Competition and Mergers among Nonprofits

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Abstract

Should mergers among nonprofit organizations be assessed differently than mergers among for-profit firms? A recent debate in law and economics, boosted by apparently one-sided court decisions, has produced the result that promoting competition is socially valuable regardless of the particular objectives of producers. In this paper, I challenge the general validity of this result by showing that it may indeed depend on the particular objectives of producers whether a merger between two nonprofits is welfare decreasing or increasing. This implies that it is impossible to assess the net effects of a merger between two nonprofits without examining the objectives of the owners involved.

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I Introduction

Should mergers among nonprofit organizations be regulated? If so, should they be treated differently by antitrust law than mergers among for-profit firms? According to Richman[1], U.S. courts seem to believe so. Focusing on the hospital market, he reports that antitrust enforcement agencies have lost 'each of the seven suits initiated since 1994 to challenge proposed hospital mergers´. A major reason for this defeat was that the empirical evidence on pricing behavior of nonprofits as compared to for-profits is largely mixed and suffers from data problems; see Chou[2] and Malani, Philipson, and David[3] for overviews. Empirical evidence on the effects of mergers between nonprofits is very limited. An exception is Vita and Sacher[4], a case study. Courts seemed to grant merging hospitals the benefit of the doubt. According to Richman[5], this was sometimes grounded on ideological reasons: for instance, the case of FTC v. Butterworth Health Corp. 'lent support to those who argued that judges have a deep-seated hostility to subjecting health care providers to competition.´

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[1] Barak D. Richman, *Antitrust and Nonprofit Hospital Mergers: A Return to Basics*, University of Pennsylvania Law Review 121-149 (2007).

[2] Shin-Yi Chou, *Asymmetric Information, Ownership and Quality of Care: An Empirical Analysis of Nursing Homes*, 21 Journal of Health Economics 293-311 (2002).

[3] Anup Malani, Tomas Philipson and Guy David, *Theories of Firm Behavior in the Nonprofit Sector: A Synthesis and Empirical Evaluation,* in: The Governance of Not-for-Profit Organizations 181-215, University of Chicago Press (2003).

[4] Michael G. Vita and Seth Sacher, *The Competitive Effects of Not-for-Profit Hospital Mergers: A Case Study*, 49 The Journal of Industrial Economics 63-84 (2001).

[5] *See* Richman, *supra* note 1, 125.

This perceived view of the courts was countered recently. Philipson and Posner[6] have analyzed the questions raised above and concluded that '[b]ecause promoting competition turns out to be socially valuable *regardless of the particular objectives of producers*, the fact that antitrust law does not distinguish between the two sectors [nonprofit and for-profit] is efficient´ (3; emphasis and brackets added).

While I do not object the specific result found by Philipson and Posner, which is based on modeling output decisions of a monopolistic nonprofit organization maximizing a combination of output and consumption, I challenge the general validity mentioned in the above quotation. In this paper, I show that it may indeed depend on the 'particular objectives of producers´ whether a merger between two nonprofits is welfare decreasing or increasing. This implies for antitrust law that it is impossible to assess the net effects of a merger between two nonprofits without examining the (likely) objectives of the owners involved.[7]

My starting point is the idea that, while it is widely undisputed that owners of for-profit firms maximize profits, it is not clear at all what decision makers in nonprofits (NFPs) optimize. An earlier draft of this paper[8] proposes a governance-based model of nonprofits, which posits that there exist different types of nonprofit organizations that can be distinguished by the objective function of the pivotal owner, that is the person who is decisive in the nonprofit's decision making process. In the paper at hand, I only model one type, a so-called *consumer-dominated nonprofit*, because this is sufficient to show that owner objectives can critically matter for the welfare effects of mergers. Nevertheless, it is necessary to employ a mathematical model in order to show that and under which conditions a merger can actually increase welfare—and to demonstrate the transmission channels of this effect.

I model duopoly competition with quality-differentiated goods in a game related to Shaked and Sutton[9], where the players first determine quality levels and second prices. The health care market serves as a suitable application, higher education is an alternative. I assume that consumers (patients) have inelastic demand for a basic service and heterogeneous preferences for additional quality. In a consumer-dominated nonprofit, the pivotal owner has an interest in buying the product himself and may have a preference for additional quality. When determining the quality produced, he will thus trade off the consumption utility from high quality and the price that all consumers, including himself, have to pay for the product. Nonprofits are prohibited both from making losses and from distributing potential profits to their owners; that is, they face a nondistribution constraint. After characterizing equilibrium behavior under duopoly competition, I impose a merger on the two organizations and examine its welfare effects.

Compared to Philipson and Posner, I enrich the scope of analysis by (i) introducing quality as a strategic variable, (ii) introducing strategic duopoly competition, (iii) analyzing the effect of mergers among consumer-dominated nonprofits, and (iv) introducing an agency problem within the nonprofit by assuming 'separation of ownership and control´. (iv) refers to the assumption that in each nonprofit owners take long-term decisions by determining quality, while the day-to-day busi-

[6]Tomas J. Philipson and Richard A. Posner, *Antitrust in the Not-for-Profit Sector*, 52 Journal of Law and Economics 1-18 (2009).

[7]Here the term 'owners´ is used for the persons holding residual de facto control over an organization, as it is common in the property rights literature initiated by Sanford J. Grossman and Oliver Hart, *The costs and benefits of ownership: A theory of vertical and lateral integration,* 94 Journal of Political Economy 235–259 (1986), and Oliver Hart and John Moore, *Property rights and the nature of the firm,* 98 Journal of Political Economy 1119–1158 (1990). In contrast, an owner can or cannot have rights to residual income. In nonprofits the nondistribution constraint explicitly waives income rights.

[8]Jens Prüfer, *Competition and Mergers among Nonprofits*, CentER Discussion Paper, No. 2007-82, Tilburg University (2007).

[9]Avner Shaked and John Sutton, *Relaxing Price Competition Through Product Differentiation*, 49 Review of Economic Studies 3-13 (1982).

ness is run by an employed manager who determines the price level. In order to maximize his leeway to enjoy nonmonetary perks, I assume the manager maximizes profits. The cost function of the nonprofit is unobservable for owners, who have no specialized business knowledge. Hence, the manager has some discretion with respect to pricing.

The key result of this paper is that, even without assuming economies of scale, merging two consumer-dominated nonprofits *can* increase total welfare. The intuition for this result is the following. First, I find that there is no equilibrium in which the owners set different quality levels. This insight complements Shaked and Sutton, who show that profit-maximizing firms always differentiate quality levels in equilibrium. Producing the same quality level confronts the managers with Bertrand price competition in a homogenous goods market. Consequently, outside competition constrains managers from setting a price above marginal cost. Owners can foresee this effect. If they have a high personal preference for quality, they will determine a high quality level. However, this can be higher than the welfare-optimal quality level, yielding too much quality and driving some consumers out of the market.

If such duopolistic nonprofits merge and form a monopoly, the monopolist's manager is not constrained by product market competition and sets a price above marginal cost. In order to maximize his individual net consumption utility, the pivotal owner thus has to reduce the quality level as compared to the duopoly case, thereby reducing overproduction of quality. If the basic utility from consumption is high and the pivotal owners have a high preference for quality, the positive effect of reducing too much quality outweighs the negative effect of monopoly pricing on total welfare. High levels of basic utility (or regulated minimum quality) can be found in the hospital sector, for instance. The total welfare gain is due to the fact that the manager's monopoly pricing creates positive producer surplus. On a more theoretical level, the model provides an example how one market imperfection—excessive quality production due to the individual preferences of nonprofit owners—can sometimes be mitigated by another distortion—increased market power of the manager.

