used above but with different strategy spaces. In particular, we allow firms to commit to linear discounts for repeat buyers instead of committing to a predetermined price. Below we also discuss the role of uncertainty.

Suppose that in the first period firms set \((p_1, v, f)\) where \(v\) and \(f\) are the parameters of the discount function:

\[
p_{1u}(1 - v)p_2 - f
\]

Thus, \(v\) is a proportional discount and \(f\) is a fixed discount. In the second period firms set the regular price, \(p_2\).

We show that there exist an equilibrium of this game that coincides with the symmetric equilibrium of the full commitment game of Section 3.1. Thus, in our model a linear discount function is a sufficient commitment device. By fixing the two parameters of the discount function firms can actually commit to the two prices, \(p_{1r}\) and \(p_{1n}\).

More specifically, in the second period firms choose \(p_2\) in order to maximize second period profits:

\[
\pi_2 = x_1 x_2 (p_{1r} - c) + (1 - x_1) x_2 (p_{1n} - c)
\]

where \(p_{1r}\) is given by Eq. (5). The first order condition characterizes the optimal price:

\[
x_1 (1 - v) \left( x_2 - \frac{p_{1r} - c}{2t} \right) + (1 - x_1) \left( x_2 - \frac{p_{1n} - c}{2t} \right) = 0
\]

If other firms set the prices given by Proposition 1, and \(x_1 = \frac{1}{2}\), then it is easy to check that it is optimal to set those same prices provided \(v = \frac{4}{5}\) and \(f = \frac{2}{15} t - \frac{4}{5} c\). Thus, using such a pair of \((v, f)\) a firm can implement the desired pair of second period prices. Consequently, given that other firms are playing the prices given by Proposition 1, the best response for an individual firm consists of using such a linear discount function and the value of \(p_1\) given also in Proposition 1, which results in \(x_1 = \frac{1}{2}\). The next proposition summarizes this discussion.

**Proposition 3.** There exist an equilibrium of the linear discount game that coincides with the equilibrium of the full commitment game.

Hence, in our deterministic model there is no difference between price commitment and coupon commitment, at least as long as firms can use a combination of proportional and lump-sum coupons. This equivalence result suggests that the emphasis of the existing literature on lump-sum coupons was probably misleading. However, two remarks are in order. First, in practice it may not be so easy to use a combination of proportional and fixed coupons, as some consumers may be confused about the actual discounting rule. Second, firms may be uncertain about future demand and/or cost conditions. Let us discuss these two issues in turn.
In the absence of uncertainty and if firms feel that they should use one type of coupons exclusively then they will attempt to use the type that performs better as a commitment device, which depends on parameter values. For instance, if \( c \) is approximately equal to \( \frac{1}{6} \) then proportional discounts alone will approximately implement the payoffs of the full commitment game (the optimal value of \( f \) is approximately zero). Actually, in a broad set of parameters, proportional discounts are better than lump-sum discounts at approximating full commitment strategies. We illustrate this point in Appendix A.3.

In the duopoly model of CM firms prefer committing to \( p^2_r \) than committing to a lump-sum discount. Our point here is that if commitment to \( p^2_r \) is not feasible or desirable then firms are likely to prefer proportional discounts to lump-sum discounts.

If firms are uncertain about future market conditions then they face the usual trade-off between commitment and flexibility. Suppose first, that firms are uncertain about future marginal costs. In this case the ex-ante optimal, full contingent pricing rule involves both \( p^2_r \) and \( p^2_n \) exhibiting the same sensitivity with respect to the realization of the marginal cost variable. Thus, in terms of the optimal discounting rule, flexibility calls for a zero proportional discount. In fact, if uncertainty is so large that it is the dominant effect then the optimal discounting rule probably involves a small \( v \). Let us now consider the case of firm-specific demand shocks. For instance, suppose that in the second period a new generation of consumers enter the market and their distribution over different brands is random. In this case, the ex-ante optimal, full contingent pricing rule involves a fixed \( p^2_r \) and a variable \( p^2_n \). Thus, in terms of the optimal discounting rule, flexibility calls for a large proportional discount in order to disentangle \( p^2_r \) from changes in \( p^2_n \).

Summarizing, uncertainty about future market conditions clearly breaks the equivalence between price and coupon commitment. However, its impact on the equilibrium discounting rule is difficult to ascertain and probably depends on the dominant source of uncertainty. Perhaps, we could explain the prevalence of lump-sum discounts in some real world markets on the basis of the relative strength of cost uncertainty. In this case, the commitment power of the discounting rule would be rather limited but nevertheless the use of lump-sum coupons would be a signal of fiercer competition among firms, at least as long as the number of firms is sufficiently large.

