Quality Differentiation and the Insurance Industry

Essays on Quality Competition and its Welfare Effects in Markets for Repair Goods, Insurance Mediation, and Health Care

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1. General Introduction

Differentiation is a valuable marketing strategy (Smith, 1956).[1] Regarding the insurance industry, the design of the optimal insurance contract as well as differentiation of insurance policies has been discussed extensively (Arrow, 1963; Spence, 1978; Raviv, 1979). Insurance, in general, influences consumer behavior (Pauly, 1968). This should be taken into account when designing insurance contracts (Shavell, 1979). Furthermore, providing insurance policies that are differentiated with respect to risk allocation takes consumer heterogeneity into account (Rothschild & Stiglitz, 1976). However, differentiation is not restricted to the insurance policy itself. The goal of this thesis is to analyze the effects of insurance on the organization of markets with vertical differentiation and how quality differentiation in markets that are closely related to the insurance market affects social welfare. Three of these markets are analyzed and policy implications derived. Figure 1.1 schematically illustrates the areas of the insurance industry this thesis deals with, namely markets for repair goods, insurance mediation, and health care.

A broad range of literature deals with differentiation: the seminal analysis of Hotelling (1929) has shown how horizontal differentiation can be used to relax price competition in a duopolistic competition of retail stores. This analysis was extended by Salop (1979) by considering free entry of retail stores in a circular city market. Bouckaert (2000) added a mail-order-business which globally competes with all retail stores on the circle.[2] When customers' preferences differ horizontally, firms produce differentiated products that account for the various customer tastes. In the automobile industry, for instance, cars are offered in different designs and various colors. But customer preferences are also heterogeneous with respect to a product's quality. Thus, while design and color of a product can influence a purchase decision, the material of the components used and their sustainability is also very important. Furthermore, some customers prefer sub-compact cars that come at a low price, others want upper-class vehicles with only the best interior equipment. Whether firms differentiate horizontally or vertically, they directly take customers' preferences into account when deciding which products to provide. This

[1] For a review of definitions of differentiation, see Sharp & Dawes (2001).

[2] For literature on vertical differentiation, see Gabszewicz & Thisse (1979); Shaked & Sutton (1982); Tirole (1988). A broader literature review is given in Part III of this thesis.

direct interaction of firms with customers' heterogeneous preferences is indicated by Line 1 in Figure 1.1.[3]

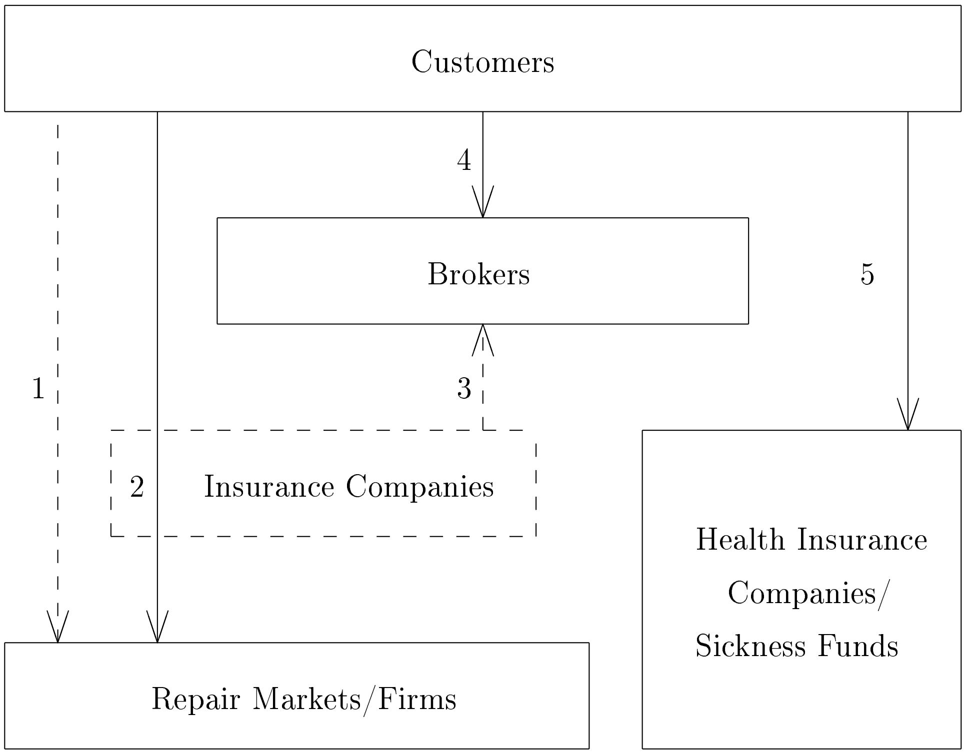

Figure 1.1.: Schematic depiction of the structure of this thesis.

It is well established, empirically and theoretically, that insurance coverage can have a great impact on related markets since customers take their insurance contract into account when making purchasing decisions.[4] Line 2 in Figure 1.1 indicates this influence of insurance on other markets. Nell et al. (2009) have analyzed the organization of a repair market in a Salop (1979)-style circular city model in the case of customers being partially insured. In their analysis, firms offer horizontally differentiated products. Part I of this thesis, containing Chapter 2, analyzes how insurance coverage influences the market organization when vertically differentiated products are offered. The basic model deals with the market for pharmaceuticals. Despite bio-equivalency, generics can cause different and possibly more severe side effects and some consumers can suffer allergic reactions to inactive ingredients. Furthermore, psychologically driven variations in effectiveness can occur. Therefore, a brand-name drug is perceived as a superior product. A monopolistic incumbent who sells the brand-name drug faces entry by competitors who sell generics.[5] In this setting, insurance coverage leads to an increase

[3]The line is dashed, which indicates that this direct interaction is not in the scope of this thesis.
[4]See, for instance, Pauly (1968), Shavell (1979) or Schreyögg (2004) for the impact of moral hazard.
[5]The analysis is based on Bouckaert (2000) and follows Nell et al. (2009) by adding insurance coverage.

of the overall price level, which leads to excess entry and, at the same time, increases the incumbent's profits. This should be taken into account when calculating the extent of patent periods. The first extension analyzes the market for car repair services. Here, an authorized repair shop faces entry by independent garages. The authorized repair shop uses expensive original parts and therefore produces at higher costs than the independent garages which use less expensive replicas. In this situation, excess entry is attenuated when coinsurance-rates are high. For high levels of insurance coverage, however, results from the basic model retain. In the analysis, the insurance contract was full insurance with proportional coinsurance. Since this is a very simplified way of modeling insurance, a second extension of the basic model analyzes the impact of different insurance contract designs. It is shown that employing different coinsurance rates for the different products is not socially desirable since it increases excess entry. The reimbursement of a fixed fraction of the lower price or a first-loss insurance with a low amount of coverage do not negatively affect market organization, but lack a substantial risk transfer and therefore the customers bear a high basis risk.

As the analysis in Chapter 2 indicates, insurance policies can be designed very differently and may include various different features. Often, customers do not know exactly which insurance policy best suits their needs. In this case, brokers act as a market maker to match customers with suitable insurance policies. As Line 3 in Figure 1.1 illustrates, insurance companies can influence brokers.[6] Inderst & Ottaviani (2012a) show how insurance companies can steer advice towards their own products by choosing the commission strategically. A broad range of studies deals with the question of how brokers should be compensated (Focht et al., 2013; Inderst & Ottaviani, 2012b). Most of these studies compare the commission system to a fee-for-advice system and focus on monopolistic brokers or assume perfect competition in the broker market (Hofmann & Nell, 2011). All of these studies have in common that the world is assumed to be black or white: brokers are either remunerated by commission or they charge a fixed fee, the broker market is either monopolistic or perfectly competitive, and advice is either nonstrategic and perfect or strategic with intentional misselling.[7] Line 4 in Figure 1.1 illustrates the interdependence of the broker market and the customers. Part II of this thesis, including Chapter 3 and 4, deals with broker competition and advice quality and adds several shades of gray to the discussion described above. The broker market is duopolistic, which allows the modeling of competition. Brokers can engage

See Frank & Salkever (1997) and Kanavos et al. (2008) for empirical studies on generic entry.

[6]A possible way of influencing dependent intermediaries is discussed by Inderst & Ottaviani (2009).

[7]An exception is Sonnenholzner et al. (2009), who analyze a reinsurance broker that faces entry by a competitor in a fee-for-advice system.

in quality competition by choosing either a low or a high advice quality. Furthermore, the general remuneration system is commission-based, which is the predominant type of broker compensation in consumer business (GDV, 2012). The analysis in Chapter 3 shows that allowing brokers to pass their commissions on to their customers enables them to engage in price competition and induce differentiation in quality, which is beneficial from a welfare perspective.[8] Chapter 4 discusses possible market failures due to imperfect observability of broker qualities. This leads to a situation in which brokers are obligated to attend a certified training in order increase their advice quality which is then recognized by the customers. Nevertheless, the results of Chapter 3 remain valid: customers with a high misselling risk ask for costly high quality advice while customers with a lower misselling risk ask for less costly low quality advice. Therefore, the customers trade off the cost of advice against the potential disutility when buying the wrong product.

The analyses in the previous chapters were based on differentiated insurance policies that account for heterogeneous preferences of the consumers. Part III of this thesis, including Chapter 5 and 6, deals with the strategies of health insurance companies and especially sickness funds in market segments where quality differentiation is possible. Figure 1.1 indicates that health insurance companies act as insurers and product providers at the same time and can directly compete for customers, which is illustrated by Line 5 in Figure 1.1. Differentiation in the health insurance industry is not only horizontal but also vertical.[9] Different health plans can contain different coinsurance rates and deductibles. Furthermore, health insurance companies can make agreements with physicians' networks and can offer access to these networks to their customers. Of course, it is not only important which specialized doctor is consulted and how quickly an appointment is made. Covering the costs of use of high cost technologies which might be excluded from primary health care is a way to offer a high quality health insurance product to customers with a sufficiently high willingness to pay for such high cost technologies. Hence, supplementary health insurance offers room for differentiation. In Chapter 5, the strategies of heterogeneous sickness funds that can differentiate in quality and aim for sales volume maximization are analyzed. The goal of sales volume maximization stems from a one-sided cross-selling potential from the strategically important supplementary health care business to the primary health care market, which is the core business of sickness funds. It is shown that entry deterrence is possible even without any fixed costs, which is in contrast to the competition of profit maximizing

[8] Currently, the prohibition of giving kickbacks to customers is being revised after it was declared void by the administrative court of Frankfurt am Main (VG FFM, 2011).

[9] An extensive literature review is given in Section 5.2 and 6.2.

firms. In a simultaneous quality competition, the efficient sickness fund provides a lower quality and might deter entry. An equilibrium only exists if consumers react sufficiently sensitive to quality changes and if cost inefficiency is sufficiently high. If consumers' sensitivity decreases in quality and the inefficient sickness fund can act as a first mover, the inefficient sickness fund can always find a high quality niche providing coverage for extreme high cost technologies at a very high price for a handful of customers. Thus, quality differentiation is not only used by profit maximizing firms in order to relax price competition, but can also be a useful tool for inefficient firms that follow other goals and need to differentiate from efficient competitors. Using a vertical differentiation approach, Chapter 6 investigates how the market for supplementary health insurance should be organized. The firms are either public non-profit sickness funds or private for-profit health insurance companies. Due to the fact that some countries organize their supplementary health care market via mixed competition, the welfare of such mixed competition is compared with the welfare of competing private health insurance companies and with that of competing public sickness funds. It is shown that mixed competition is inefficient and supplementary health care should only be provided by private health insurance companies which try to maximize their profits. The rationale behind this result is that profit maximizing firms offer qualities close to social optimal qualities since they are looking to elicit a high willingness to pay so they can enforce high mark-ups. Public sickness funds differentiate too little or on the wrong level, if at all. Therefore, the qualities offered do not correspond to those highly valued by the customers. Hence, countries such as Germany that have made first steps into the direction of organizing the market for supplementary health care via sickness funds as well as private health insurance companies need to review their health care reforms.