These results complement Philipson and Posner as they depend on a different objective function of nonprofit owners. They imply for antitrust law that the organizational form of merging parties and their owners' objectives do matter. Mergers among nonprofit organizations should not necessarily be treated in the same way as mergers among for-profit firms. As far as possible, an examination of the owners' objectives should be part of merger case analysis involving nonprofits. This notion is absent in current merger guidelines both in the U.S. and the EU.

The paper is organized as follows. In the next Section, I review the related literature. The model is described in Section III. In Section IV, I describe the effects of a nonprofit merger from duopoly to monopoly (the Appendix contains a game theoretical treatment of Section IV). I discuss some key assumptions in Section V and conclude in Section VI.

II Related Literature

This paper relates to several strands of the literature in economics. First, it shares a common topic, horizontal mergers, with the classical studies of Salant, Switzer

and Reynolds[10], Deneckere and Davidson[11], Perry and Porter[12] and Farrell and Shapiro[13] and more recent work such as Bian and McFetridge[14] and Davidson and Mukherjee[15], to name just a few. With the exception of Philipson and Posner, however, the impact of the organizational form of the merging parties on the welfare effects of mergers is largely ignored.

The second strand of related literature is on theories of organizational choice between the for-profit and the nonprofit forms: Glaeser and Shleifer[16], Kuan[17], Francois[18], and Herbst and Prüfer[19] provide formal studies contrasting nonprofits and firms. The work of Hansmann[20] offers a valuable descriptive approach. In this literature, the main questions studied are on the factors which make the nonprofit organizational form more attractive than profit-maximizing alternatives (apart from tax exemption).

Third, there is a related literature, both theoretical and empirical, that deals with the question, what is the objective function of nonprofits? Gertler and Kuan[21] provide an overview of this literature and a clever empirical approach, based on sales prices of entire nonprofit organizations, how to identify the value of a certain nonprofit mission to the sellers of a nonprofit. Other empirical studies of nonprofit objectives include Deneffe and Masson[22], Horwitz[23], and Horwitz and Nichols[24], which identify a set of several objective functions in practice. In an earlier draft of this paper[25] I propose a governance-based model of nonprofits and speculate that there exist different types of nonprofit organizations that can be distinguished by the objective function of the pivotal owner. The paper at hand relates to that approach but only models one type, a so-called consumer-dominated nonprofit.

Fourth, Glaeser[26] speculates that competition among nonprofits is important to keep those organizations well governed. This idea is supported by the main result

[10]Stephen W. Salant, Sheldon Switzer and Robert J. Reynolds, *Losses from Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium*, 98 The Quarterly Journal of Economics, 185-99 (1983).

[11]Raymond Deneckere and Carl Davidson, *Incentives to Form Coalitions with Bertrand Competition*, 16 RAND Journal of Economics 473-486 (1985).

[12]Martin K. Perry and Robert H. Porter, *Oligopoly and the Incentive for Horizontal Merger*, 75 American Economic Review 219-27 (1985).

[13]Joseph Farrell and Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis,* 80 American Economic Review 107-126 (1990).

[14]Lin Bian and Donald G. McFetridge, *The Efficiencies Defence in Merger Cases: Implications of Alternative Standards*, 33 Canadian Journal of Economics 297-318 (2000).

[15]Carl Davidson and Arijit Mukherjee, *Horizontal Mergers with Free Entry*, 25 International Journal of Industrial Organization 157-172 (2007).

[16]Edward L. Glaeser and Andrei Shleifer, *Not-For-Profit Entrepreneurs*, 81 Journal of Public Economics 99-115 (2001).

[17]Jennifer Kuan, *The Phantom Profits of the Opera: Nonprofit Ownership in the Arts as a Make-Buy Decision,* 17 Journal of Law, Economics, and Organization 507-520 (2001).

[18]Patrick Francois, *Not-For-Profit Provision of Public Services,* 113 The Economic Journal C53-C61 (2003).

[19]Patrick Herbst and Jens Prüfer, *Firms, Nonprofits, and Cooperatives: A Theory of Organizational Choice*, CentER Discussion Paper, No. 2007-07, Tilburg University (2007).

[20]Henry Hansmann, The Ownership of Enterprise, Belknap/Harvard University Press (1996).

[21]Paul Gertler and Jennifer Kuan, *Does It Matter Who Your Buyer Is? The Role of Nonprofit Mission in the Market for Corporate Control of Hospitals,* 52 Journal of Law and Economics 295-306 (2009).

[22]Daniel Deneffe and Robert T. Masson, *What Do Not-For-Profit Hospitals Maximize?,* 20 International Journal of Industrial Organization 461-492 (2002).

[23]Jill R. Horwitz, *Does Nonprofit Ownership Matter?*, 24 Yale Journal on Regulation 139-204 (2007).

[24]Jill R. Horwitz and Austin Nichols, *Hospital ownership and medical services: Market mix, spillover effects, and nonprofit objectives,* 28 Journal of Health Economics 924-937 (2009).

[25]*See* Prüfer, *supra* note 8.

[26]Edward L. Glaeser, *Introduction,* in: The Governance of Not-for-Profit Organizations, University of Chicago Press (2003).

of my paper, which shows that product market competition can substitute for the absence of binding intraorganizational constraints, that is good internal governance. Castaneda, Garen, and Thornton[27] study the effects of competition for donors on the behavior of nonprofits. They do neither examine competition on the product market nor mergers among nonprofits, though.

The paper most closely related to mine is Philipson and Posner, which builds on Lakdawalla and Philipson[28]. In those models, the owners of nonprofit organizations prefer increased output. The main result is that after a merger nonprofit organizations have the same incentives to reduce output and, hence, to decrease social welfare as for-profit firms. This result is based on the assumption that nonprofit owners can exchange profits into own consumption. Consequently, the owners appear as de facto profit maximizers. This assumption is inconsistent with the formal nondistribution constraint. I should note, however, that some other authors also allow nonprofits to distribute profits to their owners, be it directly (Chau and Huysentruyt[29]) or indirectly via price subsidies (Kuan) or via non-monetary perks an owner or manager of a nonprofit could extract (Glaeser and Shleifer). In turn, Bilodeau and Slivinsky[30] and Francois assume in their models that the nondistribution constraint cannot be relaxed. In the paper at hand, I use an intermediate approach: owners cannot extract profits but there is a manager who maximizes profits in order to enjoy non-monetary benefits.

III The Model

A Demand: heterogenous preferences for quality

There is a unit mass of consumers. Each consumer i demands one unit of a product and obtains utility from consumption $u^i(p, b, q, \theta^i)$, which is decreasing in the first argument and increasing in the others. p is the uniform price charged for a unit of the product or service. $b \geq 0$ is the exogenous basic utility that providers must produce in order to get a license to offer their services. This reflects inelastic unit demand for a service of basic quality and the existence of a regulator ensuring a minimum quality standard in the industry. θ^i, which is drawn from a uniform distribution over the interval $[0, 1]$, is the individual preference for additional quality, q. Henceforth, I will use the following quasi-linear specification of consumer i's utility function but drop the index i wherever possible:

$$u^i(p, b, q, \theta^i) = b + \theta^i q - p. \tag{1}$$

B Supply: a consumer-dominated nonprofit

There are two producers $j \in \{A, B\}$ competing for the consumers. Market entry costs of third parties are prohibitive.[31] Owners of the organizations, that is, its final decision makers, are risk-neutral and have zero reservation utility. They determine quality levels first; only then the managers determine prices (see below for more

[27] Marco A. Castaneda, John Garen and Jeremy Thornton, *Competition, Contractibility, and the Market for Donors to Nonprofits,* 24 Journal of Law, Economics, & Organization 215-246 (2007).

