Loyalty and Investment in Cooperatives[†]

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Abstract

The paper makes two points. First, it shows that cooperatives are fragile institutions. The lack of the buffer usually provided by outside financing and the concomitant sharing of fixed costs among members create a form of network externality and expose cooperatives to runs. Because member exit involves both an efficiency rationale and negative externalities on remaining members, cooperatives need to erect small barriers to exit so as to create some loyalty and thereby enable investment.

Second, the efficient amount of loyalty depends on the nature of the competitive threat faced by the cooperative. In particular, while a cooperative enjoys a level-playing field vis-à-vis another cooperative, it wages an asymmetric competition with a for-profit rival. A for-profit rival is not hindered in its use of second- and third-degree price discrimination; it can lock in its licensees and integrated users; and, finally, its access to outside finance makes it less vulnerable to defections. We show that, even under the assumptions most favorable to the stability of the cooperative (no coordination failure, no targeted offers from the for-profit), in the absence of barriers to exit, a for-profit corporation can destabilize a not-for-profit competitor even when it offers no superior service (or even offers an inferior one). This competitive edge, unrelated to comparative efficiency, discourages investment by the cooperative; and the edge is stronger when the for-profit corporation makes targeted offers to attract members of the cooperative or when the coordination process follows the "risk-dominance" criterion.

Finally, we apply our insights to shed light on the current debate regarding the credit card associations' policy of duality among themselves and exclusivity vis-à-vis for-profit systems.

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1 Introduction

Cooperatives come in many forms, and no model can encompass all the features observed in various industries. For the purpose of our theoretical analysis, we will define a cooperative as a form of organization controlled by the users of the goods or services produced by the organization, operated on a nondiscriminatory basis, and being not-for-profit in the sense that it pays no dividends to equityholders. This definition is broad enough to encompass a wide range of membership types and business organizations.

This paper argues that cooperatives must induce some member loyalty in order to finance investments. In contrast with for-profit corporations, which can avail themselves of the cushion provided by equity and long-term debt, cooperatives make little or no use of outside capital and permanently operate on a break-even basis; that is, their investment costs and earnings are directly passed through to their members.[1] This particular way of financing investments creates a network externality: if some members leave, the remaining members face an increase in the assessments needed to finance the investments. This, in turn, exposes cooperatives to runs: exit by a few members may trigger additional exit, and so forth.

A metaphor: Suppose you want to start a theater or sports club that will meet every Friday evening. You need to gather enough players to build a cast or two teams, to rent facilities on a one-year lease basis, and to make sure that participants are committed enough to make the whole enterprise worthwhile. For, individuals may turn out to be overworked, uninterested in the play or game, or be tempted to undertake some alternative Friday night activity. If you choose to charge club members on a weekly basis, the following may well happen. Some members may initially drop out for quite reasonable reasons: They are indeed overworked, disinterested or have found a more interesting Friday night activity. At that point, other members who would otherwise have been happy to stay may drop out because the cast or teams may be incomplete, or, more interestingly,

[1]In the following, "for-profit corporation" refers to enterprises owned by equity investors, while "cooperative" refers to enterprises that are owned by their members. For-profit corporations and cooperatives both maximize the profit of their owners, but these profits take the form of stock appreciation and dividends in the former case, and of goods and services supplied by the cooperative in the latter case.

because the weekly charge per member has gone up. Their departure will induce other members's departure, and so on. Concerned by this possibility, the facilities' owner and the organizer probably will ask for some downpayment, perhaps even the full yearly subscription upfront, from the members.

Note that a for-profit organizer is less vulnerable to such "runs". To be certain, the for-profit owner of a football team organizes a year-long schedule whose success depends on continued participation by the team's fans. The owner therefore takes the risk of low future demand but, in contrast with the case of a cooperative enterprise, current spectator defections need not induce subsequent ones, because they won't lead to an increase in the price of tickets.

Nonprofit investment financing: How relevant is the metaphor? Nonprofit institutions play an important role in several industries, including health care, education, art, means of payments, agriculture, charities and finance.[2] Nonprofits are precluded from obtaining capital funds from the sale of equity shares. So equity must stem from donations or retained earnings. Philantropic contributions and government subsidies play a major role in higher education, art and broadcasting. By contrast, nonprofits with less lofty goals can count at most on retained earnings to build a cushion.[3] Retained earnings are hard to accumulate, though; for one thing, the associated surcharges may discourage membership. Furthermore, in many countries, tax authorities frown upon retained profits by nonprofits when these exceed what is normally expected to result from errors in forecasting revenues.

Nonprofits in principle have access to debt capital; however, because they are run for the benefit of their members, and the latter can easily pay themselves dividends in kind, lenders are particularly reluctant to acquire long-term debt (a substitute cushion) from such organizations.[4] Thus, nonprofits must of-

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[2] Cooperatives also play a major role in the US in the franchise business (hardware stores, groceries, moving companies and pharmacies). Nonprofit organizations have accordingly received much recent attention in the economics literature. See in particular Banerjee et al (1997), Glaeser-Schleifer (1997), Hansmann (1996, 1999), Hart-Moore (1996, 1998), Rey-Tirole (1998) and Weisbrod (1988, 1998). This literature focuses primarily on the governance of cooperatives, and does not, to the best of our knowledge, investigate the issues studied in this paper.

[3] This is one of the distinguishing features between nonprofits and governmental organizations. The latter often have access to taxpayer money in case of hardship.

[4] Some cooperatives –e.g., rural electricity companies– do borrow, but the debt is then usually quite safe (the cooperative is highly hedged and has substantial collateral).

ten finance current investment from current surcharges imposed on usage. And, unsurprisingly, cash flows are a crucial determinant of nonprofits' investment.[5] Finally, note that debt makes future runs more likely; thus, our no-debt assumption, besides being broadly realistic, does not rig the analysis by introducing a bias toward snowballing.

Limiting the nonprofit's exposure to runs: It is important to recognize that in any cooperative undertaking, exit by members entails efficiency as well as opportunism aspects. Efficiency gains come from the fact that a member may find a better match or a higher quality product elsewhere; so it is in general important to preserve flexibility. However, exit also exerts negative externalities on members who are left stranded. The key point is that efficiency gains are often internalized by exiting members while externalities are born by remaining members. Therefore, as this paper shows, it is in general efficient for cooperatives to erect limited barriers to exit so as to create an appropriate amount of loyalty and thereby enable investment.[6] And indeed, the evidence supports the theory; in practice, cooperative undertakings restrict opportunism by installing sand in the wheels:

- *Long-term contracts.* For example, many clubs ask for a yearly subscription and then give members free or low-cost access to their activities. Long-term contracts create a barrier to exit. Another illustration is provided by the insurance industry. A key principle of insurance is that insurees with favorable realizations should not be allowed to exit costlessly. There is a literature on how long-term insurance can be provided either through public insurance or through a private system with loyalty payments, and in no way by a system in which insurees contribute on a pay-as-you-go basis. US Life insurance policies have a heavy front-end load (Hansmann, 1996, p268-9).

[5] For example, Hoerger (1995) shows that cash flow has a much bigger impact on investment for nonprofit than for for-profit hospitals.

[6] Interestingly, the need for loyalty is also emphasized in the literature on bank runs initiated by Diamond-Dybvig (1983). This literature emphasizes the strategic complementarities among depositors. When a large number of depositors withdraw their deposits simultaneously, the bank must liquidate its illiquid assets at a cost, leading other depositors to withdraw their own deposits. Diamond and Dybvig have emphasized the suspension of convertibility as a way to eliminate bank runs in the absence of lender of last resort. The depositors' unability to withdraw deposits is of course just a barrier to exit.