5. An overlapping generations framework

In many situations firms may find it difficult to distinguish between consumers who have just entered the market and consumers who have previously bought from rival firms. In order to understand how important this assumption was in the analysis of the benchmark model we extend it to an infinite horizon framework with overlapping generations of consumers, in the spirit of Klemperer and Beggs (1992).13

Time is also a discrete variable, but now there is an infinite number of periods, indexed by \( t=0, 1, 2,... \). Demand comes from overlapping generations of the same size. Each generation is composed of consumers who live for two periods and have the same preference structure as the one described in Section 2. Thus, besides the greater number of periods, the main difference with respect to the benchmark model is that in this section we assume that firms are unable to discriminate between first period (young) consumers and second period (old) consumers that previously patronized rival firms. Firms set two prices for each period: \( p_t \), the price they charge to all consumers who buy from the firm for the first time, and \( p_r^t \), the price they charge to repeat buyers.

13 See also To (1996) and Villas-Boas (2004).
Thus, profits in period \( t \) are given by:

\[
\pi_t = (p_t - c) [x_t + (1 - x_{t-1}) x^n_t] + x_{t-1} (p_t^r - c) x^r_t
\]

where \( x_t, x^r_t, x^n_t \), as in previous sections, stand for the firm’s period \( t \) market share with young consumers, old consumers loyal to the firm, and new customers of the old generation, respectively, which are given by:

\[
x_t = \frac{1}{2t} \left\{ \bar{p}_t - p_t + x^n_{t+1} \left( p_{t+1} + \frac{x^n_{t+1}}{2} \right) + (1 - x^n_{t+1}) \left( \bar{p}_{t+1} + \frac{1 - x^n_{t+1}}{2} \right) \right\}
\]

\[
x^r_{t+1} = \frac{t + p_{t+1} - p^r_t}{2t}
\]

\[
x^n_t = \frac{t + \bar{p}_t - p_t}{2t}
\]

These set of equations are analogous to Eqs. (3), (1), and (2, respectively. The firm’s payoff function in period 0 is:

\[
V_0 = \sum_{t=0}^{\infty} \beta^t \pi_t
\]

where \( \beta \in (0, 1) \) is the discount factor. We will focus later on the limiting case of \( \beta \to 1 \).

Here we deal with the full commitment case.\(^{14}\) Thus, given the sequence of current and future prices set by the rivals, \( \{\bar{p}_t, \bar{p}^r_t\}_{t=0}^{\infty} \), the price for repeat buyers set in the past, and the past \( p^r_0 \) market share with young consumers, \( x_{-1} \) an individual firm chooses \( \{p_t, p^{r+1}_t\}_{t=0}^{\infty} \) in order to maximize Eq. (9). We focus on the stationary symmetric equilibria, for the limiting case of \( \beta \to 1 \). The result is summarized below (See Appendix A.5 for details):

**Proposition 4.** *In the unique stationary symmetric equilibrium \( c + t > p > c + \frac{t}{2} > p^r > c \).*

Thus, the favor of the results is very similar to the one provided by the benchmark model. Firms have incentives to discriminate between repeat buyers and newcomers, which creates artificial switching costs, and nevertheless consumers are better off than in the absence of such discrimination.

The reasons are analogous to those of the benchmark model. The main difference is that in the current set up \( p^r \) is set above marginal cost. In the two-period model \( p_1 \) was the only instrument.

---

\(^{14}\) In the working paper version (Caminal and Claici, 2005) we also discuss two alternative set ups. First, the partial commitment case, in which firms set in period the current price for newcomers, \( p_t \), and the next period price for repeat, buyers, \( p^{r+1}_t \). Second, firms offer a menu of contracts to induce newcomers to self-select. We argue that in these two variations the main qualitative results still hold.
used by the firm to collect the rents created by setting a lower price to repeat buyers in the second period. Since an individual firm could fully appropriate all these rents, it was also willing to commit to marginal cost pricing in the second period, which maximizes the joint surplus of the firm and its customers. In the current framework, the regular price \( p_t \) is not only paid by young consumers but also by old newcomers. Thus, if \( p_t \) increases in order to capture the rents created by a lower \( p_{t+1} \), then the firm loses old newcomers. As a result, the firm does not find it profitable to set the price for repeat purchases equal to marginal cost. Nevertheless, such a price is still lower than the regular price.