[28] Darius Lakdawalla and Tomas Philipson, *The Nonprofit Sector and Industry Performance,* 90 Journal of Public Economics 1681-1698 (2006).

[29] Nancy H. Chau and Marieke Huysentruyt, *Nonprofits and Public Good Provision: A Contest Based on Compromises,* 50 European Economic Review 1909–1935 (2006).

[30] Marc Bilodeau and Al Slivinski, *Rival Charities*, 66 Journal of Public Economics 449-467 (1997).

[31] Shaked and Sutton show that, in a market with quality differentiated goods and under standard assumptions, at most two goods can have a positive market share.

details on timing). Without loss of generality, I assume that producers have the common belief that $q_A \geq q_B$. Monetary profits are defined in the usual way:

$$\pi_j = p_j s_j - C(q_j),$$

where s_j denotes producer j's output, which equals its market share if the market is covered. $C(q_j) = s_j q_j^2$ are total costs. I normalize all other costs to zero. This specification captures that production of higher quality gets more and more expensive and that higher quality also increases marginal costs of output. It rules out economies or diseconomies of scale, which are discussed in some empirical papers on health care markets without finding clear-cut results; see Gertler and Waldman[32], O'Neill and Largey[33], or Bilodeaux, Cremieux and Oulette[34]. Moreover, it is obvious that the introduction of economies (diseconomies) of scale would benefit (penalize) a single entity over two competitors. Therefore, assuming economies (diseconomies) of scale would make the case for (against) mergers independent of the type of merger even stronger. Because this paper focuses on the *relative* welfare effects of mergers among nonprofits compared to mergers among for-profit firms, I assume the most simple case of constant returns to scale, where marginal and average costs of production are constant in output.

Nonprofits are required to meet a *non-distribution constraint*: if profits are positive, they can either be retained or be donated to a charity not modeled as a strategic player, which is a common legal rule internationally. The charity is part of the economy, hence donations are not lost when calculating total welfare. This rules out profit maximization as the objective function of rational owners. However, it is not clear in general which objective function owners of nonprofits do maximize (see the discussion in Section II).

I model competition between so-called consumer-dominated nonprofits. In such an organization, by assumption, the pivotal owner of organization j maximizes his individual net consumption utility. In practice, this could refer to a hospital where the pivotal owner lives close-by and expects that he will be treated in the hospital himself. For instance, if the votes of each nonprofit board member had equal weight, the member with median preferences for quality would be the pivotal owner. Formally, the consumer-owner solves:

$$max_{q_j} u = b + \theta q_j - p_j, \tag{2}$$

where θ is his individual preference for quality.

To reproduce the stylized fact that in many nonprofits ownership and control are separated and that the interest of the persons with day-to-day control are not necessarily aligned with the persons holding residual control, I model a *manager* in each organization; see section V for a discussion of this assumption. While the owners can determine the long-term variable, quality, and set up the manager's employment contract, the manager is in charge of the short-term variable, price.[35]

As the focus of this paper is not on contractual design, I assume that quality is contractible. This assumption is a reduced form of the following set of assumptions: Assume that quality is noncontractible but observable for buyers after consumption. Thus, if the pivotal owner is a buyer himself, he will learn the quality produced by the manager. If he is not satisfied, he can refuse to prolong the manager's contract.

[32]Paul Gertler and Donald M. Waldman, *Quality Adjusted Cost Functions and Policy Evaluation in the Nursing Home Industry,* 100 Journal of Political Economy 1232-1256 (1992).

[33]Ciaran O'Neill and Ann Largey, *Issues in Cost Function Specification for Neonatal Care: the Fordham Case,* 19 Journal of Public Health Medicine 50-54 (1997).

[34]Daniel Bilodeau, Pierre-Yves Crémieux and Pierre Ouellette, *Hospital Cost Function In A Non-Market Health Care System*, 82 The Review of Economics and Statistics 489-498 (2000).

[35]Since I only use a one-shot game, 'long-term´ and 'short-term´ are translated into the model by letting owners choose quality before the manager determines price.

Hence, the manager has an incentive to produce the quality preferred by the pivotal owner. Assuming that quality is contractible has the same effect. Alternatively, there could exist a monitoring technology by which the owners can learn the quality produced.

The manager will only be paid a wage if he produces the quality specified by the owners. Because of his specialized knowledge on running the organization, however, the manager has private knowledge on the cost function under which it operates. Consequently, he has discretion when setting the price.

Notwithstanding the owners' goals, the manager maximizes economic profits. This is a shortcut to assuming that he maximizes his own nonmonetary utility. To achieve this goal, he needs positive economic profits to spend on the nonmonetary benefits such that the final accounting profit is zero. These benefits could come in the form of perks or as 'enjoying a quiet life´, as in Bertrand and Mullainathan[36].

C Timing

To produce benchmark results, I assume that the competing producers are *symmetric*. This means that the pivotal owners have similar preferences for quality: $\theta_A = \theta_B$. I assume complete information with respect to quality and price levels and solve the game for subgame-perfect equilibria in pure strategies in the Appendix. The timing is related to Shaked and Sutton:

- t=1: *Quality:* The pivotal owner of each organization j chooses a level of quality $q_j \geq 0$.
- t=2: *Price:* In each organization the manager picks a price p_j for the product, thereby incurring costs $C(q_j)$.
- t=3: *Buying:* Each consumer learns the quality and price levels of the nonprofits and his own θ and may buy one product.

IV Analysis

Before analyzing mergers among nonprofits, I characterize the social planner's preferred solution given he only determines one quality level. In the unconstrained first-best case, the social planner would choose two distinct qualities. A low quality product would be sold for a low price, thereby making sure all consumers can afford consumption, and a high quality product would be sold for a higher price, thereby satisfying consumers with a high preference for quality.

As will be clear below, however, under duopoly the owners of nonprofits A and B voluntarily set the same quality level. Then, to show the main result of this paper it is sufficient to analyze the one-product case under monopoly (if the monopolist sets two quality levels, the main result becomes even stronger). To compare results, it is sufficient to study the quality and price decisions of a social planner in the one-product case.

A Social planner's choice in the one-product case

A social planner maximizing welfare—the sum of consumer surplus and producer surplus—solves:

$$\max_{q,p} W = \int_{\underline{\theta}}^{1} (b + \frac{1+\underline{\theta}}{2} q) d\theta - (1-\underline{\theta}) q^2. \tag{3}$$

[36] Marianne Bertrand and Sendhil Mullainathan, *Enjoying the Quiet Life? Corporate Governance and Managerial Preferences,* 111 Journal of Political Economy, 1043-1075 (2003).

where $\underline{\theta} = \frac{p-b}{q}$ defines the marginal consumer for $q > 0$ who is indifferent between buying the product and not buying.[37]

The social planner sets the price equal to marginal costs of production: $p = q^2$. Hence, output is $s = (1 - \underline{\theta}) = 1 + \frac{b}{q} - q$, which means that demand is quality sensitive as long as $b < q^2$. Substituting this into (3) reduces the social planner's maximization problem to:

$$\max_q W = \begin{cases} \frac{(b+q-q^2)^2}{2q} & \text{if} \quad b < q^2, \\ b + \frac{q}{2} - q^2 & \text{if} \quad b \geq q^2. \end{cases} \tag{4}$$

This expression illustrates the trade-off of the social planner: only a high quality level lets quality loving consumers (high θ-types) enjoy high utility. On the other hand, producing a low quality level allows for selling the good for a low price and therefore increases demand, which is especially good for welfare if the basic utility b is large. However, if $b \geq q^2$, there is no trade-off anymore because further quality reduction (and subsequent price reduction) does not increase demand further on.