- *Discounts based on cumulative volume.* Many cooperatives have "seniority-based pricing" (Hansmann 1996). Discounts based on past purchases or membership ("vesting") serve multiple purposes. They limit newcomers' incentive to free ride on the incumbents' previous investments, but they also erect a barrier to exit.[7]

- *Hostages, commitments and long-term financing.* Planned staged joint financing is a way in which parties to a joint venture can commit to the venture, while still enjoying outside opportunities. More generally, the desirability of exit barriers is related to the *hold up* literature. Joint ownership of assets and "hostages" (in the terminology of Williamson 1985) are a way of forcing some degree of commitment to the joint enterprise.

Interestingly, courts have recognized the risk of snow-balling brought by exiting members of cooperatives and has affirmed the cooperatives' boards' entire discretion over redemption policies[8] as well as their right to impose long-term contracts with severe penalties for breach on the members. For example, courts have argued that exit by a member of an electricity cooperative to be served by alternative suppliers can be disallowed if it compromises the financial viability of the cooperative.[9] For instance, in *Tri-State*, Shoshone, a distribution cooperative, was prevented from selling its assets to Pacific Power & Light (a for-profit company which would have supplied Shoshone).

Despite efforts to secure loyalty from their members, cooperatives are still occasionally subject to runs. An interesting case in point[10] is the run on the Amalgamated Insurance Fund:

> "The Amalgamated Insurance Fund, a multiemployer plan covering about 70,000 workers and retirees, had been under strain for several

[7]As discussed in Hansmann (1999) and Rathbone-Wissman (1993), redemption of the capital credits of an exiting member, if any, is usually very slow and entirely at the discretion of the cooperative board.

[8]*Great Rivers Co-op. of Southeastern Iowa v. Farmland Industries, Inc.*, 198 685, Fed. Sec. L. Rep. P90, 718 (8th Cir.(Iowa), Dec 16,1999) (NO.98-2527, 98-2528).

[9]See *Tri-State Generation and Transmission Association v. Shoshone River Power, Inc.*, 805 F.2d (10th Circuit 1986) and *Cajun Electric Power Cooperative in the City of Morgan City v. South Louisiana Elec.*, 837 F. Supp. 194, 195 (W.D.1993)

[10]We are grateful to Russ Cooper for this reference.

> years as business failures in the men's suit industry reduced the number of employers contributing to the plan from 575 in 1986 to just 200 in 1996. The plan was underfunded by about \$ 250 million. With the contraction of the industry, the funding obligations were increasingly burdensome and the remaining employers were considering a mass withdrawal from the plan. In such an event, PBGC would be required to assume financial responsibility for the plan. Under an agreement reached at yearend, the plan will continue with employers making annual contributions at their current rate. If those contributions fail to support the plan, PBGC will separate out and assume responsibility for the liabilities of the bankrupt employers, while solvent employers will continue to fund the remaining portion of the plan at the current rate. Employers who continue with the plan will have limitations on their liability if problems occur in the future. As a result of the agreement, workers will continue to earn benefits, retirees will collect full retirement benefits, and funding of the plan will improve, reducing the potential loss for the insurance program each year that the plan continues."

(Excerpt from Pension Benefit Guarantee Corporation's 1996 annual report). The US Government thus recognized the risk of run and the need for loyalty in this cooperative undertaking, and committed itself to provide a cushion. Interestingly, it also sanctioned a loyalty-inducing scheme. To stabilize the fund, employers who withdraw will now be required to pay 150 percent of their normal withdrawal liability.[11]

Competitive environment and loyalty: The risk of opportunistic behavior faced by cooperatives depends on the environment in which they operate and, in particular, on their competitive environment. For example, the entry of an additional competitor is likely to enhance the cooperative members' outside opportunities, which has beneficial effects but also exacerbates the loyalty problem. But the magnitude of the loyalty problem also depends on the nature of the competitor.

Returning to our metaphor, suppose that you compete with a rival theater or sports enterprise that is run for profit. Its owner can make attractive offers to

[11] See Cooper-Ross (2000) for an analysis of the role of government in stabilizing those pension funds.

targeted members of your cooperative club in order to induce them to move to the for-profit entity. This strategy may easily initiate the unraveling dynamics within your cooperative. This strategy furthermore is not very costly to the for-profit entity if your cooperative charges a weekly fee and does not demand any loyalty from its members. Last, those of your customers who defect will be less concerned that they may be left stranded in the other club because its owner bears the financial risk of low participation.

For the same reasons, a cooperative will find it more difficult to maintain loyalty when it competes with for-profit corporations than when it competes with other cooperatives. A for-profit corporation's competitive strategies differ from those of a cooperative in at least three ways:

- *Ability to price discriminate.* A for-profit corporation is less constrained than a cooperative in its ability to offer different terms to different customers. In other words, a for-profit governance offers much greater scope for second- and third-degree price discrimination than the cooperative institution. As we will see, a for-profit corporation's ability to use divide-and-conquer strategies (third-degree price discrimination) as well as growth-based incentives (second-degree price discrimination) is a powerful competitive weapon.

- *Integrated and affiliated customers.* A for-profit corporation may have a strong grip over its customers either through vertical integration or through long-term incentive contracts. Such customers are not easily contestable for a competing cooperative. To be certain, a cooperative could in principle benefit from the existence of a relatively captive set of customers, who would be induced to direct their additional volume to the cooperative through heavily vested pricing schemes. Some cooperatives do indeed use such schemes. Others don't; for example, credit card associations make little use of seniority-based pricing schemes (we will come back to this point in section 5.) In such cases, the competition between a cooperative and a for-profit corporation differs from that between two cooperatives to the extent that the scope for attracting the rival's customers is asymmetric in the former case and symmetric in the latter.

- *Ability to withstand competitive moves.* Because a cooperative has little access to outside finance, it is highly vulnerable to price wars and member defections when investment takes the form of a fixed (volume independent) cost. First, price wars deprive the cooperative of resources to finance new investment.[12] Second, member defections create a strong incentive for other members to defect as well: the investment cost is spread over a smaller volume of transactions, resulting in a sharp increase in the assessment. The cooperative form eliminates the buffer provided by outside finance and passes through any loss to *future* users. It is therefore quite vulnerable to snowballing. The for-profit corporations are less vulnerable to price wars than cooperative organizations.

Two remarks are now in order. First, we do not argue in this paper for or against the cooperative form. In our view, the cooperative form has substantial benefits in terms of providing easy entry and fair access to a large number of downstream users, and of protecting its user members from the exercise of market power at the upstream level. On the other hand, user cooperatives have well-known governance costs, both in terms of the provision of managerial incentives (explicit or implicit profit-related compensation being ruled out) and in terms of decision making (since owners may have dissonant objectives). Furthermore, and as we just pointed out, cooperatives may be at competitive disadvantage when playing against profit-oriented corporations. We are more interested here in the viability of cooperative forms.

Second, there is a priori nothing wrong with the competitive tools employed by for-profit corporations. In particular, second- and third-degree price discrimination and vertical integration are known to have ambiguous welfare consequences in general, and only a detailed analysis of the situation at hand can allow more definitive conclusions. Again, the focus of our paper is on the existence of a level-playing field, namely on the conditions that ensure the viability of the asymmetric competition between for-profit and cooperative organizations. Our basic insight is that the appropriate amount of exit barriers that the cooperatives need to introduce depends on the nature of competition: higher barriers are required when competing with for-profit corporations.

[12]Due to credit rationing, this applies also, *but to a lesser extent*, to for-profits, and more particularly to those with weak balance sheets.

Outline of the paper: The paper is organized as follows. Section 2 provides a more detailed illustration of the issues in the context of the credit card industry. Section 3 builds the model. Section 4 analyzes system competition both between cooperatives and between a cooperative and a for-profit. Section 5 relaxes various assumptions and discusses alternative ways of ensuring loyalty. Section 6 concludes.