6. Discussion

6.1. Entry

In this paper we have characterized loyalty programs as a business-stealing device provided there is sufficient competition (the market is fully served). However, in markets where there is room for entry, incumbents may use loyalty programs as a barrier to entry. The existence of a large share of consumers with claims to the incumbents’ loyalty program may be sufficient to discourage potential entrants. Hence, the claim that loyalty-rewarding schemes are pro-competitive needs to be qualified in markets where entry is still an issue.

6.2. Partnerships

Recently airlines have formed FFP partnerships. On the one hand, those partnerships enhance the FFP program of each partner by expanding earning and redemption opportunities. On the other hand, they may affect the degree of rivalry. Those observers that interpret FFP as enhancing firms’ market power have a hard time understanding the formation of partnerships of domestic airlines who compete head to head on the same routes. In their view those partnerships appear to increase airline substitutability and hence they are likely to reduce profits. In contrast, we claim that FFP are business-stealing devices. Hence, partnership between directly competing firms may relax competition by colluding on less generous loyalty rewards. A rigorous analysis of these issues is beyond the scope of this paper, but some intuition can be provided. Consider the duopoly model analyzed in CM. In the non-cooperative equilibrium firms offer loyalty-rewarding policies (commit to a lower price for repeat buyers) and as a result industry profits are lower. Hence, firms would like to collude and agree to cancel these programs even if they choose regular prices non-cooperatively. This type of collusion can be implemented by forming a partnership and setting a common and negligible reward system (setting \( p_2 = c + t \)) that would apply to all customers independently of which firm they patronized in the first period. In this case, the reward system does not affect the allocation of consumers in the first period, and in equilibrium first period prices are equal to \( c + t \) (the one-period equilibrium price). In an oligopoly with more than two firms the effect of a partnership would be less drastic, but still each pair of firms would like to commit not to steal consumers from each other through loyalty programs, although they still wish to lure consumers from their rivals. As a result, we conjecture that direct rivals still have incentives to form partnerships, and they result in less generous loyalty rewards and higher industry profits.

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16 See Lederman (2003), Section VI.
6.3. Relative sizes

In order to study the effect of firm size we need to go back to an oligopoly model. Let us consider the duopoly model of CM with an asymmetric distribution of consumers. In particular, there are two firms located at the extreme points of the Hotelling line. A proportion $\alpha$ of consumers are located at 0, and a proportion $1 - \alpha$ are uniformly distributed over $[0, 1]$. Thus, the firm located at 0 is the large firm. Consumer location is independent across periods. Therefore, the large firm’s commitment to $p^L_2$ is more valuable to any consumer than the small firm’s commitment to the same $p^S_2$ because they anticipate that repeating a purchase at the large firm is more likely than at the small firm.\(^{17}\)

In the working paper version (Caminal and Claici, 2005)\(^{18}\) we have analyzed the solution of this game through numerical simulations, since an analytical solution was not feasible. It turns out that both firms lose with the introduction of loyalty programs, but the large firm loses relatively less, because its market share increases as consumers attach a higher value to the large firm’s program.

Thus, the empirical evidence reported by Lledó & Lederman (2003) indicating that the impact of an airline’s FFP on its market share is relatively more important for large firms is perfectly compatible with our model. However, it is not obvious that such a fact implies that FFP’s enhance airlines market power. In fact our model proposes the opposite interpretation. In our view, large airlines are relatively protected from the pro-competitive effects of FFP, but all airlines lose in absolute terms with the introduction of FFPs.

7. Concluding remarks: The role of the number of firms

In the current paper we have shown that in highly competitive environments loyalty-rewarding pricing schemes are essentially business stealing devices, and hence they reduce average prices and increase consumer welfare. Such a pro-competitive effect is independent of the form of commitment (price level versus discounts). Thus, those organizations that aim at protecting consumer interests need not be upset about the proliferation of those schemes. In fact, they should actually consider promoting them.

These results have been derived in a model with a large number of firms. How important is this assumption? Are the results of this paper relevant for industries with an intermediate number of firms, like the airline industry?\(^{19}\)

We know that in the duopoly case (CM) lump-sum coupons are anti-competitive. Hence, the number of firms could be important. However, the current model offers a new perspective on the

\(^{17}\) Redemption opportunities of an airline’s FFP increases with its size: number of destinations, frequency of flights, etc.