In Appendix A, I calculate the social planner's preferred quality and price levels and corresponding total welfare. The main intuition of these results is that the level of the basic utility b equally enjoyed by all consumers when they get hold of the product matters a lot. If b is sufficiently high, the social planner will set a price that makes sure all consumers can afford the product and thereby enjoy the high basic utility. This avoids inefficient exclusion at the lower end of the preference-for-quality spectrum. Then all revenues are used to produce additional quality, thereby paying some tribute to quality loving consumers. In contrast, if b is low, it does not pay for the social planner to sell to all consumers. Consequently, the lower the basic utility is, the higher the social planner pushes additional quality (and price), which drives out more and more consumers.

B Duopoly competition

In $t = 3$, consumers choose which producer to buy from. A consumer prefers to buy from organization A if he cannot increase his net consumption utility by buying from B, that is, if $b + \theta q_A - p_A \geq b + \theta q_B - p_B$. Solving this expression for the indifferent consumer located at $\hat{\theta}$ gives:

$$\hat{\theta} = \frac{p_A - p_B}{q_A - q_B}. \tag{5}$$

To sell a positive quantity, producer B has to make sure that the participation constraint of consumers holds, that is that $b + \theta q_B - p_B \geq 0$. Solving this expression for the consumer who is indifferent between buying and not buying gives:

$$\underline{\theta} = \frac{p_B - b}{q_B}. \tag{6}$$

It follows from (6) that all consumers buy some product ($\underline{\theta} = 0$) if $p_B \leq b$. In this case $s_B = 1 - s_A$. Similarly, it follows from (6) that no consumer will buy any product if $\underline{\theta} = 1$, which holds for $p_B \geq b + q_B$.

Due to assumed beliefs, that $q_A \geq q_B$, the consumers with highest preferences for quality, located between $\hat{\theta}$ and 1, will buy from A. Consumers with medium preferences, located between $\underline{\theta}$ and $\hat{\theta}$, will buy from B. Consumers with low quality

[37] This formulation of welfare uses the fact that the average θ of buying consumers is $\frac{1+\underline{\theta}}{2}$.

preferences, located below $\underline{\theta}$, will not buy at all. Summarizing:

$$s_A = 1 - \frac{p_A - p_B}{q_A - q_B}; s_B = \frac{p_A - p_B}{q_A - q_B} \quad \text{if} \quad p_B \leq b \tag{7}$$

$$s_A = 1 - \frac{p_A - p_B}{q_A - q_B}; s_B = \frac{p_A - p_B}{q_A - q_B} - \frac{p_B - b}{q_B} \quad \text{if} \quad b < p_B < b + q_B \tag{8}$$

$$s_A = s_B = 0 \quad \text{if} \quad p_B \geq b + q_B. \tag{9}$$

Henceforth, I will refer to (7) as the case where the *market is covered*, to (8) as the case where *demand is elastic*, and to (9) as the case where the *market breaks down*.

In $t = 2$, managers determine the prices p_A and p_B. The manager of organization j, who maximizes profits, chooses p_j to solve:

$$\max_{p_j} p_j s_j(p_j) - s_j(p_j) q_j^2. \tag{10}$$

In Appendix B, I solve the model for a subgame-perfect equilibrium in which both nonprofits have positive market shares. In order to do this, I first establish that in duopoly competition between symmetric nonprofits there exists no subgame-perfect equilibrium in pure strategies in which $q_A \neq q_B$. Instead, in such an equilibrium $q_A = q_B$.

The idea behind this result is the following. Consumer-owners prefer that nonprofits price according to marginal cost and do not charge a markup on top of marginal cost. This holds because a positive markup increases the price they have to pay as consumers in $t = 3$ but the sellers' profits associated with such a markup do not give the owners additional utility, due to the nondistribution constraint. Next, I show that the only way for nonprofit owners to contain their managers from setting a price above marginal cost is to choose a similar level of quality in both nonprofits in $t = 1$ and, thereby, to let the managers face Bertrand competition with homogeneous products in $t = 2$. This result complements Shaked and Sutton[38], who show that in equilibrium duopolistic profit-maximizing firms *never* produce the same level of quality—for the very reason to avoid Bertrand price competition.

This result is also interesting from another perspective. By assumption, the managers in my model have some discretion over pricing, which they are eager to use because their objective function is different from the one of owners. However, despite the lack of intraorganizational constraints on managerial behavior, I find that nonprofit owners can strategically use product market competition in order to discipline their managers. This discipline forces managers to price according to marginal cost and, hence, takes away their market power. It gives the owners the maximum amount of resources, which they can spend according to their objective function, (2). As a consequence, subgame-perfect equilibrium prices in duopoly competition are $p_A^* = p_B^* = q_A^2 = q_B^2$ and both producers share the market equally.

As the next step in Appendix B, I calculate equilibrium qualities, prices, and market shares for the cases where the market is covered and where demand is elastic. Which of the two cases occurs depends on the owners' preference for quality, θ, and the basic utility from consumption, b. I show that owners increase quality in line with their own preferences for quality. Due to the positive basic quality b, this has the effect that, for low θ, all consumers buy the product, even if they do not value additional quality, $q > 0$, at all. If θ exceeds a certain threshold, the consumers with the lowest preference for additional quality drop out of the market. Due to the individual utility maximization of the consumer-owners, however, the market never breaks down, even if θ reaches its maximum, one.

[38] *See* Shaked and Sutton, *supra* note 9, 7.

To conclude the analysis of the duopoly competition case, I state the corresponding welfare result in Appendix B, that is, the precise levels of consumer surplus, producer surplus, and the sum of both, total welfare. This result will be interpreted below, where I compare it to welfare in the monopoly case, which is the topic of the following Section.

C Merger to monopoly

Now let the two nonprofits merge and form a monopoly in the market. I do not assume a special reason for the merger because the focus of this paper is on the impact of the nonprofit organizational form on the welfare effects of the merger. Therefore, the subsequent analysis could come on top of a traditional merger analysis that focuses on other aspects than organizational form.[39] In particular, I rule out efficiency gains of mergers because of economies of scale.

After a merger there is only one pivotal owner, by definition. However, there could still be two products, A and B, such that the owner could determine two quality levels, q_A and q_B. Nevertheless, because of the fact that there is only one pivotal consumer-owner and that this owner only has an individual demand of one unit, it is sufficient for him to tailor one product (quality) to his needs. He is indifferent with respect to the second quality level. Therefore, I assume that the single owner determines a single quality level, which is produced by a single manager. Note that introducing a second product that serves consumers who cannot afford the pivotal owner's preferred quality would *increase* the welfare of the merger scenario as compared to welfare of the single product market modeled here. This would make the main result of this paper, comparing welfare under duopoly and under monopoly, even stronger (see below).

It is also practically impossible for the owner to hire two managers and let each one run one production facility, thereby facing competition from the other manager. This would not work because those two managers would have to be monitored by a specialist, a job that the owner cannot perform himself. The specialist, however, would act as a monopolistic manager with discretion over pricing. If instead the owner had the expertise to monitor managers, he could run one nonprofit—the one that produces the good he wishes to consume—himself. Along the same lines, the assumption that quality is contractible depends on the fact that the owner actually consumes the product himself; see Section B. As he only demands one unit, it is de facto impossible to contract on two quality levels.

Note that the fact that it is sufficient to study the one-product monopoly case also explains why the social planner's preferred choice of quality and price was characterized for the one-product case in Section A.