2 An illustration: the credit card industry

The credit card industry offers a particularly interesting illustration of the issues at stake. This industry is a "mixed-mode" marketplace, with two cooperative systems, Visa and MasterCard, competing with vertically integrated for-profit rivals such as American Express and Discover.[13] As predicted by theory, an organization like Visa has very little debt. It also carries over limited retained earnings, in part due to the threat of significant taxes on the latter.[14]

Cooperative credit card systems have come under attack for their "selective exclusivity policy". While Visa and MasterCard currently allow member duality and some extent of board duality[15] between them, they ask their members to choose between cooperative systems and for-profit systems.

[13] Mixed-mode market places are actually common. For example, Ocean Spray, a cooperative, competes with for-profit price manufacturers. Partnerships compete with investor-owned consultancies and law firms. Farm cooperatives operating their own oil refineries compete effectively with investor-owned firms, and large moving companies include both cooperatives and for-profits.

[14] Technically, Visa is a for-profit entity. However, for all relevant matters, it is de facto not-for-profit since it has a long standing policy of not borrowing and not distributing profits. As a simplification, Visa forecasts revenues and core expenses over the next 12 months and identifies business initiatives for which surcharges on service fees will need to be levied over several years. Occasionally, total revenue may differ from expenses, as was the case in 1999 due to an unexpectedly strong economy. The unforeseen earnings are not rebated to users in the form of refunds. They lead to either an immediate reduction in system fees or extra spending on investment.

[15] "Member duality" refers to the possibility for issuers to issue cards in both systems. "Board duality" formally means that members sitting on the board or committees of one system may issue cards on the other system. Of course, the actual governance process differs from what can be inferred by simply looking at the allocation of formal control rights. In particular, large members not sitting on the board have some real authority since their threatening to leave the system must be taken seriously in the presence of strong network externalities. Large members therefore may have substantial influence even if nondiscriminatory requirements prevent them from obtaining substantially better deals than smaller ones. They can for example thwart investments that are not a priority for their business development.

Member and/or board duality have costs and benefits for the systems' members.[16] Board duality may facilitate benchmarking and thereby provide managements with high-powered incentives. It may also speed up diffusion of innovation from one system to the other, which has both costs and benefits. On the cost side, quick imitation may discourage innovation, although it need not if it is clear who came up with the idea first. On the benefit side, diffusion enhances efficiency, and also promotes stability. Since cooperative organizations are naturally unstable institutions, in the absence of equilibrating mechanisms, system competition may rapidly give way to dominance by a single system.

Member duality also has costs and benefits. Duality enhances the members' ability to "vote with their feet". They can react to a comparative advantage of one system over the other by shifting customers only "at the margin", while exclusivity forces them to incur the cost of moving the entire installed base to the superior system. Duality therefore increases the sensitivity of market share evolution to "nondrastic" comparative advantages; this in turn provides stronger incentives to management if managerial compensation is related to system market share. In contrast, "drastic" differences between the systems induce issuers to switch their portfolios under exclusivity, and duality may then slow down the market share reaction to comparative advantage. Overall, the choice between duality and exclusivity is a complex governance issue that should be addressed with the view of offering the best input to the issuers and their customers.[17]

This paper emphasizes that this trade-off between duality and exclusivity depends in particular on the nature of the rival credit card systems. Being dual with another cooperative or with a for-profit system does not have the same implications, due to the wider range of competitive strategies available to the for-profit system. Suppose for example that an investment in a specific innovation (say, a better corporate card) or in the survival of the association as a whole depends on whether people feel committed to the enterprise and can promise to make a minimum use of the innovation (or association) unless they have a clearly superior outside opportunity. If it is anticipated that a fraction of the members will leave opportunistically, then the investment may not be made. Duality with

[16] See Hausman et al (1999).

[17] As stressed by Hausman *et al* (1999), the not-for-profit nature of Visa and MasterCard also implies that duality does not raise the anticompetitive concerns that would naturally arise if the systems were for-profit.

another cooperative system somewhat triggers such risk of opportunism, but duality with a for-profit system triggers it even more. Therefore, while some exit barriers may be needed in both cases to ensure member loyalty, they are needed more in the case of a for-profit rival, since in effect the duality is asymmetric in that case.[18]

3 Model

Because the financing of investment by credit card associations is an interesting application of our more general theory, it is convenient for motivational purposes to couch our model in the language of that industry. As should be clear to the reader, our model more generally depicts an investment choice that affects the members' existing business as well as their future development effort.

There are two systems, S_1 and S_2. The systems start with equal numbers of identical issuers (users). Since we are interested in the dynamics of investment and market shares, we assume that issuers have their installed base on a single system, that is, they initially are not dual. [Starting from a dual situation complicates the analytics and creates dissonance in goals among the members of a cooperative if members do not have the same installed base composition. The case studied here exhibits the main effects and is quite simple.]

There is on each system a large number of issuers, which we will describe as a continuum of mass one. All issuers are identical. Their installed base of customers generates a volume of transaction q. Issuers' volume grows by an amount Δ. So total volume is $q + \Delta$. The innovation studied here is sufficiently minor so that it does not pay for an issuer to switch the installed base from its existing system to the other system; in contrast, under duality, the issuers may want to affect their new volume Δ and their installed-base volume to two different systems. Allowing for more drastic innovations would create stronger tipping effects than

[18] The asymmetry follows the three lines described in the introduction. American Express, unlike its cooperative rivals, is not bound by nondiscrimination requirements; it has access to outside finance; and it has locked in its issuing business primarily through vertical integration, and secundarily through long-term contracts with independent issuers in Europe (their standard network contract has a duration of five years. In one instance (Banco Popular), a ten-year contract has been signed). These long-term relationships with banks still represent a very minor activity of Amex, which by and large is still a vertically integrated entity, but they illustrate potential future developments in this industry.

those analyzed below.

Each system's marginal cost per transaction is initially equal to c. Each system can at cost I implement an innovation that reduces by g the cost of servicing a unit transaction. Throughout the paper we will assume:

Assumption 1: $$gq < I < g(q + \Delta).$$

Assumption 1 states that the innovation is worthwhile if the system attracts the total volume of transactions of its initial issuers, but too costly if the system does not expand. [The gains analyzed here are private gains. One could also introduce a "benchmarking benefit" from having the two systems innovate. For example, managerial competition could add a further cost reduction, g', for the system beyond the reduction, g, that exists even if the system is the only one to innovate. For simplicity, we ignore such benchmarking benefits.]

We have studied two variants for modelling competition between cooperative and for-profit systems. The main difference between the two variants comes from the treatment of the "balanced budget" constraint imposed on cooperatives. In the first timing, studied in section 4, this constraint is taken at full value, with the implication that a cooperative cannot commit in advance to the level of its system fee. The exact level depends on how many issuers it will have attracted: the larger its issuers base, the lower the fee it has to charge to recover the fixed cost of its investment. In the second timing, discussed in section 5.1, it is instead assumed that third parties (e.g., suppliers) can serve as residual claimants if some unexpected deficit arises. A cooperative system is then allowed to commit itself to a certain system fee, provided that it leads to a balanced budget in equilibrium. The analyses of the two variants deliver broadly consistent implications, up to a few interesting differences.

4 Symmetric versus asymmetric competition

We consider successively the case where both systems are cooperatives and the case of a cooperative competing with a for-profit corporation.

The timing, in the case of *two cooperatives*, goes as follows:

Stage 1: Each system decides whether to invest.

Stage 2: [Under member duality] the users noncooperatively decide where to allocate their new customers (Δ).

Stage 3: Each system i invests if it has chosen to invest at stage 1, and sets a system fee a_i equal to its average cost (c in the absence of investment, c minus g, plus I divided by system volume in the presence of investment).

We assume that a cooperative takes its innovation decision so as to maximize the expected benefit of its members (since all issuers in a system are alike and the cooperative is subject to a non-discrimination rule, the expected benefit is the same for all).

