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Essays on Competition and Entrepreneurial Choice between Nonprofit and For-profit Firms

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Introduction

The nonprofit sector prompts a number of interesting, yet not clearly answered research questions. In my dissertation I focus on two specific areas: the objectives of nonprofit institutions and the competition between nonprofit and for-profit firms within an industry.

Chapter 1 is a literature review and looks at the nonprofit sector in a more general way, touching on its size and importance for society, its focus, and the characteristics that distinguish it from the for-profit sector. I also discuss theories of nonprofits and theoretical and empirical papers that build on these basic theories and ask more fundamental questions related to consumers' perceptions about the trustworthiness of the nonprofit sector, consumers' sorting between nonprofit and for-profit sector, and the enforcement of constraints imposed on nonprofits.

The last two sections of the literature review return to the focus of my dissertation and motivate three theoretical chapters. Specifically, I survey the literature on managerial motivations to enter the nonprofit sector and objective functions that nonprofits pursue. I also summarize studies modeling mixed competition. These two sections reveal gaps in our understanding of behavior of nonprofits, particularly, yet unanswered questions of what type of entrepreneurs enters the nonprofit sectors given current operational definition and legal enforcement, how entrepreneurial types affect objectives of nonprofits and how nonprofit objectives affect mixed competition between nonprofit and for-profit firms. Chapters 2 to 4 are attempts to fill in the gaps that I see in the literature.

In Chapter 2, that is based on Brhlikova (2004a), I design a theoretical model of competition between one nonprofit and one for-profit firm in the market for an excludable public good and derive equilibrium qualities, prices, and the market shares of the two competing firms. The nonprofit firm maximizes quality and faces the non-distribution constraint, modeled as a zero profit constraint. The for-profit firm maximizes profit. Firms are assumed to op-

timize with respect to quality and price. Consumers are heterogeneous with respect to quality. The firms' behavior in mixed competition is compared to behavior when two nonprofit firms compete and when two for-profit firms compete. Among other results, the model reveals that the nonprofit firm is a natural leader in the market. The for-profit firm prefers a nonprofit competitor to a for-profit one. Moreover, the for-profit firm is better off when its nonprofit competitor is efficient and subsidized.

In Chapter 3, I explore the robustness of results derived in the previous chapter. This is done in two directions. I analyze mixed competition for other two nonprofit objectives and various cost configurations. The alternative nonprofit objectives studied are the maximization of the nonprofit firm's quality and market share and the maximization of quality and market share of both competing firms. Welfare is analyzed for these two scenarios and the original quality maximization. The largest market share and the highest total surplus is attained when the nonprofit firm maximizes its own quality and market share. The various cost configurations are considered for the quality maximization pursued by the nonprofit firm. Results show that competition is tougher and for-profit's profit decreases for steeper cost functions. When variable costs comprise a significant part of total production costs, producers tend to have smaller market shares and serve consumers that are similar in their preferences.

In Chapter 4, coauthored with Andreas Ortmann, we theoretically investigate the effect of weak enforcement of the non-distribution constraint on entrepreneurial choice between nonprofit and for-profit status. We also look at the impact weak enforcement has on the quality of products delivered by the nonprofit firm. We find that under weak enforcement the nonprofit sector becomes more attractive to entrepreneurs. Results also reveal that the quality provided by the nonprofit firms is lower under weak enforcement than that of the nonprofit firm under strict enforcement, but higher than the quality delivered by a for-profit firm.

Chapter 1

Literature Review

1.1 Nonprofit Sector

The nonprofit sector has gained economic, social, and political importance and attracted growing attention throughout the world in the last decades. Salamon, Anheier, and Associates (1999), in their empirical study of the nonprofit sector in 22 countries, state that the third sector is "a $1.1 trillion industry that employs close to 19 million full-time equivalent paid workers" (p. 8). Interestingly and importantly, across all 22 countries studied "two-thirds of all nonprofit employment is concentrated in the three traditional fields of welfare services: education, with 30 percent of the total; health, with 20 percent; and social services, with 18 percent" (Salamon et al., 1999, p. 15). This particular focus, and its importance to human and social capital, explains why the social and political importance of the third sector is often disproportional to its economic significance (which is, obviously, not small either).

The nonprofit, third, or voluntary sector refers to entities that are, by their choice of organizational form, not run for profit. Despite a widespread misperception, these organizations can earn profits. However, the non-distribution constraint and its side-kick, the reasonable compensation constraint, restrain their founders and managers from distributing profits among themselves or

among stakeholders. The non-distribution constraint is inherent to all nonprofit entities. Other common characteristics include separation from the state (they are private), tax and regulatory breaks, and donations in the form of money or voluntary labor. Despite these common features, the nonprofit sector is a hodgepodge of organizational forms with a wide variety of activities. With respect to the organizational form, the nonprofit sector incorporates entities such as foundations, foundation funds, churches and religious organizations, educational institutions, civic associations, sport clubs, and even advocacy groups.[1] Nonprofit activities range from welfare services including health and social care, and education, through culture and art, sport and recreation, to preservation of human rights, cultural heritage, and environment.

The diversity of the nonprofit sector becomes even more apparent when we compare nonprofit sectors across countries. Although Salamon et al. (1999) classify the 22 countries they focus on, into four groups (Western Europe, Central Europe, Latin America, and other developed countries), nonprofit sectors differ significantly even within these groups. Nonprofit sectors in Western Europe are dominated by welfare services. When measured by employment, three-fourths of nonprofit employment work in education, health, or social services. The role of other areas, such as culture and recreation, environment, and business and professional is significantly smaller. In contrast, nonprofit sectors in Central Europe focus on culture and recreation, while the nonprofit traditional fields of education, health, and social services remain the responsibility of the governmental sectors. In Latin America nonprofits are concentrated in education. In other developed countries (the U.S., Japan, Australia, and Israel) the two most important nonprofit employers are education and health care. This result is driven mainly by the importance of these two fields in the nonprofit sectors of the U.S. and Japan.

Salamon et al. (1999) document that overall the most important sources of revenues are fees and charges (49%), with the public sector contributing 40%

[1]Specific legal forms of these nonprofit entities and the degree of tax and regulatory advantages corresponding to these forms depend on the regulation of a particular state.

and philanthropy accounting for only 11%. The revenue structure, however, also differs significantly across countries. For instance, the nonprofit sector in Mexico lives on fees and charges (85%) while the sectors in Ireland and Belgium are highly dependent on public resources (77%).

Differences between nonprofit sectors across countries is a consequence of many factors such as history and traditions, the role of the public sector in welfare areas as well as the legal environment for nonprofit institutions. All these factors, for instance, affected the size and focus of nonprofit sectors in Central European countries. Nonprofit sectors in these countries were stifled by communist regimes that often, and sometimes for decades, put on hold the activities of nonprofits. The nonprofit sectors in Central European countries started to re-emerge only in the last decade of the 20^{th} century and are significantly smaller and under-developed in comparison with nonprofit sectors in developed countries (Salamon et al., 1999). As mentioned above, nonprofit sectors in Central Europe are dominated by culture and arts, sport, and recreation while the state remains the main provider of education, health care, and social services, i.e. traditional nonprofit fields. The evolution of legal regulation of nonprofit institutions lagged behind the growth of the sector and was solving, mainly in a reactive manner, problems that could not be ignored any longer. Moreover, weak enforcement of existing law that attracted "for-profits in disguise" [2] to the sector had a negative impact on public and political support of nonprofit institutions, thus slowing down the convergence of the sector's resemblance to that of nonprofit sectors in Western countries.

Even developed nonprofit sectors evolve over time. Hansmann (2001) focuses on adjustments in legal regulation of nonprofit institutions in the U.S. that account for changes in the character of the nonprofit sector. Hansmann points out that in the last half-century, the U.S. nonprofit sector changed from a sector dominated by donative entities, i.e. entities for which donations and gifts comprise the main source of revenues, to a sector dominated

[2]The term "for-profit-in-disguise" was introduced by Weisbrod (1988) to describe entrepreneurs motivated by profits who opt for the nonprofit form to exploit tax and regulatory breaks bestowed on nonprofit institutions.

by commercial nonprofits that receive the major part of resources from fees and charges. Commercialization of the nonprofit sector was caused by the increased competition with for-profit firms as well as government retrenchment that prompted donative nonprofits to turn to commercial markets to cross-subsidize their nonprofit activities (Schiff and Weisbrod, 1991; Weisbrod, 1997, 1999; and Tuckman, 1999). Various stakeholders, the public, and policy makers perceive a shift in nonprofit behavior that eliminates differences between the nonprofit and for-profit ownership form. With the convergence in behavior of the two forms, questions about the role of nonprofit sector in society and the justification of tax and regulatory breaks have become more pressing. A growing literature, however, suggests that the convergence in behavior of the two forms is driven by for-profits changing their behavior in the presence of nonprofits, thus offering a justification for the role of nonprofits in society (see e.g. a theoretical study by Hirth, 1999) or an empirical test of Hirth's predictions on positive spillovers from nonprofits on their for-profit competitors (Grabowski and Hirth, 2003).

In comparison to for-profit firms, nonprofit institutions enjoy numerous tax and regulatory breaks (Facchina, Showell, and Stone, 1993). In return, they are expected to transfer voluntary contributions from the upper tail of income distribution to the poor or needy. The evidence in Clotfelter (1992) suggests that, at least in the U.S., activities of a rather small fraction of nonprofit institutions is directed primarily to needy recipients, although there is a wide variety across industries where nonprofits operate. More recent data reveal that in 2004 less than 10% of the $ 248 billion donations in the U.S. went to organizations most directly related to helping the poor (Strom, 2005). That indicates that the poor are not the primary beneficiaries of the nonprofit sector. Rather, Ben-Ner (1994) suggests, "the nonprofit sector exists for a different reason: to correct market and governmental failures that affect some consumers, donors, and sponsors of certain services, and to satisfy their demand for an alternative type of organization" (p. 761). The following section focuses on the theories that explain the existence of nonprofit institutions as a correction mechanism to market and governmental failures.

1.2 Theories of Nonprofit Institutions

Despite the considerable volume of academic literature, a persuasive rationale for the existence of the nonprofit sector remains in dispute. The dominant theory of nonprofits was formulated by Hansmann (1980) and suggests that nonprofits are an institutional response to market asymmetries existing in markets where quality and/or effort are adjustable. In such situations, nonprofit institutions are more trustworthy because the non-distribution constraint weakens their incentives to exploit these market asymmetries at consumers' expense. A competing theory formulated by Weisbrod (1975) is based on the heterogeneity hypothesis and says that nonprofits satisfy demands for collective goods and services that are unmet by the state, which provides services to a median voter. Kingma (1997) summarizes empirical studies that show the positive relationship between the heterogeneity of tastes and the existence of nonprofits. In this chapter, I focus on studies that build on Hansmann's theory of contract, or market, failure rather than Weisbrod's theory of governmental failure.

Easley and O'Hara (1983), for instance, analyze for-profit and nonprofit status as alternative contractual arrangements under asymmetric information. When the output can be costlessly observed both alternative arrangements ensure the Pareto optimal outcome. The nonprofit arrangement is preferred to a for-profit arrangement when the output is not observable or is too expensive to observe. In such a case, the non-distribution constraint imposed on nonprofits ensures increased outputs and quality and thus outperforms the for-profit sector where managers exploit the information asymmetry in order to maximize their own utility (profit). Similarly, Ben-Ner (1986) discusses the benefits of nonprofit organizations in markets with excludable public goods under symmetric information or private goods under asymmetric information.

The asymmetric information resulting from the unobservability of quality before purchase allows firms to cheat their consumers. Opportunities for

cheating may be eliminated if information about the quality of a good purchased by one consumer is revealed to other consumers, i.e. if firms have to maintain their reputation and consumers can rely on it.[3]

Reputation models were employed by Klein and Leffler (1981) and Allen (1984) among others. They focus on the market for goods of quality unobservable before purchase. Consumers know prices, technologies, and the experience of one consumer is costlessly revealed to all consumers. Consumers want to purchase only high quality goods and refuse to buy products from firms that previously delivered lower quality than contracted. Cheating firms, therefore, lose all future sales. Klein and Leffler argue that perfect communication among consumers is not a sufficient condition for inducing high-quality production. Cheating will be prevented only if the charged price is sufficiently above salvageable production costs. The gap between the charged price and the perfectly competitive price reflects a firm-specific investment (advertising costs), so that profit is zero. Allen argues that such a non-price competition is not always possible. For instance, firm-specific investments may not be feasible or have the nature of public goods and therefore are unlikely to cause repeated purchases. He shows that the price, then, can be above marginal costs ensuring strictly positive profits. Producers are, however, not willing to reduce the price since the reduction would change their incentives and consumers, knowing this, would stop buying their products.

Employing a similar approach, Chillemi and Gui (1991) show that the non-profit ownership can solve the problem of inefficiently high prices (above minimum average cost level). Rather than looking at the stream of a firm's prof-

[3]Ortmann (2001), as Heal (1976) did in response to Akerlof (1970) and implicitly Hansmann (1980) before him, points out that although asymmetric information can be modeled as a one-shot one-sided prisoner's dilemma game, firm and consumer often are engaged in an indefinitely repeated game where reputation plays an important role in constraining opportunism. See also Ortmann and Schlesinger (2003).
However, incentives for cheating might not be eliminated due to reputational concerns in markets where consumers do not have the skills and knowledge needed to assess goods/services appropriately, and therefore, their recommendations might be misleading (Liebeskind and Rumelt, 1989) or when a good/service provider wants to exit the market and does not care about reputation anymore (Gale and Rosenthal, 1994).

its as Klein and Leffler (1981) and Allen (1984) do, Chillemi and Gui (1991) look at the stream of entrepreneur's utilities and add the non-distribution constraint that is imposed on nonprofit firms. This constraint ensures that managers do not have incentives to maximize profits by cheating consumers. Nonprofit ownership thus makes the price at minimum average cost level credible (Hansmann, 1980). This prompts the obvious question why would a manager opt for an ownership form that restricts her earnings?[4]

Glaeser and Shleifer (2001), while buying into Hansmann's basic story, focus on founders' and managers' choice of nonprofit ownership form over the for-profit form. They show that nonprofit firms deliver higher quality than for-profit firms in situations with non-verifiable quality. This result is driven by the assumption of reputational costs incurred by entrepreneurs who delivered a lower quality than contracted. Due to the non-distribution constraint faced by nonprofit entrepreneurs, these reputational costs have a higher impact on nonprofit entrepreneurs, who therefore want to avoid such costs and deliver a higher quality. Higher quality is appreciated especially in markets where consumers care about the product quality and therefore prefer dealing with nonprofit firms. In such markets, it is optimal even for self-interested entrepreneurs to opt for the nonprofit ownership.

These studies show the potential superiority of the nonprofit ownership form under asymmetric information. In all these studies, however, the nonprofit and for-profit form are analyzed in isolation implying that the whole market is either nonprofit or for-profit. These studies fail to explain the coexistence of nonprofit and for-profit firms within an industry common to health care, education, or nursing and elder care. Still, these studies support Hansmann's theory for donative nonprofits that almost always dominate the industry in which they exist. As Hansmann points out, the situation seems to be different for commercial nonprofits. Although commercial nonprofits operate in markets where asymmetric information remains relevant, the possibilities for exploitation are possibly smaller than in the case of donative nonprof-

[4]More on entrepreneurial motivations in the next section.

its. Commercial nonprofits usually coexist and compete with for-profit firms suggesting that advantages and disadvantages of these ownership forms are in balance.

Alternatively, the heterogeneity of entrepreneurs and consumers has something to add to contract failure theory. Entrepreneurs are likely to be heterogeneous and decide whether to run a nonprofit or for-profit firm according to their individual characteristics. Even if all entrepreneurs were alike and attained the same utility whether running a nonprofit or for-profit firm, there are likely to be differences among consumers that might explain the coexistence of nonprofit and for-profit firms within an industry. Consumers might be heterogeneous, for example, in their taste for quality or with respect to an awareness of the quality level. Some distributions of tastes and/or awareness might lead consumers to different choices of service providers.

Recently, several studies on the coexistence of nonprofit and for-profit firms have been published. These studies are summarized in Section 5. I first discuss the assumption of strict enforcement of the non-distribution constraint that is crucial for the nonprofit signal of trustworthiness to remain credible. This assumption is implicitly used in all papers discussed so far. The reality, however, is rather different.

Even in the U.S. and other countries with well-established nonprofit sectors, the non-distribution constraint tends to be only weakly enforced. This might have a negative impact on the incentives of those working in nonprofit firms. Hansmann (1980) argues that "most states in fact make little or no effort to enforce this prohibition [on distribution profits]" (p. 873). In the U.S., only the state (attorney general) can indict nonprofits and file a suit. "Yet in most states neither the office of the attorney general nor any other office of the state government devote any appreciable amount of resources to the oversight of nonprofit firms" (p. 873). Another way of policing nonprofit organizations that are exempted from the federal corporate income tax is through the Internal Revenue Service. Originally, the only sanction that could be applied in cases of self-dealing by the IRS was the denial of ex-

emption. The possibilities of the IRS to punish self-dealing changed by the introduction of intermediate sanctions in 1996. These sanctions include the restitution of excess benefits to the nonprofit institution and a penalization of up to 25% of the excess benefits. The intermediate sanctions, however, do not cover cases of other breaches of fiduciary duties such as accumulating excess income or paying insufficient attention to investment returns. In addition to intermediate sanctions, the IRS is sometimes able to enforce improvements in governance via negotiations with a charity under the threat of revoking exemption. For more details on possible penalties and how they are put in practice see Brody (2006).

Enforcement of law and regulations is considerably weaker in transition countries with negative consequences for the trustworthiness of the nonprofit sectors in these countries that are young and yet undeveloped. In the Czech Republic, for instance, foundations and foundation funds are required to publish annual reports, and one copy has to be available in the register of a corresponding regional court. In reality, only 54% of foundations and 30% of foundation funds do so (CVNS, 2004). Before the attempt of the CVNS to gather information about foundations and foundation funds through annual reports available in registries of regional courts, the latter overwhelmed with other obligations, barely noticed the low submission rate of required documents. Up to now, organizations disregarding the duty of submitting the reports have not been penalized although courts finally made the first steps to force these organizations to fulfil their duty.

Weak enforcement of the non-distribution constraint makes the nonprofit sector more attractive to 'for-profits-in-disguise' (Chapter 4). Since the objectives of 'for-profits-in-disguise' differ from those attributed to nonprofit organizations, the average quality/quantity of services and products delivered by the nonprofit sector decreases (more on this in Chapter 4). Therefore, the effectiveness of the nonprofit ownership as a protection for poorly informed consumers against exploitation is limited.

Accounting for both, the coexistence of nonprofits and for-profits within

an industry and weak enforcement of the non-distribution constraint, Hirth (1999) analyzes mixed competition under three levels of enforcement. Under the strict and moderate enforcement, the credibility of the nonprofit sector is preserved since 'for-profits-in-disguise' cannot profitably enter. The segmentation of the market is achieved since informed consumers prefer dealing with for-profits, and the uninformed patronize nonprofit firms. The nonprofit sector, moreover, improves the performance of the for-profit sector because the probability of for-profit firms serving an uninformed consumer is very low. The trustworthiness of the nonprofit form is, however, not preserved under weak enforcement. With a rather unrealistic assumption that honest nonprofits receive subsidies but 'for-profits-in-disguise' do not, the credibility of non-profit status could be preserved. If it is impossible to ensure such discrimination with respect to subsidies, then either both honest nonprofits and 'for-profits-in-disguise' coexist, or only the latter ones can remain viable and the credibility of the signal is breached.

Even under strict enforcement, to make use of the nonprofit 'signal' consumers have to know the ownership status of service providers and what it involves. That means, they have to know that nonprofit firms are more trustworthy since they are barred from profit distribution. Are consumers' decisions about a provider indeed based on the ownership form?

The evidence in Schlesinger and Gray (2003) and Ortmann and Schlesinger (2003) suggest that consumers' impressions of the implications of ownership are not always reliable. Mauser (1998) studying parent perceptions about ownership differences in the day care industry finds that while 56% of respondents correctly identify the ownership form of their day care center, only 14% consider the ownership form to be important. However, almost all, for whom the organizational form matters, use nonprofit centers.

For nursing homes, Holtmann and Ullmann (1993) test the hypothesis that costs of securing information on the quality of care accounts for the existence of nonprofit providers. These costs also determine the type of consumers who prefer the nonprofit nursing home to a for-profit provider. The results show,

indeed, that consumers looking for a protection from opportunistic behavior choose a nonprofit nursing home. In the empirical test of Hirth's model that accounts for competition, Grabowski and Hirth (2003), however, do not find evidence in the support of any suggested sorting of uninformed consumers into the nonprofit sector.

The empirical evidence on consumers' sorting between sectors is thus mixed suggesting that consumers' decisions are more complex and are based on additional characteristics of service providers. Similarly, an intriguing, and not yet satisfactorily answered, question relates to the self-sorting of entrepreneurs and/or managers into the nonprofit and for-profit sectors. In the next two sections, I survey papers related to two specific fields within the nonprofit sector research: entrepreneurial choice between nonprofit and for-profit ownership form and a mixed competition between nonprofits and for-profits. The topics of these two sections reflect the focus of my dissertation.

1.3 Entrepreneurial Motivations and Nonprofit Objectives in Mixed Industries

Legal restrictions, if properly enforced, imply different incentives for entrepreneurs and managers[5] in the nonprofit and for-profit sectors. The main distinction being the non-distribution constraint imposed on nonprofit firms: it is at first sight surprising that there are entrepreneurs and managers that decide to start or run a nonprofit firm. Do nonprofit firms offer better financial conditions, or more pleasant working environments, or do they better align the scope of the work with an individual's attitudes and values? How does the self-selection of entrepreneurs between the two sectors work? Unless

[5]In this section, I focus mainly on the motivations of entrepreneurs and managers although some empirical findings for other positions will be presented. The reason for this is that I am interested in the objectives pursued by nonprofit firms. Entrepreneurs and managers have the power and possibilities to influence the goals of the firm they manage while the influence of other employees is much smaller.

the benefits of working in the nonprofit and for-profit sectors are the same for all entrepreneurs and managers, the two sectors obviously attract different types of entrepreneurs and managers.