In Appendix C, I calculate the subgame-perfect equilibrium consisting of the quality and price choices of the monopolistic nonprofit owner and resulting demand for the single product offered in the market. I show that demand is elastic if the preference for quality of the owner, θ, is sufficiently high. If it is low, the owner prefers to set quality to such a low level—and the manager accordingly decreases the profit-maximizing price—that all consumers buy the product. For $\theta < \frac{1}{2}$, this even means that additional quality $q = 0$, unlike the duopoly case where $q > 0$ for all $\theta > 0$. To make the monopoly result comparable to the duopoly case, I also calculate the corresponding welfare result in the Appendix.

By comparing welfare levels, I find the following key result of this paper. A monopolistic consumer-dominated nonprofit *can* create higher total welfare than competing consumer-dominated nonprofits.

This result shows that mergers between consumer-dominated nonprofits need

[39] See Section II for some references on mergers among profit-maximizing firms.

not be a bad thing as they can increase welfare and do not unambiguously decrease it. Note that the case where such a merger decreases welfare also exists, related to the result of Philipson and Posner. The latter mechanism is not the focus of this paper, though.

What is the intuition of this key result? To better understand it I plotted equilibrium quality and price levels for a numerical example in Figure 1. The left panel illustrates for this case that competing consumer-dominated nonprofits produce higher quality than a monopolist: $q_{NN} > q_N$ (for the corner solution $\theta = 1$, $q_{NN} = q_N$). This is intuitive because the monopolistic manager maximizes profits, which implies that he produces less quality for a given market price. Competitive nonprofits, in contrast, face Bertrand price competition and sell for marginal cost. Therefore, they can afford to produce higher quality for a given price.

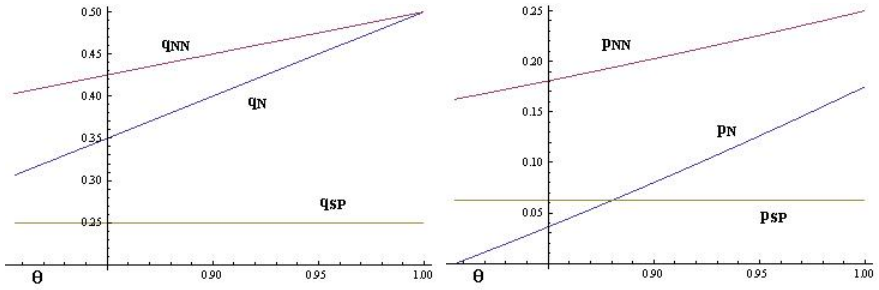

Figure 1: Numerical example for $b = 0.4$. Horizontal axis: $\theta \in [0.806, 1]$. The three curves in the left [right] panel plot equilibrium quality [price] levels under duopoly $(q_{NN})[p_{NN}]$, monopoly $(q_N)[p_N]$, and social planner's choice $(q_{SP})[p_{SP}]$.

Now it is enlightening to compare quality levels produced in the market with the quality preferred by the social planner, which is also displayed in the left panel of Figure 1. In the example, q_{SP} is strictly lower than both q_{NN} and q_N. Due to the fact that $q_{NN} > q_N$, however, the social planner's quality is closer to the monopolistic quality than to the duopoly quality for all $\theta \in [0.806, 1)$. Rephrased, the quality levels chosen in duopoly and monopoly are both inefficiently high in the figure but under monopoly the overproduction of quality is less intense.

These quality ratios translate into equilibrium prices. The right panel of Figure 1 illustrates, for the same numerical example, that the price level under duopoly is strictly higher than the price level under monopoly: $p_{NN} > p_N$. For the entire support of $\theta \in [0.806, 1]$, the difference between the duopoly price and the social planner's price, $|p_{NN} - p_{SP}|$, is larger than the difference between the monopoly price and the social planner's price, $|p_N - p_{SP}|$.

In a nutshell, if two consumer-dominated nonprofits merge to monopoly, quality decreases and the price-to-quality ratio increases. However, there are cases where both the quality level and the price level under competition are excessive as compared to the social planner's preferred levels. A merger reduces the absolute quality and price levels and brings them more in line with the levels preferred by the social planner. In net welfare terms, this reduction of excessive quality can outweigh the loss created by monopoly pricing of the manager.

In the numerical example illustrated in Figure 1, the positive effect of a merger on welfare occurs because the basic utility from consumption is high, $b \geq \frac{1}{12}$, such that all consumers buy the product in the duopoly case. High levels of regulated basic utility (or minimum quality) can be found in the hospital sector, for instance. If the pivotal owners' preference for quality, θ, is also high, this drives up quality and price such that, in the monopoly case, demand becomes elastic. If within this

range ($\theta \geq 0.806$, in the example), θ is reduced, the parallel reduction of quality and price allows more consumers to buy the good, which increases welfare. The same reduction of θ in the duopoly case does not have such a positive effect on demand, though, because the market is already covered. This prevents welfare in the duopoly case to increase as much as in the monopoly case.

V Discussion

Separation of ownership and control: Why introduce a manager to carry out day-to-day business and to decide p? Why do the owners not determine both q and p themselves? Let us assume, in contrast to the above model, that the pivotal consumer-owner of a nonprofit can decide q and p together! He maximizes $u(p, b, q, \theta)$ over q, p, s.t. $\pi \geq 0$. As he does not benefit from positive profits, $\pi = 0$, which implies choosing $p = q^2$. The remaining reduced maximization problem is similar to the one analyzed above in the duopoly competition case. Hence, the consumer-owner chooses the same quality and price levels as found there. These choices are independent of the degree of competition, though. In other words, such a mighty pivotal owner acts in the same way not regarding the competitive environment he operates in. Mergers have no effect on his behavior.

In contrast, empirical studies show that the degree of competition indeed influences behavior in nonprofits; see Malani, Philipson and David. Separation of ownership and control is a ubiquitous fact in all types of organizations in practice. This is true, in particular, in industries where very specialized knowledge of the production technology (reflecting owners' decisions on q) is needed in line with specialized business knowledge (reflecting the manager's decision on p in my model), for instance in health care, where experts in both disciplines, management and medical science, are rare.

Despite the business ignorance of owners, they set q in my model and know the reaction function of the manager and, hence, indirectly also determine $p(q)$. More realistically, this could be interpreted in a way such that owners cannot foresee $p(q)$ exactly but believe in some distribution function of possible reaction functions of the manager. $p(q)$ would then be the expectation of that distribution function.

More than two suppliers: The main goal of my model is to show that the objectives of nonprofit owners can actually affect the welfare result of a merger. For this end, modeling a merger from duopoly to monopoly is sufficient as it shows the main mechanism in a simple way. To characterize conditions that better predict which real mergers may be welfare improving, a richer model is required. This is a fruitful area of future research. The intuition of this paper's main result, however, can be generalized to the extent that the market power of the manager increases in the course of a merger. Then the manager can increase the price, which leads to a decrease of equilibrium quality. Overproduction of quality is diminished, which can lead to a welfare gain along the lines identified above.

VI Conclusion

This paper has analyzed the welfare effects of mergers among so-called consumer-dominated nonprofits. Its main question, whether mergers among nonprofits should be treated differently by antitrust law than mergers among for-profit firms, has been studied by constructing a model of duopoly competition related to Shaked and Sutton. After imposing a merger to monopoly between two nonprofits, I have shown that, holding all else equal, welfare can either decrease or increase after a merger. Consequently, the organizational form of the merging parties and the

objectives of their pivotal owners can have a critical effect on welfare. This finding is relevant for antitrust law.