The timing reflects the idea that a cooperative cannot commit to a system fee. Ex post it must balance its budget regardless of the number of issuers who have elected to allocate their new volume to the system. The timing also captures in a highly stylized way the fact that investments involve "time-to-build". We have in mind multi-year (3 to 5 years, say) investments that the board approves and are later financed through service fees: development of a debit card, of a corporate card or of e-commerce technology.[19] While issuers know the service fee that they will pay during the first year of the investment, the system fee closer to completion will depend on the system's total volume in the future. This is reflected in the timing by the fact that issuers, when allocating their new volume at stage 2 (that will later become an installed base itself), need to assess whether other issuers will also stay with the system in order to anticipate the stage-3 system fee.

This timing creates scope for *network externalities* and coordination problems: Because total cost is shared among members in a cooperative system, an issuer, ceteris paribus, prefers to belong to a system attracting a large number of other issuers. As we will see, this fact in some situations implies that there may be multiple equilibria. We will then make the standard assumption that issuers having the same payoff function succeed in coordinating on the equilibrium that best fits their common interest. This Pareto-dominance criterion gives the best chance for a cooperative system against a for-profit rival system because the cooperative is vulnerable to coordination failures while the for-profit system is not. An alternative assumption is to use "risk-dominance" (Harsanyi-Selten (1988), Kandori-Mailath-Rob (1993), Carlsson-Van Damme (1993)) to select an equilibrium.[20] As we will see, the cooperative system is then more fragile.

[19] For notational simplicity, we do not introduce an initial investment at stage 1 (year 1). If we did, I should be thought of as the completion cost at stage 3 (years 2 through 5, say).

[20] For example, Carlsson and Van Damme use iterated strict dominance to select the risk

In the case of competition between a cooperative system S_1 and a for-profit system S_2, we will keep the same timing except that the for-profit system S_2 announces its system fee a_2 between stages 1 and 2, after the systems decide whether to invest (stage 1). [21] Note that we do not thereby introduce an asymmetry in timing between the two systems; for, the cooperative system S_1 could also announce a system fee at the same time as system S_2. The point is that such an announcement cannot be binding since ultimately a_1 is determined by the budget balance constraint at stage 3.

The thrust of the analysis concerns the competition between a cooperative and a for-profit system in the absence of exclusivity, but we first start with two benchmark cases.

4.1 Exclusivity

Suppose first that the two systems impose exclusivity. System S_2 here can indifferently be for-profit or a cooperative. Our assumption that issuers are reluctant to move their installed base implies that the net gain per system is

$$g(q + \Delta) - I,$$

which under assumption 1 is positive. Systems then both innovate. And a cooperative charges a system fee $\hat{a}$ given by

$$\hat{a} \equiv c + \frac{I - g(q + \Delta)}{q + \Delta} = c - \left(g - \frac{I}{q + \Delta}\right) < c.$$

4.2 Two cooperatives with member duality (non exclusivity)

Suppose now that both systems are cooperatives and that issuers are free to allocate their new volume to the system of their choice. Is the outcome prevailing under exclusivity still an equilibrium? Suppose both systems invest, and issuers remain loyal to their system. Then no single user has an incentive to switch even partly to the other cooperative since both cooperatives charge $\hat{a}$.[22] It must be the

dominant equilibrium in two-player, two-action games by adding noise to the perception of the true payoffs. See Frankel et al (2000) for a broader analysis.

[21] Letting S_2 announce a_2 at stage 1 yields similar results, but is technically more complex.

[22] An individual issuer's preferences between the two systems is then not strict in that it is indifferent between being loyal and moving its new customers to the other system. Arbitrarily

case that the members of a system do not gain by not investing and allocating their new volume to the other system. Or

$$\hat{a}(q+\Delta) \leq cq + \underline{a}\Delta, \tag{1}$$

where

$$\underline{a} \equiv c - \left(g - \frac{I}{q+2\Delta}\right).$$

Condition (**??**) can be rewritten as:

$$gq \geq \frac{q+\Delta}{q+2\Delta} I. \tag{2}$$

Conversely, if this condition is satisfied, the Pareto-dominance criterion implies that it is optimal for each system to innovate and for its members to remain loyal to the system.[23]

4.3 One cooperative system, one for-profit system, with member duality

Suppose now that system 2 is for-profit. Let us assume that the for-profit system need not be concerned by its issuers' moving to the other system (at least as long as the former innovates). For one thing, vertical integration and long-term contracts would prevent such a move. The for-profit issuer may also obtain the loyalty of its issuers by offering favorable terms to those issuers who are about to depart.

a) Non targeted offers

Suppose that both systems invest. In a first step, let us assume that the for-profit system makes the same offer a_2 to all system-1 issuers; that is, it does not make targeted offers to some of the rival system's issuers. Under the Pareto-dominance criterion, the for-profit issuer succeeds in attracting the new volume of system-1 issuers if and only if

$$\hat{a}\Delta \geq a_2\Delta.$$

small frictions (cost of moving new customers to a new system) would make the equilibrium strict.

[23]If (**??**) is not satisfied, then there are two equilibria under the Pareto criterion. These equilibria are asymmetric and have a single system invest.

Indeed, because the cooperative system is most attractive when all its issuers remain faithful and the system fee is therefore $\hat{a}$, loyalty to system 1 is not an equilibrium if $a_2 < \hat{a}$. In contrast, if $a_2 \geq \hat{a}$ loyalty is the Pareto-dominant equilibrium for issuers in system 1. The for-profit system then attracts all new volume as long as[24]

$$a_2 \leq \hat{a} = (c - g) + \left(\frac{I}{q + \Delta} \right).$$

But then, it is indeed profitable for system 2 to attract these customers, whom it services at marginal cost $c - g$.

Does system 1 invest nevertheless? There is a strategic benefit for system 1 to invest: it reduces the system fee offered by system 2 to system 1 issuers from $a_2 = c$ to $a_2 = \hat{a}$. So at stage 1 issuers in system 1 must compare their cost when system 1 does not invest:

$$c(q + \Delta)$$

with that

$$\left(c + \frac{I}{q} - g \right) q + \hat{a}\Delta,$$

when system 1 invests. If

$$I \geq \frac{g(q + \Delta)^2}{q + 2\Delta}, \tag{3}$$

which holds for Δ small, system 1 does not invest. Otherwise, it invests even though it will service a low volume.

This analysis leads to two important remarks:

First, by continuity, system 2 would attract issuers *even if its innovation were inferior*, as long as the difference in efficiency is not too large. If for example $I_1 = I_2 = I$ but $g_1 > g_2$, then system 2 wins (that is, attracts the new volume of all issuers), as long as $g_1 - g_2$ is not too large, namely, as long as

$$c - g_2 < \hat{a}_1 \equiv c - g_1 + \frac{I}{q + \Delta},$$

[24] Note the existence of the standard "openess problem" common to most Bertrand games. System 2 attracts the issuers for all $a_2 < \hat{a}$ but does not for a_2 exactly equal to $\hat{a}$. Without loss of generality we adopt the convention that system 2 selects $a_2 = \hat{a}$ and attracts the issuers.

or

$$g_1 - g_2 < \frac{I}{q+\Delta}. \qquad (4)$$

Second, system 2 has an even easier time attracting system 1's issuers if we use the *risk- dominance criterion.* This criterion postulates that issuers go to system 2 as long as they individually prefer system 2 when they put equal chances on any alternative issuer going to either system (see Harsanyi-Selten (1988) for an exposition, and Kandori-Mailath-Rob (1993) for an evolutionary dynamics motivation of the concept). Then, system 2 attracts system 1 issuers if and only if

$$\left(c - g + \frac{I}{q+\frac{\Delta}{2}}\right)\Delta \geq a_2\Delta,$$

or

$$a_2 \leq \widetilde{a} \text{ where } \widetilde{a} \equiv c - g + \frac{I}{q+\frac{\Delta}{2}} > \hat{a}.$$

This, in turn implies that the for-profit system will win (i.e., attract all new customers), for a broader range of parameters than before[25]. If for example $I_1 = I_2 = I$ but $g_1 > g_2$, then system 2 now wins as long as

$$c - g_2 < \widetilde{a}_1 \equiv c - g_1 + \frac{I}{q+\frac{\Delta}{2}},$$

that is, as long as

$$g_1 - g_2 < \frac{I}{q+\frac{\Delta}{2}}. \qquad (5)$$

b) Divide and conquer.