In this section, I first survey the findings of several empirical studies, and then I look at theoretical predictions on the differences in managerial types and objectives in the nonprofit and for-profit sectors.

The only empirical study comparing the characteristics of managers in the nonprofit and for-profit sector, I am aware of, is Rawls, Ullrich, and Nelson (1975). Rawls et al. compare MBA students that later entered the nonprofit and for-profit sector. The study finds no differences in demographic variables (age, work experience, military experience, nationality, and sex) and no significant differences in problem solving, intelligence, or creativity measures. Individuals that entered the nonprofit sector are, however, more dominant and flexible, have a greater capacity for status, social presence, and concern for personal relations than those who prefer the for-profit sector. The for-profit sector subjects placed greater value on a comfortable life and economic wealth.[6]

Another approach to studying the self-sorting of employees and managers we find in the empirical literature is based on differences in compensations and their structure across sectors. In this section, I survey several studies that compare wages and compensation structure in nonprofit and for-profit firms. Since the motivations of those who start or run nonprofit firms determine the objectives these firms pursue (Young, 1983), in the second part I turn to nonprofit objectives that were assumed in empirical and theoretical studies of the nonprofit sector.[7] A number of plausible objectives have been proposed by various authors, but there is no consensus about their relative importance which, quite possibly, might vary across and even within non-

[6]For a summary of evidence on entrepreneurial sorting based on different personal goals, attitudes, and values see Weisbrod (1988).

[7]As nonprofit firms grow, founders are soon replaced by professional managers who affect organizational objectives. Thus, the determination of a firm's objectives is in reality more complicated since objectives might change over time.

profit industries. The consequences of various nonprofit objective functions on products and services will be discussed in the next section, which focuses on mixed competition studies.

One of the most ambitious and insightful empirical studies of the nonprofit sector is Leete (2001). Using observations on 4.1 million private-sector employees from the 1990 U.S. census, Leete estimates wage differentials between nonprofit and for-profit firms. Her estimation controls for employee characteristics such as age, education, gender, and race as well as for occupation characteristics related to decision-making, autonomy and responsibility. Leete finds zero or slightly positive wage differentials at the aggregate level. The wage differentials between nonprofit and for-profit firms, however, appear to be significant at the industry level.

Specifically, the study finds negative differentials (lower nonprofit wages) in legal services, elementary and secondary schools, broadcasting, and publishing services. Leete argues that in these industries nonprofit firms usually produce different goods and serve a different clientele compared to their for-profit counterparts. This result supports the "donative labor hypothesis" suggesting that employees of nonprofit firms accept lower wages when they receive non-pecuniary benefits from their work (Hansmann, 1980; Preston, 1989; and Rose-Ackerman, 1996).

Leete observes mixed evidence for industries where differences either in products or product qualities are not evident. Wage differentials are positive for bus service and urban transit, as well as insurance companies. Negative differentials are found for electric light and power utilities and telephone communications. Leete suggests that wage differentials, in these cases, might reflect differences in market or work conditions.

Positive differentials (higher nonprofit wages) are found, for instance, in hospitals, nursing and personal care facilities, and colleges and universities. In these industries differences might be driven by the differences in the quality of services or by inefficiently higher wages in nonprofits. Although given the

available empirical evidence, it is difficult to say which of the two reasons causes the wage differential; higher wages are likely to be the reason why some entrepreneurs and employees opt for the nonprofit sector.[8]

Focusing on hospitals, Weisbrod and his various co-authors have recently provided a more detailed analysis of the compensation structure of mid- and low-level employees on the one hand and top-level employees on the other. Roomkin and Weisbrod (1999) look at the composition of managerial compensation at top, senior, and middle management positions in nonprofit and for-profit hospitals. Their findings show greater base salaries and lower bonuses in nonprofits. Total compensation is higher in for-profits for two top executive levels (CEO, COO) and for the top patient care executive, but lower at three other managerial positions. Roomkin and Weisbrod, moreover, account for the possibility of different productivity between the same jobs in nonprofits and for-profits that might affect wage differentials in the two sectors. Their data, however, do not support the hypothesis that jobs are less complex in nonprofits. To the contrary, the CEO position seems to be more complex in nonprofit hospitals.

Accounting for competition and the distinction between religious and secular nonprofits, Erus and Weisbrod (2002) confirm weaker incentives for CEOs in nonprofit hospitals, both religious and secular, when compared to for-profits. This difference in compensation structure, however, decreases with competition and over time, suggesting that nonprofits and for-profits are becoming more alike. They look also at 14 lower levels - middle managers and technical workers, but for these levels, the differences across ownership forms are more limited.

Erus and Weisbrod point out that weaker incentives in nonprofits support the model of different objectives across ownership forms but can also reflect inefficiency in nonprofits. Although nonprofits are legally constrained from using a profit-sharing bonus system, they can link compensation to other

[8]The empirical evidence on the differences in quality in these industries is, however, strong for some of these industries and weak for others (see Weisbrod, 1997; Ruch, 2001; Malani, Philipson, and David, 2003; and Ortmann and Schlesinger, 2003).

aspects of performance such as a provision of public services. These aspects are, however, more difficult to measure.

Some researchers suggest that those working in nonprofits are more altruistic (see e.g. Rose-Ackerman, 1996). Brickley and Van Horn (2002) include proxies for altruistic performance to examine managerial incentives in hospitals. However, they do not find evidence that nonprofits provide incentives for their CEOs to focus on altruistic activities. The compensation and turnover of CEOs is significantly related to financial performance. Due to data limitations, they cannot compare compensation incentives across ownership forms. The relationship between turnover and financial performance is stronger in nonprofit hospitals.

Focusing on health maintenance organizations, Schlesinger, Mitchell, and Gray (2003) compare nonprofit and for-profit providers with respect to community benefit activities. They do not find any significant difference between administrators' commitment to such activities in nonprofit and for-profit health plans. They argue that it is organizational incentives that drive ownership related differences in the engagement of health plan providers in community benefit activities. The study, indeed, reveals consistent differences between nonprofit and for-profit plans in several activities. Nonprofit plans are more likely to be active in medical research, services that benefit the whole local population, and redistributive programs, i.e. to provide subsidized medical services and to be engaged in general philanthropy.

What do these empirical studies suggest about objectives pursued by entrepreneurs and managers who enter the nonprofit sector? The findings seem to give some support to the donative labor hypothesis. Studies on compensation structure suggest that, although salaries are smaller for managers in nonprofit hospitals, the compensation structure is related to financial performance in nonprofits too. Overall, objectives of those working in the nonprofit sector might not be too different from those working in the for-profit sector.

Theoretical studies modeling entrepreneurial sorting between nonprofit and

for-profit sectors also suggest several characteristics of individuals, for whom it is beneficial to start a nonprofit firm. Depending on modeling assumptions, such characteristics might include time preferences, wealth, or valuation of perquisites.

Bilodeau and Slivinski (1996) assume heterogeneous individuals who get utility from their private consumption and from a public good and who are willing to contribute toward the production of the public good. First somebody, however, has to volunteer to set up a nonprofit firm to organize the production of the public good. Organizing the firm is costly for the entrepreneur. Costs might be related to direct costs of starting the firm, advertising and fund-raising costs, and opportunity costs of entrepreneur's time spent on these activities. Benefits of starting the public good production might involve direct influence on the character of the public good, managerial perks, warm glow feelings, or enhancement of manager's career opportunities. Not surprisingly, the model predicts that nonprofit entrepreneurs are those with low costs of starting and operating the nonprofit firm, i.e. those with the best managerial skills or experience with similar activities, or those entrepreneurs whose benefits from public good production are highest. Another aspect that possibly influences the decision to start the public good production reflects time preferences. The most impatient individuals or those with a relatively long time horizon are likely to become nonprofit entrepreneurs. With respect to wealth, nonprofit entrepreneurs are expected to be either the wealthiest contributors (if individuals are willing to contribute large amounts toward the production) or from the center of the wealth distribution (if individuals contribute small amounts toward the production).

In another of their studies, Bilodeau and Slivinski (1998) show that it may be rational for the entrepreneur who decides to start the production of a public good, to organize a nonprofit firm even without any tax and regulatory breaks bestowed on nonprofits. Bilodeau and Slivinski present a multistage model of entrepreneurial choice to set up a firm, collecting funds, and production of a public good. The entrepreneur has the final word about the use of the collected funds and that affects contributions by other individuals. The

entrepreneur's commitment to the non-distribution constraint induces higher donations and the entrepreneur benefits from consumption of more of the public good. The strict enforcement of the non-distribution constraint is crucial - the entrepreneur cannot consume perks.

If the entrepreneur is interested in public good provision only, he would produce the maximum amount of public good regardless of the level of enforcement of the non-distribution constraint and regardless of the availability of perks. There have to be, however, constraints that allow only public-good lovers to enter the nonprofit sector. If entrepreneurs are allowed to collect benefits in the form of perks, then nonprofit firms will be started also by entrepreneurs that are not pure public good maximizers.

Glaeser and Shleifer (2001), for instance, derive conditions under which it is rational for a self-interested entrepreneur who does not care about public good production to start a nonprofit firm. They assume that nonprofit entrepreneurs can consume a fraction of profit in the form of perquisites (or they can consume the whole profit but only in the form of perks that are valued less by the entrepreneur than cash). In contrast to pure public good maximizers in Bilodeau and Slivinski (1998), now the unobservability of product/service quality by consumers at purchase leads to opportunistic behavior of entrepreneurs interested in perks. These entrepreneurs are willing to increase profit by delivering a lower quality than contracted and to consume a fraction of the profit as perks. The increase in profits is, however, only temporary since they incur reputation costs reflected in the loss or decrease in future profits. These reputation costs have a higher impact on incentives of nonprofit entrepreneurs who, therefore, prefer to avoid such penalty and in equilibrium deliver a higher quality than their for-profit counterparts would deliver.[9] The nonprofit sector is more attractive to entrepreneurs in markets where consumers are sensitive to quality.

In the model of Glaeser and Shleifer (2001), the non-distribution constraint

[9]This quality is, of course, lower than would be quality delivered by a nonprofit entrepreneur who puts zero weight on perk consumption.

restricts the form in which profits can be consumed (or limits the fraction of profit that can be consumed.) Similarly, Eckel and Steinberg (1993) assume that excess revenues can be consumed in the form of managerial perks due to weak enforcement of the non-distribution constraint. The entrepreneurs' utility then depends on pecuniary and non-pecuniary benefits. Non-pecuniary benefits are of two types: one relates to the provision of public good, the second one are managerial perks. Eckel and Steinberg show that potential nonprofit entrepreneurs are both, public good lovers and perks lovers, who represent the extremes of the continuum of entrepreneurial types.

Chapter 4 shows that under the weak enforcement of the non-distribution constraint, the nonprofit sector attracts more entrepreneurs motivated by profits. Incentives of nonprofit entrepreneurs converge to those of for-profit entrepreneurs and the quality of nonprofit services decreases. Harrison and Lybecker (2005) derive a similar result. The presence of a profit motive is not the only case when the quality might decrease. Even in the case of purely nonprofit objectives, the quality of nonprofit services and products might vary considerably (Hansmann, 1981, Chapter 3).

Hansmann (1981), for example, studies three plausible objectives of art-performing nonprofits: maximization of quality, audience, and budget. The quality maximizer tends to sacrifice the number of consumers to quality if donations/subsidies are small. The audience maximizer chooses the quality level that maximizes profit because profits can be used to reduce ticket prices and thus attract additional consumers. The budget maximizer chooses quality level that is between the quality set by quality and audience maximizers, and he attracts the corresponding audience.

Objectives obviously affect the nonprofit outcome. The problem is that objectives of nonprofit firms are likely to be more complex than objectives of for-profit firms. Nonprofit objectives vary across but also within industries. Several objectives one can find in the literature have been already mentioned: perquisites and quality (Glaeser and Shleifer, 2001; Eckel and Steinberg, 1993); public good production (Bilodeau and Slivinski, 1996, 1997);

and audience and budget maximization (Hansmann, 1981). Other nonprofit objectives assumed in the literature include the combination of quality and quantity (Newhouse, 1970); care for the needy (Harrison and Lybecker, 2005); consumer surplus (Lien, 2002); and total surplus (Lien, 2002).

The objectives enumerated in the previous paragraph, are exogenously imposed objectives. To estimate the real objective function of nonprofit firms, Steinberg (1986) assumes that the potential objectives belong to a set of functions with budget maximization and service maximization as two limiting cases. Budget maximization corresponds to the maximization of gross revenues while service maximization corresponds to the maximization of net revenues that can be used to enhance the quality or increase the quantity of services. Empirical results suggest that health firms are budget maximizers while those operating in welfare, education, and the arts are service maximizers.[10]

In my thesis, I focus on two issues related to this literature on nonprofits. First, what are the consequences of the weak enforcement of the nondistribution constraint on entrepreneurial choice between nonprofit and for-profit ownership form, and what does it imply for the quality provided by nonprofit firms (Chapter 4)? Second, how do nonprofit objectives affect the position of nonprofit firms and the quality of products in markets where nonprofit firms coexist with their for-profit counterparts (Chapter 3)? The next section focuses on models formalizing the competition in mixed duopoly markets.

1.4 Mixed Competition

In oligopoly markets, the nonprofit outcome depends on a firm's objective as well as on the objectives of the firm's competitors. The character of competition is different if the nonprofit firm competes with other nonprofits, or

[10]More on empirical studies uncovering nonprofit objectives in Steinberg (2006).

governmental institutions, or with for-profit firms. The competition between nonprofits is discussed in more detail in Weisbrod (1999); Tuckman (1999); and Chapter 2. Mixed competition has been studied in a variety of settings. For instance, Cremer, Marchand, and Thisse (1991) focus on competition of public and private for-profit firms in the market with spatially differentiated products. Cremer and Crémer (1992) compare Cournot and Bertrand competition between an employee-controlled firm that maximizes value-added per worker and a profit-maximizing firm. Klemm (2004) uses the Cournot framework to study competition between a for-profit firm and a quantity maximizer.

Formal models of mixed competition between nonprofit and for-profit firms have been published only recently. Hirth (1999), already discussed in more detail in Section 3, is based on the asymmetric information rationale. In what follows, I focus on four studies that model mixed competition in full information settings: Lien (2002); Liu and Weinberg (2004); Friesner and Rosenman (2001); and Harrison and Lybecker (2005).[11] All these models examine mixed duopolies. However, as mentioned in the previous section, models of mixed competition differ in the assumed nonprofit objectives, in strategic variables of competing firms as well as in assumptions about demand. They, therefore, analyze different aspects of mixed competition and/or look at mixed competition in different industries.

To study the effect of the profit tax rate on output in a mixed duopoly, Lien (2002) applies a Cournot framework where the good is homogeneous, and the two firms compete over quantities. In addition to the profit motive, the nonprofit firm is assumed to have altruistic preferences modeled as consumer surplus or as total surplus (consumer plus producer surplus). The nonprofit firm is tax-exempted and receives no subsidies. Equilibrium be-

[11] I was not aware of these studies until I finished the modeling parts of chapters 2 and 3. Although without these studies an explicit model of mixed competition seemed more urgent, there is a number of differences distinguishing my model from those (e.g. demand derived from consumers' preferences, comparison of nonprofit, for-profit, and mixed duopoly, comparison of equilibrium outcomes under various nonprofit objectives and cost configurations).

havior is driven by nonprofit objectives. The for-profit firm always reduces its output if the tax rate increases. In contrast, the nonprofit firm caring about the total surplus increases its output when the tax rate increases. The reaction of the non-profit firm maximizing profit plus consumer surplus depends on weights given to the two components of its objective function. The firm increases (reduces) output if it weighs consumers surplus more (less) than profit. Comparing equilibria under the two different objectives pursued by the nonprofit firm, the for-profit firm produces more, the nonprofit firm produces less, the total output is larger, and the price therefore smaller if the altruistic component is modeled as total surplus rather than consumer surplus. The nonprofit firm, thus, works as a regulator of the total output (and total surplus) through its objective function, more specifically through the altruistic component of its objective function and the weight put on this component.

Instead of the Cournot framework, Liu and Weinberg (2004) focus on Bertrand competition with varying degrees of product substitutability. The nonprofit firm maximizes quantity and faces a zero profit constraint. The for-profit firm maximizes profit, and its reaction function is upward sloping (strategic complement) as in typical Bertrand games. The reaction function of the nonprofit firm is, however, downward sloping (strategic substitute). The equilibrium exists only in the case when the nonprofit price is lower than the for-profit price. Results of the model show that the degree of competitive intensity (product substitutability) affects the equilibrium. If the two products are too similar, the equilibrium might not exist because either the for-profit does not earn a positive profit or the nonprofit cannot break even. The nonprofit firm is less sensitive to an increase in competitive intensity, and the nonprofit price decreases at a slower rate than the for-profit price when the two products are more similar. The nonprofit firm is, however, more sensitive to changes in the cost structure. This is due to the budget constraint that the nonprofit firm faces, and that implies that the nonprofit price increases at a faster rate than the for-profit price when production costs increase.

In general, the for-profit firm is much worse off when it competes with a nonprofit firm (even in the absence of any breaks bestowed on the nonprofit firm) than when it competes with another for-profit firm. The results suggest that the dominant factor influencing the competitive outcome is the difference in objectives pursued by the two firms. In addition to a game of simultaneous price competition, Liu and Weinberg explore Stackelberg price leadership that allows one competitor to credibly announce its price in the first stage with a foresight to the reaction of its rival. In more competitive markets, the Stackelberg price leadership protects the for-profit firm that competes with the nonprofit firm. In less competitive markets, the Stackelberg equilibrium is identical to the equilibrium when rivals move simultaneously.

Liu and Weinberg examine also the effect of donations available to the nonprofit firm. It is assumed that donations increase with the quantity sold by the nonprofit firm (i.e. with the pursued nonprofit mission) and decrease the costs that have to be covered by consumers' fees. In response to the availability of donations, both competing firms decrease prices and the nonprofit firm gains additional consumers (that were served by the for-profit firm previously).

The next two studies, Friesner and Rosenman (2001) and Harrison and Lybecker (2005), examine duopolies with competitors having two strategic variables. Friesner and Rosenman (2001) apply a modified Bertrand framework to study competition of one nonprofit and one for-profit health care provider. The two firms compete over prices and qualities. The nonprofit provider is assumed to maximize a combination of non-pecuniary benefits, output for each consumer group, and quality for each consumer group subject to a budget constraint. Friesner and Rosenman consider two types of consumers: self-paying and insured. This distinction leads to different behavior/demand of the two groups since the first type's decision for a service provider is based on both, quality and price of care, while the second type decides only with respect to service quality.

The results suggest that nonprofits are able to compete with for-profits even

without tax and regulatory advantages. The necessary requirement is that the nonprofit manager has to care about non-pecuniary benefits. In the limiting case when the nonprofit entrepreneur cares only about the non-pecuniary benefit the nonprofit firm indeed behaves as a profit maximizer. Both firms then offer services of the same quality and charge equal prices. In contrast to the for-profit manager, however, the nonprofit manager spends the firm's profit in the form of non-pecuniary benefits (similarly as in Glaeser and Shleifer, 2001). In a more general case when the nonprofit manager pursues also other goals than non-pecuniary benefits, the equilibrium outcome depends on the marginal profitability of treating one more self-paying consumer. If this marginal profitability is positive the nonprofit firm offers to insured consumers a higher quality than the for-profit firm. The results for self-paying consumers are ambiguous. Depending on preference of the nonprofit manager, the nonprofit firm offers to self-paying consumers a higher or lower quality than the for-profit firm. If the marginal profitability of treating one more self-paying consumer is negative the nonprofit firm offers a higher quality at a higher price to self-paying consumers and is less willing to offer high quality to insured consumers irrespective of its preference weighting.

Harrison and Lybecker (2005) also employ a modified Bertrand model to examine the effect of various nonprofit objectives on the competition between nonprofit and for-profit hospitals. In particular, they study the impact of the profit motive pursued by the nonprofit firm on prices, quantity of patients served, uncompensated care, and quality of care. The objective of the nonprofit hospital is assumed to be a convex combination of a nonprofit motive (quantity, care for the needy, and quality) and for-profit motive. The specification of the nonprofit objective significantly affects the character of the competition. When the nonprofit motive is quantity maximization, prices increase for both hospitals as the nonprofit objective moves away from the nonprofit motive toward the for-profit motive. If the care for the needy is the nonprofit motive, then both prices decline with the higher weight put on profit. The quantity of uncompensated care decreases with the shift toward the profit motive. With the quality maximization being the nonprofit mo-

tive the nonprofit firm produces a higher quality at a higher price than the for-profit firm. If the nonprofit hospital puts a higher weight on profit, it tends to decrease quality and price. Then the for-profit hospital can better compete on quality and increases both quality and price of its services. These results are identical to results in Chapter 2.

In light of these models and the empirical evidence on consumers' sorting between the two sectors, it seems to be important to explore mixed competition when firms serve consumers with a heterogeneous taste for quality. In Chapter 2, I analyze the sorting of heterogeneous consumers between one nonprofit and one for-profit firm. The demand is derived from consumers' preferences. Competing firms are assumed to optimize with respect to two strategic variables: quality and price. In Chapter 3, the robustness of the analysis of mixed competition is checked with respect to the choice of the nonprofit objective and for one of these objectives, quality maximization, also with respect to a variety of cost configurations.