This result complements Philipson and Posner. The differences are due to several assumptions in my paper, the inclusion of which Philipson and Posner[40] call for: (i) They agree that firm governance should be addressed and point to the fact that decision makers in nonprofits 'may have [more] trouble agreeing on the right course of action for the nonprofit´ as for-profit firms. (ii) They speculate, based on the insight that nonprofit governance is important, that nonprofits 'are more likely to be disciplined by output markets rather than by input markets or corporate control´. (iii) 'Other utility functions should be considered in future work.´

This paper addresses all three points: (i) It builds on a governance-based model of nonprofits[41] that emphasizes the role of owners' objectives for their behavior on output markets. The assumption of heterogenous owner preferences and the concept of the pivotal owner relate to the lack of goal alignment in many nonprofits. (ii) This paper shows that nonprofits can indeed be disciplined by competition on output markets—it just disagrees that this ability is welfare increasing in general. (iii) This paper analyzes the effects of a nonprofit objective function that differs from Philipson and Posner's, namely to maximize the pivotal owner's own consumption utility from vertically differentiated goods.

The next steps in improving our understanding of mergers among nonprofits and nonprofit behavior in general are twofold. First, to better characterize the conditions that predict which mergers may be welfare improving a richer model that incorporates variables that are easy to observe empirically is required. In particular, is it possible to map a certain type of nonprofit, for example a consumer-dominated nonprofit, to an existing legal form of organization? Second, the model, in particular the idea of the existence of different types of nonprofits, awaits empirical testing. Can the current empirical controversy about the effects of nonprofits on price, output, quality, and other variables of interest be explained if data sets are split according to the type of nonprofit?

A Appendix

A The social planner's decisions

Solving the social planner's maximization problem (4) leads to the following result.

Result A.1 (Social planner's preferred quality and price) *(i): Consider* $b \geq \frac{1}{16}$*: the social planner chooses a quality level of* $q_{SP} = \frac{1}{4}$ *and sells for* $p_{SP} = \frac{1}{16}$ *to* $s = 1$ *consumers. This generates total welfare of* $W_{SP} = b + \frac{1}{16}$.
(ii): Consider $b < \frac{1}{16}$*: the social planner produces a quality level of* $q_{SP} = \frac{1+\sqrt{1-12b}}{6}$ *and sets a price of* $p_{SP} = \frac{(1+\sqrt{1-12b})^2}{36}$. *A share* $s = \frac{2}{3}(2 - \sqrt{1-12b})$ *of consumers buys the product, that is,* $s \in [\frac{2}{3}, 1]$ *for* $b \in [0, \frac{1}{16}]$. *Welfare is* $W_{FB} = \frac{(1+12b+\sqrt{1-12b})^2}{27(1+\sqrt{1-12b})}$.

Proof: *(i):* The second line of (4) has a straightforward solution, $q_{SP} = \frac{1}{4}$, which is valid if $b \geq q^2 = \frac{1}{16}$ and leads to $p_{SP} = \frac{1}{16}$, $s = 1$ and a welfare of $W = b + \frac{1}{16}$.
(ii): The only quality level that is nonnegative, generates positive demand, and is a maximum, is $q = \frac{1+\sqrt{1-12b}}{6}$. Hence, there is a welfare maximum, which exists $\forall$ $b \leq \frac{1}{12}$. As the case in (4) requires a stronger condition, $b < \frac{1}{16}$ (see above), the

[40] *See* Philipson and Posner, *supra* note 6, 16/17.
[41] *See* Prüfer, *supra* note 8.

latter is always fulfilled. Hence, $q_{SP} = \frac{1+\sqrt{1-12b}}{6}$ generates $p_{SP} = q^2 = \frac{(1+\sqrt{1-12b})^2}{36}$ and output of $s = \frac{2}{3}(2 - \sqrt{1-12b})$. Welfare is $W_{SP} = \frac{(1+12b+\sqrt{1-12b})^2}{27(1+\sqrt{1-12b})}$. *Q.E.D.*

Note that both cases *(i)* and *(ii)* converge at $b = \frac{1}{16}$, where $q_{SP} = \frac{1}{4}$, $p_{SP} = \frac{1}{16}$, $s = 1$, and $W_{SP} = \frac{1}{8}$.

B Duopoly competition

The central goal of this section is to characterize the subgame-perfect equilibrium in duopoly competition, which is stated in Result A.4. This main positive result is complemented by the normative result on welfare, Result A.5. It is preceded by an analysis of managerial pricing behavior, given quality levels are fixed (Result A.2), and an analysis of owners' quality choices, knowing how managers will react to these choices (Result A.3).

Solving the maximization problem of organization j's manager (10) shows:

Result A.2 (Price Nash equilibria) *(i): In $t = 2$, all Nash equilibria in pure strategies that lead to positive market shares for both producers ($s_A, s_B > 0$) and where $q_A \neq q_B$ lead to positive price markups ($M_A, M_B > 0$). (ii): The only pure strategy Nash equilibrium with a (q_A, q_B)-combination that leads to positive market shares and to zero markups is characterized by $q_A = q_B$.*

Proof: Define:

$$M_A^{elastic} \equiv \frac{(q_A - q_B)(b + 2q_A(1 - q_A) - q_A q_B)}{4q_A - q_B}, \tag{A.1}$$

$$M_B^{elastic} \equiv \frac{(q_A - q_B)(2b + q_B(1 - q_B) + q_A q_B)}{4q_A - q_B}, \tag{A.2}$$

$$M_A^{covered} \equiv \frac{1}{3}(q_A - q_B)(2 - q_A - q_B), \tag{A.3}$$

$$M_B^{covered} \equiv \frac{1}{3}(q_A + q_A^2 - q_B - q_B^2), \tag{A.4}$$

After maximizing (10), these definitions allow to express Nash equilibrium prices in $t = 2$ as:

$$p_A^{elastic} = q_A^2 + M_A^{elastic}; \quad p_B^{elastic} = q_B^2 + M_B^{elastic} \quad \text{if } b < p_B < b + q_B, \tag{A.5}$$

$$p_A^{covered} = q_A^2 + M_A^{covered}; \quad p_B^{covered} = q_B^2 + M_B^{covered} \quad \text{if } p_B \leq b, \tag{A.6}$$

where M_j is the price markup on the marginal cost of organization j in equilibrium. Substituting these prices into equations (7) and (8) yields equilibrium output:

$$s_A^{covered} = \frac{1}{3}(2 - q_A - q_B); s_B^{covered} = \frac{1}{3}(1 + q_A + q_B) \tag{A.7}$$

in the covered market case. In the elastic case, the producers sell:

$$s_A^{elastic} = \frac{b + q_A(2(1 - q_A) - q_B)}{4q_A - q_B}; s_B^{elastic} = \frac{q_A(2b + q_B(1 - q_B)) + q_A q_B)}{q_B(4q_A - q_B)}. \tag{A.8}$$

In order to prepare subsequent results, I have to check when the price markups are equal to zero. First, I define:

$$q_A^- \equiv \frac{1}{4}(2 - \sqrt{8b + (q_B - 2)^2} - q_B) \quad ; \quad q_A^+ \equiv \frac{1}{4}(2 + \sqrt{8b + (q_B - 2)^2} - q_B);$$

$$q_B^- \equiv \frac{1}{2}(1 + q_A - \sqrt{8b + (1 + q_A)^2}) \quad ; \quad q_B^+ \equiv \frac{1}{2}(1 + q_A + \sqrt{8b + (1 + q_A)^2});$$

$$q_A^{+,covered} \equiv 2 - q_B \quad ; \quad q_B^{+,covered} \equiv -(1 + q_A).$$