Let us now show that the for-profit system can exploit the externalities among system 1's issuers in an even more effective way by using a divide-and-conquer strategy (we here borrow ideas developed in Innes-Sexton (1993, 1994) in the context of an upstream supplier trying to prevent backward integration by its downstream customers or inefficient entry by a potential rival). Suppose for

[25]Note that, in the case of competition between two not-for-profit associations, the risk-dominance criterion yields the same prediction as the Pareto-dominance criterion (since a balanced flow between the two systems does not affect their attractiveness).

example that system 2 offers a sweet deal to a fraction y of system 1's customers ("how sweet a deal" will be examined later on), who are then induced to move to system 2. The remaining fraction $1-y$ of system 1's issuers is then left stranded with a larger per unit fixed cost and are individually tempted to defect to system 2. More formally, if system 2 offers them a_2 such that

$$a_2(y)\,\Delta \equiv \left[c - g + \frac{I}{q + (1-y)\Delta}\right]\Delta \geq a_2\Delta,$$

then each of the system 1's issuers prefers to move its new volume to system 2 even if it is not offered a sweet deal and if it anticipates that the other nontargeted issuers remain loyal to system 1.

Next, note that system 2 should offer $\hat{a}$ (or slightly below $\hat{a}$) to the targeted customers. These customers cannot get a better deal than $\hat{a}$ by remaining loyal. Conversely, if they were offered more than $\hat{a}$, all customers of system 1 would be better off refusing system 2's offers.

Thus, a divide-and-conquer strategy is always more effective: instead of offering $\hat{a}$ to all system-1 issuers, the for-profit system offers $\hat{a}$ to a fraction y of these issuers and $a_2(y) > \hat{a}$ to the remaining fraction. And it further reduces system 1's incentive to invest at stage 1.

Let us finally derive the *optimal* divide-and-conquer policy. It is actually optimal for system 2 to make a continuum of offers rather than just two. Indexing (identical) issuers by $y \in [0,1]$, the profit-maximizing strategy for system 2 to offer $a_2(y)$ to issuer $y \in [0,1]$ where $a_2(0) = \hat{a}$, $a_2(1) = \overline{a}$, and

$$a_2(y) \equiv c - g + \frac{I}{q + (1-y)\Delta} \quad \text{for all } y. \tag{6}$$

This deters coordination by issuers in $[y, 1]$ on remaining loyal to system 1 and, more generally, any type of such coordination.

We summarize this section's analysis in:

Proposition 1 *Suppose that the innovation is amortized over the cooperative's total business but is not vindicated if it applies only to the installed base (assumption 1). Then*

(a) A cooperative always innovates under exclusivity.

(b) For an industry structure with two cooperatives and member duality, cooperatives innovate provided condition (2) *is satisfied.*
(c) If one of the systems is a cooperative and the other a for-profit, the for-profit has a competitive edge if it is more efficient than the cooperative. For equal efficiency, the cooperative does not invest if (3) *is satisfied, and invests but is undercut for new business if* (3) *does not hold.*
(d) The for-profit's competitive advantage over the cooperative is stronger i) the weaker the coordination among the cooperative's members, and ii) when the for-profit uses price discrimination.

5 Discussion

Let us discuss the robustness of our results to the modeling assumptions, and consider a few alternative loyalty-inducing schemes.

5.1 Looser budget constraint

We have assumed that associations must break even in all states of nature. The consequence of this assumption was that an association can never commit to a system fee, which in fact is determined ex post to balance the association's budget. We can endow associations with a bit more freedom. Namely, an association can commit to a fee as long as, on the equilibrium path, this fee balances the budget. Thus, the implicit assumption is that a supplier or financier serves as a buffer in case of an unexpected event. We otherwise keep a three-stage timing:

Stage 1: The systems decide whether to invest.

Stage 2: The systems set their fees.

Stage 3: Issuers allocate their new customers between the two systems.

The analysis (available from the authors upon request) confirms the insights derived in the previous section: While both systems innovate when they are protected by exclusivity, the competition between an association and a for-profit system is, in the absence of exclusivity, distorted in favor of the latter, thereby making it more difficult for the association to keep the loyalty of their members and to finance the innovation. The main difference between the two analyses is that, even in the case of two symmetric associations, under member duality (non exclusivity), one system always ends up attracting the new volume of all issuers.

In other words, the absence of exclusivity makes the associations more fragile and exposed to runs. As a result, when

$$\frac{I}{q} > g > \frac{I}{q}\frac{q+\Delta}{q+2\Delta},$$

only one system innovates under this looser budget constraint whereas both associations would innovate under the stricter budget constraint considered in the previous section. In particular, whenever there are some managerial benefits from benchmarking, competition between two nonexclusive associations generates too little innovation (that is, only one system innovates in equilibrium even though it would be efficient to have both systems innovate).

The analysis can further be extended by allowing for different characteristics of the two systems' projects (different benefits g_1 and g_2 as well as different costs I_1 and I_2). This extension shows that, even in the absence of managerial benefits from benchmarking, competition between two not-for-profit associations may again generate too little innovation in the absence of exclusivity (this possibility is even more likely under the looser budget constraint than under the stricter budget constraint considered in section 4). Finally, it can be shown that even if a not-for-profit faces this looser budget constraint, the for-profit system can still easily attract all new customers through price discrimination (e.g., second-degree discrimination such as volume discounts) and thus discourage investments by the not-for-profit system.

5.2 Uncertainty: an analogy with the stranded assets problem

We have assumed that the innovation technology is deterministic. Suppose in contrast that the eventual investment cost I faced by a system is unknown at the date at which the system decides whether to innovate (stage 1). Let this cost be distributed according to cumulative distribution F with density f on $\left[\underline{I}, \bar{I}\right]$ and mean I^e.

Let us return to the timing of section 4. We abstract from the description of system competition and simply assume that members of the system can allocate at stage 2 their new customers to another system at deterministic system fee a^*, where

$$a^* > c - g \tag{7}$$

and

Condition (**??**) implies that it is always efficient that members use the sy

$$cq + a^* \Delta > (c - g)(q + \Delta) + I^e. \tag{8}$$

stem fully once the investment has been made. Condition 8 then implies that, conditional on an efficient use of the investment, the investment is worthwhile for the system. It also implies that the investment would be made and (under the Pareto criterion) efficiently used, were the investment cost deterministic.

In contrast, with a random investment cost, the innovation may not be efficiently used. Indeed, for realizations I such that

$$a^* < c - g + \frac{I}{q + \Delta},$$

the only equilibrium is for all issuers to allocate their new customers outside the system even though it would be more efficient for them to remain loyal. For realizations I such that

$$a^* \geq c - g + \frac{I}{q + \Delta},$$

the Pareto criterion yields loyalty. The welfare loss due to the absence of loyalty is equal to (in expectation)

$$[a^* - (c - g)] \Delta [1 - F[(a^* - (c - g))(q + \Delta)]].$$

Furthermore, anticipating this inefficient use of the investment, the system may decide not to invest at all.

This situation is formally analogous stranded asset problem in regulation.[26] Like an association, a utility is subject to a budget constraint. Its customers are protected from high prices by the regulatory contract when the utility's cost is lower than competitive opportunities; in contrast customers who have access to these competitive opportunities (e.g., industrial users) want to leave the utility when the latter's cost proves to be higher than the alternative: the utility's

[26] See Sidak-Spulber (1997) for an exhaustive treatment.

shareholders then run the risk of being left stranded with large losses on their assets in bad states of nature while they cannot make supra-normal profits in good states of nature. This is why most regulatory authorities in the world have set up stranded asset taxes.