Several policy implications can be drawn from the analyses in this thesis. The main implications are discussed in the following with a special focus on recent regulatory changes and discussions in Germany. In Part III it is shown that public or a mixed provision of supplementary health care is inferior to the private provision of supplementary health insurance. The Social Health Insurance Competition Strengthening Act, which was adopted in 2007 and permits German sickness funds, to some extent, to provide supplementary health care. The analysis in Chapter 6 shows that especially in market segments which contain steep cost increases and expensive high quality treatments, providers of supplementary health insurance should be private health insurance companies. Most health care systems face increasing costs due to demographic changes and the rapid technological progress in medicine. Rationing is a possible way to cope with these problems. The basic coverage in primary health care should be restricted to an appropriate level of care.[10] This would lead to an increasing importance of supplementary health care. Private health insurance companies can step in and offer supplementary health insurance with higher levels of care.[11] Individuals that are not satisfied with the basic coverage of primary health care can privately invest in supplementary insurance.

When customers have different needs, the benefits of the provision of differentiated insurance policies depend on the assumption that the potential policyholders know which insurance contract suits their needs best. In many cases, especially when dealing with long term insurance contracts, at least some customers will not be able to identify the most suitable insurance contract and, therefore, face a high misselling risk when buying a random insurance policy. In this case, brokers can act as match-makers and advise the customers which products to buy. In general, improved matching leads to a welfare gain, but it also accrues costs. If the misselling risk is identical for all customers, from a welfare perspective, either all or none of them should be advised, depending on the cost of advice and its quality. If misselling risk differs among customers and high quality advice accrues higher costs than low quality advice, customers should be enabled to choose whether to ask for costly high quality advice or less costly low quality advice. So from a policymaker's perspective, brokers should offer differentiated advice qualities. But as the analysis in Chapter 3 shows, brokers only have an incentive to differentiate their quality if they can also differentiate their prices. While a fee-for-advice system enables brokers to compete in prices, other imponderables need to be taken care of.[12] As already mentioned above, the commission system is the predominant remuneration system; allowing brokers to give fractions of their commissions to their customers enables them to compete in prices and also engage in quality competition. So, the prohibition of giving kickbacks to customers should be disestablished by German policymakers and, as discussed in Chapter 4, the regulation authority should provide means of credibly signaling a high advice quality due to informational issues.

Insurance coverage can have contrary effects. On the one hand, insurance coverage is beneficial with respect to risk-allocation. On the other hand, policymakers should take into account which influence insurance has on related markets. While high levels of insurance coverage in segments with elastic demand can cause significant moral hazard problems, insurance coverage can also lead to welfare losses in segments in which demand

[10] Of course, the definition of the appropriate level of care can vary widely between countries and even individuals. Hence, some sort of social consensus has to be found.

[11] The public sickness funds should not be permitted to provide costly supplementary health insurance. This does not necessarily mean that it should be prohibited that public sickness funds continue offering certain managed care and disease management programs to efficiently deal with specific diseases.

[12] These are discussed in Section 4.6.

is inelastic, as shown in Part I of this thesis. Insurance coverage can influence the price setting behavior of firms in markets with insured customers. When prices rise and demand is inelastic, firms' profits rise, which attracts even more firms to enter the market. When entering the market accrues costs and the number of firms in the market is too high compared to the socially optimal number of competitors, insurance coverage can lead to a welfare loss. This problem can be avoided by enforcing an insurance contract design that does not influence the firms' price competition. By doing so, risk-allocation benefits are not entirely counteracted by welfare losses caused by changes in the market organization. With respect to health insurance and the market for pharmaceuticals, the reimbursement of a fixed amount limited to the price of the cheapest generic (and possibly additionally limited to a fixed monetary amount) would not affect the market organization. Including an additional deductible in such a contract could prevent a raise of prices for very low priced pharmaceuticals.

In conclusion, quality differentiation allows consumers to choose between varying products, which positively affects social welfare. In order to activate these potential welfare gains, policymakers have to enable the players in the market to engage in quality competition in a way that leads to the provision of differentiated products and services.

Part I.

Repair Goods

2. Insurance in Vertically Differentiated Repair Markets

The basic results of this chapter are published in Economics Letters, see Urmann (2012).

2.1. Introduction

Recent empirical and theoretical studies have shed light on the interaction between the existence of insurance and other markets. Being insured makes consumers less price sensitive and therefore influences the firms' pricing decisions in the affected markets. Finkelstein (2007) presents empirical evidence for a disproportionately large increase in hospital spending after the introduction of Medicare. Pavcnik (2002) finds significant price reductions in the market for pharmaceuticals when patient out-of-pocket expenses are increased. In a theoretical framework, Akin & Platt (2013) introduce insurance contracts in a search model. Nell et al. (2009) analyze a Salop (1979) circular city model with insured consumers and focus on the welfare implications of the existence of insurance on markets for repair goods. The latter study considers horizontal differentiation only. In particular, there is no product that is superior for all consumers.

In fact, repair markets often exhibit vertically differentiated products since some firms produce the repair good at a higher quality than others do. In car repair services, for example, authorized repair shops compete with independent garages. An authorized repair shop can be considered to provide a higher quality as it is specialized on a certain brand. Furthermore, the owner of a new car might be forced to buy repair services from an authorized repair shop in the first years in order to maintain warranty, and customer loyalty makes him stay with this particular garage.[13] Another example is the market for pharmaceuticals. When the patent period for a brand-name drug ends, firms can produce and provide generic drugs. These generics are often considered to be perfect substitutes for the brand-name drug, although therapeutic equivalence might

[13]For a study on customer loyalty and quality competition see Gans (2002).

not be given.[14] However, even if brand-name drugs and generic drugs are chemically identical, it is likely that consumers have a higher preference for the brand-name drug. Consumers might know and trust the brand-name, or they might have already used the brand-name drug and found it helpful, but they do not know the effectiveness of the generic drug.[15] Thus, the brand-name drug is considered to be of superior quality.

Both examples have in common that consumers are insured and that the firm considered to provide the superior product already serves the whole or at least part of the market before facing competition by other firms. This study therefore analyses the influence of insurance on a market for vertically differentiated repair goods with a former monopolistic incumbent and several entrants. It answers the questions how insurance coverage influences pricing and entry decisions and subsequently influences the market outcome, and whether the existence of insurance favors the incumbent or the potential entrants.

2.2. Basic Model

The market is modeled using Salop's circular city, but a supplier of a superior good is added.[16] The supplier of the superior good is considered to be a former monopolistic incumbent facing entry by competing firms. If a firm decides to enter the market, fixed entry costs $f > 0$ are incurred and the $n > 0$ entrants are located symmetrically on the circle. All firms face identical costs per unit $c \geq 0$. The incumbent sells the product at price p_i, and all entrants sell their products at price p_e.[17]

The valuation of the products' qualities differs between consumers. These differences are represented by the distance x of a consumer to a seller on the circle in form of linear transportation costs $t(x) = tx$, $t > 0$.[18] No transportation costs are associated with the incumbent's product, which therefore is of superior quality from every consumer's point of view. Consumers are insured with coinsurance rate $\delta \in (0, 1]$ and are uniformly distributed on the circle with mass one.[19] We normalize the perimeter of the circle to one and assume that every consumer has suffered a loss and needs exactly one unit

[14] See Wilner (2004) for a survey regarding the therapeutic equivalency of generic anti-epileptic drugs.

[15] Guberman & Corman (2000) state that the pharmacokinetics of generic drugs may differ and bioequivalence does not guarantee the same therapeutic effects.

[16] This supplier can be thought of being placed at the center of the circle as in Bouckaert (2000) and Madden & Pezzino (2011).

[17] This study focuses on equilibria where all entrants charge the same price.

[18] The results also hold for more general transportation costs. Linear transportation costs are assumed for convenience and comparability of the results to the above mentioned studies.

[19] In case of full insurance, i.e. $\delta = 0$, all consumers would buy the superior product regardless of its price. The issue of the design of the insurance contract is addressed in section 2.6.

of the repair good to repair the damage.[20] We further assume that even without any insurance ($\delta = 1$) the consumers prefer to repair the damage. This allows us to rule out ex post moral hazard.[21] The consumers can choose whether to buy from the incumbent or from the nearest entrant. When buying from an entrant, transportation costs are not covered by insurance.

The structure of the game is the following. First, firms make their entry decision. Second, the incumbent and the entrants simultaneously choose their prices. Third, consumers choose where to buy.

2.3. Results

The game is solved via backward induction. On the third stage, consumers minimize their total expenditures for purchasing the product. The marginal consumer, indifferent between buying from the incumbent or from the nearest entrant, is located at distance $x^* = \delta(p_i - p_e)/t$ from the respective entrant. For given prices, a smaller coinsurance rate puts the marginal consumer closer to the entrant since the relative weight of the transportation costs is increased. Obviously, higher transportation costs have the same effect.

2.3.1. Pricing

On the second stage, price competition takes place. Assume n entrants symmetrically located on the circle. Each entrant maximizes $\pi_e = 2x^*(p_e - c)$ and the incumbent maximizes $\pi_i = (1 - 2nx^*)(p_i - c)$. Simultaneously solving the first order conditions yields $p_i = t/(3n\delta) + c$ and $p_e = t/(6n\delta) + c$. Thus, providing a superior good allows the incumbent to charge a higher price than the entrants. A larger number of entrants intensifies competition and therefore lowers prices. As already stated above, higher transportation costs favor the incumbent, but when the incumbent increases his price, so do the entrants. Insurance coverage also leads to higher prices in the repair market and therefore influences the prices in the same manner as in Nell et al. (2009).

Each entrant's demand is $D_e = 2x^* = 1/(3n)$ and the incumbent's demand is $D_i = 2/3$, independent of the coinsurance rate δ and, quite surprisingly, independent of the number of entrants n. Even for general transportation costs the incumbent's market share depends only on the mark-up ratio, i.e. $D_i/(nD_e) = (p_i - c)/(p_e - c)$.[22]

[20] So, we consider the ex post repair market after the realization of losses.

[21] The effects of ex post moral hazard will be briefly analyzed later by assuming consumers' mass greater than one.

[22] Example: for $t(x) = tx^k$, with $k \geq 1$, the incumbent's market share is $(k + 1)/(2k + 1)$.

Since a variation of δ affects the incumbent's and the entrants' prices in the same way, the incumbent's market share remains the same. The incumbent's profits are $\pi_i = 2t/(9n\delta)$ and every entrant makes profits $\pi_e = t/(18n^2\delta)$. Since insurance coverage and transportation costs do not influence the market shares, their price effects are directly reflected in the respective profits of the incumbent and the entrants. So for a given number of entrants, insurance coverage leads to higher profits for all firms.

2.3.2. Free entry

After having derived the optimal pricing strategies for a given number of firms in the last section, the firms can now choose to freely enter the market. Thus, the equilibrium number of firms n is now endogenous. If a firm enters the market, entry costs $f > 0$ are incurred. Therefore, firms enter the market as long as $\pi_e \geq f$. In equilibrium, $n^* = \sqrt{t/(18f\delta)}$ firms enter on the circle. If entry costs are low, many firms enter the market. High transportation costs as well as insurance coverage (a small coinsurance rate δ) also increase entry, since profits are increased, as derived in Section 2.3.1, which attracts more firms. Increased entry enforces competition, which brings down prices. The equilibrium prices are $p_e^* = \sqrt{tf/(2\delta)} + c$ and $p_i^* = \sqrt{2tf/\delta} + c$. Insurance coverage allows more firms to enter the market, but the increased competition does not fully compensate the price-raising effect of insurance. The same holds for the transportation costs. Clearly, higher fixed costs lead to less entry and the relaxed competition allows higher prices.