\(^{18}\) In the working paper we also study the impact of exogenous switching costs. In particular, we show that endogenous (loyalty programs) and exogenous switching costs are imperfect substitutes. That is, the presence of exogenous switching costs reduces firms’ incentives to introduce artificial switching costs.

\(^{19}\) In fact, our model can be literally interpreted as a model of the airline industry under some restrictions on the set of strategies. Consider a world with $n$ equidistant cities. Each city hosts the headquarters of a different airline. Each airline competes in all routes that start or end in the city where its headquarters are located. Hence, each firm produces $n - 1$ different goods (flies $n - 1$ routes) but there is a duopoly in each route. Each city is populated by the same number of travelers, and each consumer travels once per period to one of the possible destinations, which is chosen randomly (from a uniform distribution) and is the same in all periods. Consumers that travel a particular route perceive the two airlines as horizontally differentiated in an additional dimension (service, schedules, etc.), which can be modeled as location in the Hotelling line with linear transportation costs. Finally, pricing policies are identical to those considered in the main text, under the constraint that prices of a particular airline must be the same in all routes. The results of this model are identical to those presented in the main text.
duopoly results. In particular, we argue below that loyalty programs have a pro-competitive effect in most cases, and that the opposite will be true only under very specific circumstances: if the number of firms is sufficiently small and if they are restricted to program designs with weak commitment capacity.

A firm’s loyalty program is a commitment device with respect to current customers but also with respect to rival firms. In the current paper the number of firms is large and hence the commitment value with respect to rival firms is nil, since each firm understands that its loyalty program will not affect its rivals’ future pricing decisions. Such an assumption has allowed us to focus on the commitment capacity of alternative designs with respect to consumers. In all cases considered (full commitment, partial commitment, and linear discounts) loyalty programs turned out to be pro-competitive.

In order to complete the discussion let us now suppose that our monopolistically competitive firms are restricted to use lump-sum coupons. In Appendix A.4 we compute the symmetric equilibrium of the following game: Firms set \((p_1,f)\) in the first period and \(p_2\) in the second. In this case we have that \(p_2^\ast=p_2-f\). It turns out that in equilibrium \(f>0\), firm profits are below the equilibrium level of the static game, but above the level obtained in the equilibrium of the partial commitment game. The ranking of these three games in terms of consumers surplus is the reverse. Thus, lump-sum coupons are a poor commitment device (with respect to consumers) and hence the business stealing effect is smaller than under price commitment, but it is positive. This last result completes the first column of Table 2. If the number of firms, \(n\), is large then loyalty programs are always pro-competitive, although the size of the effect is smaller in the case firms are restricted to use specific designs which involve low commitment value for consumers (lump-sum coupons).

Let us now contrast these results with the other extreme case (\(n=2\)). As we mentioned in Section 3 the outcome of the full commitment game is independent of the number of firms. Hence in the duopoly case loyalty programs are also pro-competitive. Similarly, as shown by CM, loyalty programs are also pro-competitive in the partial commitment game. Thus, loyalty programs with a high commitment capacity with respect to consumers are also pro-competitive in the duopoly case.

In contrast, if duopolists are restricted to use lump-sum coupons, then their profits are higher than in the absence of any commitment device (CM).\(^{20}\) The reason is that lump-sum coupons are a very poor commitment device with respect to consumers, but in the duopoly case they are a powerful instrument to commit to a high regular price in the future, which induces the rival firm to set also a high future price. It is this Stackelberg leader effect, combined with a poor commitment capacity with respect to consumers, that made lump-sum coupons a collusive device in CM.\(^{21}\)

\(^{20}\) The analysis of general linear discounts in the duopoly model poses some technical problems, whose solution goes beyond the scope of this paper. Intuitively, the outcome depends on the net balance of two countervailing effects, as the firm’s discount strategy must attend conflicting goals: commitment towards consumers (with better instruments than in the case of lump-sum coupons) and commitment towards the rival firm.

\(^{21}\) In Appendix A.4 we discuss the intuition behind the difference between the duopoly and the monopolistic competition cases in more detail.
What would be the effect of loyalty programs for arbitrary values of \( n \)? Clearly, as \( n \) increases the size of the strategic effect with respect to rival firms decreases very fast. Hence, it seems quite safe to conjecture that loyalty programs will be anti-competitive only if the following two conditions hold simultaneously: the number of firms is sufficiently small and firms are restricted to use specific designs which involve low commitment value for consumers.