1.5 Conclusion

Despite the considerable literature on the nonprofit sector, we do not know much about entrepreneurs that enter the nonprofit sector, how their motivations translate into nonprofit objectives, and how different objectives affect the competition in mixed industries.

These struck me as the main problems I encountered while becoming familiar with the nonprofit literature. Do entrepreneurs entering the nonprofit sector differ from those that choose the for-profit sector? Entrepreneurial sorting depends on the incentive mechanism in the nonprofit sector relative to what the for-profit sector offers. The altruistic entrepreneurial type is not the only type that is attracted to the nonprofit sector. Theoretical studies show that also self-interested entrepreneurs opt for the nonprofit ownership form. The situation in the Czech nonprofit sector in 1990s makes it even clearer that weak regulations and enforcement of given rules open doors for entrepreneurs

motivated by profit rather than social goals usually attributed to nonprofit entrepreneurs. How is the entrepreneurial choice affected by weak enforcement of the non-distribution constraint? How does it affect the quality of products and services provided by nonprofit institutions? We attempt to answer these questions in Chapter 4.

A number of interesting questions relates to the competition of nonprofit and for-profit firms, i.e. firms with different constraints and objectives, within an industry. Can different objectives survive in competitive markets? Does the nonprofit firm offer a different quality when it competes with other nonprofit rather than for-profit firm? How do different nonprofit objectives affect equilibrium qualities, prices, and welfare? I focus on these questions in Chapter 2 and Chapter 3.

Since the character of the competition depends on assumed objectives of nonprofit firms, empirical studies on competition in mixed industries should account for differences in objectives of nonprofit and for-profit institutions. For that we need to know the real objective functions of nonprofit firms and whether and how they are affected by entrepreneurial/managerial motivations. Ultimately, this is an empirical question that is complicated by the fact that entrepreneurial motivations may differ across and within industry sectors. Knowing real nonprofit objectives, it would be possible to analyze their impact on equilibrium outcomes in mixed industries and to examine the benefits of nonprofit firms in these industries given the advantages they enjoy.

Chapter 2

Models of Competition between One Nonprofit and One For-profit Firm

Abstract

To study the coexistence of two different ownership forms within an industry, I develop a simple model of competition between one for-profit and one nonprofit firm. The two firms have different objectives and face different constraints due to their choice of ownership status. Firms compete over quality and price in the market for an excludable public good. Assuming heterogenous consumers, I derive quality-price bundles provided by the two firms and their market shares under various conditions.

2.1 Introduction

The focus of this paper is competition between one nonprofit and one for-profit firm, i.e. firms characterized by different ownership forms, in the market for an excludable public good. Properties of private good duopolies are well known. Less is known about excludable public good duopolies and even less about mixed competition in markets for excludable public goods. However, mixed competition between nonprofit and for-profit firms is common in many service industries offering excludable public goods such as health care, education, theatrical production, orchestras, as well as sport and recreational clubs (Rose-Ackerman, 1996).

Different ownership forms mean different objectives and constraints and imply different behavior of nonprofit and for-profit firms in the market. In comparison to for-profit firms, nonprofit organizations are given several advantages including exemption from paying certain taxes and regulatory breaks (Facchina et al., 1993). Moreover, they are more likely to receive donations that have the effect of subsidies. In return, nonprofits, through non-distribution and reasonable compensation constraints, may not distribute profits to managers. Instead, they are expected to use their profits for enhancing quality, lowering price, or offering price discounts for indigent consumers.[1]

Although the theoretical and empirical research has been analyzing the distinctive nature and performance of these two types of firms, usually it treated them separately, ignoring the interaction between their production decisions. Modeling the coexistence of the two ownership forms and links between their production decisions are topics of empirical studies mainly on the competition in health care (e.g. Kessler and McClellan, 2001; Grabowski and Hirth, 2003) and a few recent theoretical studies.

[1] In the present paper, I focus only on quality enhancements. For the basic model, I assume that the non-distribution and reasonable compensation constraints do not introduce inefficiencies although I discuss the effect of inefficiency in the nonprofit firm.

Based on Hansmann's theory of contract failure[2], Hirth (1999) builds a model of competition between for-profit and nonprofit nursing homes. Hirth assumes two types of consumers - informed and uninformed about the quality of care provided by individual nursing homes. In the equilibrium with strict enforcement of the non-distribution constraint (which is my focus in this chapter, but see the chapter on weak enforcement), the existence of 'for-profits-in-disguise' is not feasible. There are only honest nonprofit homes. Uninformed consumers patronize nonprofit homes, which deliver higher quality and charge a higher price than for-profit homes. For specific values of parameters, it is even possible that the quality produced in the for-profit sector equals the quality of nonprofit products, but the price of the for-profit product is lower than the price of the nonprofit product. Hirth also analyzes situations when the non-distribution constraint is moderately or weakly enforced. In such cases, nonprofit status signals trustworthiness only under certain conditions or not at all.

Hirth (1999) sketches also a full information model where consumers have different preferences for quality. Nonprofit firms choose a market niche corresponding to their objectives, leaving the residual demand to for-profit firms. Specifically, if nonprofits want to deliver high quality, for-profit firms would (are forced to) take the low quality niche. Hirth suggests that if nonprofits would be eliminated, for-profit firms would replace them, still providing the optimal quality spectrum. However, as I show in the model presented in this chapter, if the costs of producing high quality are too, high for-profit firms might not be willing to produce as high a quality as nonprofit firms would.

Four other theoretical studies look at mixed (nonprofit - for-profit) duopolies from various points of view. Lien (2002) models mixed competition *à* la Cournot for the provision of a homogeneous private good and analyzes the

[2]Hansmann's theory is the dominant theory of nonprofits and says that nonprofit organizations are an institutional response to information asymmetries in markets where quality and effort are adjustable (Hansmann, 1980). Because of the non-distribution and reasonable compensation constraints, nonprofits do not have incentives to exploit market asymmetries. They (are "forced" to) deliver higher quality than their for-profit counterparts.

effect of the profit tax on the amount produced by the two competitors. Liu and Weinberg (2004) focus on Bertrand competition with a varying degree of product substitutability. The other two studies, Friesner and Rosenman (2001) and Harrison and Lybecker (2005), examine mixed competition in a modified Bertrand setting that means that the two firms compete over prices and qualities.

In the present paper, I also employ the modified Bertrand setting to model mixed competition in an art performing industry such as theatrical production. In contrast to previous studies, the demand is derived from consumers' preferences for the quality of an excludable public good. The provision of excludable public goods by both nonprofit and for-profit firms was previously analyzed. Ben-Ner (1986) studies the two forms separately and compares outcomes of nonprofit and for-profit monopoly. Preston (1989) focuses on goods having several characteristics with a varying degree of private and public benefits and shows that nonprofit firms tend to provide goods with a higher social component than their for-profit counterparts.

I analyze also the competition between identical firms, nonprofit and for-profit duopolies[3], and compare results with the case of a mixed duopoly, where one nonprofit firm competes with one for-profit firm. Throughout the paper, I assume positive production costs that are independent of quantity and monotonically increasing in quality. The cost functions of for-profits and nonprofits are identical. Given cost configurations and consumer demand, I answer the following questions: How do differences in objectives and constraints affect quality-price pairs supplied by competing firms? What are the market shares of competing firms?

Although the specific parametrization of the model is a limitation, I derive several interesting results that are likely to be robust in a wider range of parametrization (see extension chapter). In a mixed duopoly, the nonprofit firm acts as a "natural leader" and occupies the high quality niche while the

[3]Monopolistic competition between identical for-profit firms was studied by Shaked and Sutton (1982), among others.

for-profit firm satisfies consumers with smaller preferences for quality. The top quality under a mixed duopoly is higher than the top quality in both symmetric duopolies: nonprofit and for-profit. With respect to potential inefficiency of the nonprofit firm, the for-profit firm prefers to compete with an efficient non-profit competitor because of larger product differentiation that ensures larger profit for the profit maximizer.

The structure of the paper is as follows. To better understand the impact of different objectives for product price and quality, I discuss first the two cases with only one firm in the market: a single for-profit firm and a single nonprofit firm (Section 2.2.1). Then, I proceed with models of duopoly (Section 2.2.2): for-profit versus for-profit firm; nonprofit versus nonprofit firm; and finally mixed industry. For duopoly cases, two different structures of the game are analyzed. In sequential choice firms first choose quality of production and then decide the price. In simultaneous choice, both firms choose their prices and qualities at the same time. In the third section, I summarize the results obtained and discuss several generalizations of the model. The fourth section concludes. Computational details are described in Appendix 2.A on page 59.

2.2 Model

The demand side is populated by a continuum of heterogeneous consumers. Specifically, consumers differ in their taste for quality, although they have the same wealth, w. Consumers can consume two goods: a public good and a private good. The public good is assumed to be a nonrival excludable public good (e.g. a play, concert, or art exhibition) and is provided by the nonprofit firm or the for-profit firm, or both. It is characterized by quality, q, and price, $p \leq w$. Consumers differ in their preferences for the quality of the public good. Their heterogeneity is modeled by a taste parameter, θ, that is uniformly distributed over the interval $\langle 0, 1 \rangle$. According to their preferences, consumers buy one or zero (non-buying option) units of the public good in total, i.e. they can either buy the nonprofit product, the for-profit product,

or buy nothing. The private good can be purchased outside the market of our interest. It is characterized by quantity, x, and its price, p_x, is set equal to one. The utility function, $U_i(\theta_i q, x) = \theta_i q + x$, is increasing in the consumption of both goods, public and private.

Consumer i's optimization problem is

$$\max_{j,x} \theta_i q_j + x \quad \text{s.t.} \quad p_j + x = w,$$

where $j = n, f, z$ stands for the (q, p)-bundles offered. The nonprofit firm offers (q_n, p_n), the for-profit firm produces (q_f, p_f), and $(q_z, p_z) = (0, 0)$ represents the non-buying option (denoted by z as a zero quality). Note that consumers do not choose along a continuous budget constraint, but are offered only three (q, p)-bundles to choose from (see Figure 2.1). The for-profit and nonprofit bundle is determined by firms' maximization problems described below.

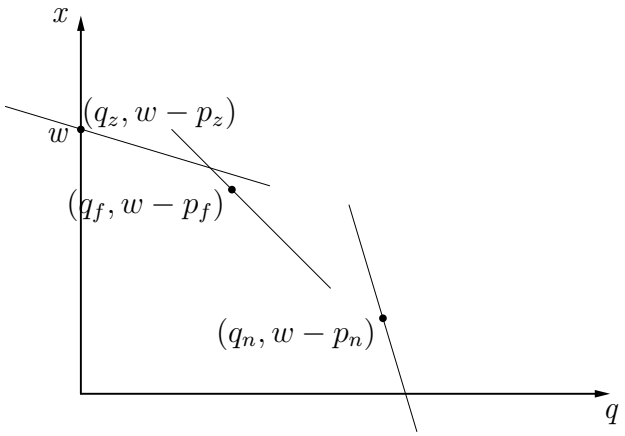

Figure 2.1: Three Quality Price Bundles Offered

The public good, as mentioned, is supplied by the nonprofit (NP) and for-profit (FP) firm. The NP firm is assumed to maximize quality and is restricted from distributing profits.[4] This means that the NP firm invests its

[4]An alternative objective function of the NP firm is a combination of quality and quantity (Newhouse, 1970) or as in Hansmann (1981), who focuses on art performing firms, quality, audience, or budget maximization. The focus of the present paper is quality maximization.

profits in further quality enhancement or alternatively, decreases price to increase its market share. The realization of profits and investments in quality or price subsidization happen in the same period, i.e. the NP firm, in fact, faces a zero-profit constraint. The FP firm maximizes profit.

The costs of producing the public good are described by $c(q)$, which is an increasing function in quality, q, with increasing MC (i.e. it is convex in q).[5] As mentioned, the public good is assumed to be an excludable and nonrival good whose costs are independent of the number of consumers. This means the costs, $c(q)$, incurred are in fact the fixed costs of producing quality q. This is a reasonable assumption for art performing industries where fixed costs stand for the major part of total costs and variable costs are negligible (Hansmann, 1981). For the NP firm's production costs, I assume that all the advantages mentioned (tax exemption, regulatory breaks, and donations) are aggregated in a subsidy, s. Thus, the NP firm's costs are $(1-s)c(q)$. Throughout the paper I use the quadratic cost function that has linearly increasing marginal costs of quality.[6]

Reaction functions come from the maximization problems of the two types of firms:

$$\begin{aligned} \text{NP}: &\quad \max_{q_n, p_n} q_n \quad \text{s.t.} \quad t_n p_n = (1-s)c(q_n) \quad \text{and} \\ \text{FP}: &\quad \max_{q_f, p_f} t_f p_f - c(q_f), \end{aligned}$$

where t_n and t_f represent shares of consumers that purchase the public good from NP and FP respectively. These shares are, as I will show later, in fact functions of the products' characteristics, q_n, p_n, q_f, and p_f. t_z, analogously, represents the share of consumers that prefer the non-buying option. Thus, the condition on market shares is $t_n + t_f + t_z = 1$.

[5] Note that the MC refers here to the quality margin.

[6] This is to keep the analysis as simple as possible. Towards an exploration of the robustness of my results for quadratic cost functions, I also use in Chapter 3 a scaled quadratic and shifted cubic cost function.

2.2.1 Monopoly

In the following two sections, I analyze cases when there is a single firm in the market, either one nonprofit or one for-profit firm. I'm interested in quality-price pairs that would be produced by the two different firms. I put aside, for now, the question why there is a single firm in the market, and I also ignore the problem of potential entrants.

For-profit (FP) Monopoly

In this section, I study the case when only the FP product and the non-buying option, (q_z, p_z), are available to consumers. To determine demand for the FP product, we need to characterize a pivotal consumer with taste parameter $\tilde{\theta}$. This consumer is indifferent between consuming the FP product and not buying the public good at all. Formally, $\tilde{\theta}$ solves $U(\tilde{\theta}q_f, w - p_f) = U(\tilde{\theta}q_z, w - p_z)$. Using the utility function specified above, this equation characterizes the pivotal consumer through her taste parameter, $\tilde{\theta} = \frac{p_f}{q_f}$.

The FP firm supplies its product to all consumers with a sensitivity parameter of at least $\tilde{\theta}$, and its market share is $1 - \frac{p_f}{q_f}$. The FP firm chooses q_f and p_f to optimize

$$\max_{q_f, p_f} \left(1 - \frac{p_f}{q_f}\right) p_f - q_f^2.$$

The FP firm chooses quality such that $MR = MC$ (with MC referring to the quality margin) and price such that $MR = 0$. The solution to this problem, given the assumption on uniformly distributed tastes for quality, is $(q_f, p_f) = (0.1250, 0.0625)$. The FP firm supplies its product to the upper segment of the market and serves one-half of the market, i.e. consumers with a sensitivity parameter of at least $1/2$. The profit of the FP firm is 0.0156.

Nonprofit (NP) Monopoly

In this case, consumers opt between the NP bundle, (q_n, p_n), and the non-buying option. The pivotal consumer is characterized by $\tilde{\theta} = \frac{p_n}{q_n}$.

The NP's market share is $1-\tilde{\theta} = 1-\frac{p_n}{q_n}$. The NP firm chooses the (q_n,p_n)-pair that maximizes quality given the non-distribution constraint:

$$(1 - \frac{p_n}{q_n})p_n = (1 - s)q_n^2.$$

The solution for the NP firm's maximization problem, given the assumption on uniformly distributed tastes for quality, is $(q_n, p_n) = \left(\frac{1}{4(1-s)}, \frac{1}{8(1-s)}\right)$ with $(q_n, p_n) = (0.2500, 0.1250)$ for $s = 0$. Both q_n and p_n are increasing in s. For all $s \in \langle 0, 1\rangle$, the NP firm serves half of the market (the upper segment), i.e. consumers with $\theta_i \geq 1/2$ buy the NP product while those who value the quality of the public good less prefer the non-buying option.

With the NP firm maximizing a linear combination of quality and market share, i.e. $max_{q_n,p_n} bq_n + (1 - b)(1 - \frac{p_n}{q_n})$ s.t. $(1 - \frac{p_n}{q_n})p_n = (1 - s)q_n^2$, where $b \in \langle 0, 1\rangle$, an interior solution exists only for $b \in (1/2, 1\rangle$. For a lower weight on quality maximization and a correspondingly higher weight on market share maximization, there is only a corner solution $(q_n, p_n) = (0, 0)$. Intuitively, the market share of the NP firm is maximized at $p_n = 0$ (in such a case, its market share equals 1). At zero price, the NP firm's revenue is zero for any market share; thus, to satisfy the zero profit constraint it can produce only zero quality. When quality maximization becomes more important, the NP firm finances the production of higher quality by increasing its price. Its market share, however, declines.[7].

Comparison: FP versus NP Monopoly

Comparing the FP and NP monopoly outputs derived in the previous two sections, both monopolies supply to the upper half of the market. The quality

[7]Equilibria for $s = 0$ and $b > 1/2$ are presented in Section 2.A.1.

delivered and price charged by the NP firm is, however, higher than in the FP case. Specifically for $s = 0$, we have $(q_n, p_n) = (2q_f, 2p_f)$. The nonprofit firm, under the assumption of quality maximization, invests its potential profit and available subsidies only into quality enhancement. It does not subsidize price to increase market share. Conversely for increased quality, consumers' willingness to pay is higher, and the NP firm is able to increase price. If the NP firm would also give positive weight to market share maximization, it would start to subsidize price in order to increase market share.

2.2.2 Duopoly

In this section, I proceed with analyzing firms' choice of (q, p)-pairs when there are two firms in the market. I start with competition between two identical FP firms, then turn to the competition between two identical NP firms, and finally focus on the coexistence of one FP and one NP firm. In all three cases, I analyze a one-stage game ("simultaneous choice") and a two-stage game ("sequential choice"). In the one-stage game, the two firms simultaneously choose their qualities and prices. In the two-stage game firms are assumed to choose qualities simultaneously in the first stage. In the second stage, they choose prices given optimal qualities. This seems to be a reasonable assumption since price can be adjusted more easily than the quality of production.

Independently of the ownership form of competing firms there are two different qualities at different prices provided (plus the non-buying option is available) in the duopoly.[8] The three bundles are similar to those depicted in Figure 2.1 [the $(q_h, w - p_h)$ bundle would replace the NP bundle from Figure 2.1 and the $(q_l, w - p_l)$ bundle would replace the FP bundle]. The market is divided into three segments: consumers buying the high-quality product (q_h); consumers buying the low-quality product (q_l); and consumers who do not buy the public good at all (non-buying option).

[8]The reasoning why this is so for all types of duopolies studied here is given in other sections.

The taste for quality is again assumed to be uniformly distributed. Then the sensitivity parameter of the consumer indifferent between the high-quality and low-quality product, $\overline{\theta}$, and of the consumer indifferent between the low and zero quality, $\underline{\theta}$, are the following:

$$U(\overline{\theta}q_h, w - p_h) = U(\overline{\theta}q_l, w - p_l) \Rightarrow \overline{\theta} = \frac{p_h - p_l}{q_h - q_l};$$
$$U(\overline{\theta}q_l, w - p_l) = U(\overline{\theta}q_z, w - p_z) \Rightarrow \underline{\theta} = \frac{p_l - p_z}{q_l - q_z} = \frac{p_l}{q_l}.$$

The market share of the high-quality producer is, therefore, $t_h = 1 - \overline{\theta}$, and the low-quality producer supplies a $t_l = (\overline{\theta} - \underline{\theta})$-fraction of the market. The rest of the consumers, $\underline{\theta}$, prefer the non-buying option to both the high-quality and low-quality products.

FP Duopoly - Simultaneous Choice

The two FP firms simultaneously choose quality and price to maximize their profits. Their optimization problems are as follows:[9]

$$\text{FP}_h: \quad \max_{q_h, p_h} \left(1 - \frac{p_h - p_l}{q_h - q_l}\right) p_h - q_h^2 \quad \text{and}$$
$$\text{FP}_l: \quad \max_{q_l, p_l} \left(\frac{p_h - p_l}{q_h - q_l} - \frac{p_l}{q_l}\right) p_l - q_l^2.$$

Note that in equilibrium, the two FP producers offer different qualities at different prices. Producing the same quality and charging equal prices can not be an equilibrium since both producers have incentives either to slightly increase quality or slightly decrease price in order to gain all the consumers who want to purchase the public good. Producing the same quality and charging different prices (or alternatively offering different qualities at a single

[9]In this problem, I assume that the market size is normalized to 1. In Appendix 2.A.2, I derive a solution to a more general case, where a positive parameter a represents a possible increase/decrease in the market size. The reason is that in the case of fixed production costs, the increase/decrease in the market size translates into higher/smaller profits available for for-profit firms or into higher/smaller quality in the case of nonprofit producers.

price) is not optimal for the producer with a higher price (or lower quality), who earns zero or negative profit (zero revenue while costs are greater than or equal to zero). Thus, two FP firms offer two different qualities at different prices, i.e. enjoy a locally monopolistic position and earn positive profits.

The equilibrium is $(q_h, q_l, p_h, p_l) = (0.12, 0.04, 0.05, 0.01)$.[10] Corresponding market shares and profits are: $t_h = 0.54, t_l = 0.27, \Pi_h = 0.01$, and $\Pi_l = 0.0005$. Thus, the firm producing high quality delivers slightly lower quality and charges a lower price than the FP monopoly. It, however, serves more than one-half of the market while the FP and NP monopolies serve exactly one-half of the market. The firm producing low quality serves more than one-quarter of the market. The two firms do not supply to the whole market because a positive share of consumers prefers the non-buying option to products offered by the two firms.[11] Both firms earn positive profits.

FP Duopoly - Sequential Choice

In this section, it is assumed that producers decide about their choice variables in two stages. First they simultaneously choose qualities to maximize their profits. Then, given optimal qualities, they choose optimal prices.