Each entrant's demand is $D_e = 2x^* = \sqrt{2\delta f/t}$ and the incumbent's demand still is $D_i = 2/3$, independent of the coinsurance rate. The price effect of insurance therefore just reallocates the entrants' overall demand between the insurance induced higher number of firms on the circle. Since the incumbent's demand is independent of insurance coverage, it directly follows that insurance coverage increases the incumbent's profits $\pi_i^* = \sqrt{8tf/(9\delta)}$. In effect, insurance coverage still leads to higher profits for the incumbent although the effect is attenuated due to increased entry and, as a consequence, increased competition. These results are in line with the empirical and theoretical findings of Pavcnik (2002) and Nell et al. (2009). Higher fixed entry costs f also increase the incumbent's profits, since a lower number of entries relaxes the price competition. Higher transportation costs t also lead to higher prices and therefore to higher profits for the incumbent, although the number of entrants is higher at the same time.

2.3.3. Ex post moral hazard

In this section, the impact of ex post moral hazard on the repair market is briefly discussed. While standard literature suggests higher prices due to ex post moral hazard, Nell et al. (2009) show that ex post moral hazard can also lead to decreasing prices due to an intensified competition caused by additional market entries. Ex post moral hazard is incorporated in the model by assuming an overall demand for repair goods increasing in insurance coverage. More specifically, consumers' mass is now $A(\delta)$ with $dA/d\delta < 0$ and $A(1) = 1$.[23]

The marginal consumer's distance to the nearest repair shop is not influenced by ex post moral hazard. As before $x^* = \delta(p_i - p_e)/t$ holds. In consequence, the incumbent's profits are now $\pi_i = (A - 2nx^*)(p_i - c)$, while each entrants profits π_e are unaffected by ex post moral hazard. For a given number of entrants, the second stage price competition yields $p_i = At/(3n\delta) + c$ and $p_e = At/(6n\delta) + c$. The additional demand caused by ex post moral hazard c.p. leads to higher prices. The first stage entry game thus results in an increased number of entries $n^* = A\sqrt{t/(18f\delta)}$. Subsequently, equilibrium prices are still $p_i^* = \sqrt{2tf/\delta} + c$ and $p_e^* = \sqrt{ft/(2\delta)} + c$ leading to $D_i^* = 2A/3$ and $D_e^* = \sqrt{2\delta f/t}$. Any raise in prices caused by the additional demand directly leads to an increase of the number of entering firms and therefore intensifies competition, which in consequence brings prices down again. In equilibrium, the prices are independent of consumers' mass A. Thus, every entrant gains the same demand as in the case without ex post moral hazard. The number of entrants and the incumbent's demand are scaled according to the additional demand while the incumbent's market share, which again depends only on the mark-up ratio, remains the same as before. An increased incumbent's demand at an unchanged price obviously leads to a higher profit $\pi_i^* = A\sqrt{8tf/(9\delta)}$ for the incumbent. Thus, ex post moral hazard allows more firms to enter the market and at the same time favors the incumbent. Hence, it amplifies the effects of insurance coverage.

2.4. Differences in Production Costs

While bio-equivalent brand-name and generic drugs may have identical costs per unit, this assumption cannot be made in the market for car repair services.[24] An authorized repair shop is likely to use only expensive brand-name parts, independent garages might

[23] See Riordan (1986) and Nell et al. (2009) for this way of modeling ex post moral hazard.

[24] I am indebted to Richard Peter for pointing out the importance of this extension at the 2012 Annual Congress of the German Insurance Science Association.

tend to use less expensive replicas, for instance, when changing the exhaust. Therefore, in this scenario, a heterogeneity regarding the variable costs per unit seems to be a more adequate description of reality. This extension analyzes whether the results derived in the basic model still hold when low quality entrants have smaller costs per unit compared to the high quality incumbent. Consider the same model as in the previous chapter, but now let $c_i > 0$ denote the incumbent's variable costs and $c_e > 0$ the entrants' variable costs, with $c_\Delta := c_i - c_e > 0$. On the one hand, the higher unit costs make it harder for the incumbent to compete with the entrants. On the other hand, the effect of insurance coverage is strengthened since the diminishing effect of prices relative to transportation costs becomes even more apparent. For tractability, assume $c_\Delta < \sqrt{2ft/\delta}$. Otherwise, the incumbent does not make any profits in equilibrium and drops out of the market.

2.4.1. Price Competition with Heterogeneous Costs

Assume n entrants on the circle. The marginal consumer is still given by $x^* = \delta(p_i - p_e)/t$. Price competition yields the following:

$$p_i = \frac{c_e + 2c_i}{3} + \frac{t}{3n\delta} \qquad p_e = \frac{2c_e + c_i}{3} + \frac{t}{6n\delta}$$

The cost difference increases the price gap between the incumbent and the entrants. Still, insurance coverage leads to higher prices for a fixed number of firms in the market. The marginal customer is $x^* = 1/(6n) + \delta c_\Delta/(3t)$ and therefore now depends on the level insurance coverage. The incumbent's market share now also depends on the level of insurance coverage since each entrant gains a higher demand due to the higher price gap caused by the cost differences:

$$D_i = \frac{2}{3}\left(1 - \frac{n\delta c_\Delta}{t}\right) \qquad D_e = \frac{1}{3n} + \frac{2\delta c_\Delta}{3t}$$

$$\pi_i = \frac{2t}{9n\delta} - \frac{2c_\Delta}{9} + \frac{2n\delta c_\Delta^2}{9t} \qquad \pi_e = \frac{t}{18n^2\delta} + \frac{2c_\Delta}{9n} + \frac{2\delta c_\Delta^2}{9t}$$

Insurance works in favor of the incumbent since the price gap becomes less apparent and the transportation costs, which again are not covered by insurance, are weighted relatively higher when customers make their decision which product to purchase.

2.4.2. Free Entry

In equilibrium the number n^* of entrants, such that $\pi_e = f$ is

$$n^* = \frac{t}{\sqrt{18ft\delta} - 2c_\Delta\delta}.$$

Compared to the situation in Section 2 for a given level of insurance coverage, more firms enter the market since the cost gap and, subsequently, the increased price gap favors the entrants. Insurance now has two different effects on excess entry: analogous to Chapter 2, insurance coverage increases excess entry due to rising prices. On the other hand, insurance coverage alleviates excess entry caused by the cost gap. For a given cost gap, insurance coverage reduces entry as long as $\delta > 9ft/(8c_\Delta^2)$. When the coinsurance rate is lower, the price gap which results from the cost gap becomes less important and the price raising effect of insurance coverage outweighs its entry alleviating effect. Equilibrium prices are

$$p_i^* = c_e + \sqrt{\frac{2ft}{\delta}}, \qquad p_e^* = c_e + \sqrt{\frac{ft}{2\delta}}.$$

As in Section 2, prices increase when insurance coverage is increased. The incumbent's profits are

$$\pi_i^* = \left(\frac{2}{3} - \frac{\sqrt{2ft\delta}c_\Delta}{9ft - 2c_\Delta^2\delta}\right) \cdot \left(\sqrt{\frac{2ft}{\delta}} - c_\Delta\right),$$

which also increases in insurance coverage.

2.5. Effects of Different Insurance Contract Designs

2.5.1. Limitations of a Fixed Coinsurance Rate

In the basic model, the insurance contract included a fixed coinsurance-rate. Thus, the customers had to bear only a certain fraction of the price when purchasing a repair good. Therefore, insurance affected the incumbent as well as the entrants in a similar and proportional way. The presence of insurance coverage led to higher profits for the incumbent and, in most cases, also to additional excess entry. A fixed coinsurance rate is a rather drastic simplification of the insurance contract design. This chapter analyzes whether this simplification is without loss of generality or whether alternative insurance contract designs affect results in different ways. We analyze insurance contracts with different coinsurance rates, a fixed reimbursement, and a first-loss insurance.[25] As we have seen in Section 2.4, a cost gap between the incumbent and the entrants has no major impact on results in the basic model. To keep things simple we therefore assume $c_i = c_e = c$ and focus on the market for pharmaceuticals as in the basic model.

2.5.2. Different coinsurance rates

Several health plans in the Unites States include different coinsurance rates for brand-name drugs and generics.[26] Therefore in this section, let there be different coinsurance rates δ_i for the brand-name drug and δ_e for the generic. Assume $\delta_i p_i > \delta_e p_e$, otherwise all customers would buy the brand-name drug.[27] The marginal consumer is given by $x^* = (\delta_i p_i - \delta_e p_e)/t > 0$. The optimal prices are then given by

$$p_i = \frac{t}{3n\delta_i} + \left(\frac{\delta_e}{\delta_i} + 2\right)\frac{c}{3}$$
$$p_e = \frac{t}{6n\delta_e} + \left(\frac{\delta_i}{\delta_e} + 2\right)\frac{c}{3}.$$

Again, $\pi_e = f$ leads to the equilibrium number of entrants:

$$n^* = \frac{t}{\sqrt{18\delta_e ft} - 2c(\delta_i - \delta_e)}$$

Note that the variable costs c suddenly come into play, whereas they are irrelevant for $\delta_i = \delta_e$ in Chapter 2. The insurance effects on entry are quite intuitive, n^* increases in δ_i and decreases in δ_e. An increase of the coinsurance rate for the brand-name drug favors the entrants and therefore induces excess entry. If, on the other hand, the coinsurance rate for the generics increases, demand is shifted towards the incumbent and hinders some firms to enter the market. The equilibrium prices are

$$p_i^* = \frac{\delta_e}{\delta_i}\left(\sqrt{\frac{2ft}{\delta_e}} + c\right)$$
$$p_e^* = \sqrt{\frac{ft}{2\delta_e}} + c.$$

[25] An insurance contract which includes a fixed deductible, as it is common in (comprehensive) collision automobile insurance, cannot be analyzed in the applied model framework in an adequate way. Either the deductible is too high so that consumers are de facto uninsured, or the deductible is so low that consumers act as if they were fully insured. A discussion of the limitations of the proposed model takes place in Section 2.6.

[26] E.g. CoverColorado Health Plans.

[27] If the coinsurance rate for the brand-name drug δ_i is higher than δ_e, this inequality is fulfilled.

For a comparison with the results in Section 2.3, first assume $\delta_i > \delta_e = \delta$. When the coinsurance rate for the brand-name drug is increased, in equilibrium, only the incumbent charges a lower price and there are more entrants in the market. If, on the other hand, the coinsurance rate for the generics is decreased, i.e. $\delta = \delta_i > \delta_e$, the incumbent and the entrants charge lower prices and, again, there are more entrants in the market. In both cases, applying the same coinsurance rate for both product types, i.e. $\delta_i = \delta_e$, is better from a welfare perspective.

2.5.3. Reimbursement of a fixed amount

Let the fixed reimbursement be defined as a fraction α of the low quality product's price. Then the marginal consumer is determined through the equation

$$p_i - \alpha p_e = p_e - \alpha p_e + tx \Leftrightarrow p_i = p_e + tx.$$

Therefore, the reimbursement of a fixed amount has no impact on the market outcome as long as demand is not influenced by this reimbursement. In this case, the existence of insurance coverage does not affect welfare negatively due to changes in the market organization. If the reimbursement differs depending on the purchased product type, this situation can be covered by choosing the adequate coinsurance rates δ_i and δ_e in section 2.5.2.

2.5.4. First loss insurance

Let the amount of coverage in a first loss insurance contract be denoted by $m > 0$. Hence, in case of a loss $l \geq 0$, the insurance companies have to pay indemnity $I(l) = \min(l, m)$. This means that for losses larger than m, there is only partial coverage while for losses smaller than m, consumers are fully insured. In the context of this study, the loss that occurs is the price of one of the repair goods. There are three scenarios to be analyzed and compared: (I) both prices are higher than the amount covered ($m < p_e < p_i$), (II) both prices are lower than the amount covered ($p_e < p_i \leq m$), or (III) the incumbent's price is higher and the entrants' prices are lower than the amount covered ($p_e \leq m < p_i$).