**Appendix A**

**A.1. Proposition 1**

The first order conditions of the firm’s optimization problem are given by:

\[
\frac{d\pi}{dp_1} = x_1 - \frac{M}{2t} = 0
\]

\[
\frac{d\pi}{dp_2^r} = x_1 x_2^r - \frac{x_2^r M}{2t} - \frac{x_1 (p_2^r - c)}{2t} = 0
\]

\[
\frac{d\pi}{dp_2^n} = (1-x_1) x_2^n + \frac{x_2^n M}{2t} - \frac{(1-x_1)(p_2^n - c)}{2t} = 0
\]

where \( M = p_1 - c + x_4^t(p_2^r - c) - x_3^t(p_2^n - c) \) and \( x_4^t, x_3^t \) and \( x_1 \) are given by Eqs. (1), (2) and (3) in the text. In a symmetric equilibrium we have that \( x_1 = \frac{1}{2}, x_2^r = 1 - x_2^n \). Plugging these conditions into the first order conditions and solving the system we obtain the strategies stated in the proposition.

If we denote the elements of the Hessian matrix by \( H_{ij} \), then evaluated at the first order conditions we have that \( H_{11} = \frac{-1}{t}, H_{22} = \frac{-17}{18t}, H_{33} = \frac{-13}{18t}, H_{12} = \frac{-5}{6t}, H_{13} = H_{23} = 0 \). Hence, the matrix is negative semidefinite and second order conditions are satisfied.

**A.2. Proposition 2**

In the second period the firm chooses \( p_2^n \) in order to maximize second period profits, which implies that:

\[
p_2^n = \frac{t + p_2^r + c}{2}
\]

After plugging this expression into Eq. (3), the firm chooses \((p_1, p_2^r)\) in order to maximize Eq. (4). The first order conditions are:

\[
\frac{d\pi}{dp_1} = x_1 - \frac{M}{2t} = 0
\]

\[
\frac{d\pi}{dp_2^r} = x_1 x_2^r - \frac{x_2^r M}{2t} - \frac{x_1 (p_2^r - c)}{2t} = 0
\]

Evaluating these conditions at a symmetric equilibrium and solving, we obtain the strategies stated in the proposition.
The elements of the Hessian matrix evaluated at the first order conditions are $H_{11} = -1/t$, $H_{12} = -3/(4t)$, $H_{22} = -13/(16t)$. Hence, second order conditions are satisfied.

A.3. The commitment capacity of lump-sum coupons

Suppose that other firms have set $\bar{p}_2^t = c$ and $\bar{p}_2^n = c + 2/3$. Then the best response in the first period is to set exactly these prices. Instead, consider a firm that arrives at the second period with $x_1 = 1/2$ and a lump-sum coupon $f$. Then such a firm would choose $p_2$ in order to maximize:

$$\pi_2 = \frac{1}{2} \left( (p_2 - f - c)x_2^t + (p_2 - c)x_2^n \right)$$

where

$$x_2^t = \frac{t + \bar{p}_2^t - p_2 + f}{2t}$$
$$x_2^n = \frac{t + \bar{p}_2^n - p_2}{2t}$$

If $f$ is large, then the solution includes $x_2^n = 0$ and the outcome is dominated from the ex-ante point of view by $f=0$. If is not too large the solution is interior and the ex-post optimal prices will be given by:

$$p_2^t = p_2 - f = \frac{2t}{3} + c - \frac{f}{2}$$
$$p_2^n = p_2 = \frac{2t}{3} + c + \frac{f}{2}$$

Thus, as $f$ increases $p_2^t$ gets closer to the optimal ex-ante response, but $p_2^n$ is driven further away from its ex-ante optimal value. Therefore, there is no value of $f$ that allows the firm to commit to a pair of prices close to the best response.

A.4. Equilibrium with lump-sum coupons

For arbitrary prices and market shares the second period optimization problem provides the following first order condition:

$$p_2 = \frac{t + c + \bar{p}_2 + 2x_1 f - (1-x_1)\bar{f}}{2}$$

In the first period, firms choose $(p_1, f)$ in order to maximize first period profits. The first order conditions are:

$$\frac{d\pi}{dp_1} = x_1 - \frac{M}{2t + (f+f)(2f+f)} = 0$$
$$\frac{d\pi}{df} = -\frac{x_1(1-x_1)(2f+\bar{f})}{2t} + M \frac{\bar{p}_2 + t-c + f(2-4x_1) + \bar{f}(1-3x_1)}{8t^2 + (f+f)(2f+f)} = 0$$
where \( M \equiv p_1 - c + x_2^2(p_2 - f - c) - x_2^0(p_2 - c) \). If we evaluate these conditions at the symmetric allocation, then we have that \( p_1 = c + t, p_2 = c + \frac{4t}{3}, f = \frac{2t}{3} \). Thus, profits are \( \pi = \frac{4t}{9} \), and consumer surplus per firm is \( CS = R - c - \frac{43t}{36} \).