Similarly to the simultaneous choice, different qualities and different prices are chosen by the two FP firms. The choice of the same quality would lead to Bertrand competition in the second stage. As a result firms would earn negative profits equal to fixed costs. If they choose different qualities, profits are strictly positive. The choice of the same price when qualities are different is not optimal since the firm with lower quality loses all its customers.

[10] First order conditions and the analytical solution are in Section 2.A.2. In the case of the FP duopoly, the simultaneous choice and also the sequential choice have two asymmetric equilibria in which one or the other firm produces high quality. The problem with the asymmetric equilibria is that both firms want to produce high quality but the high-high combination is not an equilibrium. Also a symmetric equilibrium exists that I do not specify here in which the two firms play a mixed strategy.

[11] In Shaked and Sutton (1982), the two top firms cover the whole market since the consumer with the lowest taste for quality has strictly positive preferences for quality.

To solve the problem, I start by analyzing the second stage - simultaneous choice of optimal prices. Given optimal q_h and q_l, producers set prices to optimize profits:

$$\begin{aligned} \text{FP}_h: \quad & \max_{p_h} \left(1 - \frac{p_h - p_l}{q_h - q_l}\right) - q_h^2 \quad \text{and} \\ \text{FP}_l: \quad & \max_{p_l} \left(\frac{p_h - p_l}{q_h - q_l} - \frac{p_l}{q_l}\right) - q_l^2. \end{aligned}$$

This is equivalent to optimizing their revenues since production costs are treated as a constant at this stage (fixed costs of producing a certain quality level). Optimal prices are $p_h^*(q_h, q_l) = \frac{2q_h(q_h - q_l)}{4q_h - q_l}$ and $p_l^*(q_h, q_l) = \frac{q_l(q_h - q_l)}{4q_h - q_l}$.[12]

In the first stage, producers choose optimal qualities given optimal prices $p_h^*(q_h, q_l)$ and $p_l^*(q_h, q_l)$:

$$\begin{aligned} \text{FP}_h: \quad & \max_{q_h} \frac{4q_h^2(q_h - q_l)}{(4q_h - q_l)^2} - q_h^2 \quad \text{and} \\ \text{FP}_l: \quad & \max_{q_l} \frac{q_h q_l(q_h - q_l)}{(4q_h - q_l)^2} - q_l^2. \end{aligned}$$

The equilibrium is $(q_h, q_l, p_h, p_l) = (0.13, 0.02, 0.05, 0.01)$, with $t_h = 0.53, t_l = 0.26, \Pi_h = 0.01$, and $\Pi_l = 0.0008$.

Comparison: FP Duopoly - Simultaneous versus Sequential Choice

Table 2.1 summarizes the results of the two previous sections

Choice	q_h	q_l	p_h	p_l	t_h	t_l	Π_h	Π_l
sim	0.1242	0.0364	0.0474	0.0069	0.5395	0.2698	0.0101	0.0005
seq	0.1267	0.0241	0.0538	0.0051	0.5250	0.2625	0.0122	0.0008

Table 2.1: FP Duopoly – Simultaneous and Sequential Choice

[12] See Section 2.A.3 for computational details.

The two FP firms are better off when they optimize the choice of quality and price in two stages. Prices are chosen in the same way in both cases, but there is larger quality differentiation in the sequential game. The market share served in the sequential game is smaller than in the simultaneous game and profits earned by the two firms are higher. This is due to the additional information the firms have about qualities actually chosen in the first stage. Knowing that they have an opportunity to adjust prices to the chosen qualities in the second stage, firms choose a better 'location' in the market in the first stage. The optimal 'location' choice corresponds to maximal differentiation. It increases the monopolistic power of the two firms in their 'locations', and firms can exploit consumers' willingness to pay.

NP Duopoly - Simultaneous Choice

Similar to the FP duopoly in Section 2.2.2, the two NP firms simultaneously choose their qualities and prices. The NP's objective is quality maximization rather than profit maximization. The NP firms, in addition, face the zero profit constraint. The qualities offered by the two NP firms are expected to be, therefore, higher than qualities produced by two FP firms. This is true even in the case of zero subsidy.[13] Optimization problems of the two NP firms are as follows

$$\text{NP}_h: \quad \max_{q_h, p_h} q_h \ \text{ s.t. } \ \left(1 - \frac{p_h - p_l}{q_h - q_l}\right) p_h = q_h^2 \quad \text{and}$$

$$\text{NP}_l: \quad \max_{q_l, p_l} q_l \ \text{ s.t. } \ \left(\frac{p_h - p_l}{q_h - q_l} - \frac{p_l}{q_l}\right) p_l = q_l^2.$$

[13] In this section I assume that $s = 0$. A strictly positive subsidy would lead to higher qualities offered by the two firms. They are, however, expected to proportionally move toward higher quality if they have the same cost structure. In reality, it might be the case that s is different for the two NP firms. For instance, the NP firm producing high quality most probably receives larger donations because consumers preferring high quality have a higher willingness to pay while they pay a price equal to the willingness to pay of the pivotal consumer. Hansmann (1981) argues that a big part of contributions is received from those who attend the performance. Donations then correspond to voluntary price discrimination. This is true also for colleges and universities whose donations from alumni can be conceptualized as deferred fee payments. In the present paper I, nevertheless, ignore consumers' opportunities to donate.

As in the FP duopoly, two different qualities at different prices are produced by two NP firms. Rather than profit, the NP firms maximize the quality of their products. The quality offered by the NP monopoly is not feasible when there are two NP firms. The production costs of two units of such a high quality are twice as high as the production costs of one unit, while the revenue is the same. This would mean negative profits for both NP firms producing such a high quality. A quality they could together produce is half of that produced by the NP monopoly. However, that cannot be the equilibrium outcome of the NP duopoly since both firms have an incentive to increase their own quality and charge a higher price. Higher qualities are, however, feasible only if the two products are differentiated and attract different consumers. Thus, two NP firms, like FP firms, produce two different qualities and charge different prices.

Specifically, the equilibrium is $(q_h, q_l, p_h, p_l) = (0.2133, 0.0533, 0.0853, 0.0107)$.[14] The corresponding market shares are $t_h = 0.5333, t_l = 0.2667$, and profits of the two firms are zero due to the zero profit constraint ($\Pi_h = \Pi_l = 0$).

NP Duopoly - Sequential Choice

In sequential choice, NP firms first optimize with respect to quality and then, knowing the optimal qualities, they choose prices. Prices are, however, automatically determined by qualities through the zero-profit constraint. NPs in fact, have no choice in the second stage and sequential choice leads to the same solution as simultaneous choice.[15]

[14] Similarly to the FP duopoly, there are again two asymmetric equilibria with both firms in the market, in which one or the other firm produces high quality. Again both firms prefer the high-quality production to the low-quality production, but the high-high combination is not an equilibrium. It is, however, reasonable to assume that the objective of the low-quality firm would shift away from the quality maximization, but this is a subject for future research. There is also one symmetric equilibrium (not specified here) in which the NP firms play a mixed strategy. There are, however, two asymmetric equilibria with only one firm in the market, in which one or the other NP firm delivers the NP monopoly outcome.

[15] For completeness, first order conditions and the analytical solution are in Appendix 2.A.5.

Comparison: NP Duopoly - Simultaneous versus Sequential Choice

The equilibria for simultaneous and sequential choice with two NP firms are the same.

Comparison: FP versus NP Duopoly

In the FP duopoly sequential choice leads to a larger quality differentiation. In contrast, the quality differentiation is not attractive to two NP firms that aim to maximize quality. Increasing the top quality means moving toward the NP monopoly output that does not allow a lower quality to exist in the market.

In the NP duopoly, the qualities offered are higher than in the FP duopoly.[16] The market share is slightly lower than in the FP case: 0.80 compared to 0.81.

Mixed Duopoly - Simultaneous Choice

In the previous two sections, I examined the segmentation of the market when there are two producers of the same type. In this section, I analyze the possible coexistence of one NP and one FP firm within an industry. Recall that the NP has to satisfy the non-distribution constraint (=zero-profit constraint) and is assumed to maximize quality. In addition, the NP firm has a cost advantage due to the availability of subsidies (tax exemption, regulatory breaks, and donations) stemming from its NP status. The FP firm is assumed to maximize profit.

In the mixed duopoly, it is not reasonable for the FP firm to choose the

[16]To compare the top qualities in simultaneous choice of two FP firms to two NP firms starting from FP's quality, the NP firm has to satisfy the zero profit constraint; thus, it can invest the FP's profit (0.01) into quality enhancement. This allows ,it to increase quality from 0.12 to approximately 0.16. The increased quality positively affects consumers' willingness to pay, and the NP firm is able to increase price and thus enhance quality further.

same quality as the NP firm. Since the NP firm aims to break even, the FP firm choosing the same quality would imply zero (if $s = 0$) or negative (if $s > 0$) profit. Moreover, similar to the NP duopoly case, the same quality produced by two firms is significantly lower than the quality produced by the NP monopoly. The NP firm in the mixed duopoly, therefore, has an incentive to increase quality. Thus, two different qualities at different prices are offered also in the mixed duopoly with the higher quality being provided by the NP firm.

The above argument also rules out the case of the FP catering to the top end of the market and the NP producing a lower quality. The FP firm would produce the top quality only if it is a profitable option. The NP firm can, however, produce the same quality at a lower price than the FP has to charge. Alternatively, the NP firm can produce a higher quality than the FP firm at a price equal to the FP price. In both cases, consumers previously served by the FP firm would now prefer the NP product. The FP firm would be forced to produce a lower quality than the NP firm. Thus, unlike the FP duopoly and NP duopoly cases, there is a natural 'leader' solving the coordination problem in the mixed duopoly.

The two maximization problems are the following:

$$\begin{aligned} \text{NP}: \quad & \max_{q_n, p_n} q_n \ \text{ s.t. } \ (1 - \frac{p_n - p_f}{q_n - q_f}) p_n = (1 - s) q_n^2 \quad \text{and} \\ \text{FP}: \quad & \max_{q_f, p_f} \left(\frac{p_n - p_f}{q_n - q_f} - \frac{p_f}{q_f} \right) p_f - q_f^2. \end{aligned}$$

First order conditions and a general solution can be found in Appendix 2.A.6 on page 63. Specifically, if $s = 0$, the two firms choose in equilibrium the following qualities and prices: $(q_n, q_f, p_n, p_f) = (0.2299, 0.0337, 0.1019, 0.0075)$. The corresponding market shares and profits are $t_n = 0.5190, t_f = 0.2595$, and $\Pi_n = 0, \Pi_f = 0.0008$.

Mixed Duopoly - Sequential Choice

In this section, I analyze the competition between one NP and one FP firm when they decide about qualities and prices in two stages. First, they simultaneously choose qualities. Second, knowing the chosen quality levels, both its own and the rival's, they set prices. The FP firm maximizes profit in both stages while the NP firm maximizes quality and then chooses price to satisfy the zero profit constraint.

Similar to the simultaneous case, there are two different qualities offered at different prices, and the NP firm produces high quality while the FP firm delivers low quality. Starting with the analysis of the second stage, the two maximization problems are as follows:

$$\begin{aligned} \text{NP}: &\quad \text{choose } p_n \text{ s.t } \left(1 - \frac{p_n - p_f}{q_n - q_f}\right) p_n = (1-s)q_n^2; \\ \text{FP}: &\quad \max_{p_f} \left(\frac{p_n - p_f}{q_n - q_f} - \frac{p_f}{q_f}\right) p_f - q_f^2. \end{aligned}$$

The optimal prices are

$$p_n^*(q_n, q_f) = \frac{q_n(q_n - q_f)}{2q_n - q_f} \quad \text{and} \quad p_f^*(q_n, q_f) = \frac{q_f(q_n - q_f)}{2(2q_n - q_f)}.$$

Using the optimal pricing strategies, in the first stage the two firms solve

$$\begin{aligned} \text{NP}: &\quad \text{choose } q_n = \frac{1 + 2(1-s)q_f + \sqrt{(1 + 2(1-s)q_f)^2 - 16(1-s)q_f}}{8(1-s)} \quad \text{and} \\ \text{FP}: &\quad \max_{q_f} \frac{q_n q_f (q_n - q_f)}{4(2q_n - q_f)^2} - q_f^2. \end{aligned}$$

The equilibrium for $s = 0$ is $(q_n, q_f, p_n, p_f) = (0.2323, 0.0308, 0.1079, 0.0071)$. The corresponding market shares and profits are $t_n = 0.5000, t_f = 0.2677$, and $\Pi_n = 0, \Pi_f = 0.0010$.

Comparison: Mixed Duopoly - Simultaneous versus Sequential Choice

First, there is a smaller product differentiation in simultaneous choice than in sequential choice in the mixed duopoly. Recall that larger differentiation in the sequential game was present in the FP duopoly but impossible in the NP duopoly. In the mixed duopoly, product differentiation coincides with producers' incentives since the NP firm wants to increase quality and the FP firm wants to increase its profit. The FP firm can exploit consumers' willingness to pay more the more different the NP product is.

When one FP and one NP co-exist, the NP firm produces quality (0.2299 in simultaneous choice and 0.2323 in sequential choice) that is close to the NP monopoly output (0.2500) and serves half of the market. The FP firm provides much lower quality, serves more than one-quarter of the market, and earns a positive profit.

The equilibria for positive subsidy[17] available to the NP firm and the case when the market size is doubled (i.e. $a = 2$) are shown in Appendix 2.A.6 on page 63. A positive subsidy means a comparative advantage for the NP firm, which is able to produce a higher quality. The subsidy, however, also helps the FP firm which is, after the NP's move toward a higher quality, able to increase its price and earn a higher profit. Note that the FP quality is decreasing with the subsidy given to the NP firm. The FP firm wants to enlarge product differentiation, which results in a higher profit.

Comparison: Mixed Duopoly versus FP and NP Duopoly

To emphasize the differences between quality-price bundles offered under various combinations of ownership types, Table 2.2 summarizes the equilibria

[17] Equilibria for simultaneous choice are computed for $s \in \langle 0, 0.9\rangle$ (see Section 2.A.6). The lowest values of subsidy (0.1 and 0.2) characterize commercial NP firms while higher subsidies characterize donative NP firms. Hansmann (1981, citing Baumol and Bowen 1968) reports that donations to art performing groups stand for between one-third and one-half of their income.

of sequential quality-price choices.

Type	q_h	q_l	p_h	p_l	t_h	t_l	Π_h	Π_l
$h = FP, l = FP$	0.13	0.02	0.05	0.01	0.53	0.26	0.0122	0.0008
$h = NP, l = NP$	0.21	0.05	0.09	0.01	0.53	0.27	0.0000	0.0000
$h = NP, l = FP$	0.23	0.03	0.11	0.01	0.50	0.27	0.0000	0.0010

Table 2.2: FP Duopoly, NP Duopoly, and Mixed Duopoly

$q_h(q_l)$ and $p_h(p_l)$ represent high (low) quality and prices. t_h, t_l, Π_h and Π_l are corresponding market shares and profits. The left-most column describes the duopoly type. For instance, $(h = NP, l = FP)$ represents the mixed duopoly since the NP firm delivers high quality (h), and the FP firm delivers low quality (l).

We can see that the market shares of the firms catering to the upper and lower end of the market are very similar across different combinations of ownership types: $0.50 - 0.53$ for the top product and $0.26 - 0.27$ for the low quality product. There are, however, large differences in qualities produced and prices charged. In the FP duopoly, the top quality (0.13) is significantly lower when compared to the other two cases (0.21 in the NP duopoly and 0.23 in the mixed duopoly). Surprisingly, the competition between an FP and an NP firm leads to a higher top quality than in the case of two NP firms. This can be explained by the attempt of the top firm to decrease its quality when the low quality increases.[18] This means if the competition is tougher (as in the case of two NP firms, or when firms decide simultaneously compared to sequentially), the top quality is lower so as to offer more competitive quality-price bundles and in this way to protect the market share of the top firm. If the NP firm competes with a FP firm, the NP firm does not decrease quality as much as in the case of two NP firms since the low quality offered by the FP rival is lower than the low quality produced by the NP competitor. The FP firm, in addition, maximizes profit, which means that the competition for the marginal consumer is not as tough as in case of the zero-profit competitor.

[18]This is true for sequential choice when the NP competes with the FP.

2.3 Discussion

In the preceding sections, I analyzed the coexistence of one NP and one FP firm within a market. The two firms choose simultaneously or sequentially qualities and prices. The choice of each firm affects its own but also the rival's market share. In the following subsections, I discuss several generalizations and extensions of the mixed duopoly model discussed in Section 2.2.2.

2.3.1 Inefficiency in the NP Firm

It is often argued that tax-exemption, donations, and lack of owners lower pressure on the NP's competitiveness and create an opportunity for productive inefficiency in NP firms (Newhouse, 1970; Rose-Ackerman, 1996). In this section, I analyze the impact of NP inefficiency on mixed competition that means on (q, p)-pairs offered by the FP and NP firm. Within the present model, the easiest way to capture exogenous inefficiency of the NP firm is to allow the subsidy, s, to be negative. In such a case, the NP firm has a comparative disadvantage introduced through higher production costs.

If an exogenously inefficient NP firm receives a subsidy, this shows up in the model as a net s that can be positive or negative. For example, a subsidy larger than the inefficiency is equivalent to a firm receiving smaller but positive subsidy.

In Table 2.3, I compare the equilibrium with $s = 0.3$ to equilibria with $s \in \langle -0.3, 0.0 \rangle$.

s	q_n	q_f	p_n	p_f	t_n	t_f	Π_n	Π_f
0.3	0.3388	0.0328	0.1568	0.0076	0.5124	0.2562	0	0.0009
0.0	0.2299	0.0337	0.1019	0.0075	0.5190	0.2595	0	0.0008
-0.1	0.2065	0.0340	0.0900	0.0074	0.5215	0.2607	0	0.0008
-0.2	0.1868	0.0343	0.0799	0.0073	0.5241	0.2620	0	0.0007
-0.3	0.1699	0.0347	0.0713	0.0073	0.5269	0.2634	0	0.0007

Table 2.3: Inefficiency in the NP Firm

In equilibrium the NP firm delivers the top quality even in the case of inefficient NP production.[19] This quality is, however, lower than in the case of efficient production. This is obvious since resources are spent for internal benefits rather than for quality enhancement. Due to the zero-profit constraint, the NP price decreases correspondingly. The NP firm now serves additional consumers that were previously served by the FP firm.

The NP product is 'closer' to the FP product now. The possibilities for positive profits shrink, and the FP firm is forced to offer a more competitive product, i.e. to increase the quality and decrease the price of its product. The market share of the FP firm slightly rises. It loses consumers with higher taste for quality (higher willingness to pay) in favor of the NP firm but gains new consumers with little taste for quality, who previously preferred the non-buying option. Overall, the profit of the FP firm declines. Interestingly, the FP firm prefers an efficient NP competitor or even better, an efficient NP competitor with positive subsidies.

2.3.2 Market Size

The effect of market size, a, (which I derive in Appendix 2.A.6 on page 63) is symmetric. Both qualities and prices are increasing in a. Market shares of competing firms are independent on a. If the market size is increased, numbers of consumers with a certain taste are increased equally and the proportion of high to low quality consumers stays the same. The increase in the market size, however, decreases fixed production costs per consumer served. Revenues of the two competitors are, therefore, higher and this corresponds to a higher quality provided by the NP firm and higher profit gained by the FP firm.

[19] The opposite is not true even for inefficiency close to one. Should the FP firm produce the top quality, the NP would leave the market, i.e. produce zero quality.

2.4 Conclusion

The coexistence of nonprofit and for-profit firms within an industry is common in many service fields. To date, few studies focused on mixed competition looking at interactions between the nonprofit and for-profit firms in various settings. In this chapter, I analyzed competition between one nonprofit and one for-profit firm in the market for an excludable public good. The two firms have different objectives, face different constraints, and compete over qualities and prices, i.e. in a modified Bertrand setting. In contrast to previous mixed duopoly models, I derive demand for the public good from consumers preferences and study also symmetric duopolies, two nonprofit competitors and two for-profit competitors, to compare optimal quality-price bundles offered by the two firms and their market shares.

Under the assumption of heterogeneous tastes for quality, the quality maximizing the nonprofit firm acts as a natural leader and produces the top quality in the market. The nonprofit firm sells its product to the upper segment of the market and serves slightly more than one-half of the market. The for-profit firm serves consumers with a lower willingness to pay, and its market share is slightly above one-quarter. The results are driven by different objectives rather than subsidies and tax advantages available to the nonprofit firm. For instance, under the assumption of fixed production costs, an increase in the market size results in a higher profit available to the for-profit firm while the nonprofit provider translates higher revenue into higher quality.

Comparing equilibria of symmetric and asymmetric duopolies, there is a significant difference between the top quality delivered in the for-profit duopoly and top qualities offered in the nonprofit and mixed duopoly. Surprisingly, the top quality is the highest in the mixed duopoly. Competition between two nonprofits actually forces the firm providing the top quality to decrease quality and price to remain competitive with the second nonprofit provider. This is because both nonprofit firms are assumed to maximize quality. In

reality, however, the provider left with a lower quality niche would probably switch to another objective. Such an adjustment of objectives is an interesting problem that should be addressed in future research.

Since the nonprofit firm can receive subsidies, their impact on equilibrium outcomes is discussed. Subsidies decrease production costs of the nonprofit firm that consequently, in line with its objective, increases quality. Consumers are willing to pay more for the increased quality, and the NP firm can use additional revenue for further quality enhancement. A positive subsidy given to the NP firm benefits also the FP firm. The upward shift of the NP firm to a higher quality widens quality differentiation what corresponds to lower competitive pressure. The FP firm is able to increase its profit by decreasing quality and price of its product. Market shares of both firms decline. The total market share served by the two firms, therefore, decreases with the subsidy given to the NP firm.