The situation is similar here, except that the opportunistic users and the stranded stakeholders are the same players! Issuers have two incarnations, as "installed base" issuers and "new customers" issuers. The later incarnations act opportunistically, leaving the former ones stranded with high investment costs. We therefore see that uncertainty may justify barriers to exit in a situation in which there would be no need for such barriers under perfect certainty.

Last, this example allows us to formalize a point made by Gilson (1999). Suppose now that issuers belong to two associations and are really dual in that their installed base is split equally between the two systems. Then, when issuers flee from a high-investment-cost system to a low-investment-cost system, they do not really leave each other stranded because they contribute to and benefit from the reduction of the system fee in the latter system.

5.3 Mutualization

We have analyzed the case of a general-interest program financed from the association's general budget. While many programs benefit most of or all members of the associations, others, such as a corporate card program, interest a smaller fraction of issuers. Such programs may be financed either from the association's general budget or through fees paid specifically by the users of the program.[27] The modeling of the latter, "cafeteria-style" financing mode follows the lines of the analysis of this paper.

The former mode of financing, "mutualization" or "socialization" of the expenses, puts all investment costs in the same pot. One might think that the associations can reduce their instability by not setting different fees for different programs. Things are more complex, though. First, the general fee will reflect the cost of the specific programs and therefore the instability will remain. Suppose for example that half of the users benefit from program A and the other half from program B. While the program-A users are charged only for half of the cost of

[27] Initially, the investment is still born by the general budget, which in a sense "lends" to the users of the program and expects to be reimbursed through their specific user fees later on.

their program (the program-B users bearing the remaining cost), they also have to pay half of the cost of a program for which they have no use. So their incentive to allocate new customers to another system has not changed.

To fix ideas, suppose that for each program the innovation cost $I/2$ and generates a program-specific *benefit* g to the issuers interested in the program.[28] If both innovations are made and all members remain loyal, each issuer will be charged

$$\hat{a}' = c + \frac{\frac{I}{2} + \frac{I}{2}}{\left(\frac{g}{2} + \frac{\Delta}{2}\right) + \left(\frac{g}{2} + \frac{\Delta}{2}\right)},$$

where the last term comes from the fact that the total cost of investment, $I/2 + I/2$, is shared by all issuers (the half interested in program A as well as the half interested in program B); note that the net cost for an issuer is now $\hat{a} - g$. Now, a for-profit system having made both innovations could attract the new volume of all the association's members exactly as before – for example, by offering all members a system fee slightly below $\hat{a}'$; mutualization thus does not reduce the association's fragility.

Second, a true mutualization is hard to achieve, as stressed by Hansmann (1996). A specific-interest program encounters resistance by those members who do not benefit from it. To move ahead with the program, the beneficiaries must spend political capital (engage in logrolling). But the negotiation may break down and result in a deadlock. In practice, and for this reason, successful cooperatives often establish separate accounts for different programs and thereby adopt the cafeteria financing mode.

5.4 Comparison of alternative loyalty-inducing policies

The two key points are the need for cooperatives to secure some loyalty and the dependence of the desired level of loyalty on the existence on a level- playing field in competition. Selective exclusivity is one instrument to achieve these goals. As we have seen in the introduction, alternative policies can also secure loyalty. Comparing loyalty-inducing policies requires analyzing their impact on the other

[28]While we have focused so far on cost-reducing innovations, it seems more relevant here to think in terms of (program-specific) quality improvements that enhance the "value" of the service provided by the issuers interested in the program. The previous analysis is unchanged for such quality innovations.

objectives of the cooperative: The policy must not conflict with the users' willingness to approve the investment project, must not discourage new members from using the cooperative, and must not create insurmountable governance problems.

The choice of a loyalty-inducing policy must therefore be tailored to the specificities of the industry. We here focus on the credit card industry. Several specificities of that industry should be highlighted: First, a credit card cooperative faces "mixed-mode competition" from another cooperative and for-profit systems. This feature by itself implies that the loyalty-inducing policies discussed below cannot be appropriate, since they are insensitive to the nature of competition.[29] Second, there is intense downstream competition among users; this feature distinguishes the credit card industry from, say, clubs or even marketing cooperatives. Third, the development business is not necessarily associated with incumbent issuers (as exemplified by successful entry in the nineties), and so policies that secure incumbents' loyalty to the detriment of new business brought by entrants may be hazardous. Let us look at the implications of these specificities.

At an abstract level, members of a cooperative must lower the future opportunity cost of using the system to ensure that the investment be used properly. A natural policy could then be the introduction of nonlinear contracts such as two-part tariffs (in the same way a sports or theater club demands a yearly subscription fee).[30] This policy is tantamount to an equity investment or fixed investment contribution. Leaving aside the question of how such two-part tariffs could be set up in light of the wide heterogeneity in issuer size and growth prospects, issuers are unlikely to adopt such two-part tariffs, since the reduction of the linear part will be at least partially competed away. As shown by Hausman et al (1999), the low marginal system fee induces low prices charged by issuers who then cannot recoup their upfront payment. This effect, which does not exist in the case of a sports or theater club or of a joint venture of noncompeting users, argues against nonlinearities.

The alternative for the cooperative is then to try to differentiate marginal

[29] At least as these policies are implemented in other industries. One could conceivably combine selective exclusivity with those policies. For example, assessments could be based on both the members' past activity with the cooperative and on its having a relationship with the for-profit.

[30] More generally, both the yearly subscription and the system fee could also be based on a targeted volume, decided each year; the system fee could then be adjusted as a function of the realized volume.

system fees, as in the case of discounts based on (past) cumulative volume.[31] This policy offers lower system fees to established issuers. It may however not serve the same purpose as an exclusivity requirement. In particular, if the new volume comes primarily from the growth of recent entrants or from new entrants, the cumulative-volume discount is self-defeating: it discourages those issuers that are growing fastest from allocating their new volume to the system. And, from a competitive standpoint, the association also encourages loyalty ... by the issuers of the rival systems. Conversely, the association could charge *lower* marginal fees to newcomers. This policy has however two drawbacks. First, part of the development business comes from the incumbents and is therefore discouraged. Second, this policy encourages free-riding on the existing membership.

Last, the association could set different system fees for the use of cards by installed-base customers and by new customers, discriminating in favor of the latter. That is, fees are based on realized volume growth for the issuer. This policy however has several drawbacks. As is well-known, it creates a ratchet effect and induces intertemporal incentives that conflict with sound business practice.[32] Furthermore, it benefits some issuers (those with high growth prospect) to the detriment of others. The process of fixing such discounts may therefore be highly political.

These observations and the fact that standard loyalty-inducing policies do not react to the nature of the competitive environment all imply that these policies cannot duplicate the properties of selective exclusivity in the credit card industry. Naturally, while the points made in this paper apply quite generally, the comparison of loyalty-inducing policies is specific to this particular or similar industries.

6 Summary

The paper has made two points. First, cooperatives are fragile institutions. The lack of the buffer usually provided by outside financing and the concomitant sharing of fixed costs among members create a form of network externality and expose cooperatives to runs. Because member exit involves both an efficiency

[31] That is, the (linear) system fee is function of the issuer's past volume. A different policy, discussed below, is a nonlinear system fee, with progressive rebates for larger (current) volumes.

[32] See Weitzman (1980).

rationale and negative externalities on remaining members, cooperatives need to erect small barriers to exit so as to create some loyalty and thereby enable investment.

Second, the efficient amount of loyalty depends on the nature of the competitive threat faced by the cooperative. In particular, while a cooperative enjoys a level-playing field vis-à-vis another cooperative, it wages an asymmetric competition with a for-profit rival. A for-profit rival is not hindered in its use of second- and third-degree price discrimination; it can lock in its licensees and integrated users; and, finally, its access to outside finance makes it less vulnerable to defections. Even under the assumptions most favorable to the stability of the cooperative (no coordination failure, no targeted offers from the for-profit), in the absence of barriers to exit, a for-profit corporation succeeds in destabilizing a not-for-profit competitor even when it offers no superior service (or even an inferior one). This competitive edge, unrelated to comparative efficiency, discourages investment by the cooperative; and the edge is stronger when the for-profit corporation makes targeted offers to attract members of the cooperative or when the coordination process follows the "risk-dominance" criterion.