If we compare the equilibrium under monopolistic competition and duopoly (CM) then we observe that both coupons and second period prices are the same in both games, but the first period under duopoly is \( p_1 = c + \frac{13t}{9} \), which is far above the first period price of the monopolistic competition equilibrium. The intuition is the following. Under duopoly the elasticity of the first period demand with respect to the first period price is higher than under monopolistic competition. The reason is that a higher first period market share (because of a lower first period price) induces the rival firm to set a lower second period price, since it has more incentives to attract new customers. Such a lower expected second period price makes the first period offer of the rival firm more attractive, which in turn reduces the increase in first period market share. As a result, such a reduction in the price elasticity of demand induces firms to set a higher first period price.

Strategic commitment has two separate effects of different signs on the level of coupons, and it turns out that they cancel each other. On the one hand, a higher coupon induces the rival firm to set a lower second period price, which has a negative effect on second period profits. Hence, duopolists would tend to set lower coupons. On the other hand, a higher coupon involves a commitment to set lower prices for repeat buyers, which increases first period demand. If the first period price is higher then the increase in first period profits brought about by a higher coupon is heightened. Hence, through this alternative channel, duopolistic firms would tend to set higher coupons. In our model both effects cancel each other out and coupons are the same under both duopoly and monopolistic competition and therefore, second period prices are also the same.

A.5. Proposition 4

The first order conditions with respect to \( p_t \) and \( p_t^r \) are respectively:

\[
\beta_t \left\{ x_t + (1 - x_{t-1}) x_t^0 - (p_t - c) \frac{2 - x_{t-1}}{2t} + [(p_t^r - c) x_t^r - (p_t - c) x_t^0] \frac{dx_{t-1}}{dp_t} \right\} + \beta_t^{-1} \left\{ (p_{t-1} - c) \frac{dx_{t-1}}{dp_t} \right\} = 0
\]

\[
\beta_t \left\{ x_{t-1} \left[ \frac{p_t^r - c}{2t} \right] + [(p_t^r - c) x_t^r - (p_t - c) x_t^0] \frac{dx_{t-1}}{dp_t^r} \right\} + \beta_t^{-1} \left\{ (p_{t-1} - c) \frac{dx_{t-1}}{dp_t^r} \right\} = 0
\]

From Eqs. (6)–(8):

\[
\frac{dx_{t-1}}{dp_t} = \frac{x_t^0}{2t}
\]

\[
\frac{dx_{t-1}}{dp_t^r} = -\frac{1}{2t}
\]

\[
\frac{dx_{t-1}}{dp_t^r} = \frac{x_t^r}{2t}
\]
If we evaluate these first order conditions at a symmetric and stationary equilibrium \(\left(x_t = \frac{1}{2}, x_r = 1 - x_t^0\right)\) with \(\beta = 1\), then we get:

\[
\begin{align*}
t(2-x^r) - \frac{3}{2}(p-c) + (p + p^r - 2c)x^r(1-x^r) &= 0 \\
t + p - 2p^r + c - \frac{p + p^r - 2c}{2t^2}(t + p-p^r) &= 0
\end{align*}
\tag{10}
\tag{11}
\]

where

\[x^r = \frac{1}{2} + \frac{p-p^r}{2t}\]

If \(p^r = c\) the value of \(p\) that satisfies Eq. (10) is in the interval \(\left(c + \frac{1}{2}, c + t\right)\). Also, \(p\) increases with \(p^r\) for all \(p^r > c\). On the other hand, the equation implicitly characterized by Eq. (11) goes through the points \((p^r = c, \ p = c + t)\) and \((p^r = p = c + \frac{1}{2})\) and is decreasing in this interval. Therefore, there is a solution of the system in this interval, which proves the proposition.

References


Lederman, M., 2003. Do Enhancements to Loyalty Programs Affect Demand? The Impact of International Frequent Flyer Partnerships on Domestic Airline Demand, mimeo MIT.