The models presented here are based on specific assumptions. Although Section 2.3 discusses some extensions (e.g. inefficiency in the NP firm) other interesting questions remain unanswered.

First, in the present models, I assumed that the NP firm maximizes quality. Quality maximization by the NP firm is a useful benchmark case since it illustrates how large the product differentiation could be if two competing firms have different objectives. In reality, NP firms may have more complicated objectives such as a combination of quality and market share maximization. Also, I assumed that consumers are identical in wealth. With wealth differences it would be possible to explore objectives of the NP firm such as serving indigents, a *quid pro quo* that constitutes a major rationale for various tax and regulatory breaks bestowed on NPs.

Second, in the analysis I put aside the possibility of entry by an additional firm. In the NP monopoly the entry of another firm, whether NP or FP, is not possible. It would be interesting to explore whether a third firm could enter the mixed duopoly or whether an entering NP firm could push the FP

firm out of the market.

In the extension of the present paper (see Chapter 3), I explore the mixed duopoly under various nonprofit objectives. Specifically, I assume that the nonprofit firm maximizes its own quality and market share or quality and market share of both competing firms. The robustness of the present analysis is also checked with respect to various cost configurations.

Appendix 2.A Computational Details

2.A.1 FP and NP Monopoly

FP: First order conditions

$$\frac{p_f^2}{q_f^2} - 2q_f = 0$$
$$1 - \frac{2p_f}{q_f} = 0$$

NP: First order conditions

$$1 - \mu(\frac{p_n}{q_n^2}p_n - 2(1-s)q_n) = 0$$
$$0 - \mu(1 - \frac{2p_n}{q_n}) = 0$$
$$(1 - \frac{p_n}{q_n})p_n - (1-s)q_n^2 = 0$$

The following table summarizes equilibrium outcomes from the NP monopoly with $s = 0$ and $b > 1/2$.

b	q_n	p_n	t_n
0.6	0.1389	0.0231	0.8333
0.7	0.2041	0.0586	0.7143
0.8	0.2344	0.0879	0.6250
0.9	0.2469	0.1097	0.5556
1.0	0.2500	0.1250	0.5000

2.A.2 FP Duopoly - Simultaneous Choice

The general formulation of the problem from Section 2.2.2 is as follows:

$$\text{FP}_h: \quad \max_{q_h, p_h} a(1 - \frac{p_h - p_l}{q_h - q_l})p_h - q_h^2;$$
$$\text{FP}_l: \quad \max_{q_l, p_l} a(\frac{p_h - p_l}{q_h - q_l} - \frac{p_l}{q_l})p_l - q_l^2,$$

where the positive parameter a represents market size. The first order conditions are the following:

$$\begin{aligned} p_h - (q_h - q_l + p_l)/2 &= 0; \\ ap_h \frac{p_h - p_l}{(q_h - q_l)^2} - 2q_h &= 0; \\ p_l - \frac{p_h q_l}{2q_h} &= 0; \text{and} \\ ap_l(\frac{p_h - p_l}{(q_h - q_l)^2} + \frac{p_l}{q_l^2}) - 2q_l &= 0. \end{aligned}$$

From the first and third equation, we can write prices as functions of qualities

$$p_h = \frac{2q_h(q_h - q_l)}{4q_h - q_l}, p_l = \frac{q_l(q_h - q_l)}{4q_h - q_l},$$

where $4q_h \neq q_l$. Plugging these expressions into the second and fourth equations we get the following system of two equations and two variables, q_h and q_l:

$$\begin{aligned} a(2q_h - q_l) &= (4q_h - q_l)^2 \quad \text{and} \\ aq_h^2 &= 2q_l(4q_h - q_l)^2 \end{aligned}$$

In equilibrium,

$$\begin{aligned} q_h &= \frac{a(26 + 7\sqrt{2})}{289} & q_l &= \frac{a(19 - 6\sqrt{2})}{289} \\ p_h &= \frac{2a(364 + 387\sqrt{2})}{4913(5 + 2\sqrt{2})} & p_l &= \frac{a(-23 + 250\sqrt{2})}{4913(5 + 2\sqrt{2})} \\ t_h &= \frac{2(364 + 387\sqrt{2})}{1479 + 1343\sqrt{2}} & t_l &= \frac{2272 + 5169\sqrt{2}}{11985 + 16643\sqrt{2}} \\ \Pi_h &= \frac{2a^3(366315 + 206587\sqrt{2})}{83521(751 + 569\sqrt{2})} & \Pi_l &= \frac{a^2(1720161 - 686644\sqrt{2})}{83521(7441 + 6305\sqrt{2})} \end{aligned}$$

2.A.3 FP Duopoly - Sequential Choice

Second stage - the choice of optimal prices

First order conditions to the problem in Section 2.2.2 are the following:

$$\begin{aligned} p_h - (q_h - q_l + p_l)/2 &= 0, \text{and} \\ p_l - \frac{p_h q_l}{2q_h} &= 0. \end{aligned}$$

Solving the system we get $p_h^*(q_h, q_l) = \frac{2q_h(q_h-q_l)}{4q_h-q_l}$ and $p_l^*(q_h, q_l) = \frac{q_l(q_h-q_l)}{4q_h-q_l}$.

First stage - the choice of optimal qualities
First order conditions are the following:

$$-\frac{32aq_h^2(q_h-q_l)}{(4q_h-q_l)^3} + \frac{4aq_h^2+8aq_h(q_h-q_l)}{(4q_h-q_l)^2} = 2q_h, \quad \text{and}$$
$$\frac{aq_h(q_h-q_l)-aq_hq_l}{(4q_h-q_l)^2} + \frac{2aq_hq_l(q_h-q_l)}{(4q_h-q_l)^3} = 2q_l.$$

2.A.4 NP Duopoly - Simultaneous Choice

First order conditions to the maximization problem (2.2.2) are

$$1+\mu(-2q_h+\frac{ap_h(p_h-p_l)}{(q_h-q_l)^2}) = 0;$$
$$\mu(a(1-\frac{p_h-p_l}{q_h-q_l})-\frac{ap_h}{q_h-q_l}) = 0;$$
$$-q_h^2+ap_h(1-\frac{p_h-p_l}{q_h-q_l}) = 0;$$
$$1+\nu(ap_l(\frac{p_h-p_l}{(q_h-q_l)^2}+\frac{p_l}{q_l^2})-2q_l) = 0;$$
$$\nu(ap_l(-\frac{1}{q_h-q_l}-\frac{1}{q_l})+a(\frac{p_h-p_l}{q_h-q_l}-\frac{p_l}{q_l})) = 0; \quad \text{and}$$
$$ap_l(\frac{p_h-p_l}{q_h-q_l}-\frac{p_l}{q_l})-q_l^2 = 0$$

From the first and fourth condition we see that μ and ν are non-zero. Therefore the second and fifth equation can be rewritten as

$$a(1-\frac{p_h-p_l}{q_h-q_l})-\frac{ap_h}{q_h-q_l} = 0; \quad \text{and}$$
$$ap_l(\frac{1}{q_h-q_l}+\frac{1}{q_l})-a(\frac{p_h-p_l}{q_h-q_l}-\frac{p_l}{q_l}) = 0.$$

From these two equations we get $p_h = \frac{2q_h(q_h-q_l)}{4q_h-q_l}$ and $p_l = \frac{q_l(q_h-q_l)}{4q_h-q_l}$.
For q_h and q_l non-zero and $4q_h \neq q_l$ FOCs numbers 3 and 6 can be then simplified to
$4a(q_h-q_l) = (4q_h-q_l)^2$ and

$aq_h(q_h - q_l) = q_l(4q_h - q_l)^2$.
The system can be solved for q_h and q_l and the equilibrium is
$(q_h, q_l, p_h, p_l, t_h, t_l, \Pi_h, \Pi_l) = (\frac{16a}{75}, \frac{4a}{75}, \frac{32a}{375}, \frac{4a}{375}, \frac{8}{15}, \frac{4}{15}, 0, 0)$.

2.A.5 NP Duopoly - Sequential Choice

First, the two NP firms choose prices:

$$\begin{aligned} \text{NP}_h: &\quad \max_{p_h} q_h \text{ s.t. } \left(1 - \frac{p_h - p_l}{q_h - q_l}\right) p_h = q_h^2, \quad \text{and} \\ \text{NP}_l: &\quad \max_{p_l} q_l \text{ s.t. } \left(\frac{p_h - p_l}{q_h - q_l} - \frac{p_l}{q_l}\right) p_l = q_l^2. \end{aligned}$$

First order conditions are:

$$\begin{aligned} \mu(a - a\frac{p_h - p_l}{q_h - q_l} - a\frac{p_h}{q_h - q_l}) &= 0; \\ a(1 - \frac{p_h - p_l}{q_h - q_l})p_h &= q_h^2; \\ \nu(a\frac{p_h - 2p_l}{q_h - q_l} - a\frac{p_l}{q_l}) &= 0; \text{and} \\ a(\frac{p_h - p_l}{q_h - q_l} - \frac{p_l}{q_l})p_l &= q_l^2. \end{aligned}$$

Focusing on the case when $\mu \neq 0$ and $\nu \neq 0$, the optimal prices are:

$$p_h^*(q_h, q_l) = \frac{2q_h(q_h - q_l)}{4q_h - q_l} \quad \text{and} \quad p_l^*(q_h, q_l) = \frac{q_l(q_h - q_l)}{4q_h - q_l}.$$

Then, the two firms simultaneously choose qualities:

$$\begin{aligned} \text{NP}_h: &\quad \max_{q_h} q_h \text{ s.t. } 4(q_h - q_l) = (4q_h - q_l)^2, \text{and} \\ \text{NP}_l: &\quad \max_{q_l} q_l \text{ s.t. } q_l(q_h - q_l) = q_2(4q_h - q_l)^2 \end{aligned}$$

First order conditions are:

$$\begin{aligned} 1 + \kappa(4a - 8(4q_h - q_l)) &= 0; \\ 4a(q_h - q_l) - (4q_h - q_l)^2 &= 0; \\ 1 + \lambda(-aq_h - (4q_h - q_l)^2 + 2(4q_h - q_l)q_l) &= 0; \text{and} \\ aq_h(q_h - q_l) - (4q_h - q_l)^2 q_l &= 0. \end{aligned}$$

The unique solution of the system above is $q_h = \frac{16a}{75}, q_l = \frac{4a}{75}, \kappa = \frac{5}{12a}$, and $\lambda = \frac{125}{96a^2}$. Using optimal q_h and q_l, we can derive equilibrium prices, market shares, and profits:
$p_h = \frac{32a}{375}, p_l = \frac{4a}{375}, t_h = \frac{8}{15}, t_l = \frac{4}{15}$, and $\Pi_h = \Pi_l = 0$.

2.A.6 Mixed Duopoly - Simultaneous Choice

First order conditions to the problem are:

$$\begin{aligned}
1 + \mu(a\frac{p_n - p_f}{(q_n - q_f)^2}p_n - 2(1-s)q_n) &= 0;\\
\mu(a - a\frac{p_n - p_f}{q_n - q_f} - ap_n\frac{1}{q_n - q_f}) &= 0;\\
a(1 - \frac{p_n - p_f}{q_n - q_f})p_n - (1-s)q - n^2 &= 0;\\
a\frac{p_n - p_f}{q_n - q_f} - a\frac{p_f}{q_f} - a\frac{p_f}{q_n - q_f} - a\frac{p_f}{q_f} &= 0; \text{and}\\
a\frac{p_n - p_f}{(q_n - q_f)^2}p_f + a\frac{p_f}{q_f^2}p_f - 2q_f &= 0.
\end{aligned}$$

From the first equation $\mu \neq 0$, thus the second equation can be rewritten as

$$a - a\frac{p_n - p_f}{q_n - q_f} - ap_n\frac{1}{q_n - q_f} = 0.$$

This equation together with the fourth equation implies

$$p_n = \frac{2q_n(q_n - q_f)}{4q_n - q_f} \text{and} p_f = \frac{q_f(q_n - q_f)}{4q_n - q_f},$$

with $q_n \neq q_f$,$q_f \neq 0$, and $4q_n \neq q_f$. The third and fifth equations then become

$$\begin{aligned}
4a(q_n - q_f) &= (1-s)(4q_n - q_f)^2, \quad \text{and}\\
aq_n^2 &= 2q_f(4q_n - q_f)^2.
\end{aligned}$$

There are two solutions to this system of two equations with two unknowns:
Solution 1:

$$(q_n, q_f) = (\frac{8a(170+71\sqrt{2(1+s)}+s(-26+\sqrt{2(1+s)}))}{(1-s)(97-s)^2}, \frac{4a(99+s-14\sqrt{2(1+s)})}{(97-s)^2}).$$

Solution 2:

$$(q_n, q_f) = \left(\frac{8a(170-71\sqrt{2(1+s)}-s(26+\sqrt{2(1+s)}))}{(1-s)(97-s)^2}, \frac{4(99a+as+14a\sqrt{2(1+s)})}{(97-s)^2}\right).$$

Solution 2 gives negative profit to the FP firm so the FP firm would not enter the market. The only equilibrium is, therefore, Solution 1. In the equilibrium the prices, market shares, and profits of the two competitors are

$$\begin{aligned}
p_n &= \frac{16a(241+s^2+156\sqrt{2(1+s)}+s(46-12\sqrt{2(1+s)}))(170+71\sqrt{2(1+s)}+s(-26+\sqrt{2(1+s)}))}{(1-s)(97-s)^3(13-s+6\sqrt{2(1+s)})};\\
p_f &= \frac{5a(99+s-14\sqrt{2(1+s)})(241+s^2+156\sqrt{2(1+s)}+s(46-12\sqrt{2(1+s)}))}{(97-s)^3(13-s+6\sqrt{2(1+s)})};\\
t_n &= \frac{4(170+71\sqrt{2(1+s)}+s(-26+\sqrt{2(1+s)}))}{(97-s)(13-s+6\sqrt{2(1+s)})};\\
t_f &= \frac{2(170+71\sqrt{2(1+s)}+s(-26+\sqrt{2(1+s)}))}{(97-s)(13-s+6\sqrt{2(1+s)})};\\
\Pi_n &= 0; \quad \text{and}\\
\Pi_f &= \frac{z}{(97-s)^4(13-s+6\sqrt{2(1+s)})^2}
\end{aligned}$$

where
$$\begin{aligned}
z = {} & 8a^2(1844112 + 1591649\sqrt{2(1+s)} + s(1515040 - 196004\sqrt{2(1+s)})\\
& + s^4(-80 + \sqrt{2(1+s)}) + 4s^3(-5512 + 327\sqrt{2(1+s)})\\
& + 2s^2(-175520 + 48019\sqrt{2(1+s)})).
\end{aligned}$$

For specific values of parameters a and s the equilibrium is:

a=1								
s	q_n	q_f	p_n	p_f	t_n	t_f	Π_n	Π_f
0.0	0.2299	0.0337	0.1019	0.0075	0.5190	0.2595	0	0.0008
0.1	0.2583	0.0334	0.1162	0.0075	0.5167	0.2583	0	0.0008
0.2	0.2936	0.0331	0.1340	0.0076	0.5145	0.2572	0	0.0008
0.3	0.3388	0.0328	0.1568	0.0076	0.5124	0.2562	0	0.0009
0.4	0.3988	0.0326	0.18691	0.0076	0.5104	0.2552	0	0.0009
0.5	0.4825	0.0323	0.2289	0.0077	0.5085	0.2543	0	0.0009
0.6	0.6079	0.0321	0.2918	0.0077	0.5067	0.2533	0	0.0009
0.7	0.8167	0.0319	0.3963	0.0077	0.5049	0.2525	0	0.0009
0.8	1.2337	0.0317	0.6049	0.0078	0.5032	0.2516	0	0.0010
0.9	2.4841	0.0314	1.2302	0.0078	0.5016	0.2508	0	0.0010
a=2								
0.0	0.4598	0.0673	0.2037	0.0149	0.5190	0.2595	0	0.0032
0.1	0.5166	0.0667	0.2324	0.0150	0.5167	0.2583	0	0.0033
0.3	0.6775	0.0656	0.3135	0.0152	0.5124	0.2562	0	0.0035
0.5	0.9651	0.0646	0.4579	0.0153	0.5085	0.2543	0	0.0036

2.A.7 Mixed Duopoly - Sequential Choice

For the choice of prices, firms solve

$$\text{NP}: \quad \text{choose } p_n \text{ s.t. } (1-\frac{p_n-p_f}{q_n-q_f})p_n=(1-s)q_n^2.$$
$$\text{FP}: \quad \max_{p_f}\left(\frac{p_n-p_f}{q_n-q_f}-\frac{p_f}{q_f}\right)p_f-q_f^2.$$

The optimal prices are:

$$p_n^*(q_n,q_f)=\frac{q_n(q_n-q_f)\pm q_n\sqrt{(q_n-q_f)^2-2(1-s)q_n(q_n-q_f)(2q_n-q_f)}}{2q_n-q_f}, \text{and}$$
$$p_f^*(q_n,q_f)=\frac{q_f(q_n-q_f)\pm q_f\sqrt{(q_n-q_f)^2-2(1-s)q_n(q_n-q_f)(2q_n-q_f)}}{2(2q_n-q_f)}.$$

The condition for prices to be real numbers $(q_n-q_f)^2-2(1-s)q_n(q_n-q_f)(2q_n-q_f)\geq 0$.[20] This inequality gives a feasible interval for the quality

[20]Note, that these prices are non-negative since $q_n(q_n-q_f) > \sqrt{(q_n-q_f)^2-2(1-s)q_n(q_n-q_f)(2q_n-q_f)}$.

of the NP firm:

$$q_n \in \left\langle \frac{1+2(1-s)q_f-\sqrt{(1+2(1-s)q_f)^2-16(1-s)q_f}}{8(1-s)}, \frac{1+2(1-s)q_f+\sqrt{(1+2(1-s)q_f)^2-16(1-s)q_f}}{8(1-s)} \right\rangle.$$

From the upper and lower bound on q_n, the following bounds on q_f follow:

$$(a+2(1-s)q_f)^2 - 16a(1-s)q_f \geq 0, \quad \text{i.e.} \quad q_f \in \left\langle 0, \tfrac{3-2\sqrt{2}}{2} \right\rangle \cup \left\langle \tfrac{3+2\sqrt{2}}{2}, \infty \right\rangle.$$

With such q_f, the bound on q_n becomes $q_n \in \langle \frac{2-\sqrt{2}}{4}, \frac{1}{4} \rangle$.
We are able to restrict q_f to be from the interval $\langle 0, \frac{3-2\sqrt{2}}{2} \rangle$ since $q_f < q_n$.

The NP firm maximizes its quality when it chooses

$$q_n = \frac{a+2(1-s)q_f + \sqrt{(a+2(1-s)q_f)^2 - 16a(1-s)q_f}}{8(1-s)}.$$

This formula is, in fact, the NP's best response to the FP's quality. Differentiating it with respect to q_f we can see that q_n is decreasing in q_f

$$\frac{dq_n}{dq_f} = \frac{\sqrt{(a+2(1-s)q_f)^2 - 16a(1-s)q_f} - 6a + 4(1-s)q_f}{8\sqrt{(a+2(1-s)q_f)^2 - 16a(1-s)q_f}} < 0.$$

The denominator is positive while the numerator is always negative.

Since the NP firm chooses the upper boundary of the interval for q_n specified above, optimal prices can be rewritten as

$$p_n^*(q_n, q_f) = \frac{q_n(q_n - q_f)}{2q_n - q_f} \quad \text{and} \quad p_f^*(q_n, q_f) = \frac{q_f(q_n - q_f)}{2(2q_n - q_f)}.$$

The FP maximizes its profit with respect to quality in the first stage:

$$Max_{q_f} \frac{q_n q_f (q_n - q_f)}{4(2q_n - q_f)^2} - q_f^2.$$

Its best response function to the NP quality, in implicit form, is

$$0 = -2q_f + \frac{q_n q_f (q_n - q_f)}{2(2q_n - q_f)^3} + \frac{q_n(q_n - 2q_f)}{4(2q_n - q_f)^2}.$$

Solving the system of best response functions of the two firms we get the following numerical solution for $a = 1$ and $s = 0$:
$(q_n, q_f, p_n, p_f) = (0.2323, 0.0308, 0.1079, 0.0071)$. The corresponding market shares and profits are $t_n = 0.5000, t_f = 0.2677$, and $\Pi_n = 0, \Pi_f = 0.0010$.

Chapter 3

Mixed Competition: Robustness and Welfare Analysis

Abstract

In the first part of this paper, I study competition between one nonprofit and one for-profit firm under various objective functions of the nonprofit firm. The two firms optimize their objectives with respect to quality and price of their products. I analyze the welfare implications of different preferences for quality and quantity of services in the nonprofit firm. In the second part, I derive for several cost configurations the competitive equilibrium for one particular nonprofit objective function (quality maximization).

3.1 Introduction

Nonprofit and for-profit firms coexist and compete in areas such as health and social care, education, and art production (Rose-Ackerman, 1996). Market shares of nonprofit and for-profit firms vary across industries and within industries across time (Rose-Ackerman, 1996; Hansmann, 1994). The variation might result from different objectives pursued by nonprofit firms or different groups of consumers they aim to serve but also from cost structures that differ among industries.

In this chapter, I focus on a mixed duopoly with vertical product differentiation. The two firms, one nonprofit and one for-profit, have different objectives, face different constraints, and compete over qualities and prices. The effects of various nonprofit objectives on equilibrium qualities, prices, and market shares as well as on welfare are analyzed. The effects of several cost specifications for one particular nonprofit objective function, quality maximization, on equilibrium outcome is also studied.