Solving (A.1) and (A.2) for zero yields that $M_A^{elastic} = 0$, for $q_A = \{q_B, q_A^-, q_A^+\}$. $M_B^{elastic} = 0$, for $q_B = \{q_A, q_B^-, q_B^+\}$. $M_A^{covered} = 0$, for $q_A = \{q_B, q_A^{+,covered}\}$. $M_B^{covered} = 0$, for $q_B = \{q_A, q_B^{+,covered}\}$. Substituting these values into the individual demand functions in (A.7) or (A.8), respectively, and assuming $q_A, q_B > 0$ yields:

$$s_A^{elastic}(q_A = q_B) = \frac{2}{3} + \frac{b}{3q_B} - q_B; s_B^{elastic}(q_A = q_B) = \frac{1}{3} + \frac{2b}{3q_A}; \tag{A.9}$$

$$s_A^{covered}(q_A = q_B) = \frac{2}{3}(1 - q_B); s_B^{covered}(q_A = q_B) = \frac{1}{3}(1 + 2q_A). \tag{A.10}$$

Furthermore, we obtain:

$$\begin{aligned} s_A^{elastic}(q_A = q_A^-) = s_A^{elastic}(q_A = q_A^+) = s_A^{covered}(q_A = q_A^{+,covered}) &= 0; \\ s_A^{elastic}(q_A^- < q_A < q_A^+) &> 0; \\ s_A^{covered}(q_A < q_A^{+,covered}) &> 0; \\ s_B^{elastic}(q_B = q_B^-) = s_B^{elastic}(q_B = q_B^+) = s_B^{covered}(q_B = q_B^{+,covered}) &= 0; \\ s_B^{elastic}(q_B^- < q_B < q_B^+) &> 0; \\ s_B^{covered}(q_B < q_B^{+,covered}) &> 0. \quad Q.E.D. \end{aligned}$$

Considering only cases where the producers sell positive quantities on the market, this result implies that the price equals marginal cost if and only if $q_A = q_B$. This is intuitive because only then the two products are not differentiated and price competition in $t = 2$ resembles the classical Bertrand game with homogeneous goods.

In $t = 1$, what is the standpoint of owners on a price equal to marginal cost, q_j^2, as compared to positive price markups? All else equal, consumer-owners prefer a markup of zero because a positive markup increases the price they have to pay as consumers in $t = 3$ but does not give them additional utility from increased quality. Due to the nondistribution constraint, they would also not benefit from the producer surplus that would be generated through positive markups. Given the pivotal owners of A and B could coordinate, they would first agree to set the same level of quality, $q_A = q_B$, thereby making sure the markup is zero. Then they would jointly choose the quality level that maximizes their consumption utility assuming the price markup is zero. They can fix the same quality level without explicit coordination. Expecting that the other pivotal owner sets this jointly optimal quality, each owner cannot do better if he chooses a different quality because it would lead to positive markups. This insight is summarized in the following result.

Result A.3 (Quality Nash equilibrium) *In $t = 1$, in duopoly competition between symmetric nonprofits there exists no subgame-perfect equilibrium in pure strategies in which $q_A \neq q_B$. In equilibrium $q_A = q_B$.*

Proof: Substituting $p_j = q_j^2 + M_j(q_j, q_{k\neq j})$ for the price variable in the objective function of owners yields that the pivotal consumer-owner of nonprofit j maximizes $u_j = b + \theta q_j - (q_j^2 + M_j(q_j, q_{k\neq j}))$ with respect to q_j. Obviously, the partial derivative:

$$\frac{\partial u_j}{\partial M_j(q_j, q_{k\neq j})} < 0. \tag{A.11}$$

Hence, c.p. any $M_j(q_j, q_{k\neq j}) > 0$ decreases the pivotal owner's utility. Now define $q_{k\neq j}^*$ as the $q_{k\neq j}$ that solves, $argmax\{b + \theta q_{k\neq j} - (q_{k\neq j}^2 + 0)\}$, and note that $q_{k\neq j}^*$ depends on a markup of $M_k = 0$. Then, by the definition of $q_{k\neq j}^*$, (A.11), and Result A.2, the unique q_j that solves, $argmax\{b + \theta q_j - (q_j^2 + M_j(q_j, q_{k\neq j}^*)\}$, is $q_j = q_{k\neq j}^* \equiv q_j^*$. $Q.E.D.$

Result A.3 states that the only way for nonprofit owners to contain their managers from setting a price above marginal cost is to determine the same level of quality in $t = 1$ and, thereby, to let the managers face Bertrand competition with homogeneous products in $t = 2$. It follows from Results A.2 and A.3 that subgame-perfect equilibrium prices in duopoly competition are:

$$p_A^* = p_B^* = q_A^2 = q_B^2 \tag{A.12}$$

and that both producers share the market equally:

$$s_A^* = s_B^* = \frac{1}{2} \quad \text{if } q_B^2 \leq b \tag{A.13}$$

$$s_A^* = s_B^* = \frac{1-\theta}{2} = \frac{q_B - q_B^2 + b}{2q_B} \quad \text{if } b < q_B^2 < b + q_B \tag{A.14}$$

$$s_A^* = s_B^* = 0 \quad \text{if } b + q_B \leq q_B^2. \tag{A.15}$$

These preliminaries allow me to characterize the unique subgame-perfect equilibrium in the following result.

Result A.4 (Subgame-perfect equilibrium when nonprofits compete) *Depending on the preferences of the pivotal owners, θ, consumer-dominated nonprofits produce $q_A^* = q_B^* = \frac{\theta}{2} \equiv q_{NN}$. The managers set $p_A^* = p_B^* = \frac{\theta^2}{4} \equiv p_{NN}$. If $\theta \leq 2\sqrt{b}$, the market is covered: $s_A^* = s_B^* = \frac{1}{2}$. If $\theta > 2\sqrt{b}$, demand is elastic: $s_A^* = s_B^* = \frac{1}{2} + \frac{b}{\theta} - \frac{\theta}{4}$.*

Proof: Substituting (A.12) in (1) and maximizing with respect to q_j yields $q_A = q_B = \frac{\theta}{2} \equiv q_{NN}$. Substituting q_{NN} in (A.12) gives $p_A = p_B = \frac{\theta^2}{4} \equiv p_{NN}$. Substituting q_{NN} in (A.13), (A.14), and (A.15) shows that the market is covered for $\theta \leq 2\sqrt{b}$, that it breaks down for $\theta \geq 1 + \sqrt{1+4b}$, and that in the elastic demand case the marginal buyer is located at $\frac{\theta}{2} - \frac{2b}{\theta}$, which implies an output per producer of $s_A = s_B = \frac{1}{2} + \frac{b}{\theta} - \frac{\theta}{4}$. Due to the fact that the upper bound on θ is 1, by assumption, which is strictly smaller than $1 + \sqrt{1+4b}$, the market breakdown case is never reached in this scenario. *Q.E.D.*

The welfare result corresponding to Result A.4 is:

Result A.5 (Welfare under duopoly) *Producer surplus is zero. Consumer surplus and welfare are:*

$$CS = W = b + \frac{\theta - \theta^2}{4} \quad \textit{if} \quad \theta \leq 2\sqrt{b}, \tag{A.16}$$

$$CS = W = \frac{(-4b + (\theta-2)\theta)^2}{16\theta} \quad \textit{if} \quad \theta > 2\sqrt{b}. \tag{A.17}$$

Proof: This proof follows from Result A.4. Because of marginal cost pricing, producer surplus is 0. Thus, consumer surplus equals total welfare, which is $b + \frac{1}{2}q_{NN} - q_{NN}^2 = b + \frac{\theta - \theta^2}{4}$ in the covered market case. If demand is elastic, welfare is $\int_{\frac{\theta}{2}-\frac{2b}{\theta}}^{1} (b + \frac{1+\frac{\theta}{2}-\frac{2b}{\theta}}{2} q_{NN} - q_{NN}^2) d\theta = \frac{(-4b+(\theta-2)\theta)^2}{16\theta}$. *Q.E.D.*

C Monopolistic nonprofit

Consumer behavior in $t = 3$ is independent of the market structure. Hence, equations (7) to (9) imply the demand for the single product, s, where $s = s_A + s_B$. If demand is elastic, $s = \frac{b+q-p}{q}$. If the market is covered, $s = 1$. If the market breaks down, $s = 0$.