Case (I): $p_e < p_i \leq m$

When both prices are smaller than the amount of coverage of the first loss insurance policy, the out-of-pocket payment for both products is zero, but customers have to bear transportation costs when buying from an entrant. Therefore in this case, there are no entrants and the incumbent charges $p_i^* = m$, yielding profits $\pi_i^* = m - c$. Of course, this scenario is only possible if the amount of coverage m exceeds the unit costs c.

Case (II): $m < p_e < p_i$

If both prices are higher than the amount covered, the results are exactly the same as in Section 2.5.3, as the marginal consumer is determined by $p_i - m = p_e + tx - m \Leftrightarrow p_i = p_e + tx$ and the market organization is not affected by insurance.

Case (III): $p_e \leq m < p_i$

In this case, the entrants will choose $p_e^* = m$. The incumbent chooses $p_i = t/(4n) + (m+c)/2$ and in equilibrium,

$$n^* = \frac{1}{2} \cdot \frac{(m-c)t}{ft + (m-c)^2}$$

firms enter the market. This leads to the following price and profit for the incumbent:

$$p_i^* = m + \frac{ft}{2(m-c)}$$
$$\pi_i^* = \frac{1}{m-c} \cdot \frac{[ft/2 + (m-c)^2]^2}{ft + (m-c)^2}$$

The question is what the strategy of the incumbent is. He could either charge a high price or deter entry. It turns out that the incumbent will always choose a price p_i higher than m, which can be seen by comparing π_i^* and $m - c$.[28] The entrants will choose $p_e = m$ if and only if $m \geq \sqrt{ft/2} + c$, which is the entrants' equilibrium price in the absence of insurance. Therefore, as long as $m < \sqrt{ft/2} + c$, a first loss insurance has no negative welfare effects and might enhance welfare if demand was dependent on wealth effects. If the amount of coverage is high, i.e. $m > \sqrt{ft/2} + c$, the first loss insurance leads to a higher price level and increases entry, thereby reducing welfare.

2.6. Discussion and Conclusion

Facing entry by competitors naturally has a negative effect on the former monopolist's profits, even if the entrants' products are inferior. The fact that consumers are insured attenuates this effect, although the number of entering competitors increases.

[28] $\pi_i^* > m - c \Leftrightarrow ft > 0$.

Implications for the market for pharmaceuticals are the following. At the end of the patent period, the former monopolist retains a competitive advantage, which allows him to make nonzero profits. The existence of insurance strengthens this advantage. This should be taken into account when determining the extent of the patent periods for pharmaceuticals.

The basic model is extended by taking cost differences between the incumbent and the entrants into account. In equilibrium, prices are exactly the same as in the basic model with $c = c_e$. If the cost difference is sufficiently high and the level of insurance coverage is small, an increase in insurance coverage leads to less entry. So, in repair markets with high cost differences, the introduction of insurance with substantial out-of-pocket payments enhances welfare. When fewer firms enter the market, competition becomes less intensive and the incumbent's profits rise. A further increase of insurance coverage attracts more firms to enter the market, but the price-increase outweighs the intensified competition so that insurance still increases the incumbent's profits. The general effects of ex post moral hazard are not affected by the cost structure. When comparing these results with those of the basic model, the only difference is that insurance might alleviate excess entry for small levels of insurance coverage if the cost gap is sufficiently high. However, on must also take into account that the number of entrants is always higher when this cost gap exists since it is easier for the potential entrants to compete with the incumbent. Of course, the incumbent's profits are lower since he has less demand and a lower mark-up.

The analysis shows that the use of coinsurance rates negatively affects welfare. By implementing different coinsurance rates for brand-name drugs and generics, an unintended favoring of the incumbent can be avoided. The position of the entrants, on the other hand, is always strengthened; leading to additional excess entry and thus reducing welfare. Excess entry can be avoided if indemnity payments are not proportional to the price of the pharmaceuticals. A fixed reimbursement conditional on the smaller price or a first-loss insurance with a small amount of coverage does not affect the market's organization and therefore has no negative welfare effects.

In order to derive any policy implication as to how insurance contracts should be defined from a social planner's point of view, the limitations of the analysis have to be discussed. The consumers' response to insurance coverage highly depends on the elasticity of demand (Schreyögg, 2004). In the previous analysis, overall demand was perfectly inelastic. While the consumers could choose whether to buy the incumbent's brand-name drug or a generic from an entrant, they were not able to opt-out of the market. If demand was elastic, the fixed reimbursement and the first-loss insurance would also influence the market outcome, which might reduce welfare. On the other hand, by focusing on an ex-post market with inelastic demand, the trade-off between risk allocation and external moral hazard is not discussed extensively. As mentioned above, small fixed indemnities or, when production costs differ, a high coinsurance rate is beneficial from an industrial organization point of view. The consumers' behavior is only slightly influenced by insurance, so that external moral hazard changes the market organization only marginally, if at all. On the other hand with high out of pocket payments, the customers bear a high basis risk that their costs in case of a loss exceeds their indemnity.

In the analysis, each firm provided exactly one product. In fact, firms provide multiple products for different diseases at different prices but consumers have, if at all, only one insurance contract. Therefore, the amount covered in a first-loss insurance policy has to be chosen sufficiently low so that none of the product pricing mechanisms is distorted. This negatively affects risk allocation. Thus, a fixed reimbursement with $\alpha = 1$ conditional on the price of the cheapest generic would ensure that risk allocation is optimal under the condition that the market outcome is not affected by insurance.

Part II.

Insurance Mediation

3. Competition between Brokers and the Quality of Advice

3.1. Introduction

Insurance policies and financial products in general are often sold via brokers.[29] Following Schlesinger & Schulenburg (1991), customers have different needs and therefore, insurance companies offer differentiated products. Brokers do not only act as a distribution channel for insurance companies, but are also market makers when customers do not know which of the offered products suits their needs best (Cummins & Doherty, 2006). When customers suffer a disutility through buying the wrong product, the customers' willingness to pay for advice depends on the quality of the advice and on the individual misselling risk. Most studies in this area focus on the impact of commissions on advice quality in the case of a single broker (Focht et al., 2013; Inderst & Ottaviani, 2009, 2012a) or they compare the commission system and a fee-for-advice remuneration system when facing strategic advice (Inderst & Ottaviani, 2012b) or even perfect advice (Hofmann & Nell, 2011). All these studies have in common that there is no price competition between brokers since either only a single broker exists or, as in the study mentioned last, the broker market is assumed to be competitive, yielding marginal cost pricing. An exception is Sonnenholzner et al. (2009), who study an incumbent reinsurance broker who faces a potential entrant in a fee-for-advice system. It has not yet been analyzed in the literature whether price competition among brokers is beneficial from a welfare perspective compared to the status quo commission-based remuneration system when brokers can also choose the quality of advice. Allowing brokers to pass their commissions on to their customers is a possibility of giving rise to price competition among brokers without changing the general remuneration system.[30] So, answering questions of whether it is desirable to allow kickbacks to customers contributes to the ongoing discussion of who should pay for financial advice.

[29] I subsume all kinds of independent intermediaries under the name 'broker'.

[30] In Germany, the prohibition of kickbacks to customers, which was invoked in 1934, is currently being revised by the regulation authority.

The remainder of the article is structured as follows: the next section describes the model framework. Section 3 analyzes the pure broker competition when kickbacks to customers are prohibited. In Section 4, kickbacks to customers are allowed. Section 5 discusses some welfare issues. Section 6 concludes.

3.2. Model Framework

The Firms

Two firms, Firm A and Firm B, sell horizontally differentiated financial products. Each firm only sells one product, and they are referred to as product A and B, respectively. Since this study focuses on the impact of price competition in the broker market on advice quality, an explicit modeling of the firms' competition is omitted.[31] The firms sell their products at an identical net-price $p_A = p_B = p^*$.[32] When selling the product via broker, firms have to pay a commission αp^* to the broker. Therefore, the gross-price the customer has to pay is $(1+\alpha)p^*$. The commission rate α is exogenously given. Two scenarios make this assumption noncritical: firstly, products might be calculated with a fixed level of acquisition costs.[33] Secondly, competition between insurance companies for brokers might lead to a certain commission level.[34]

The Brokers

There are two brokers in the market, Broker 1 and Broker 2. The brokers simultaneously decide on their advice technologies $q_i \in \{q_L, q_H\}$ with $1/2 < q_L < q_H \leq 1$. So, Broker i identifies a customer's type correctly with probability q_i. Advice qualities are common knowledge, so there is no quality uncertainty on the side of the customers. Since both products are identical regarding prices and commissions, advice is nonstrategic and brokers advise according to the type they have identified. Unit costs of advice c_i are assumed to be constant in quantity and high quality advice is more costly than low quality advice. Therefore, let $\Delta c_i := c_i(q_H) - c_i(q_L) > 0$, $i = 1, 2$. Furthermore, it

[31] As long as firms produce at identical unit costs, price competition would lead to identical prices if it was endogenized.

[32] The price p^* can be interpreted as the price level in a more competitive market where the other firms offer other horizontally differentiated products; in that sense, this study focuses on a special segment., e.g. on a fraction of a Salop (1979) circular city.

[33] An example: until 2007, regulation in Germany stated that an annuity insurance had to be calculated with acquisition costs of 4% of the sum of premiums at most.

[34] When firms steer advice through commissions as in Inderst & Ottaviani (2012a), symmetry and the distributional assumptions on the customers' preferences lead to identical commissions if they were endogenized.

is assumed that Broker 2 is less cost-efficient. Therefore, let $\Delta c_k := c_2(q_k) - c_1(q_k) > 0$, $k = L, H$. While the analysis is not restricted to a special cost function, we assume that the following inequalities hold: $c_1(q_H) > c_2(q_L)$ and $\Delta c_H \geq \Delta c_L$. The former inequality states that high quality advising is more expensive for Broker 1 than advising with a low quality is for Broker 2. According to the latter inequality, inefficiency does not decrease when quality is increased. This is equivalent to $\Delta c_2 \geq \Delta c_1$, so switching to high quality accrues at least the same additional costs for the inefficient Broker 2 as it does for the efficient Broker 1. When regulation allows that brokers give part of their commission back to the customers, Broker i chooses his kickback to customers γ_i, with $\gamma_i \leq \alpha p^*$, in a profit maximizing way.[35]

The Customers

Customers are assumed to be uniformly distributed along $[\underline{\theta}, \overline{\theta}] = [0, 1]$ and have horizontal preferences for the products A and B, where Firm B is located at $\underline{\theta} = 0$ and Firm A is located at $\overline{\theta} = 1$.[36] All customers are a priori uninformed about the individual suitability of the different products.[37] While the customers do not know which product is suitable, they receive a signal regarding their individual misselling (or suitability) risk s, where the customer located at $\theta \in [0, 1]$ receives the signal $s(\theta) := |\theta - 1/2| \in [0, 1/2]$. Thus, the customer located at $\theta = 1/2$ is indifferent between the two products and therefore has no misselling risk. Customers located near the boundaries of $[0, 1]$ have extreme preferences and, therefore, a high misselling risk. Customers receive positive utility v from buying any of the two products.[38] At the same time, there are two sources of disutility for the customers: price and non-suitability. The former refers to the net-price paid by the customer, which takes any kickbacks received from a broker into account. Since customers do not know in advance which product will be advised, the expected advice needs to be taken into account when assessing expected utility of advice.[39] The latter corresponds to the fact that, for almost all customers, none of the products is a perfect match. This non-suitability disutility is $d \cdot (1/2 - s(\theta)) \in [0, d/2]$ when receiving the more suitable product and $d \cdot (1/2 + s(\theta)) \in [d/2, d]$ when receiving

[35] Due to the symmetry of prices and commissions and the uniform distribution of consumer preferences, it is assumed that a broker chooses the same kickback for both products.