Mixed competition between nonprofit and for-profit firms has been analyzed in several studies. In light of the often alleged inefficiency of nonprofits (attributed to the absence of owners), it is at first sight surprising that nonprofits can successfully compete with strictly profit-maximizing firms. Among the obvious reasons that explain nonprofits' competitiveness are tax and regulatory breaks that the state bestows on nonprofits to support their socially beneficial activities (Facchina, Showell, and Stone, 1993).

With respect to the alleged inability of nonprofits to compete with for-profits, Friesner and Rosenman (2001) show that nonprofits are able to compete with for-profit firms even without barriers to entry, regulatory and tax breaks, and other subsidies. Under certain conditions a nonprofit's ability to compete can be improved by increasing the nonpecuniary benefits in the form of quality or service, i.e. prestige. Similarly, the results in Chapter 2 suggest that a nonprofit can successfully compete with a for-profit. Moreover, the nonprofit might act as a natural leader in the market. Liu and Weinberg

(2004) show that competition has a positive impact on nonprofit production since it diminishes inefficiencies in the firm. Liu and Weinberg also show that the competition with a nonprofit with regulatory advantages has only a marginal effect on the for-profit. Instead, the different objectives are the main force for the competitive outcome. This result coincides with findings presented in Chapter 2 and Harrison and Lybecker (2005) that suggest that the competition with a nonprofit might be advantageous for the for-profit in comparison to the competition with another for-profit. If the nonprofit delivers a significantly different product (e.g. under quality maximization) than the for-profit, then sufficient maneuvering space for the for-profit to increase its profits is left. That maneuvering space is not available when both firms maximize their profits. The nonprofit could, however, sacrifice high quality in order to increase its market share. Product differentiation then narrows and the tougher competition decreases profit of the for-profit.

The findings summarized above suggest that the competitive outcome depends on objectives pursued by nonprofits and for-profits. The objectives of nonprofits, unfortunately, cannot be defined as clearly and simply as the objectives of for-profits. In general, nonprofits aim to provide publicly beneficial services, but their specific goals vary across industries as well as within particular industries. For instance, Newhouse (1970), analyzing nonprofits in health care, suggests a combination of quality and quantity as a nonprofit objective. In addition to quality and quantity, Hansmann (1981) considers budget maximization to be included in the objective function of art performing firms. Steinberg (1986) estimates a nonprofit objective function within a family of functions with service maximization (maximization of net revenue available for service provision) and budget maximization as limiting cases. The empirical test suggests that welfare, education, and arts firms are service maximizers while health firms are budget maximizers.

Among studies that focus on competition between nonprofits and for-profits, Liu and Weinberg (2004) look at output maximization pursued by the nonprofit. Friesner and Rosenman (2001) assume that the nonprofit maximizes a convex combination of quality and quantity of services, and nonpecuniary

benefits. These nonpecuniary benefits include prestige, that is increasing in quality of services provided and perquisites. Harrison and Lybecker (2005) analyze the effect of the profit motive on competitive behavior of nonprofit hospitals. Hospitals are assumed to maximize a combination of a profit and a nonprofit objective such as quantity, quality, or the provision of care to the needy.

Table 3.1 summarizes nonprofit objectives assumed in the literature.

NP objective	
quality	Newhouse (1970), Hansmann (1981), Friesner and Rosenman (2001), Harrison and Lybecker (2005)
quantity	Newhouse (1970), Hansmann (1981), Friesner and Rosenman (2001), Liu and Weinberg (2004), Harrison and Lybecker (2005)
care to needy	Harrison and Lybecker (2005)
budget	Hansmann (1981), Steinberg (1986)
profit	Steinberg (1986)[1], Harrison and Lybecker (2005)
net income per staff member	Pauly and Redisch (1973)
nonpecuniary benefits	Friesner and Rosenman (2001), Glaeser and Shleifer (2001)

Table 3.1: Objectives of Nonprofits as Found in the Literature

In the present paper, similarly to Friesner and Rosenman (2001) and Chapter 2, I analyze competition between one nonprofit and one for-profit over qualities and prices. In the first part, I compare equilibria under three different objective functions of the nonprofit. The assumed nonprofit objectives are: quality maximization (here summarized in Section 3.2); maximization of its quality and market share (subsection 3.3.1); and maximization of quality and market share of both firms (subsection 3.3.2). The goal is to explore the ability of nonprofits to compete with for-profits and to compare distinctive features of equilibria resulting from different objectives. Welfare consequences

[1]Steinberg assumes that all available profits are used for service provision, i.e. to enhance quality or increase quantity, or both.

of the three nonprofit objectives are also discussed.

In the second part of the paper, I study competitive equilibria for one of the nonprofit objectives (quality maximization) and for various cost specifications (section 3.4). I depart from Chapter 2, where I assume quality maximization as the nonprofit objective and fixed costs of producing a certain quality (quadratic in quality). Incorporating variable production costs make the model better suited for the analysis of the coexistence of nonprofits and for-profits in health care, where the variable cost component is non-negligible. In addition, the differences in cost structure are probably the key driver of the variation in market shares of nonprofits and for-profits across industries where they coexist. Specifically, I consider several degrees of steepness of cost functions and the effects of variable costs on equilibrium qualities, prices, and market shares of the two competing firms. The fifth section concludes.

3.2 Model

In this section, I follow the model of the mixed duopoly competition from Chapter 2. Consider one nonprofit and one for-profit that compete within an industry. The for-profit is assumed to maximize its profit while the nonprofit maximizes its quality[2] and faces a zero-profit constraint. The zero-profit constraint represents the non-distribution constraint imposed on nonprofits, which requires all profits to be invested in the provision of services. In the original model (Chapter 2), it is assumed that all advantages bestowed on nonprofits such as tax and regulatory breaks as well as the availability of donations are aggregated in a subsidy. This subsidy lowers the part of production costs that has to be covered by consumers' payments. In the present paper, I omit this assumption since the effect of subsidies seems to be of comparatively little importance. Qualities and prices depend for the most

[2]The model assumes the simplest possible objective, quality maximization, of the nonprofit. In the following sections, I analyze alternative nonprofit's objectives.

part on the specification of nonprofit objectives (Liu and Weinberg, 2004; Harrison and Lybecker, 2005).

Demand is derived from consumers' preferences. Heterogeneous consumers maximize an additive utility function, $U_i(\theta_i q, x) = \theta_i q + x$, where θ represents consumers' sensitivity to quality and is uniformly distributed over $\langle 0, 1\rangle$; q is the quality of public good; and x is the amount of a private good that is purchased outside the industry of interest here. Individuals' demand is constrained by the budget, $p_j + xp_x = w$. p_j is the price of public good bought from the nonprofit ($j = n$) or for-profit ($j = f$), or not at all ($j = z$, zero price). The price of the private good, p_x, is normalized to one.

In the market for the public good, consumers choose among three quality-price bundles: nonprofit (q_n, p_n); for-profit (q_f, p_f); and a non-buying option (q_z, p_z). Since the nonprofit produces higher quality than the for-profit[3], consumers with the highest sensitivity to quality prefer the nonprofit product. Specifically, all consumers with sensitivity parameter $\theta \in \left\langle \frac{p_n - p_f}{q_n - q_f}, 1 \right\rangle$ prefer the nonprofit producer, consumers with $\theta \in \left\langle \frac{p_f}{q_f}, \frac{p_n - p_f}{q_n - q_f} \right\rangle$ prefer the for-profit product, and consumers with $\theta \in \left\langle 0, \frac{p_f}{q_f} \right\rangle$ prefer the non-buying option. The market shares of the two firms are $t_n = 1 - \frac{p_n - p_f}{q_n - q_f}$ and $t_f = \frac{p_n - p_f}{q_n - q_f} - \frac{p_f}{q_f}$.

The two firms choose the quality and price of the product in two stages regardless of the nonprofit maximand. In the first stage they simultaneously choose qualities, q_n and q_f

$$\begin{aligned} \text{NP}: &\quad \max\ q_n \\ \text{FP}: &\quad \max\ t_f p_f - c(q_f).^4 \end{aligned}$$

[3] See the discussion in Chapter 2.

[4] Production costs are assumed to be fixed costs of producing a certain quality. Costs are increasing and convex in quality. Specifically, I assume costs to be quadratic in quality, $c(q) = q^2$. In section 3.4, I also work with a scaled quadratic, shifted cubic, and a linear combination of variable and fixed cost functions.
As mentioned above, I abstract from subsidies given to nonprofits here. Results for quality maximization presented here correspond to results in Chapter 2 for $s = 0$.

In the second stage, firms choose optimal prices, p_n and p_f

$$\begin{aligned} \text{NP}: &\quad \text{choose } p_n \text{ s.t. } t_n p_n = c(q_n) \\ \text{FP}: &\quad \max_{p_f} t_f p_f - c(q_f). \end{aligned}$$

In equilibrium the nonprofit produces higher quality at a higher price than the for-profit and serves half of the market. The for-profit serves slightly above one-quarter of the market and earns a strictly positive profit.

3.3 Alternative Objectives of the Nonprofit

In the previous section, the nonprofit maximizes the quality of an excludable public good. Many nonprofits, however, care also about their market share. The reason might be economies of scale or an attempt to increase consumers' exposure to the quality they provide. High quality arts and religious education are examples of fields where such goals are common.

In this section, I focus on objective functions of the nonprofit that include market share of the general form of $q_n t_n + k q_f t_f$ for $k \in \langle 0, 1 \rangle$. Specifically, I look at the two limiting cases, $k \in \{0, 1\}$. For $k = 0$, the nonprofit cares about its own quality and market share, i.e. the nonprofit thinks that people should consume a high quality good, more precisely the high-quality nonprofit good, and therefore aims at serving as many consumers as possible with the highest possible quality. For $k = 1$, the nonprofit cares about the quality and market share of the for-profit in addition to its own quality and market share. The nonprofit has a paternalistic objective and thinks that the consumption of the particular public good is beneficial in general. The nonprofit, however, cannot serve all the market with a high quality. Therefore, it wants the for-profit to serve also as many consumers as possible with a relatively high quality.

3.3.1 The Nonprofit Maximizes $q_n\, t_n$

The nonprofit is assumed to maximize its product quality and market share. Thus, there is a trade off between higher quality and larger market share. Since there are fixed production costs the nonprofit needs to cover, a larger market share is always better for the nonprofit. The trade off, however, relates to consumers' willingness to pay. Recall that consumers' taste for quality is uniformly distributed and thus there might not be a sufficient number of consumers that want to purchase the high nonprofit quality. Production decisions of the two firms are made in two stages. First, the two firms simultaneously choose optimal qualities

$$\begin{aligned} \text{NP}: &\quad \max_{q_n} q_n t_n \\ \text{FP}: &\quad \max_{q_f} t_f p_f - q_f^2. \end{aligned}$$

Then, given equilibrium qualities they simultaneously choose prices

$$\begin{aligned} \text{NP}: &\quad \max_{p_n} q_n t_n \ \text{ s.t. } \ t_n p_n = q_n^2 \\ \text{FP}: &\quad \max_{p_f} t_f p_f - q_f^2, \end{aligned}$$

where t_n and t_f are market shares as derived above.

Despite the difference in the nonprofit objective, the second stage leads to the same decision with respect to prices as in the previous section (pure quality maximization by the nonprofit). This is due to the non-distribution constraint being binding and indeed determining the nonprofit pricing strategy irrespective of the nonprofit objective. Prices are, therefore, determined in the same way. The difference is only in the first stage when the nonprofit maximizes the product of its quality and market share. Since the nonprofit cares also about market share it is willing to sacrifice a high quality in favor of its market share. The equilibrium qualities, prices, and market shares under quality and quality-market share maximization are summarized in Table 3.2 (see subsection 3.3.2).[5]

[5] As in Chapter 2, a closed form solution does not seem to exist for this problem. The table summarizes numerical solutions.

The nonprofit, indeed, decreases its quality when compared to the pure quality maximization case. Now, it is able to lower its price and attract additional consumers that were served by the for-profit previously. The nonprofit now serves two-thirds of the market (compared to one-half).

The for-profit also has to cover its production costs and since a part of 'its' consumers now prefers the nonprofit product, it wants to attract additional consumers from the low end of the taste distribution, i.e. the consumers that previously preferred the non-buying option. The for-profit, therefore, also decreases its quality and price. The for-profit's market share is less than one-fifth (compared to one-quarter). Its profit decreases since the for-profit serves consumers with a smaller willingness to pay.

This shift toward consumers that were not served under quality maximization, has a positive consequence for the total market share served. In addition, as mentioned, the profit of the for-profit decreases and therefore consumer surplus increases when compared to the case of pure quality maximization pursued by the nonprofit (see Table 3.3 on page 77). The total surplus also increases.

3.3.2 The Nonprofit Maximizes $q_n\, t_n + q_f\, t_f$

In this subsection, the nonprofit is concerned about the quality and market share of the for-profit as well. The nonprofit now operates as a public motive maximizer or ideologist, who thinks that the consumption of high quality products is good for consumers and cares about customers of the for-profit in addition to its own customers. The nonprofit thus wants to serve as many consumers as possible with the maximal feasible quality (just because it is beneficial for consumers) and also wants the for-profit to do the same.

The quality-price setting is again done in two stages. First, the two firms

simultaneously choose optimal qualities

$$\begin{aligned} \text{NP}: &\quad \max_{q_n} q_n t_n + q_f t_f \\ \text{FP}: &\quad \max_{q_f} t_f p_f - q_f^2, \end{aligned}$$

where $t_n = 1 - \frac{p_n - p_f}{q_n - q_f}$ and $t_f = \frac{p_n - p_f}{q_n - q_f} - \frac{p_f}{q_f}$. Note that the nonprofit maximand, $q_n t_n + q_f t_f$, simplifies to $q_n - p_n$ since $q_n t_n + q_f t_f = q_n \left(1 - \frac{p_n - p_f}{q_n - q_f}\right) + q_f \left(\frac{p_n - p_f}{q_n - q_f} - \frac{p_f}{q_f}\right) = q_n - p_n$. Given equilibrium qualities they simultaneously choose prices in the second stage

$$\begin{aligned} \text{NP}: &\quad \max_{p_n} q_n - p_n \ \text{ s.t. } \ t_n p_n = q_n^2 \\ \text{FP}: &\quad \max_{p_f} t_f p_f - q_f^2. \end{aligned}$$

The nonprofit again wants to decrease its quality (compared to the quality maximization case). At the same time, it is in line with its objective if the for-profit increases its quality and gains a larger market share. The equilibrium is summarized in Table 3.2[6].

NP objective	q_n	q_f	p_n	p_f	t_n	t_f	O_n	Π_f
q_n	0.2323	0.0308	0.1079	0.0071	0.5000	0.2677	0.2323	0.0010
$q_n t_n$	0.2147	0.0168	0.0697	0.0027	0.6617	0.1761	0.1421	0.0002
$q_n t_n + q_f t_f$	0.2159	0.0174	0.0709	0.0029	0.6569	0.1788	0.1449	0.0002

Table 3.2: Mixed Duopoly under Various Objectives of the Nonprofit

Under quality maximization, the market share served by the nonprofit is only 0.5, and the total market share by the two firms is 0.7677. Intuitively, in this case the nonprofit maximizes only quality and cares about the number of consumers only to the point that it can cover fixed production costs. In the second case, the nonprofit aims to serve a market share as large as possible with as a high quality as possible. Some of consumers that were served by the for-profit previously (those with a higher taste for quality), can now be served by the nonprofit and consume a significantly higher quality.

[6]To compare, in the for-profit duopoly, qualities offered are 0.1242 and 0.0364 at prices 0.0474 and 0.0069 respectively. Corresponding market shares are 0.5395 and 0.2698 and profits are 0.0101 and 0.0005.

In the third case, the nonprofit again wants to serve a maximal possible market share with a maximal feasible quality and at the same time the nonprofit wants the for-profit to serve a maximal possible market share with a maximal possible quality. The nonprofit is willing to let go their consumers with the lowest willingness to pay under the second case, since it can thus increase quality knowing that these consumers are profitable for and will be served by the for-profit. The for-profit is then also able to increase its quality.

The second column from the right reports O_n, the value of the nonprofit objective function in equilibrium. Nonprofit objectives in these three cases are fundamentally different; therefore, these values are not comparable across the three alternatives. In the next section, however, I look at differences in consumers' well-being across the three cases.

3.3.3 Welfare

For the welfare analysis, let us assume that there are three types of nonprofit entrepreneurs that might enter the market: the pure quality maximizer, the quality and market share maximizer, and the maximizer of her own and her rival's quality and market share. Equilibrium outcomes of these three mixed duopoly scenarios were compared in the previous section with respect to qualities, prices, and market shares. In this subsection, the equilibrium outcomes are compared with respect to total market share served and welfare. The following table summarizes total market share covered, the profit of the for-profit, and consumer and total surplus across the three alternative settings discussed above.

NP objective	$t_n + t_f$	Π_f	CS	Total surplus
q_n	0.7677	0.0010	0.0342	0.0352
$q_n t_n$	0.8378	0.0002	0.0492	0.0494
$q_n t_n + q_f t_f$	0.8357	0.0002	0.0489	0.0491

Table 3.3: Welfare under Various Objectives of the Nonprofit

Considering the total market share, the smallest is attained under the pure

quality maximization by the nonprofit, 0.7677. There are only small differences between the second and third alternative. In case when the nonprofit cares about its own (and its competitor's) market share, the total market share served increases to 0.8378 (0.8357). The for-profit earns the same profit in the second and third case and this profit is significantly smaller than under the first alternative. Consumers are better off when the nonprofit objective includes also market share. The highest consumer surplus is attained under quality-market share maximization pursued by the nonprofit. This is driven by the surplus of consumers purchasing the nonprofit product. One half of the market consumes a relatively high quality of 0.1421.

The total surplus is the sum of for-profit's profit and consumer surplus, and it is the highest in the case of quality-market share maximization by the nonprofit. Interestingly, the total surplus is maximized when the nonprofit cares only about its own quality and market share and not under the third alternative when the nonprofit cares also about the for-profit outcome (although the difference between the two alternatives is tiny). This result seems to stem from the fact that under the third alternative, the nonprofit takes the for-profit as a partner that helps to achieve its goal to serve as many consumers with as high a quality as possible. Nonprofit's interest also in for-profit quality means that the nonprofit sacrifices some of its consumers. These consumers will now consume lesser quality produced by the for-profit, but all consumers of the for-profit benefit because the for-profit quality increases. At the same time, the nonprofit by letting go its consumers with the lowest willingness to pay, can increase its quality and price, what transforms into a smaller consumer surplus.

3.4 Alternative Cost Configurations

Industries where nonprofits and for-profits coexist are likely to differ in the cost structure. For example, in some industries such as hospitals and education, fixed costs are high while in other industries such as old-folk and

a	q_n	q_f	p_n	p_f	t_n	t_f	Π_n	Π_f
1/2	0.4834	0.0311	0.2336	0.0075	0.5000	0.2583	0	0.0015
1	0.2323	0.0308	0.1079	0.0071	0.5000	0.2677	0	0.0010
2	0.1053	0.0287	0.0443	0.0060	0.5000	0.2894	0	0.0001

Table 3.4: Numerical Solutions to Mixed Competition with the Scaled Quadratic Cost Function

nursing homes, fixed costs are low relative to variable costs. The purpose of this section is to explore the effect of various cost configurations on equilibrium outcome, namely on product differentiation, market shares of the two firms, and profit opportunities of the for-profit. The setup of the problem remains the same as in Section 3.2, but cost specifications differ. In comparing competitive equilibria, I start with a generalized version of quadratic fixed costs of producing quality, $c(q) = aq^2$ for $a \in R^+$, then look at a cost function that increases slowly for low qualities and increases quickly for higher qualities, and a shifted cubic function $c(q) = (q-b)^3 + b^3$ with $b \in \langle 0, 1/4 \rangle$. Finally, I analyze a linear combination of variable and fixed production costs, $c(q) = btq + (1-b)q^2$ with $b \in (0,1)$ and t representing market share served by the firm.

3.4.1 $c(q) = a\,q^2$

First, I look at a small variation (in the steepness) of the fixed quadratic cost function. Intuitively, when fixed costs increase more slowly ($a < 1$) than in the benchmark case ($a = 1$), the nonprofit can enhance its quality and possibly widen the gap between its own quality and the quality of its competitor. The for-profit can then increase its profit. High levels of parameter a, in contrast, diminish the difference between the two products and decrease the profit of the for-profit. The first order conditions to the problem can be found in Appendix 3.B.1 on page 88. Table 3.4 contains numerical solutions to the problem with $a = 1/2, 1$, and 2.

These numbers show that quality differences between the two products are

indeed decreasing with a. The difference goes from 0.4523 ($a = 1/2$) to 0.0766 ($a = 2$). The competition is, thus, tougher for quickly increasing cost functions. That means that the for-profit has to offer a more competitive product (with a better price-quality ratio) and its profit declines. The market share served by the nonprofit is always 1/2. The market share of the for-profit is more than half of the nonprofit's share ($t_f > t_n/2$). It is increasing in a because the product with a better price-quality ratio is purchased also by consumers with a lower taste for quality. Altogether, the total market share served is higher for higher levels of a.