In $t = 2$, the manager maximizes profits as in (10). Due to the absence of competition, he will set a price depending on quality, the analog of (A.12), as:

$$p^* = \frac{b + q + q^2}{2}, \tag{A.18}$$

which leads to demand of:

$$s = 1 \qquad \text{if} \quad q \leq \frac{\sqrt{1+4b}-1}{2}, \tag{A.19}$$

$$s = \frac{b+q-q^2}{2q} \qquad \text{if} \quad \frac{\sqrt{1+4b}-1}{2} < q < \frac{\sqrt{1+4b}+1}{2}, \tag{A.20}$$

$$s = 0 \qquad \text{if} \quad q \geq \frac{\sqrt{1+4b}+1}{2}. \tag{A.21}$$

The subgame-perfect equilibrium is characterized in the following result.

Result A.6 (Subgame-perfect equilibrium in monopoly) *A monopolistic consumer-dominated nonprofit sets quality and price such that in equilibrium:*

$$q_N = 0, p_N = b, s = 1 \quad \textit{for} \quad \theta \leq \frac{1}{2}, \tag{A.22}$$

$$q_N = \theta - \frac{1}{2}, p_N = b, s = 1 \quad \textit{for} \quad \frac{1}{2} < \theta \leq \frac{\sqrt{1+4b}}{2} \tag{A.23}$$

$$q_N = \theta - \frac{1}{2}, p_N = \frac{4\theta^2+4b-1}{8}, s = \frac{3-2\theta}{4} + \frac{b}{2\theta-1} \quad \textit{for} \quad \theta > \frac{\sqrt{1+4b}}{2}. \tag{A.24}$$

Proof: Substituting (A.18) in (1) gives $q = \theta - \frac{1}{2}$. As q cannot be negative, this holds only for $\theta > \frac{1}{2}$. For $\theta \leq \frac{1}{2}$, $q = 0$, which leads to profit-maximizing pricing of $p = b$ and, subsequently, $s = 1$. Substituting $q = \theta - \frac{1}{2}$ in (A.18) yields a monopoly price of $p = \frac{4\theta^2+4b-1}{8}$ as long as demand is elastic, which is given for $\theta > \frac{\sqrt{1+4b}}{2}$. In this case, demand equals $s = \frac{q-p+b}{q} = \frac{3-2\theta}{4} + \frac{b}{2\theta-1}$. In the intermediate case, where $\frac{1}{2} < \theta \leq \frac{\sqrt{1+4b}}{2}$, demand is inelastic. Thus, $s = 1, p = b$, and $q = \theta - \frac{1}{2}$. *Q.E.D.*

The impact of the merger on total welfare is stated in the following result.

Result A.7 (Welfare in monopoly) *Welfare is given by:*

$$W = b \quad \textit{for} \quad \theta \leq \frac{1}{2}, \tag{A.25}$$

$$W = b + \frac{(1-\theta)(2\theta-1)}{2} \quad \textit{for} \quad \frac{1}{2} < \theta \leq \frac{\sqrt{1+4b}}{2}, \tag{A.26}$$

$$W = \frac{3(3-4b+4(\theta-2)\theta)^2}{64(2\theta-1)} \quad \textit{for} \quad \theta > \frac{\sqrt{1+4b}}{2}. \tag{A.27}$$

Proof: This proof builds on Result A.6. If $\theta \leq \frac{1}{2}$, consumer surplus is $1(b+0-b) = 0$, whereas producer surplus is $s(p-q^2) = 1(b-0) = b$, which sums to welfare of b. If $\frac{1}{2} < \theta \leq \frac{\sqrt{1+4b}}{2}$, producer surplus is $s(p-q^2) = 1(b-(\theta-\frac{1}{2})^2) = b + \theta - \theta^2 - \frac{1}{4}$. Consumer surplus is $1(b + \frac{1}{2}q - p) = b + \frac{1}{2}(\theta - \frac{1}{2}) - b = \frac{2\theta-1}{4}$, which sums to welfare of $b + \frac{(1-\theta)(2\theta-1)}{2}$. If $\theta > \frac{\sqrt{1+4b}}{2}$, then producer surplus equals $\frac{(3-4b+4(\theta-2)\theta)^2}{32(2\theta-1)}$, consumer surplus equals $\frac{(3-4b+4(\theta-2)\theta)^2}{64(2\theta-1)}$, which sums to welfare of $\frac{3(3-4b+4(\theta-2)\theta)^2}{64(2\theta-1)}$. *Q.E.D.*

Result A.7 allows for a comparison of welfare under duopoly and monopoly, which is stated in the following result.

Result A.8 (Merger welfare effects) *A monopolistic consumer-dominated nonprofit* can *create higher total welfare than competing consumer-dominated nonprofits.*

Proof: Consider the case where $b \geq \frac{1}{12}$. Then $\frac{1}{2} < \frac{\sqrt{1+4b}}{2} \leq 2\sqrt{b}$. For $\frac{\sqrt{1+4b}}{2} < \theta \leq 2\sqrt{b}$, welfare under duopoly is given by (A.16) and welfare under monopoly by (A.27). Consider $b = 0.4$, which fulfils the requirement that $b \geq \frac{1}{12}$. Inserting $b = 0.4$ in the boundaries, $\frac{\sqrt{1+4b}}{2}$ and $2\sqrt{b}$, shows that eligible θ-values lie between 0.806 and 1.265. As θ is only defined between zero and one, the relevant range to be considered is $\theta \in [0.806, 1]$. For a value of $\theta = 0.815$, for instance, welfare under monopoly exceeds welfare under duopoly:

$$\text{(A.27) - (A.16)} = 0.014 > 0. \qquad Q.E.D.$$

Figure 2 illustrates this example.

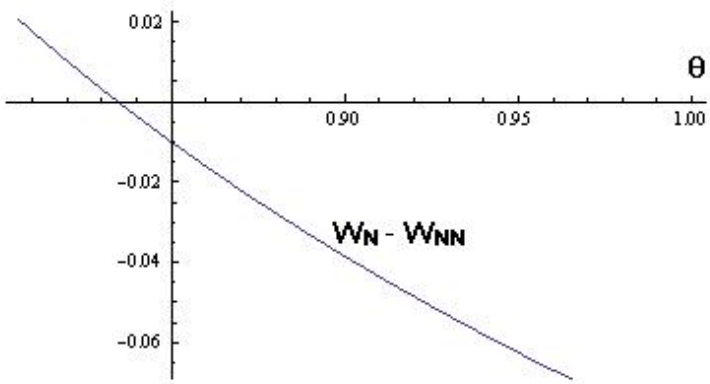

Figure 2: Numerical example for $b = 0.4$. Horizontal axis: $\theta \in [0.806, 1]$. The curve $W_N - W_{NN}$ illustrates the welfare difference between monopoly and duopoly, which is positive for $\theta < 0.835$ and negative for $\theta > 0.835$.