[36] The principle of maximum differentiation according to spatial competition of insurance companies applies, see also Hofmann & Nell (2011).

[37] If there were informed customers, they would drop out of the intermediation process and purchase directly if possible.

[38] This is the gross utility of covering the financial risk. Following Hofmann & Nell (2011), customers are risk-averse with respect to the financial product and risk-neutral regarding the mismatch risk.

[39] From a customer's perspective, both products are a priori equally probable. Therefore, the customer's expects product j being advised with probability one half.

the less suitable product.[40] The scale parameter $d > 0$ indicates the severity of the misselling risk or, in other words, the complexity and heterogeneity of the segment analyzed. When d is small, products are quite standardized, while a larger d makes a good matching more important.[41] The expected utility for a customer with suitability risk $s(\theta)$ when being advised by Broker i is

$$\begin{aligned} EU_i(s(\theta)) &= q_i \cdot [v - (1+\alpha)p^* + \gamma_i - d(1/2 - s(\theta))] \\ &\quad + (1-q_i) \cdot [v - (1+\alpha)p^* + \gamma_i - d(1/2 + s(\theta))] \\ &= v - (1+\alpha)p^* + \gamma_i - \frac{d}{2} + d(2q_i - 1)s(\theta). \end{aligned}$$

The willingness to pay for advice therefore depends on the signaled suitability risk. This enables brokers to engage in quality and price competition, as long as this is allowed by regulation.

The timing of the game is as follows:

1. Nature draws commission rate factor $\alpha \in (0,1)$ and price level $p^* > 0$.
2. Brokers decide on advice technology $q_i \in \{q_L, q_H\}$.
3. Brokers decide on kickbacks to customers γ_i.
4. Suitability-risk $s(\theta)$ is signaled to customers.
5. Customers choose which advice to take.
6. Customers' type is signaled to brokers according to advice technology q_i.
7. Brokers give advice according to the signaled type and customers purchase the advised product.

3.3. Pure Quality Competition among Brokers

For now, let kickbacks to customers be prohibited so that there is a pure quality competition between the brokers. If both brokers choose the same advice technology,

[40] This corresponds to the classic horizontal preference model. As in Hotelling (1929), horizontal preferences of the customers lead to a utility loss $|\theta - x^*|$ for the customer with preference parameter θ when buying from a firm located at x^*.

[41] An alternative way of modeling the market complexity is keeping $\overline{\theta}$ as a parameter and not normalizing it. Also, in a slightly different model interpretation the misselling signal could be distributed according to some cumulative distribution function F. The skewness of the distribution would then represent the market complexity.

demand is split equally between them. If only one broker chooses q_H, all the customers will ask advice from him since, at the moment, price differentiation is not possible. The profits in the different situations are:

$$\begin{aligned} \pi_i(q_k, q_k) &= (\alpha p^* - c_i(q_k))/2, & i = 1,2;\ k = L,H \\ \pi_1(q_H, q_L) &= \alpha p^* - c_1(q_H) & \pi_2(q_H, q_L) = 0 \\ \pi_2(q_L, q_H) &= \alpha p^* - c_2(q_H) & \pi_1(q_L, q_H) = 0 \end{aligned}$$

As long as price differentiation is not possible, a low quality broker can never make positive profits when the competitor chooses the high advice quality. Therefore, there are two possible pooling equilibria with either high or low advice quality. A separating equilibrium occurs only if the high quality advice technology is not affordable for the inefficient Broker 2. The results are summarized in the following proposition:

Proposition 3.1. *When there is pure quality competition between the brokers without kickbacks to customers, the pooling equilibrium with low advice quality occurs if cost differences Δc_1 between high and low quality advice technologies are sufficiently large for Broker* 1. *If Δc_1 is small, either the pooling equilibrium with high advice quality is reached, or, if cost inefficiency is prohibitively high, the separating equilibrium arises.*

Proof. If $\pi_1(q_L, q_L) > \pi_1(q_H, q_L)$, a (q_L, q_L)-equilibrium occurs since it is not worthwhile for any of the brokers to choose the high quality. This is the case if and only if $\Delta c_1 := c_1(q_H) - c_1(q_L) > \pi_1(q_L, q_L)$.[42] If Broker 1 deviates and chooses q_H, it depends on the degree of Broker 2's inefficiency whether Broker 1 can deter Broker 2 or whether a (q_H, q_H)-equilibrium arises. Let $\Delta c_1 < \pi_1(q_L, q_L)$. Then Broker 2 sticks with q_L if and only if $\alpha p^* < c_2(q_H)$. So if the cost of high quality advice is too high for Broker 2, Broker 1 can easily deter Broker 2, leading to a (q_H, q_L)-equilibrium. If, on the other hand, $\alpha p^* > c_2(q_H)$, Broker 2 will also choose q_H and the (q_H, q_H)-equilibrium arises. A (q_H, q_L)-equilibrium occurs only if cost differences for Broker 1 are sufficiently small and $\alpha p^* < c_2(q_H)$. In this case, Broker 2 never has an incentive to choose q_H. □

A low price level p^* or a low commission rate α lead to advice quality being low. Only high commissions give incentives to the brokers to engage in quality competition, leading to high advice quality when kickbacks to customers are prohibited.

[42] This inequality is equivalent to $c_1(q_H) > (\alpha p^* + c_1(q_L))/2$. Then $\pi_2(q_L, q_L) < \pi_1(q_L, q_L) < \Delta c_1 < \Delta c_2$ and, therefore, $\pi_2(q_L, q_L) > \pi_2(q_L, q_H)$.

3.4. Quality and Price Competition among Brokers

Now assume that kickbacks to customers are allowed so that price competition among brokers arises. In this case, quality differentiation can be a useful tool to relax price competition.[43] Furthermore, for the inefficient broker, it is necessary to differentiate since otherwise he can be easily deterred by the efficient broker. In the following, assume commissions αp^* and the non-suitability disutility factor d to be sufficiently large.[44] Kickbacks in the undifferentiated situations are $\gamma_i^*(q_k, q_k) = \alpha p^* - c_2(q_k)$ for $i = 1, 2$ and $k = H, L$.[45] So, the inefficient Broker 2 always has the incentive to differentiate in order to gain positive profits. This is a major difference to the situation without kickbacks and yields the following:

Lemma 3.2. *When kickbacks to customers are allowed, only separating equilibria exist.*

When brokers differentiate in quality, the low quality broker has to offer a higher kickback in order to receive any demand. The willingness to pay for advice depends on the customer's suitability risk $s(\theta)$. Customers with a high suitability risk ask for advice from the high quality broker. The cutoff suitability risk is $s_1 = (\gamma_2 - \gamma_1)/[2d(q_1 - q_2)]$. Kickbacks are chosen in order to maximize profits, which yields for $i, j \in \{1, 2\}$ and $i \neq j$

$$\gamma_i^*(q_1, q_2) = \alpha p^* - \frac{d(q_H - q_L) + d(q_i - q_L) + 2c_i(q_i) + c_j(q_j)}{3}.$$

Substituting the optimal kickbacks into the brokers' profit functions yields the following profits in the different situations:

$$\pi_1^*(q_k, q_k) = \Delta c_k, \qquad \pi_2^*(q_k, q_k) = 0, \qquad k = H, L$$

$$\pi_1^*(q_H, q_L) = \frac{[2d(q_H - q_L) - (\Delta c_1 - \Delta c_L)]^2}{9d(q_H - q_L)}$$

$$\pi_2^*(q_H, q_L) = \frac{[d(q_H - q_L) + \Delta c_1 - \Delta c_L]^2}{9d(q_H - q_L)}$$

$$\pi_1^*(q_L, q_H) = \frac{[d(q_H - q_L) + \Delta c_H + \Delta c_1]^2}{9d(q_H - q_L)}$$

[43] See, for instance, Gabszewicz & Thisse (1979); Shaked & Sutton (1982); Tirole (1988).

[44] The conditions $\alpha p^* > (2d(q_H - q_L) + 2c_2(q_H) + c_1(q_L))/3$ and $2d(q_H - q_L) > \Delta c_1 + \Delta c_H$ ensure that kickbacks are positive in equilibrium. Note that this rules out the separating equilibrium in Proposition 3.1.

[45] Limit pricing deters the inefficient broker. It is assumed, that Broker 2 then stops prospecting for new customers and Broker 1 advises all customers. Otherwise, Broker 1 could marginally undercut Broker 2.

$$\pi_2^*(q_L, q_H) = \frac{[2d(q_H - q_L) - (\Delta c_H + \Delta c_1)]^2}{9d(q_H - q_L)}$$

Note that $\Delta c_1 - \Delta c_L$ is positive. When cost differences are small, i.e. $\Delta c_1 + \Delta c_2 < d(q_H - q_L)$, both brokers will attempt to be the high quality broker.[46] While Broker 2 always deviates from nondifferentiated situations and stays in differentiated situations, Broker 1's behavior depends on the cost structure, namely Δc_H and Δc_L. Broker 1 sticks to the differentiated situations if the respective inefficiency is small, namely Δc_H when not deviating from (q_L, q_H) and Δc_L when not deviating from (q_H, q_L).[47] This yields the following result for the quality competition with kickbacks:

Proposition 3.3. *When there is price and quality competition between the brokers with kickbacks to customers, (q_H, q_L) is the unique pure strategy equilibrium if high quality inefficiency Δc_H is sufficiently high and low quality inefficiency Δc_L is sufficiently low. Otherwise, either both differentiated situations are equilibria, or, if Δc_L is too high, no pure strategy equilibrium exists.*

A large high quality inefficiency makes a small low quality inefficiency probable, since $\Delta c_L < \Delta c_1$ and $\Delta c_H + \Delta c_1 < 2d(q_H - q_L)$. The following section discusses the welfare implications of allowing kickbacks to customers.

3.5. Welfare Issues

3.5.1. The Social Optimum

When two brokers can provide one quality each, a social planner has to trade off quality of advice against cost of advice. Since misselling risk differs among customers, it is optimal if both qualities are provided, so that only customers with a high misselling risk are advised with the high quality which incurs high costs. When Broker i provides high quality advice and Broker j provides low quality advice, social welfare can be calculated as

$$W_{\cdot,\cdot}^{FB} = v - \frac{d}{2} + \frac{d(2q_H - 1)}{4} - c_i(q_H) + \frac{[c_i(q_H) - c_j(q_L)]^2}{2d(q_H - q_L)}.$$

The efficient Broker 1 should provide high quality advice ($W_{HL}^{FB} > W_{LH}^{FB}$) if and only if

$$\Delta c_H > \frac{(\Delta c_1 + \Delta c_H)^2 - (\Delta c_1 - \Delta c_L)^2}{2d(q_H - q_L)}.$$

[46]Compare the respective profits in the differentiated situations.

[47]Critical values for the cost gaps are given implicitly due to the intermediate value theorem.

So, when high quality inefficiency is high relative to low quality inefficiency, the high quality advice should be brought to customers as cheap as possible. If, on the other hand, only low quality inefficiency is high, low quality advice should be cheap, so that only the customers with a very high misselling risk get the expensive high quality advice.

3.5.2. Pure Quality Competition Without Kickbacks

Now consider the situation in which kickbacks to customers are prohibited. Since price differentiation is not possible, all customers ask advice from the broker who offers the highest quality. So, effectively there is only one advice quality provided.

Second-best without kickbacks

Under the constraint that only one advice quality is offered, the efficient Broker 1 should advise all customers. Welfare then reduces to

$$\tilde{W}_{\cdot} = v - \frac{d}{2} + \frac{d(2q_1 - 1)}{4} - c_1(q_1).$$

High quality advice is optimal ($\tilde{W}_H > \tilde{W}_L$) if and only if the cost gap between the two possible qualities is not too high, i.e. $d(q_H - q_L)/2 > \Delta c_1$.