3.4.2 $c(q) = (q - b)^3 + b^3$

The cubic cost function should allow the nonprofit to increase quality similar to the quadratic costs discussed above with $a < 1$.

b	q_n	q_f	p_n	p_f	t_n	t_f	Π_n	Π_f
0	0.4535	0.1365	0.1866	0.0281	0.5000	0.2943	0	0.0057
0.05	0.5159	0.1824	0.2026	0.0358	0.5000	0.3037	0	0.0084
0.15	0.6299	0.2731	0.2278	0.0494	0.5000	0.3192	0	0.0105
0.25	0.7209	0.3610	0.2401	0.0601	0.5000	0.3335	0	0.0031

Table 3.5: Numerical Solutions to Mixed Competition with Cubic Cost Function

Slowly increasing costs for low quality indeed allow the nonprofit to significantly enhance its quality. Consumers' willingness to pay increases and the nonprofit can increase the quality even further. The for-profit quality is also significantly higher when compared to the case of quadratic costs. The nonprofit again serves half of the market while the for-profit now serves about one-third of the market (compared to one-quarter). The difference in qualities is increasing, with b and profits earned by the for-profit also decline except the last line when $b = 0.25$. Here the flat part of the cost function corresponds to relatively high quality meaning high production costs.[7]

[7]Results are similar to an extreme case when the costs are negligible up to a certain quality and then start to increase, e.g. for a shifted quadratic function $c(q) = 0$ for

3.4.3 $c(q) = b\,t\,q + (1-b)q^2$

The previous analysis was focused on fixed costs of producing quality. Firms had to attract a sufficient market share to cover fixed production costs of a given quality. The analysis was motivated by art-performing organizations, for which the variable cost component is negligible relatively to the fixed cost component. In industries such as health care, however, the variable component comprises a significant fraction of total costs. Here, however, the relative size of the two components also vary. For instance, in hospitals the fixed cost component will be higher than in nursing homes where the total costs mainly comprise the variable costs of labor, and the fixed costs are negligible.

To analyze the effect of variable production costs, I assume a linear combination of variable, $t\,q$, and quadratic fixed costs, q^2, with a weight parameter $b \in \langle 0, 1)$. As before, t represents market share served by the firm, thus variable costs increase with quantity. Variable costs are assumed to increase with quality as well (depend positively on q), since treating an additional patient in a high quality hospital is more costly than treating one more patient in a low quality hospital.[8]

Note that the introduction of variable costs in fact reflects a shift in the character of the good, which now has also some private attributes in addition to public ones. Production costs of goods with prevailing private features have a higher weight on the variable component while costs of goods with dominant public features are weighted toward a fixed costs component. Table 3.6 summarizes equilibria for the three levels of b.

The total production costs increase with the variable cost component. To cover the total costs, the nonprofit has to lower its quality and price since

$q \in \langle 0, d\rangle$, $d \in R^+$ and $c(q) = (q-d)^2$ for $q \in \langle d, \infty)$. In this case, the nonprofit can again significantly increase its quality. The for-profit produces quality of d at zero costs, and its profit is increased due to a higher product differentiation.

[8] Intuitively, treating more patients in a high quality hospital requires hiring additional high-quality physicians and nurses. This is certainly more costly than hiring physicians and nurses of lower quality.

b	q_n	q_f	p_n	p_f	t_n	t_f	Π_n	Π_f
0	0.2323	0.0308	0.1079	0.0071	0.5000	0.2677	0	0.0010
0.1	0.2122	0.0229	0.1113	0.0071	0.4500	0.2378	0	0.0007
0.5	0.1193	0.0104	0.0881	0.0064	0.2500	0.1307	0	0.0001
0.9	0.0246	0.0009	0.0233	0.0008	0.0500	0.0254	0	0.0000

Table 3.6: Numerical Solutions to Mixed Competition with Fixed and Variable Costs

consumers are not willing to pay for a very high quality. The nonprofit, then, has to also move downward with its quality and price. The higher weight on the variable component in the cost function is the lower the for-profit price is. The nonprofit price first increases and then starts to decrease with b.

Intuitively, market shares served are significantly lower than in case of production costs without the variable component ($b = 0$). Both producers tend to serve only a small group of consumers with the highest willingness to pay. The nonprofit serves only 5% of the market when $b = 0.9$. In this case, the total market share served is only 7.5% compared to 77% served when $b = 0$ (no variable costs). Profits earned by the for-profit decline as well.

The composition of total costs thus affects the market shares served by firms. With fixed costs it is important to attract a large market share over which the costs can be distributed. With the variable costs, however, smaller market shares are preferred because each consumer has to bear the whole production costs of product/service, and firms prefer more similar consumers, i.e. consumers that do not differ in their willingness to pay too much. The sharp decline in total market share served described above was driven by relatively high variable costs that equal the product quality. Even with smaller variable costs, we would, however, expect the tendency to serve a smaller number of customers in industries with high variable costs relative to fixed costs of production.

3.5 Conclusion

In this paper, I studied competition between one nonprofit and one for-profit firm under various objectives of the nonprofit. The nonprofit successfully competes with its for-profit counterpart under all objectives considered here. This result seems robust for a broad range of cost configurations. Moreover, in all cases the nonprofit acts as a natural leader as in Chapter 2.

In the first part of the paper, I analyzed mixed competition under various nonprofit objectives. The differences in nonprofit objectives clearly affect the quality-price bundles that are offered by competing firms. Market shares also vary. The nonprofit, for instance, serves half of the market under quality maximization while it serves about two-thirds of the market under the two other objectives, the maximization of its quality and market share and the maximization of quality and market share of both firms. The market share of the for-profit in contrast decreases in the two latter cases. Not surprisingly, profits earned by the for-profit also decline due to a diminished product differentiation. Varying market shares, qualities, and prices have an effect on consumer surplus and welfare. From the three alternatives considered in this paper, the maximal welfare is attained when the nonprofit maximizes its quality and market share.

In the second part of the paper, I analyzed mixed competition under various cost specifications focusing on the quality maximization pursued by the nonprofit. The steepness of cost functions significantly affects equilibrium qualities and market shares of the two competing firms. When variable costs are added to the fixed production costs, the quality decreases since each consumer has to bear production costs of a product/service. In the case when the variable component of costs outweigh the fixed component, firms serve only a small fraction of the market.

The present paper extends the analysis in Chapter 2 which is based on the assumption of quality maximization by the nonprofit and fixed quadratic production costs. Competitive equilibria in industries where nonprofits and

for-profits coexist are affected by nonprofit objectives as well as the structure of production costs. Across all nonprofit objectives investigated here, product differentiation is large suggesting less competition than would be if the nonprofit were also interested in profit/budget maximization. The toughness of the competition is to a greater extent affected by the cost function, namely its steepness and the ration between fixed and variable cost components.

The analysis of competition provided here is restricted to the case of one nonprofit competing with one for-profit. It is an interesting question, to be answered in future research, whether the entry of another nonprofit would affect opportunities of the for-profit to earn positive profit.

Appendix 3.A Alternative Objective Functions

3.A.1 The Nonprofit Maximizes $q_n t_n$

In the second stage, the two firms simultaneously choose prices. First order conditions follow

$$0 = p_n \left(1 - \frac{p_n - p_f}{q_n - q_f}\right) - q_n^2 \quad \text{and}$$
$$0 = -2\frac{p_f}{q_f} + \frac{p_n - 2p_f}{q_n - q_f}.$$

This system gives optimal prices

$$p_n = \frac{q_n \left(q_n - q_f - \sqrt{(q_n - q_f)A}\right)}{2q_n - q_f} \quad \text{and}$$
$$p_f = \frac{q_f \left(q_n - q_f - \sqrt{(q_n - q_f)A}\right)}{2(2q_n - q_f)},$$

where $A = q_f - q_n - 2q_n(2q_n - q_f)$.[9] Using the optimal prices the objectives in the first stage can be rewritten as

$$\text{NP}: \quad \max \frac{q_n \left(q_n - q_f - \sqrt{(q_n - q_f)A}\right)}{2(q_n - q_f)}$$
$$\text{FP}: \quad \max \frac{q_n q_f \left(q_n - q_f - q_n(2q_n - q_f) - \sqrt{(q_n - q_f)A}\right)}{2(2q_n - q_f)^2} - q_f^2.$$

In the first stage, firms simultaneously choose qualities. First order conditions follow.

[9] Note that there is one additional solution to the system of FOCs above with $p_n = \frac{q_n\left(q_n - q_f + \sqrt{(q_n - q_f)A}\right)}{2q_n - q_f}$ and $p_f = \frac{q_f\left(q_n - q_f + \sqrt{(q_n - q_f)A}\right)}{2(2q_n - q_f)}$. This solution, however, does not lead to an equilibrium in the first stage.

$$0 = \frac{-6q_n^3 + 10q_n^2 q_f + q_n^2 - 3q_n q_f^2 - 2q_n q_f + q_f^2 + (q_n - q_f)\sqrt{(q_n - q_f)A}}{2(q_n - q_f)\sqrt{(q_n - q_f)A}}; \text{ and}$$

$$0 = \frac{q_f\left(-7q_n^2 - q_n + 16q_n q_f - 6q_f^2 + \frac{q_n(A-q_n^2)}{\sqrt{(q_n-q_f)A}}\right)}{2(2q_n - q_f)^2}$$

$$+ \frac{(2q_n + q_f)\left(2q_n^3 + 7q_n^2 q_f - q_n^2 - 8q_n q_f^2 + q_n q_f + 2q_f^3 + q_n\sqrt{(q_n - q_f)A}\right)}{2(2q_n - q_f)^3}.$$

An analytical solution to this system of two equations does not seem to exist. The numerical solution given in Table 3.2 on page 76 were obtained using Mathematica v. 4.1.

3.A.2 The Nonprofit Maximizes $q_n t_n + q_f t_f$

In the second stage, the two firms choose optimal prices. FOCs are as follows:

$$0 = p_n\left(1 - \frac{p_n - p_f}{q_n - q_f}\right) - q_n^2; \quad \text{and}$$
$$0 = -\frac{2p_f}{q_f} + \frac{p_n - 2p_f}{q_n - q_f}.$$

Two (p_n, p_f)-pairs solve this system of FOCs:

$$(p_n 1, p_f 1) = \left(\frac{q_n(q_n - q_f + q_n\sqrt{(q_n - q_f)A})}{2q_n - q_f}, \frac{q_f(q_n - q_f) + q_f\sqrt{(q_n - q_f)A}}{2(2q_n - q_f)}\right); \text{and}$$
$$(p_n 2, p_f 2) = \left(\frac{q_n(q_n - q_f - q_n\sqrt{(q_n - q_f)A})}{2q_n - q_f}, \frac{q_f(q_n - q_f) - q_f\sqrt{(q_n - q_f)A}}{2(2q_n - q_f)}\right).$$

Maximands in the first stage then can be rewritten as

$$\text{NP}: \quad \max \frac{q_n\left(q_n+\sqrt{(q_n-q_f)A}\right)}{2q_n-q_f} \quad \text{and}$$

$$\text{FP}: \quad \max \frac{q_f\left(-2q_f^3+8q_nq_f^2-q_nq_f-7q_n^2q_f+q_n^2-2q_n^3-q_n\sqrt{(q_n-q_f)A}\right)}{2(2q_n-q_f)^2}.$$

First order conditions are

$$0=\frac{q_n(q_n-q_f)(1+2q_f-8q_n)+A(q_n-q_f(q_n-q_f))+2q_n(q_n-q_f)\sqrt{(q_n-q_f)A}}{(2q_n-q_f)^2\sqrt{(q_n-q_f)A}}; \text{and}$$

$$0=\frac{q_f\left(-6q_f^2+16q_nq_f-q_n(1+7q_n)+\frac{A-2q_n(q_n-q_f)}{\sqrt{(q_n-q_f)A}}\right)}{2(2q_n-q_f)^2}$$
$$-\frac{(2q_n+q_f)\left(2q_f^3-8q_nq_f^2+q_nq_f+7q_n^2q_f-q_n^2+2q_n^3+q_n\sqrt{(q_n-q_f)A}\right)}{2(2q_n-q_f)^3}.$$

Similarly to the previous section, an analytical solution to this system of two equations does not seem to exist. The numerical solution given in the 3.2 on page 76 were obtained using Mathematica v. 4.1.

Appendix 3.B Alternative Cost Configurations

3.B.1 $c(q) = a\,q^2$

First order conditions in the second stage are

$$\begin{aligned} 0 &= p_n\left(1 - \frac{p_n - p_f}{q_n - q_f}\right) - aq_n^2 \quad \text{and} \\ 0 &= -\frac{2p_f}{q_f} + \frac{p_n - 2p_f}{q_n - q_f}. \end{aligned}$$

Optimal prices, as a solution to this system of first order conditions are

$$\begin{aligned} p_n &= \frac{q_n\left(q_n - q_f \pm \sqrt{(q_n - q_f)B}\right)}{2q_n - q_f} \quad \text{and} \\ p_f &= \frac{q_f\left(q_n - q_f \pm \sqrt{(q_n - q_f)B}\right)}{2(2q_n - q_f)}, \end{aligned}$$

where $B = q_f - q_n - 2aq_n(2q_n - q_f)$. Then the nonprofit firm chooses maximal quality for which the above price is feasible, i.e. $q_n = \frac{1+2aq_f+\sqrt{(1+2aq_f)^2-16aq_f}}{8a}$ implying that $\sqrt{(q_n - q_f)B} = 0$. The for-profit firm then maximizes $\frac{q_n q_f(q_n - q_f)}{4(2q_n - q_f)^2} - aq_f^2$.

Optimal qualities are determined as a solution to the following system of equations

$$\begin{aligned} 0 &= \frac{1 + 2aq_f + \sqrt{(1 + 2aq_f)^2 - 16aq_f}}{8a} \quad \text{and} \\ 0 &= -2aq_n + \frac{q_n q_f(q_n - q_f)}{2(2q_n - q_f)^3} + \frac{q_n(q_n - 2q_f)}{4(2q_n - q_f)^2}. \end{aligned}$$

3.B.2 $c(q) = (q-b)^3 + b^3$

First order conditions in the second stage are

$$\begin{aligned} 0 &= p_n \left(1 - \frac{p_n - p_f}{q_n - q_f}\right) - (q_n - b)^3 - b^3 \quad \text{and} \\ 0 &= -\frac{2p_f}{q_f} + \frac{p_n - 2p_f}{q_n - q_f}. \end{aligned}$$

The system leads to the following optimal prices:

$$\begin{aligned} p_n &= \frac{q_n(q_n - q_f) \pm \sqrt{q_n(q_n - q_f)C}}{2q_n - q_f} \quad \text{and} \\ p_f &= \frac{q_f(q_n(q_n - q_f) \pm \sqrt{q_n(q_n - q_f)C}}{2q_n(2q_n - q_f)}, \end{aligned}$$

where $C = q_n(q_f - q_n) - 2(2q_n - q_f)((q_n - b)^3 + b^3)$. Then the nonprofit firm chooses maximal quality for which the above price is feasible, i.e. $q_n =$ implying that $\sqrt{q_n(q_n - q_f)C} = 0$. The for-profit firm then maximizes $\frac{q_n q_f(q_n - q_f)}{4(2q_n - q_f)^2} - (q_f - b)^3 - b^3$.

Optimal qualities are determined as a solution to the following system of equations:

$$\begin{aligned} 0 &= q_n(q_n - q_f)C \quad \text{and} \\ 0 &= -3(q_f - b)^2 + \frac{q_n q_f(q_n - q_f)}{2(2q_n - q_f)^3} + \frac{q_n(q_n - 2q_f)}{4(2q_n - q_f)^2}. \end{aligned}$$

3.B.3 $c(q) = b\,t\,q + (1-b)q^2$

First order conditions in the second stage

$$0 = (p_n - bq_n)\left(1 - \frac{p_n - p_f}{q_n - q_f}\right) - (1-b)q_n^2 \quad \text{and}$$
$$0 = \frac{bq_f - 2p_f}{q_f} + \frac{p_n + bq_f - 2p_f}{q_n - q_f}.$$

Optimal prices are

$$p_n = \frac{q_n\left((1+b)q_n - q_f \pm \sqrt{(q_n - q_f)D}\right)}{2q_n - q_f} \quad \text{and}$$
$$p_f = \frac{q_f(q_n(q_n - q_f) \pm q_f\sqrt{(q_n - q_f)D}}{2(2q_n - q_f)},$$

where $D = q_n(q_f - q_n) - 2(2q_n - q_f)((q_n - b)^3 + b^3)$. Then the nonprofit chooses maximal quality for which the above price is feasible, i.e. $q_n =$ implying that $\sqrt{q_n(q_n - q_f)D} = 0$. The for-profit then maximizes $\frac{q_n q_f(q_n - q_f)}{4(2q_n - q_f)^2} - (q_f - b)^3 - b^3$.

Optimal qualities are determined as a solution to the following system of equations:

$$0 = q_n(q_n - q_f)D \quad \text{and}$$
$$0 = -3(q_f - b)^2 + \frac{q_n q_f(q_n - q_f)}{2(2q_n - q_f)^3} + \frac{q_n(q_n - 2q_f)}{4(2q_n - q_f)^2}.$$

Chapter 4

Entrepreneurial Choice, Price, and Quality under Weak Enforcement of the Non-distribution Constraint

with Andreas Ortmann

Abstract

We study the conditions under which it is rational for a representative entrepreneur to start a nonprofit firm. Taking as a point of departure a model of entrepreneurial choice proposed by Glaeser and Shleifer (2001), we analyze the consequences of weak enforcement of the non-distribution constraint on entrepreneurial choice and price and quality of the product. We find that the nonprofit organizational form becomes unequivocally more attractive to entrepreneurs if enforcement of the non-distribution constraint is weak. We also find that the quality delivered by nonprofit firms is lower under weak enforcement than that of the nonprofit firm under strict enforcement, but higher than the quality delivered by a for-profit firm. We discuss the implications and limitations of our results.

4.1 Introduction

In developed countries, the nonprofit, or third, or civil sector is among the two or three largest industries (Salamon, Anheier, and Associates, 1999). While this fact provokes important questions about private power in a democracy, the nonprofit sector typically draws on a long history of accomplishments and is generally acknowledged to set the pace in social services as well as social innovations (Hall 1992).

Downplaying to some extent their public benefit rationale (e.g. Weisbrod, 1988) and building on theories of asymmetric information (e.g. Akerlof, 1970), Hansmann (1980) explained the existence of nonprofit (NP) organizations as institutions that evolved in response to informational asymmetries in what is sometimes called "trust markets": Markets in which the quality of a good or service is *ex ante* difficult or unreasonably costly to assess, and in which consumers, or donors, hence have to trust the provider to deliver the quality that was promised (Ortmann and Colander, 1997). Consumers' lack of information thus opens the door for various forms of *ex post* expropriation. Ignoring the possibility of a reputational solution (e.g. Heal, 1976), Hansmann (1980) argued that the non-distribution constraint[1] – arguably the most prominent characteristic of NP firms all over the world and throughout history – weakens the incentives of NP entrepreneurs to maximize profit at consumers' expense. Thus NP entrepreneurs, by their choice of ownership form, can constrain their future options and signal their trustworthiness.

In reality, however, the definition of what constitutes non-distribution often does not form a particularly binding constraint, making perk consumption (a plush office that the NP entrepreneur might value almost as much as the cash value it represents, or the additional power and prestige that comes with a staff larger than really needed, or credit cards that are generously used for

[1] A non-distribution constraint allows a nonprofit firm to make profits but does not allow it to distribute profits to managers or employees. Whatever surplus a nonprofit generates ought to be ploughed back into the quality of its products or ought to be used to finance provision of the firm's services to indigent parts of the population.

questionable purposes) quite possibly an important part of a compensation package. Moreover, even excessive perks rarely violate laws and regulations (e.g., those defining the "fiduciary duty" of nonprofit board members).

Moreover, the non-distribution constraint, as weakly binding as it is, is often only weakly enforced and there are thus many temptations to circumvent this laudable requirement (e.g. Ortmann and Schlesinger, 2003; Gibelman and Gelman, 2004). While recent debates in the U.S. have demonstrated that even in developed countries enforcement is a persistent problem (e.g. Bradley, Jansen, and Silverman, 2003; Senate Finance Committee Staff, 2004), our analysis is motivated by the well-known and pervasive problems of enforcement in developing and transition economies (Roland and Verdier, 2003). The size and importance of the nonprofit sector in the Czech Republic, for example, lags behind NP sectors in western countries (Salamon, Anheier, and Associates, 1999; Brhlikova, 2004b). This may be due to its shorter history but very likely also due to the insufficient conditions for its evolution. Brhlikova (2004b) documents how the relevant legislation evolved in irregular spurts and almost always in a reactive manner tried to address problems that had become too obvious to ignore.

The nature of changes in legislation and spotty enforcement attracted, for example, "for-profit-in-disguise"[2] entrepreneurs to the Czech NP sector, affecting its credibility, the donations it managed to collect, and thus contributing to its relatively slow development. One particularly striking example was the number of foundations very likely founded by "for-profit-in-disguise" entrepreneurs. Fric and Goulli (2001) track the number of foundations through the mid- and late nineties and report that the number was cut from about 5,000 to less than 300 in response to a more strict legislative intervention in 1998. Probably for similar reasons of insufficient legislation and regulations, the NP sector in the Czech Republic is overwhelmingly populated by civic

[2]The term "for-profit-in-disguise" was introduced by Weisbrod (1975) to describe alleged nonprofit entrepreneurs motivated by profits who enter the nonprofit sector to exploit breaks bestowed on NPs, i.e. entrepreneurs whose motivations are not of the kind typically attributed to NP entrepreneurs (Young, 1983).

associations - the least restrictive NP legal form. In 2002, there were about 49,000 civic associations comprising 88% of NP entities in the Czech Republic (Brhlikova, 2004b). This is a considerable share of "unrestricted" and uncontrolled institutions even though these numbers are likely to be overestimated because civic associations are not required to provide information about their termination.[3]

Another problem is related to the lack of transparency and information on NP entities (Ortmann, Svitkova, and Krnacova, 2005). NP entities such as foundations, foundation funds, and public benefit organizations are required by law to submit annual reports to their respective regional courts. However, in 2002 only 48% of foundations, 26.6% of foundation funds, and in 2003, 10% of public benefit organizations fulfilled their duty (CVNS, 2004, 2005). Moreover, these two studies revealed that submitted documents are often of low quality and incomplete. For instance, from those organizations that submitted their annual reports one-third of foundations and foundation funds and two-thirds of public benefit organizations did not provide the required information on assets and liabilities. Up to the present, no organization neglecting the submission requirement has been punished.