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Appendix to "Loyalty and Investment in Cooperatives"
(Available upon request)

Looser budget constraint

As mentioned in section 5.1, the second variant considers the following timing:

Stage 1: The two systems decide whether to invest.

Stage 2: The two systems set their fees.

Stage 3: Issuers allocate their new customers between the two systems.

We maintain the assumption that a cooperative takes its innovation decision so as to maximize the expected benefit of its members. At stage 2, an association must set its fee so as to break-even, given the other system's fee and the issuers' anticipated behavior in the third stage. A for-profit system in contrast sets its system fee as it likes.

A Exclusivity

We first briefly consider the situation where each system has an exclusivity rule, according to which an issuer cannot issue both cards. A cooperative then chooses

$$\hat{a} \equiv c - \left(g - \frac{I}{q + \Delta} \right).$$

As in section 3, members benefit from the innovation since $\hat{a} < c$. Similarly, a for-profit corporation chooses to innovate since $I < g\,(q + \Delta)$.

We now study the situation where no system has an exclusivity rule, starting with the case of competition between two not-for-profit associations.

B Two cooperatives with member duality (non exclusivity)

If the two associations innovate, the situation described in section 3, where both systems set their fees to $\hat{a}$, is no longer an equilibrium here since each association would have an incentive to lower its fee so as to attract the other system's "unattached" customers: starting from $a_1 = a_2 = \hat{a}$, S_1 could for example lower its fee to

$$\underline{a} = c - \left(g - \frac{I}{q + 2\Delta}\right) < \hat{a},$$

to attract all issuers' new customers, thereby increasing its volume of transaction by 2Δ instead of Δ and thus eventually breaking even, for the benefit of all of its members. Given this, the (pure strategy) continuation equilibrium would necessarily be asymmetric, with one system charging $\underline{a}$ and the other system charging

$$\bar{a} = c - \left(g - \frac{I}{q}\right) > \hat{a}.$$

This in turn implies that, in the continuation equilibrium, one system ends up with non-loyal issuers that move their new volumes to the other system. Both systems innovating is therefore an equilibrium only if $\bar{a} > c$, that is, if

$$g > \frac{I}{q}. \tag{9}$$

If instead, as we have assumed so far,

$$g < \frac{I}{q}, \tag{10}$$

both systems innovating cannot be an equilibrium, since the "loosing" system (i.e., the system who does not succeed in attracting the new volumes of its issuers) would then have to charge $\bar{a} > c$; hence, in that case, only one system decides to innovate in equilibrium.

When condition (10) is satisfied, it is actually efficient to have only one system innovating, since then

$$g\,(q + 2\Delta) - I > 2\left[g\,(q + \Delta) - I\right].$$

However, other reasons, not modelled here (e.g., benchmarking), may exist for which it might be efficient that both systems innovate even if condition (10) is satisfied.[33] Moreover, this efficiency conclusion does not entirely carry over when

[33] For example, if having both innovations allows better managerial benchmarking, the appropriate condition for efficiency could become $g\,(q + 2\Delta) - I \gtrless 2\left[(g + g')\,(q + \Delta) - I\right]$, with g' representing the value of enhanced benchmarking.

the projects of the two associations have different characteristics. In that case, competition ensures that the better project "takes over" when it is efficient to have only one project, but the number of innovations adopted may be lower than what would efficient:

Proposition 2 *Suppose that the two projects have different characteristics,* (I_1, g_1) *and* (I_2, g_2)*. Then:*

- *Whenever it is efficient to introduce only one innovation, the superior project (namely, the one with the higher unit cost reduction* $g_i - I_i/\,(q + 2\Delta)$ *when used maximally) is adopted in equilibrium while the inferior one is not;*

- *It may however be the case that only one project is adopted in equilibrium even though it would be efficient to have both projects adopted.*

Proof. Consider first the case where it is efficient to have only project 1 adopted; then:

- Project 1 must generate a net surplus:

$$g_1\,(q + 2\Delta) > I_1. \tag{11}$$

  This condition implies that, *if* S_2 *does not innovate,* S_1*'s best response is to innovate* and charge $\underline{a}_1 \equiv c - g_1 + I_1/\,(q + 2\Delta)\,(< c)$.

- Project 1 must dominate project 2 provided only one project is adopted:

$$g_1\,(q + 2\Delta) - I_1 > g_2\,(q + 2\Delta) - I_2. \tag{12}$$

  This condition implies that, *if* S_2 *innovates,* S_1*'s best response is to innovate and attract all new customers* by charging $\underline{a}_1$. It is clearly in S_1's interest to innovate and attract new customers (in order to lower the fee) if it can do so. But by charging $\underline{a}_1$, S_1 indeed attracts all new customers (and thus breaks even) since S_2 cannot charge a fee lower than $\underline{a}_2 \equiv c - g + I_2/\,(q + 2\Delta)$, and, by assumption

$$\underline{a}_1 = c - g_1 + I_1/\,(q + 2\Delta) < \underline{a}_2 = c - g_2 + I_2/\,(q + 2\Delta)\,.$$

- Adopting project 1 only must be more efficient than adopting both projects (taking into account that new customers go to most innovative system):

$$g_1(q+2\Delta) - I_1 > g_1 q + g_2 q + 2\max\{g_1, g_2\}\Delta - I_1 - I_2. \qquad (13)$$

  This condition implies $g_2 q < I_2$;[34] thus, *there cannot be an equilibrium in which S_2 innovates and does not attract new customers*, since it would then have to set $\bar{a}_2 = c - g_2 + I/q > c$.

Therefore, if it is efficient to have only one innovation, that innovation only is indeed adopted in equilibrium. This efficiency result does not however extend to the case where it is efficient to have both projects adopted. Consider for instance the following example: $I_1 = 0, q = \Delta = g_1 = 1, I_2 = 3.5, g_2 = 2$. Then, it is efficient to adopt both innovations, which yields:

$$(g_1 + g_2)q + 2\max\{g_1, g_2\}\Delta - I_1 - I_2 = (1+2)\times 1 + 2\times 2\times 1 - 0 - 3.5 = 3.5, \qquad (14)$$

rather than either project 1 only (which yields $g_1(q+2\Delta) - I_1 = 1\times 3 - 0 = 3$) or project 2 only (which yields $g_2(q+2\Delta) - I_2 = 2\times 3 - 3.5 = 2.5$). However, in equilibrium, only project 1 is adopted since S_1 always sets $a_1 = c - g_1$ and therefore indeed attracts all new customers since $c - g_1 < c - g_2 + I_2/[q+2\Delta]$. Hence S_2 does not innovate. ■

Note that other factors, such as the value of benchmarking, reinforce the risk that the equilibrium outcome yields insufficient investments. Note also that for the example studied in the second part of proof, too little innovation would again be made under the timing analyzed in section 3. Indeed, assuming that the system fee is always determined by the budget constraint ex post, the members of system 2 would rather decide not to innovate since

$$\begin{aligned} \hat{a}_2(q+\Delta) &= \left(c - 2 + \frac{3.5}{1+1}\right)\times 2 = 2c - 0.5 \\ &> cq + \underline{a}_1\Delta = c\times 1 + (c-1)\times 1 = 2c - 1. \end{aligned}$$