Welfare levels due to pure quality competition

As derived in Section 3.3, the (q_L, q_L)-situation is equilibrium if and only if Δc_1 is large. Then, it is also second-best that low quality advice is given. When Δc_1 is small, the high quality equilibrium arises which, again, is socially desirable. Note that in either situation, a welfare loss arises due to the inefficient broker serving half the market. If Δc_1 is small and $\alpha p^* < c_2(q_H)$, the respective second-best situation can be reached. When (q_k, q_k) is reached, welfare is

$$\tilde{W}_{kk} = v - d/2 + \frac{d(2q_k - 1)}{4} - \frac{c_1(q_k) + c_2(q_k)}{2}.$$

From a welfare perspective, (q_H, q_H) is better if and only if inefficiency is small, i.e. $d(q_H - q_L) > \Delta c_1 + \Delta c_2$. Otherwise, the costs for high quality advice outweigh the additional customer rent due to higher advice quality.

3.5.3. Quality and Price Competition

Second-best with kickbacks

When kickbacks are allowed, the second-best is identical to the first-best. The brokers could give kickbacks $\gamma_i = \alpha p^* - c_i(q_i)$, so that again there is the exact same trade-off between advice quality and costs of advice.

Welfare levels due to quality and price competition

When the brokers retain a fraction of their commissions that exceeds their costs, fewer customers will ask for high quality advice. Therefore, there is a dead weight loss compared to the second-best. When Broker i provides the high quality advice and Broker j chooses q_L, welfare is

$$W_{\cdot,\cdot} = v - \frac{3d}{4} + \frac{d(8q_H + q_L)}{18} - \frac{7c_i(q_H) + 2c_j(q_L)}{9} + \frac{5}{9} \cdot \frac{(c_i(q_H) - c_j(q_L))^2}{2d(q_H - q_L)}.$$

The (q_H, q_L)-situation in which Broker 1 provides high quality advice is better ($W_{HL} > W_{LH}$) if and only if

$$\Delta c_H + \frac{2(\Delta c_H - \Delta c_L)}{5} > \frac{(\Delta c_1 + \Delta c_H)^2 - (\Delta c_1 - \Delta c_L)^2}{2d(q_H - q_L)}.$$

This is also what the competition yields, since the separating (q_H, q_L)-equilibrium is the unique equilibrium if Δc_H is large and Δc_L is small.

3.5.4. Comparison of Welfare Levels

When kickbacks to customers are prohibited and the inefficient broker's high quality costs $c_2(q_H)$ are not prohibitively high, a welfare loss always occurs since the inefficient broker serves half the market. It can be shown that in the respective (q_H, q_L) situations when kickbacks are allowed, $s_1^{FB} > s_1$ is equivalent to $s_1^{FB} > 1/4$. Thus, when optimally more than half of the customers should become well-informed, the amount of well-informed customers is too low in equilibrium with kickbacks, and vice versa. Since brokers make profits in equilibrium, high quality advice is too expensive for some customers who, from a welfare perspective, should ask for high quality advice. Therefore compared to the first-best, there always is a dead weight loss when brokers engage in price competition. However, if the difference between Δc_1 and Δc_L is sufficiently large, i.e. $\Delta c_1 - \Delta c_L > d(q_H - q_L)/5$, and $\Delta c_1 < d(q_H - q_L)/2$ holds, the (q_H, q_L)-equilibrium with kickbacks is still better, from a welfare perspective, than the second-best without kickbacks. The latter inequality always holds if both brokers attempt to be the high quality provider. Therefore, this situation is likely to appear if inefficiency, at least for the lower quality, is small.

3.6. Discussion and Conclusion

Quality differentiation has the potential of increasing welfare. This study shows that in the broker market quality differentiation appears only if brokers have a tool to engage in price competition as long as costs are not prohibitively high. Giving parts of their commissions to customers enables brokers to differentiate in quality and price. It actually makes differentiation necessary for inefficient brokers as they face Bertrand competition when staying undifferentiated. In the analyzed framework, kickbacks depend on price level and commission rate. So even if the price level rose when kickbacks to customers were allowed, welfare would not be affected negatively. If direct marketing was possible, the reduction of the price of advice due to kickbacks would increase the overall amount of (at least low) informed customers which would further increase welfare. If advice was strategic, broker price competition would lead to lower margins and would therefore mitigate the brokers' misselling incentives without revolutionizing broker compensation by switching to a fee-for-advice remuneration system. Therefore, allowing brokers to give kickbacks to customers is an easy way to induce price competition between brokers, which is socially desirable.

4. Professional Training and Advice Quality

4.1. Quality Uncertainty and the Need for a Certified Training

In the scenarios analyzed in Chapter 3, the permission of giving kickbacks to customers enabled brokers to engage in price competition; therefore, quality differentiation became a useful and necessary tool to relax price competition in order to maximize profits. Providing different advice qualities not only helped the brokers to achieve their goals, but also increased welfare. The customers had the choice whether to ask for high or low quality advice. For customers with low misselling risk, it was individually rational and socially desirable to ask for the cheaper low quality advice which accrued lower costs. However, broker competition was duopolistic, which led to a binary choice of the customers which broker to go to.

Optimally, every customer should receive advice such that marginal costs of advice equal the marginal utility for the customer which depends on his individual misselling risk. If the number of brokers was not restricted to two so that there was free entry in the broker market without any fixed costs, there would be one broker for each quality that suits a certain misselling risk. Since quality differentiation would only be marginal, price competition could not be relaxed and the brokers would advise at marginal costs yielding the highest possible social welfare. The crucial underlying assumption of such a scenario is that customers have perfect information about the individual advice qualities of the brokers. In many situations, this assumption is hardly satisfied. Especially an ex-ante information about advice quality is hard to obtain. Employing costly consumer search for the best possible advice would not entirely solve this problem since even after receiving advice, the customer might not know if the advice was good or bad. If at all, the suitability of an insurance policy and thus the quality of advice often is revealed ex post after the occurrence of a loss associated with this contract. Therefore, advice quality usually is the brokers' private information. In this case, adverse selection can lead to a failure of the broker market.[48]

A possible way for the regulator to cope with these information asymmetries is to set certain requirements for brokers in order to ensure a minimum quality standard.[49] While quality standards reduce welfare in the scenario with perfect information mentioned above, it sets a lower bound for the advice quality and therefore reduces quality uncertainty if advice qualities are not perfectly observable.[50] Thus, the process of adverse selection can be stopped at the minimum quality.[51] Nonetheless, brokers have no incentive to choose a better advice technology if this accrues additional costs as long as they cannot credibly signal their high quality to customers and therefore induce a higher willingness to pay and, subsequently, charge a higher price.

As the above analysis has shown, quality differentiation is beneficial from a welfare perspective. Therefore, the regulator should provide means of credibly signaling high advice quality. One way to do so is the implementation of a certification mechanism that certifies whether a certain broker advises at least according to some defined higher quality than the minimum standard. Such a certification mechanism accrues fixed costs to the brokers. Once the critical certificated quality is reached, again, there is no incentive to provide a higher quality. Thus, the minimum standard and the certified quality are the only qualities offered in such a situation.[52]

4.2. The Training Framework

Let the general model framework regarding customers and insurance companies be the same as in Chapter 3. Also, consider two brokers, Broker 1 and Broker 2, who advise truthfully according to their advice qualities q_1 and q_2 which again correspond to the probability of identifying the type of a customer correctly. In contrast to Chapter 3, unit costs of advice are identical for both brokers. For reasons of simplicity, the unit costs are normalized to zero. Initially, both brokers' advice quality is $q_L \in (1/2, 1)$. Both

[48] Seminal work on adverse selection has been done by Akerlof (1970), in his analysis of the market for used cars. Note that the problem of adverse selection exists in exactly the same manner in a fee-for-advice system as long as qualities are not observable.

[49] A discussion of the recent requirements according to the Insurance Mediation Directive by the European Union is omitted.

[50] Brokers are hindered in providing advice at a quality lower than the standard. While this leads to over-information of customers with the lowest misselling risk, customers can be sure that any broker advises at least at the standard quality.

[51] For further information about the effects of minimum quality standards see, for instance, Bockstael (1984) or Boom (1995).

[52] If entering the market accrues fixed costs, one broker will enter for each of these qualities at most. So as long as there are no other elements of competition, such as spatial distribution, modeling the broker market as duopolistic can be justified.

brokers can invest in their human capital in order to increase their matching probability q. The effecitveness of investments in their human capital depends on the intelligence of the broker when it comes to understanding new methods. Formally, the advice quality $q(k, C)$ is a function of the knowledge k and the investment in human capital C with the following properties (for all $k, C > 0$):

I) q is partially continuously differentiable

II) $q(k, 0) = q_L$ and $\lim_{C\to\infty} q(k, C) = 1$

III) $\partial q(k, C)/\partial k > 0$

IV) $\partial q(k, C)/\partial C > 0$

So, a higher knowledge increases the effectiveness of investments in human capital. Now, both brokers can decide to attend a professional training during which they learn the state of the art methods to identify customer types and deepen their knowledge regarding the insurance products. When a broker successfully participates in such a training, his probability of identifying the type of a customer correctly is increased to $q_H \in (q_L, 1]$ and he receives a certificate that attests him the higher advice quality. Participating in the training accrues costs. On the one hand, the brokers have to pay fixed dues. On the other hand, they have to invest time in order to successfully pass the training and earn the certificate. The overall costs for Broker i to pass the training and implement the high quality advice are denoted by C_i. Assume that Broker 1 is more intelligent than Broker 2, so for the costs C_i the inequality $C_1 \leq C_2$ holds.[53] While it is relatively easy for Broker 1 to fully understand the training's contents, Broker 2 has to work harder to keep up with the different lessons in order to pass the test and receive the certificate. Since the lessons learned in the training are the same for both brokers, they end up with the same, now higher, advice quality q_H. In analogy to Chapter 3, Broker 1 will be called efficient, while Broker 2 is called inefficient.

4.3. Broker Training without Kickbacks to Customers

When kickbacks to customers are prohibited, all customers ask for the highest available advice quality. In differentiated situations, the low quality provider would have no demand and thus receive zero profits. In nondifferentiated situations, the gross profits

[53]In contrast to Chapter 3, costs of quality improvement are now fixed costs, not variable costs.

αp^* are equally split between the two brokers. Broker i has the incentive to apply to a training and receive the high quality technology and certificate if the respective costs for the training C_i are smaller than $\alpha p^*/2$.

	$q_2 = q_H$	$q_2 = q_L$
$q_1 = q_H$	$\left(\frac{\alpha p^*}{2} - C_1, \frac{\alpha p^*}{2} - C_2\right)$	$(\alpha p^* - C_1, 0)$
$q_1 = q_L$	$(0, \alpha p^* - C_2)$	$\left(\frac{\alpha p^*}{2}, \frac{\alpha p^*}{2}\right)$

Table 4.1.: Brokers' profits in different situations without kickbacks.

If Broker 2 has the incentive to choose the high quality, so does Broker 1. Therefore, when $C_2 < \alpha p^*/2$, the high quality pooling equilibrium (q_H, q_H) arises. If it is worthwhile only for Broker 1 to deviate to the high quality, i.e. $C_1 < \alpha p^*/2 \leq C_2$, the separating (q_H, q_L)-equilibrium arises. If none of the brokers has the incentive to choose the high quality, i.e. $\alpha p^*/2 < C_1$, the low quality pooling equilibrium (q_L, q_L) will be the market solution. The efficient Broker 1 always makes positive profits, regardless of which equilibrium is reached.

4.4. Broker Training with Kickbacks to Customers

When kickbacks to customers are permitted, the brokers' profits are the following:[54]

	$q_2 = q_H$	$q_2 = q_L$
$q_1 = q_H$	$(-C_1, -C_2)$	$\left(\frac{4d(q_H-q_L)}{9} - C_1, \frac{d(q_H-q_L)}{9}\right)$
$q_1 = q_L$	$\left(\frac{d(q_H-q_L)}{9}, \frac{4d(q_H-q_L)}{9} - C_2\right)$	$(0, 0)$

Table 4.2.: Brokers' profits in different situations with kickbacks.