Considering the *de facto* nonexistent enforcement of a constraint that is already not particularly binding, it does not seem surprising that many entrepreneurs entered the NP sector to exploit the subsidies and various breaks bestowed on NPs (Facchina, Showell, and Stone, 1993). Below, we study theoretically the conditions under which it is rational for a representative entrepreneur to start a NP firm even if it would mean to constrain her future options. Specifically, we analyze the impact of weak enforcement of the non-distribution constraint on entrepreneurial choice and consequently on the price and quality of the goods and services provided by NP firms.

Previous authors concerned with issues of entrepreneurial choice (e.g. Eckel and Steinberg, 1993; Bilodeau and Slivinski, 1998; and Glaeser and Shleifer,

[3]According to estimates about one third of these entities was not active in 2002 (USAID, 2002).

2001) have not addressed the consequences of weak enforcement. We address this blind spot in the literature by using as a point of departure a model by Glaeser and Shleifer (2001). These authors formalize Hansmann's asymmetry theory in a simplistic but effective manner. They assume that entrepreneurs incur nonmonetary costs related to cheating on quality. Due to the non-distribution constraint faced by NP entrepreneurs, these nonmonetary costs have a higher impact on NP entrepreneurs, who have therefore less incentives to exploit informational asymmetries than FP entrepreneurs. The model shows that the NP ownership is attractive also to self-interested entrepreneurs. In general, the NP ownership form is more advantageous in markets where quality is valued by consumers.

Modifying the basic framework of that model, we introduce subsidies to NP production and weak enforcement and definition of the non-distribution constraint. These two factors, in our view, affect the entrepreneurial choice between NP and FP ownership form. Subsidies to NP production in our model represent not only state subsidies and donations but include also tax and regulatory breaks given to NPs. These advantages reduce the competitive pressure on NPs in comparison to their FP counterparts and create opportunities for inefficiency in NP organizations (Newhouse, 1970; Rose-Ackerman, 1996). Such inefficiency is most probably reflected in better working conditions or other nonmonetary benefits that might be attractive to entrepreneurs and therefore affect the entrepreneurial choice between the NP and FP sector.

The non-distribution constraint and its enforcement are likely to influence the entrepreneurial choice even more significantly. The non-distribution constraint defines the rules of the game: It distinguishes between perks that are admissible and those that are not, i.e., it specifies the level to which perk consumption is allowed by law. Enforcement of the non-distribution constraint represents the level to which activities of NPs are checked for compliance with the rules of the game. Enforcement, therefore, applies only to perks that are not admissible by law, reducing their value to NP entrepreneurs.

Here we demonstrate, given a possibly insufficient definition of the non-

distribution constraint, the importance of enforcement to keep the NP sector credible and to make sure that NP institutions can play the corrective role in society that prevailing theories of NPs assign them: Subsidies and breaks bestowed on NPs ought to translate into a higher quality or lower prices of products and services in comparison to what FPs offer.

Our model reveals, perhaps not surprisingly, that the NP sector is more attractive to entrepreneurs when NP production is subsidized. Also, weak enforcement of the non-distribution constraint makes the choice of NP form more likely, thus providing a theoretical rationale for the empirical facts enumerated above. In line with our intuition, weak enforcement does also have negative consequences for the quality offered by NP firms: NP firms deliver lower quality than NP firms under strict enforcement of the non-distribution constraint but higher quality than FP firms. This latter result differs from suggestions in some of the literature that weak enforcement would entirely eliminate the distinctive performance of legitimate NP firms. Steinberg (1993), for example, suggests that under weak enforcement only for-profits-in-disguise can survive, implying that the quality offered in the NP sector is the same as would be produced by the FP sector. He, however, does not formally model the issue.

The remainder of the paper is organized as follows: In the second section, we correct and then extend a model proposed by Glaeser and Shleifer (2001). Specifically, we derive under what enforcement conditions it is better for an entrepreneur to start an NP firm. In the third section, we discuss the implications and limits of our model. Concluding remarks follow.

4.2 Entrepreneurial Choice

The model in this section extends the model proposed by Glaeser and Shleifer (2001).[4] It is a three-stage game whose key feature is *ex post* expropria-

[4]There are a few typos in the original paper. On p. 105, proposition 2 part (A), "$m^* = \frac{(1-d)z+b(q_f-q_n)-c(q_f)-dc(q_n)}{(1-d)q*-q_f+dq_n}$" is wrong and should be replaced by "$m^* =$

tion. The ownership status decision is made in the first stage of the game. Following the basic rationale of Hansmann (1980), in the second stage the entrepreneur sells a product of non-verifiable quality to a consumer. In the last period, the entrepreneur chooses quality and delivers the product.

The inverse demand function is represented by $P = z - m(q^* - q)$, where z, m, and q^* are constants. Demand depends on m, which measures marginal willingness to pay for quality and on the difference between standard quality, q^*, and consumers' expectations about quality that will be delivered, q.

The utility function of an entrepreneur, whether of the NP or FP variety, is equal to $Income + V(Z) - b(q^* - q)$, where Z is profit which, because of the non-distribution constraint, can be consumed by NP entrepreneurs as perks only. Hence, the utility function of a NP entrepreneur takes the specific form of $Income + V(Z) - b(q^* - q_n) = Income + f(d, e)Z - b(q^* - q_n)$, where the constant b represents costs associated with delivering a lower quality than promised. These costs can be interpreted in two ways. First, as a nonmonetary (or psychic) cost that the entrepreneur incurs when delivering a lower quality than promised. Second, as a reputational cost that has monetary consequences. This latter interpretation recaptures the arguments by Heal (1976) and Klein and Leffler (1981) in a simple and straightforward manner.

$f(d, e) \in (0, 1]$ represents the value of perks as a fraction of profit, Z, that equals price received minus production costs. $f(d, e)$ depends on two parameters, d and e. Following Glaeser and Shleifer (2001), d denotes the value of perks for which they assume that it is always less than 1. e (which is not part of their model) denotes the degree of enforcement of the non-distribution constraint, with e possibly constraining the extent to which perks can be enjoyed even further (e.g., the kind of examples in Gibelman and Gelman, 2004).

$\frac{(1-d)z+b(q_f-q_n)-c(q_f)+dc(q_n)}{(1-d)q*-q_f+dq_n}$." The statement in this proposition 2 part (A) "below which all entrepreneurs choose non-profit status and above which all entrepreneurs choose for-profit status" should be "above which all entrepreneurs choose non-profit status and below which all entrepreneurs choose for-profit status", and on p. 105, proposition 2 part (B), "... m^* falls and non-profit status..." should be "... m^* rises and non-profit status...." Obviously, this leads to a different interpretation of m^*.

As mentioned in the introduction, perk consumption may be an important part of a manager's compensation package. The value it can take is a function of how binding the non-distribution constraint is defined. Enforcement, e, stands for the attempt of the authorities to make relevant laws and regulations binding and to punish violators. Models of crime, tax evasion, and the like, typically model enforcement through penalties and probabilities of being caught (and having the penalty imposed). We choose a simplistic way to model enforcement that can be conceptually rationalized by agents that are risk neutral and take into account the expected value of penalties and probabilities. We normalize the range of expected values to the unit interval, implicitly assuming that maximal enforcement brings perks close to zero.

The more stringent the enforcement of the non-distribution constraint is, the less the NP entrepreneur will be able to enjoy the resulting amenities. Thus, $f_d > 0$ and $f_e < 0$. Under weak enforcement the value of perks not covered by a non-distribution constraint, i.e. not admissible perks, may reach the cash benefits level, $f(d, e) = 1$. (Nothing would be lost if we would constrain f to the open unit interval.)

To illustrate the relation between the non-distribution constraint, enforcement, and the entrepreneurial valuation of perks let us first assume that the legal definition of the non-distribution constraint allows only perks with zero valuation for the entrepreneur. It is useful to ponder the consequences of d and e being equal to 0 and/or equal to 1. Clearly, these realizations of d and e describe four limit cases. The first case, $d = 1$ and $e = 0$, captures the scenario where the value of the perks is not at all constrained by enforcement of the non-distribution constraint. Hence, $f(d, e) = 1$. The second case, $d = 0$ and $e = 0$, captures a scenario where the value of the perks is not at all constrained by enforcement of the non-distribution constraint either. In this case, the lack of enforcement is inconsequential since perks are not valued in the first place. The remaining cases, $d \in \{0, 1\}$ and $e = 1$, capture scenarios where the enforcement is unrelenting and therefore perks (even though they might have value) can't be enjoyed. Hence, $f(d, e) = 0$, or to be precise close

to 0 since we assume that $f(d, e) > 0$.[5]

To illustrate the situation for d and e between 0 and 1, we consider $f(d, e)$ linear in both variables (see Figure 4.1).

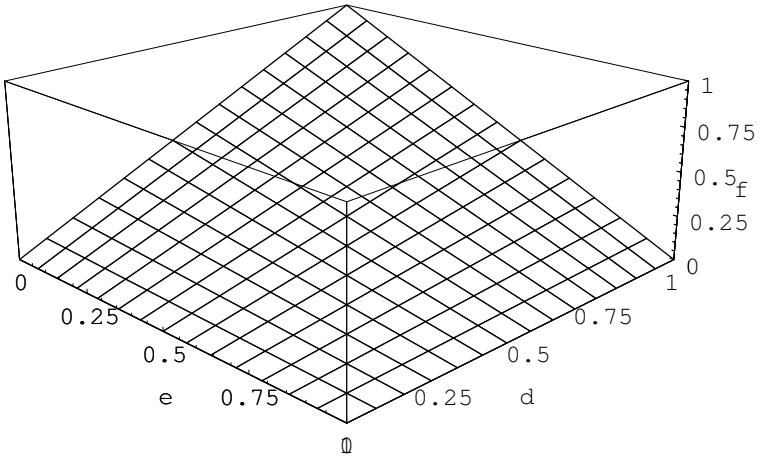

Figure 4.1: Value of Perks with NDC Set at $d = 0$, $f(d, e) = d(1 - e)$

Interestingly, given our functional specification of $f(d, e)$, we see that the value of perks is strictly smaller than one (smaller than the value of cash) for strictly positive enforcement irrespective of the individual valuation of perks d.

Recall that we are interested also in cases when the non-distribution constraint is not binding, i.e. it permits the consumption of perks with a positive value to entrepreneurs. Figure 4.2 depicts $f(d, e) = min\{d, max\{NDC, (1 - e)d\}\}$ for NDC (non-distribution constraint) set at $d = 0.2$. Now, perks are consumed even under strict enforcement of the non-distribution constraint, but these are only the perks permitted by law and regulations. Entrepreneurs with the valuation of perks admissible by the non-distribution constraint always consume the fraction of profit that equals their valuation irrespective of the enforcement level. For $d > 0.2$ and $e < 1$, the value of $f(d, e)$ increases linearly in d and e as in Figure 4.1. Consider, for instance, an entrepreneur

[5]Complete enforcement for the non-distribution constraint set at $d = 0$ is prohibitively costly.

with $d = 0.7$. He is willing to consume more perks than is permitted by the non-distribution constraint, i.e. he is thus interested in non-admissible perks. How much of non-admissible perks he in fact consumes depends on the enforcement level: Under nonexistent enforcement ($e = 0$), he consumes a fraction of the profit (0.7); a moderate enforcement of $e = 0.5$ reduces the fraction to 0.35, which is still above the level of the non-distribution constraint level; and under strict enforcement ($e = 1$), he can consume only the fraction that is allowed by the non-distribution constraint, 0.2.

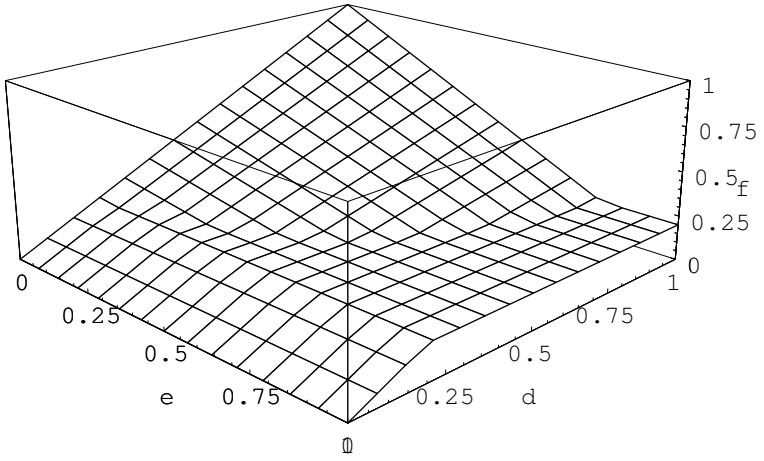

Figure 4.2: Value of Perks with NDC Set at $d = 0.2$, $f(d, e) = min\{d, max\{NDC, d(1 - e)\}\}$

Having explained the effect of non-distribution constraint and its enforcement on perk consumption, we proceed by solving the entrepreneurial choice problem backward. In the third period, both entrepreneurs take the price as given. FP entrepreneurs maximize $P - c(q_f) - b(q^* - q_f) \Rightarrow$ FOC:$c'(q_f) = b$. NP entrepreneurs face the non-distribution constraint and receive subsidies $s \in (0, 1)$, which we assume lower their production costs that need to be covered by consumers' payments. NP entrepreneurs therefore maximize $f(d, e)[P - (1 - s)c(q_n)] - b(q^* - q_n) \Rightarrow$ FOC:$c'(q_n) = \frac{b}{(1-s)f(d,e)}$. [6] We assume that $c'(\cdot)$ is an increasing function. In addition to Glaeser and Shleifer, we

[6]Setting $s = 0$ and ignoring the possibility of weak enforcement, we would get Glaeser and Shleifer's model.

model tax and regulatory breaks bestowed on NPs. These breaks are realized in our model in the form of a subsidy, s.

Proposition 1 *The non-verifiable quality of the product of the NP firm exceeds that of the FP firm.*

Proposition 1 follows from the FOCs and the convexity of the cost function.

Proposition 2

- *The subsidy causes the enhancement of the quality of products provided by the NP firm.*
- *The quality of NP products decreases when the valuation of perks, d, increases.*
- *The quality of NP products decreases, as enforcement of the non-distribution constraint weakens.*

The results summarized in Proposition 2 follow from the FOCs and the fact that $c'(\cdot)$ is an increasing function. The first part of the proposition relates to the effect of subsidy on quality produced. The increase in subsidy, s, induces higher quality of NP products due to the fact that subsidies are assumed to decrease production costs of NP firms. Note that an increase in s has qualitatively the same effect as a decrease in $f(d, e)$, which may be triggered either by increased enforcement or decreased valuation of perks by NP entrepreneurs, or a linear combination of the two. Assuming that NP entrepreneurs' valuation of perks is stable, the interesting trade-off is between the costs of increased enforcement and the costs of tax and regulatory breaks. These two ways for increasing quality have, obviously, different distributional implications.

Second, for a given level of enforcement, $f(d,e)$ increases in d and therefore q_n declines. If the value of perks rises, NP entrepreneurs have incentive to deliver lower quality than promised. This seems in line with intuition.

Third, weak enforcement prompts for-profits-in-disguise to emerge. With decreasing enforcement, alleged entrepreneurs exploit market asymmetries and decrease quality. In addition, for $f(d,e)$ defined as $min\{d, max\{NDC, (1-e)d\}\}$, the quality of NP products decreases with a higher value of perks allowed by the non-distribution constraint. The effect of non-distribution constraint and its enforcement, too, seem in line with intuition and explain the observations (Fric and Goulli, 2001; CVNS, 2004, 2005) that motivate our study.

Continuing to solve backward, in the second period consumers pay P for the product. In equilibrium consumers correctly anticipate the quality of products, therefore their willingness to pay in the second stage is higher when dealing with the NP firm than when purchasing the FP product. NP firms thus charge higher prices in equilibrium. This result is in line with theoretical findings of Hirth (1999).

In the first period, entrepreneurs opt for the ownership form by comparing the benefits of being either NP entrepreneur or FP entrepreneur. If $[f(d,e)(z - m(q^* - q_n) - (1-s)c(q_n)) - b(q^* - q_n)] - [z - m(q^* - q_f) - c(q_f) - b(q^* - q_f)] > 0$, then entrepreneurs will become NP entrepreneurs. Ultimately, entrepreneurs' choice of ownership form is determined by the value that m takes.

Proposition 3 *There is a unique value of*

$$m^* = \frac{(1 - f(d,e))z - b(q_n - q_f) - c(q_f) + f(d,e)(1-s)c(q_n)}{(q^* - q_f) - f(d,e)(q^* - q_n)}$$

above (below) which all entrepreneurs choose the NP (FP) status.[7]

The intuition is the following: FP firms will dominate markets for goods whose quality is not valued much by consumers, i.e. when m is small. If

[7]The value of m^* is now smaller than indicated by Glaeser & Shleifer's model due to the subsidy that makes the NP status more attractive.

consumers do care about quality (i.e. m is high) the market will be dominated by NP firms. Consumers who value quality are willing to pay a higher price (schools, hospitals, and nursing homes). Entrepreneurs want to charge higher prices to maximize their own utility. Charging the high price is, however, profitable only for NP firms. NP firms do not have incentives to adjust quality downward *ex post*, thus do not incur a loss in the form of non-cash costs $b(q^* - \hat{q})$. Note that the tradeoff depends on the value of the parameter b. Of course, all this is moderated by the value that $f(d, e)$ takes as stated in Proposition 2.

4.3 Discussion: Limits of the Model

Our extended version of Glaeser and Shleifer (2001) shows the conditions under which a self-interested entrepreneur opts for the NP status. The conditions are formulated for a representative entrepreneur and consumer sensitivity to quality that is assumed to be homogeneous for a market or industry segment. Thus, the resulting markets or industry segments, are either all NP or all FP.

In reality, however, the two ownership forms often coexist within one industry (e.g. health care or education): The NP and the FP ownership do attract entrepreneurs within the same market or industry segment. It would be desirable to introduce heterogeneity, either on the supply side or the demand side, or both. For example, if valuation of perks were distributed in some manner, those entrepreneurs with high valuations of perks would likely end up as nonprofit entrepreneurs while those with low valuations would likely be better off than FP entrepreneurs. Likewise, if the marginal willingness to pay for quality would differ among consumers, those consumers that do not value quality much are likely to be served by FP firms, while those that do are likely to be served by NP firms. This is supported by empirical evidence on day care centers (Mauser, 1998).

The competition between NP and FP firms was analyzed in various settings

Liu and Weinberg (2004) and Lien (2002) focus on Cournot competition with homogeneous consumers. Friesner and Rosenman (2001), Harrison and Lybecker (2005), and Chapter 2 analyze modified Bertrand competition with firms competing over price and quality. Consumers in Friesner and Rosenman (2001) differ in whether they are insured or self-paying. In Chapter 2, I assume consumers with heterogeneous taste for quality, and Harrison and Lybecker do not specify on what basis consumers sort between sectors. With a notable exception of Hirth (1999), however, all these studies assume strict enforcement of the non-distribution constraint.

Hirth (1999) analyzes competition between NP and FP firms under three different levels of enforcement. He shows that the credibility of the NP sector is preserved under strict and moderate enforcement of the non-distribution constraint. In the case of weak enforcement, however, for-profits-in-disguise enter the market and the NP status fails to signal high quality production. In Hirth's model consumers who are uninformed about quality patronize NP firms which produce a higher quality and charge a higher price than FP firms. Informed consumers, in contrast, prefer dealing with FP firms. In Hirth's model, this sorting of consumers decreases opportunism in the FP sector and thus positively affects the quality of FP products.

The objectives pursued by NP firms affect equilibrium outcomes (Harrison and Lybecker, 2005, Chapter 2). Since the NP firms' objectives are mainly determined by funding entrepreneurs and those who manage the firms (Young, 1983), it is important to know what entrepreneurial type will be attracted to the NP sector. The entrepreneurial choice of the ownership form, which is omitted in Hirth's analysis, affects the competitive outcome. Glaeser and Shleifer show that the quality delivered by NP firms is indeed higher than the FP quality even in the case where a self-interested entrepreneur enters the NP sector. We show that the quality difference diminishes under weak enforcement of the non-distribution constraint. The interesting question of how would competition affect the choice of quality under weak enforcement remains. Would the competition discipline entrepreneurs entering the NP sector? How much can they cheat to keep the NP signal credible?

4.4 Conclusion

Motivated by the empirical evidence that shows significant gaps in law and regulations of NP entities and further, the enforcement of these regulations, we studied the impact of the non-distribution constraint and its enforcement on the entrepreneurial choice between NP and FP ownership form. We also analyzed the consequences of weak enforcement of the non-distribution constraint for the quality and price of the products delivered by the NP entrepreneur.

We show that it is the combination of the possibility to consume perks with weak enforcement of the non-distribution constraint that makes the NP sector unequivocally more attractive to entrepreneurs. Moreover, the NP sector thus attracts entrepreneurial types that might not be willing to pursue objectives that are usually attributed to NP organizations. Entrepreneurs motivated by perks have also incentives to maximize profits although their incentives to do so are weaker than incentives of FP entrepreneurs. The strength of incentives, however, depends on the definition of the non-distribution constraint as well as on its enforcement that clearly affect the quality delivered by NPs. The model shows that the quality delivered by the NP firm under weak enforcement is lower than that of the NP firm under strict enforcement but higher than the quality delivered by a FP firm.

In this paper, we do not analyze the entrepreneurial choice under mixed competition. It would be interesting to see how competition affects the entrepreneurial choice under weak enforcement when NP and FP firms compete. Therefore, it would be beneficial to combine the entrepreneurial choice model with a model of mixed competition. This is a topic for current research.

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