[34] This condition can be rewritten as

$$g_2 q < I_2 - 2(\max\{g_1, g_2\} - g_1)\Delta \leq I_2.$$

However, if the example would be modified so as to give more weight to the installed bases (e.g., $q = 2$ and $I_2 = 4.5$, all other parameters being unchanged, so that it is still efficient to have both innovations (yielding now $(1+2) \times 2 + 2 \times 2 \times 1 - 0 - 4.5 = 5.5$ rather than either project 1 only –yielding 3 as before– or project 2 only –yielding now $2 \times 4 - 4.5 = 3.5$), then both projects would be adopted under the strict balanced budget constraint considered in section 3, since

$$\begin{aligned} \hat{a}_1(q+\Delta) &= (c-1) \times (2+1) = 3c - 3 \\ &< cq + \underline{a}_2\Delta = c \times 2 + \left(c - 2 + \frac{4.5}{2 + 2 \times 1}\right) \times 1 = 3c - 0.875. \end{aligned}$$

and

$$\begin{aligned} \hat{a}_2(q+\Delta) &= \left(c - 2 + \frac{4.5}{2+1}\right) \times (2+1) = 3c - 1.5 \\ &< cq + \underline{a}_1\Delta = c \times 2 + (c-1) \times 1 = 3c - 1, \end{aligned}$$

but again only project 1 would be adopted under the looser budget constraint considered in this appendix: by setting $a_1 = c - g_1$, S_1 still attracts all new customers since again $c - g_1 = c - 1 < c - g_2 + I_2/[q + 2\Delta] = c - 2 + 4.5/4$.

C One cooperative system, one for-profit system, with member duality

If S_2 is a for-profit corporation, then the competition is "asymmetric" in the sense that the second system has more freedom in its pricing policy and is thus more likely to attract the new customers, even if it has a less desirable project. In what follows, we will denote by $r \geq 0$ the maximal mark-up that S_2 can initially charge to its captive customers.

Consider first the situation where both projects are alike but only one would be adopted if both systems were associations:

$$g(q + 2\Delta) > I > gq.$$

We first show that this is still the case that only one system innovates when S_2 is operated as a for-profit organization. Furthermore, while there may be a bias in favor of the association's project under no-discrimination rules, the association will find it difficult to finance its innovation if the for-profit organization is not subject to non-discrimination rules: in that case, the association faces a disadvantage similar to the one analyzed in section 3.

Competition under non-discrimination rules

Suppose first that no system can price-discriminate. Then, if the cooperative system innovates and attracts new customers, the for-profit system will prefer to stick to its own customers, and will not find it profitable to innovate. Formally, there exists an equilibrium in which: (i) only S_1 innovates; (ii) S_1 sets $a_1 = \underline{a} = c - g + I/(q + 2\Delta)$ while S_2 sets $a_2 = c + r$; (iii) all new customers go to S_1. To check that this is indeed an equilibrium, note first that S_1 indeed breaks even with $\underline{a}$ if it attracts all new customers, and that S_1's members will vote for the innovation if it leads to the fee $\underline{a}$. It remains to check that S_2 has no incentives to deviate from this candidate equilibrium, that is, that S_2 prefers to stick to its customers and not to innovate. But note first that S_2 has no interest in undercutting S_1: by charging a_2 even only slightly lower than $\underline{a}$, S_2 indeed attracts all new customers but would at most break-even if it has innovated (since S_1 is precisely charging the break-even fee) and would make losses otherwise (since the innovation is efficient when it attracts all new customers).[35] And if S_2 sticks to its customer base, it is best for it not to innovate (since the innovation is not cost-effective for the sole customer base).[36]

While a symmetric equilibrium may exists in which only S_2 innovates, S_2's ability to "exploit" its captive customer base introduces a bias in favor of the

[35] Charging $a_2 = \underline{a} - \varepsilon$ would yield for S_2 a profit

$$(\underline{a} - \varepsilon - (c - g))(q + 2\Delta) - I = -\varepsilon (q + 2\Delta)$$

if it has innovated and

$$\begin{aligned}(\underline{a} - \varepsilon - c)(q + 2\Delta) &= -\varepsilon (q + 2\Delta) - [g(q + 2\Delta) - I] \\ &< -\varepsilon (q + 2\Delta)\end{aligned}$$

otherwise. In both cases this is negative for any positive ε.

[36] That is, given that S_2 chooses to charge r to its incumbent customers, it is not profitable to innovate since by assumption

$$(r + g) q - I > rq.$$

association. To see this, suppose that S_2's project is more efficient than S_1's project:

$$0 < g_1 (q + 2\Delta) - I_1 < g_2 (q + 2\Delta) - I_2, \tag{15}$$

but r is "large":

$$rq > 2g_2\Delta.$$

In this case, only S_2 would innovate if both systems were operated as not-for-profit associations but if S_2 operates as a for-profit organization, it is instead the association S_1 that innovates in equilibrium. The reason is that the for-profit system will in that case prefer to focus on its customer base (and charge them $a_2 = r$) rather than to attract new customers (by charging a competitive rate below a_1 –equal to c if S_1 did not innovate or $\underline{a}_1$ if S_1 innovated).[37] But then, it is not profitable for S_1 to innovate (since $g_2 q < I_2$).

For-profit discriminatory pricing

Suppose now that S_2 is not subject to no-discrimination rules. It can then "exploit" its captive customers by charging them a high price while at the same time attract new customers with special offers. As a result, the association will find it difficult to finance any innovation.[38]

Suppose first that S_2 can offer special deals for "new volumes". In that case, S_2 can easily secure its own issuers' volume increment and moreover attract the new volumes of the members of the cooperative; more precisely, S_2 can attract all new volumes by offering them slightly less than $\underline{a}_1$, and it is profitable for S_2 to do so since a_1 is higher than the marginal cost, $c - g$, of servicing those additional volumes of transactions.

If the for-profit corporation is not allowed sweet deals targeted to incremental volumes (in particular, if second-degree price discrimination through two-part tariffs or more general nonlinear tariffs is ruled out), an alternative for S_2 is to secure its "fast-growing" issuers. To see that, suppose that the overall increase in volume comes from large increases δ for a small number x of issuers; that is,

[37] Indeed, by assumption $(r + g_2) q > (q + 2\Delta) g_2 > (q + \Delta) g_2, (q + 2\Delta) (g_2 - (g_1 - I_1 / (q + 2\Delta)))$.

[38] The same argument applies to some extent to situations where S_2 is not allow to price discriminate but can still, as an integrated system, force its own incremental volume to stay within its system.

$\Delta = x \times \delta$, where x is small and δ is "large":

$$(\underline{a}_1 - c + g_2)(q + \delta) > (r + g_2) q,$$

where $\underline{a}_1 = c - g_1 + I_1/(q + 2\Delta) < c$ as before.

In that case, it is always optimal for the for-profit system S_2 to offer a special price to the issuers that generate new customers, even if the other system has innovated. In particular, if S_2 has innovated, then:

- if S_1 did not innovate, it charges $a_1 = c$; then S_2 can either:
  - ignore new customers and charge $a_2 = c + r$, or
  - try to attract new customers by charging only (slightly less than) $a_2 = c$;

  The second option is more attractive since it generates more revenue:

  $$g_2(q + \delta) > (\underline{a}_1 - c + g_2)(q + \delta) > (r + g_2) q.$$

- if S_1 has innovated, the lowest fee it can charge is $\underline{a}_1$. Therefore, in order to attract new customers, S_2 can at most charge $a_2 = \underline{a}_1$. But this still generates more revenue than focusing on captive customers (by charging all issuers $a_1' = r$), since by assumption

  $$(\underline{a}_1 - c + g_2)(q + \delta) > (r + g_2) q.$$

  Therefore, in this case, too, S_2 will attract all new customers.

As a result, S_2 always attracts new customers –those from its own members as well as the others. Note that the above condition has little connection with the relative performance of the two innovations. In other words, if the increase in the customer base comes from a sufficiently low numbers of successful issuers, the for-profit system has in interest in "targeting" those issuers and offer them special deals; this strategy is not only the most profitable, it also makes it more difficult for S_1 to finance its innovation even if its project is more efficient.