As in Chapter 3, Bertrand competition yields zero marginal profits in nondifferentiated situations. The generally possible equilibria are the following:

$$C_2 \leq \frac{4d(q_H - q_L)}{9} \Rightarrow (q_H, q_L) \vee (q_L, q_H)$$
$$C_1 \leq \frac{4d(q_H - q_L)}{9} < C_2 \Rightarrow (q_H, q_L)$$
$$\frac{4d(q_H - q_L)}{9} < C_1 \Rightarrow (q_L, q_L)$$

Actually, the inefficient Broker 2 could act more strategically: if he is better off being the low quality provider than being the high quality provider, i.e. $C_2 > d(q_H - q_L)/3$,

[54] Assume $\alpha p^* \geq 2d(q_H - q_L)/3$ so that kickbacks are well defined.

the (q_H, q_L)-situation is better for both brokers. Unless the certification costs are prohibitively high, any equilibrium is differentiated.

4.5. Welfare Analysis

Analogously to Chapter 3, $\tilde{W}_{\cdot,\cdot}$ denotes the respective welfare level under the regime without kickbacks, while $W_{\cdot,\cdot}$ denotes the welfare when kickbacks to customers are permitted. The following holds for the welfare levels in the different situations:

$$\tilde{W}_{H,H} > \tilde{W}_{L,L} \Leftrightarrow \frac{C_1 + C_2}{2} < \frac{d(q_H - q_L)}{4}$$
$$W_{H,L} > \tilde{W}_{H,H} \Leftrightarrow C_2 > \frac{d(q_H - q_L)}{18}$$
$$W_{L,H} > \tilde{W}_{H,H} \Leftrightarrow C_1 > \frac{d(q_H - q_L)}{18}$$

Only if certification costs are very low for both brokers, the nondifferentiated (q_H, q_H) equilibrium is optimal, which can only be reached in a world without kickbacks. As long as it is worthwhile for at least one of the brokers to provide the high quality advice when kickbacks are permitted, i.e. $d(q_H - q_L)/18 < C_i < 4d(q_H - q_L)/9$, the differentiated situation is always better than both nondifferentiated situations without kickbacks. Only if costs are prohibitively high, i.e. $C_i > 4d(q_H - q_L)/9$, the nondifferentiated (q_L, q_L)-equilibrium is optimal, which is then reached under both regimes. Hence, only if high quality advice is extremely cheap is the prohibition of kickbacks beneficial from a welfare perspective. In all other situations, the regulator can increase social welfare by permitting kickbacks to customers.

4.6. Discussion and Conclusion

Section 4.5 shows that the results from Chapter 3 are retained and that, in most situations, the permission to give kickbacks to customers increases welfare. When implementing a minimum quality standard and a high quality standard, it has to be defined which qualities are certified. If brokers can decide which two qualities are certified, the difference between the two qualities would be too high since brokers want to relax price competition in order to maximize their profits. It is feasible that the minimum quality standard is set by the regulator in a socially optimal way. He can, and in Europe recently has, embedded minimum requirements for working as an independent broker. If the regulator also certifies another higher quality, he can ensure that the qualities maximize consumer rent. Anyhow, it is more likely that some professionals' association will set the high quality standard. Such an additional certification from a non-public institution makes the clearest distinction between low and high quality brokers best observable by the consumers. But, in order to act in the best interest of their members, the professional association will set a standard that is too high and therefore, differentiation will be too large, which negatively affects welfare but ensures higher profits for the brokers.

Contributing to the ongoing discussion about broker remuneration, the permission of kickbacks to customers has several advantages compared to either sticking to the commission system without kickbacks or switching to a fee-for-advice system. The main criticism regarding the commission system is the incentive problem brokers have. It is stated that brokers might not act in the best interest of their customers when the best matching product is not the one with the highest commission. When brokers face price competition as soon as kickbacks to customers are permitted, they retain only a fraction of their commissions. While misselling incentives still exist, their magnitude becomes a lot smaller. A further advantage has already been mentioned above: if direct marketing is possible, the net-costs of commissions the customers have to bear are reduced and therefore, more customers ask for advice rather than stay uninformed. Both of these advantages depend on the assumption that the price level and commission rate are not affected by the permission of kickbacks. While the analysis did not focus on the impact on the insurance market, it seems at least possible that the permission of kickbacks to customers may lead to rising gross-prices.

The main advantages of permitting kickbacks to customers over a mandatory fee-for-advice system lie in the easy regulatory implementation. Switching to a mandatory fee-for-advice would need many more legal innovations and come with great uncertainty whether such a market will function well. Promoting fee-for-advice substantially without prohibiting commissions and without permitting kickbacks to customers would make it necessary to force insurance companies to offer net-tariffs that are calculated without acquisition costs. Such major interventions regarding the freedom of contract have to be seen critically. Imposing a law that forces brokers who choose fee-for-advice to pass the entire commission on to customers makes such a major intervention unnecessary but, obviously, relies on the permission of kickbacks to customers.

When allowing kickbacks to customers instead of enforcing a certain remuneration system, the market mechanism will reveal whether the customers prefer the commission system or a fee-for-advice system. It is not unlikely that remuneration with commissions will remain for rather standardized products such as liability insurance while fee-for-advice becomes predominant for complex and expensive products like health insurance or life insurance. The above analysis shows that the provision of differentiated advice qualities is especially important for segments with complex products where the misselling severity is high. And, as we have seen, the ability to engage in price competition is necessary to make quality differentiation attractive. Another possibility is the implementation of a mixed remuneration as it is already well-known in the industrial insurance where an ex ante fee is credited to the premium when an insurance contract is signed.

Part III.

Health Care

5. Competition in the Market for Supplementary Health Care: The Case of Heterogeneous Sickness Funds

Joint work with Alexander Ellert.

5.1. Introduction

This study targets the research question of how competition in the market for health insurance works when vertically differentiated products[55] are provided by competing health insurance companies that aim for costumers and might differ in cost structure (e.g., due to different bargaining power or different skills). The intention of our paper is to determine the strategies of the firms. In particular, we analyze whether an inefficient health insurance company can gain positive demand in a market where firms can provide differentiated products.[56] As an example, an efficient firm might try to deter entry while an inefficient firm might try to position itself in a niche. In an output maximizing framework in which the firms try to attract as many costumers as possible, we show that the firms' strategies and the market outcome highly depend on the consumers' sensitivity and on the degree of inefficiency.

It is very surprising that this research question has not been answered so far due to the fact that the health care market makes up a substantial part of GDP.[57] Furthermore, the market for supplementary health insurance in which firms can provide

[55]The health care market is divided into two sub-markets. These are the market for primary health insurance and the market for supplementary health insurance. In the latter the firms have the possibility of providing differentiated products. We therefore focus on the market for supplementary health insurance. A more detailed explanation will follow.

[56]In this chapter the terms *sickness fund* and *health insurance company* are used synonymously.

[57]The average health care expenditures for industrialized countries are about 9% of GDP (OECD, 2009).

differentiated products is a very fast-growing market with a high strategic potential. Additionally, its relevance will increase even more due to demographic change and epidemiologic transition. One reason why there is a lack of literature might be because each country's precise organization of the health insurance market varies widely. However, there are three major organization types: The Beveridge model (e.g. UK), the Bismarck model (e.g. Germany) or a privately organized model (e.g. USA). Our model focuses on the Bismarck model in which we often observe competing *(nonprofit)* health insurance companies. There are many countries that use the Bismarck model, such as Belgium, Germany, the Netherlands, Switzerland, Austria, France, Japan, Luxembourg, Romania, and, to some degree, Latin America.

The core business of health insurance companies in a Bismarck model can be divided into two parts. The first one is the market for primary health insurance in which the firms provide a homogeneous product, which is basic health care coverage. The second one is the market for supplementary health insurance in which the firms have the possibility of differentiating by providing different qualities (i.e. the benefit package covered by the supplementary health insurance product). Special kinds of products in the market for supplementary health insurance might be the access to the best physicians' network or to high cost technologies. The broader coverage can also include the level of care, the number of accessible doctors, the waiting time, and other amenities. These assumptions about the quality components are in line with Che & Gale (1997).

While the market for primary health insurance has a high volume, the market for supplementary health insurance has a low volume but a very high strategic potential. Hence, the goals of those business segments might be different.[58] It is very likely that the goal in the market for supplementary health insurance is output maximization, which can be explained as follows.

If people are allowed to switch between health insurance companies, a company only gets new customers if it provides products with a high quality-cost ratio which can be achieved by quality differentiation in the market for supplementary health insurance. There is a one-sided complementarity in the market for supplementary health insurance which results in a (one-sided) high cross-selling potential.[59] One reason for having a cross-selling potential is that the possibility of purchasing the supplementary health insurance can be conditional on being primarily insured by the same health insurance

[58]For literature on a variety of other goals, see Lackman & Craycraft (1974); Niskanen (1968); Fershtman (1985); Sklivas (1987); Gannon (1973); Denzau et al. (1985); Hansmann (1987); Xu & Birch (1999); Newhouse (1970); Merrill & Schneider (1966).

[59]It is worth mentioning that a health insurance company is a priori indifferent between high and low risk people due to the implemented risk adjustment schemes.For papers that deal with cream skimming, see Kifmann (2002), Kifmann (2006), Hansen & Keiding (2002), or Danzon (2002).

company. Another reason for having a high cross-selling potential is that the insured may prefer to deal with only one firm instead of two. Due to the fact that buyers of these high quality services might switch to the same firm for their primary health insurance, we assume that the firms are trying to sell as many supplementary health insurance policies as possible, which means they are output maximizers.[60]

As a result, output maximization in the market for supplementary health insurance can be used strategically to supplement the main goal in the market for primary health insurance (with its high monetary volume) which might be, for instance, budget maximization.[61]

In contrast to standard economic theory of complementary goods (Telser, 1979), supplementary health insurance is not sold below marginal costs for two reasons. First, this is prohibited by regulation in many countries. Second, due to the fact that there is only a one-sided cross-selling potential, a cross-subsidization from primary health insurance to supplementary health insurance does not make sense. Cross-subsidization makes all people who do not have supplementary health insurance switch to a company that calculates without cross-subsidization. Hence, the supplementary health care business has to be self-financing. Therefore, the firms are facing a no loss constraint.

The competition of output maximizing firms works very differently compared to the competition of profit maximizing firms. In the market for supplementary health insurance, the firms can provide products for the different needs of the consumers. It is very well known that profit maximizing firms use product differentiation in order to relax price competition.[62] However, output maximizing firms do not fear price competition. In our study, we therefore analyze whether product differentiation is a useful tool for output maximizing health insurance companies as well (e.g to deter entry).

To keep our model as simple as possible, we assume that there are only two health insurance companies in the market. Of course, this is a simplification, but it still captures a very important fact: We can model competition. These two competing health insurance companies need to position themselves in a market segment for supplementary health insurance. This means that if a health insurance company wants to be a high quality provider, it cannot provide a product that is below the quality of its competitor. To capture that point, we assume that each firm provides only one quality. We further

[60] Assuming output maximization as the goal of nonprofit organizations is not uncommon. Xu & Birch (1999), for instance, show that almost two out of three nonprofit firms aim for output maximization facing a maximum loss constraint.

[61] Steinberg (1986) shows that budget maximization is the main goal of health care companies. However, the major goal in the market for primary health insurance does not neccessarily affect the strategy in the market for supplementary health insurance.

[62] See Gabszewicz & Thisse (1979); Shaked & Sutton (1982); Tirole (1988); Ronnen (1991); Motta (1993); Boom (1995); Aoki & Prusa (1997); Lehmann-Grube (1997).

assume that the provision of high quality supplementary health insurance is costly. This assumption is very intuitive. Otherwise, there would be no trade-off between price and quality and the product could belong to the basic health care coverage as well. Since the provision of high quality supplementary health care is costly, there is a trade-off between price and quality. Furthermore, we focus on variable costs of quality improvement since the main part of the product costs in the market for supplementary health insurance accrues at the moment of purchase by consumers.[63]

In our model, we solely focus on vertical differentiation without considering horizontal differentiation.[64] This is reasonable since the relative transportation costs can be seen as sufficiently low.[65] Furthermore, we assume that there is no significant adverse selection problem, nor is there a moral hazard problem on the side of the consumers. While these two phenomena are important in the health care market, they are beyond the scope of the current paper. This assumption is in line with Che & Gale (1997). Absent adverse selection and moral hazard, we can, without loss of generality, focus on health insurance companies that offer insurance without any coinsurance. Of course, this is a simplification. However, these assumptions are consistent with many supplementary health insurance policies, since they often do not impose deductibles.

We further simplify our model by omitting risk aversion. At a first glance, this might seem unusual for a paper that deals with health insurance companies, but it is justifiable for supplementary health care. Supplementary health care has to be seen rather as a product or service than a financial contract in which there is a simple money transfer in the case of a loss event. Those high quality products (e.g. the level of care, the number of accessible doctors, the waiting time, and other amenities) are bought because they generate a positive utility to the consumer and not because the consumer wants to minimize risk. Despite the fact that there might be risk neutrality in the market for supplementary health care, there are some arguments as to why we observe a high demand for supplementary health care instead of an out of pocket market. The most important one is the transaction cost argument. First of all, a health insurance company has an information advantage concerning the optimal treatment possibilities and therefore has lower search costs. Second, and even more important, having bought supplementary health insurance (instead of paying for the high quality treatment out of pocket) is beneficial. This is due to the fact that, in the case of

[63] In the health market, there are obviously high fixed costs due to R & D, but the health insurance company only has to pay for each application.

[64] For papers that focus on horizontal differentiation see, for instance, Che & Gale (1997), Gannon (1973), and Devletoglou & Demetriou (1967).

[65] E.g. for a high quality screening with a shortened waiting time (e.g. a few weeks) a longer travel time (e.g. one hour) will be most likely not be preponderant.

illness, the customer's bargaining position is much worse (this especially holds for all acute diseases) and the acquisition costs are higher (especially the non-monetary costs). It even may be impossible for the consumer to buy the product when he needs it (e.g. in case of unconsciousness). Another argument is that supplementary health care might be sold exclusively by a health insurance company. Hence, a consumer buys the product if the individual quality-cost ratio is sufficiently high. This rather depends on his preference parameter (e.g. his income) than on his risk attitude. By assuming risk neutral consumers, we can omit uncertainty about the health status as well.[66]

Our results are the following. We show that the strategies of the firms and the market outcome highly depend on the consumers' sensitivity and the degree of inefficiency. When the firms face the same cost function, an increasing consumers' sensitivity makes the health insurance companies fight for the same customers while for a decreasing consumers' sensitivity, differentiation becomes more attractive. The former results in a stable equilibrium with both firms providing the same quality. The latter leads to a situation in which there is no equilibrium in a simultaneous competition and a first mover advantage in a sequential competition. If inefficiency occurs, the inefficient firm has to differentiate in order to gain positive demand. If consumers' sensitivity is increasing and the firms enter the market simultaneously, the efficient firm always chooses a quality that results in zero demand for the inefficient firm. In the sequential competition, each firm can try to be either the first or the second mover. We find that the inefficient firm never acts as a first mover if consumers' sensitivity is increasing in quality. However, if the consumers' sensitivity is decreasing and the inefficient firm is the first mover, it always gains a positive demand. If the inefficient firm acts as a second mover and the consumers' sensitivity is decreasing, the efficient firm might deter entry. If the inefficiency is sufficiently high, the efficient firm deters entry and therefore is the sole provider, leaving the market partially uncovered.

The rest of this article proceeds as follows. The next section, Section 5.2, gives a literature review. Section 5.3 introduces our model framework. In Section 5.4, we analyze the firms' strategies in the case of facing the same cost structure. In Section 5.5, we analyze the firms' strategies in the case of one firm being inefficient. In Section 5.6, we analyze the sequential competition in order to determine entry deterrence strategies of the efficient firm and strategies of the inefficient firm to enter the market. The concluding section, Section 5.7, summarizes our results and states the main implications.

[66]Accounting for uncertainty changes the results neither qualitatively nor quantitatively, except that firms calculate with expected costs.

5.2. Literature Review

This section gives a brief literature review about entry deterrence of profit maximizing firms and states the main distinctions to our article. Schmalensee (2011) assumes that an incumbent firm can provide more than one quality so that an entrant cannot gain any profits. Hung & Schmitt (1988) and Hung & Schmitt (1992) derive conditions under which it is feasible and profitable for a single incumbent to deter entry. They also show that if entry deterrence is not profitable the incumbent will always be the high quality provider. In their model the marginal cost of quality improvement is L-shaped, i.e. the marginal cost is zero up to a certain quality level and infinite above that level. The firms only differ in their fixed costs that can be seen as entry costs that are sunk afterwards. Ronnen (1991) analyzes a vertical quality competition in which there are no production costs but quality-development costs that are increasing in quality. Lutz (1997) has similar assumptions. Two firms have a cost function that is composed of a fixed setup cost and a quality-development cost that is increasing in quality. There a no unit costs of production. He shows that the incumbent will always deter entry if possible as long as the firms face the same marginal quality-development cost. Entry deterrence is possible if the fixed setup cost of the potential entrant is sufficiently high. If the firms face different quality-development cost the profitability of entry deterrence depends on both fixed setup cost and quality-development cost. The entrant can either have lower or higher quality-development cost. It is shown that a difference in the cost structure might make it more profitable for the incumbent to accommodate entry, even if entry deterrence is possible.

Due to the fact that variable costs might increase as well if a firm increases its quality, recent models deal with quality-dependent variable costs. Higher quality goods may be more expensive to manufacture because of, for instance, requirements of more skilled labor or more expensive raw materials and inputs. Lambertini (1996) and Wang (2003) note that the high-quality advantage may fail to hold if there are variable costs that depend on quality. Noh & Moschini (2006) analyze entry deterrence strategies when there are quality-dependent marginal production costs and market coverage is endogenous. They assume that variable costs are strictly convex in quality, but for a given quality, the unit production costs are constant. In the case of deterred entry, the incumbent modifies its behavior by either increasing or decreasing its quality in order to deter entry. Compared to costless quality improvements, a costly quality improvement leads to less differentiation, which enforces price competition and therefore reduces profits.

However, if profit maximization is not the goal of a company, as in our analysis, there is no reason to fear price competition. Therefore, the results of our analysis are different. Furthermore, we assume that marginal cost of quality improvement are the only relevant costs. Assuming that there are no fixed costs of quality improvement in the market for supplementary health insurance is reasonable for two reasons. First, due to the high treatment expenses in the health care market that are variable for a health insurance company, fixed costs are relatively unimportant. Second, the health insurance companies are already established in the primary health care market so that they are already well-known.[67]

5.3. Model

Our model builds on the following basic assumptions. There are two output maximizing health insurance companies, Firm 1 and Firm 2, which compete in a duopolistic market. We assume that Firm 2 might be inefficient. Therefore, let C_i denote the two times continuously differentiable and strictly convex unit cost function of Firm i with $C_2 \geq C_1$. Let further $\Delta C := C_2 - C_1$ denote the additional costs, where ΔC might be quality-dependent. At the first stage of the game, the firms choose whether to enter the market or not. At the second stage of the game, the firms choose their respective qualities either simultaneously or in sequential order. For reasons of simplicity, we represent quality as a one-dimensional variable, $S \geq 0$.[68] This assumption is in line with Che & Gale (1997). The firms choose the quality S_i of their respective products from the interval $[\underline{S}, \overline{S}]$ with $\underline{S} = 0$ being a mass market product.[69]

With common knowledge of the chosen qualities, the firms choose their respective prices P_1 and P_2 simultaneously at the third stage of the game under the constraint of nonnegative profits. This constraint means that the firms run a self-financing business in this market. As mentioned in the introduction, one reason for the business being self-financing is the one-sidedness of the cross-selling potential. The solution of the third stage is straightforward. The output maximizing firms choose their prices equal to their unit costs, i.e. $P_1 = C_1(S_1)$ and $P_2 = C_2(S_2)$, since an increase in price c.p. leads to a decrease in output.

Consumers exhibit different preferences for high quality supplementary health insurance. High preferences can be caused either by genetic disposition, chronic diseases,

[67] Assuming no fixed costs for an established firm is in line, for instance, with Noh & Moschini (2006). They assume that an incumbent firm can change its product quality without incurring any fixed costs.

[68] To be specific, quality is the *vertical* element of a service. As mentioned in the introduction, the *vertical* element includes the benefit package covered by the health insurance company (e.g. the access to the best physicians' network or to high cost technologies) as well as the level of care, the number of accessible doctors, the waiting time, or other amenities.

[69] The term product is to be seen in a broad sense. It especially includes all kinds of services.

or just represent a high income.[70] The consumers are described via their valuation of quality $\theta \in [\underline{\theta}, \overline{\theta}]$, with $\underline{\theta}$ normalized to zero. The net utility of a consumer with preference parameter θ from buying a product of quality S provided by Firm i is given by the Mussa-Rosen utility function (Mussa & Rosen, 1978)

$$u_{\theta,i}(S) := \theta S - C_i(S).$$

Consumers maximize their individual utility and buy one unit at most.[71] Only if the utility is nonnegative does the consumer buy the product, meaning that we might face an uncovered market. If he is indifferent between two products he buys the one with the higher quality. The marginal consumer who has utility zero from buying a product of quality S from Firm i is given by[72]

$$\theta_i(S) = \frac{C_i(S)}{S}.$$

The preference parameter indicating indifference between the products of the two firms can be derived by solving $u_{\theta_{ind},1}(S_1) = u_{\theta_{ind},2}(S_2)$ and is given by

$$\theta_{ind}(S_1, S_2) = \frac{C_1(S_1) - C_2(S_2)}{S_1 - S_2}.$$

For $\theta_{ind} \notin [\underline{\theta}, \overline{\theta}]$, no consumer is indifferent between the two products. The resulting demand of Firm i is denoted by D_i.

Before starting to analyze the firms' strategies, we go back to our research question. In the introduction, we claimed that the intention of our paper is to determine the strategies of the firms. In particular, we analyze whether an inefficient health insurance company can gain positive demand in a market in which the firms can provide differentiated products. This leads us to the following definition.

Definition 5.1. *A Two-Firm Solution is a subgame-perfect Nash equilibrium in pure strategies in which both firms gain a positive demand.*

As a benchmark case, we first analyze the strategies of homogeneous sickness funds.

[70] For the income-wise interpretation of the preference distribution see Tirole (1988).

[71] Of course, consumers can buy more than one supplementary health care product for different segments. Buying more than one supplementary health care product for the same segment does not make any sense and the competition has to be analyzed for each segment individually.

[72] If we had accounted for uncertainty with probability of health loss π, firms would have chosen $P_i = \pi C_i(S_i)$ and consumers' expected utility would have been $E[u_{\theta,i}(S)] = \pi\theta S - \pi C_i(S)$. Hence, the marginal consumer is still $\theta_i(S) = C_i(S)/S$.

5.4. Homogeneous Firms: The Benchmark

As mentioned in Section 5.3, the firms choose their prices equal to their unit costs since their sole goal is output maximization. In the following analysis we therefore focus on the second stage of the game where qualities are chosen. This section examines the benchmark case in which the firms have identical cost structures, i.e. $\Delta C \equiv 0$.[73] The benchmark allows us to analyze how the firms adjust their strategies when inefficiency occurs. The demand for Firm i's product is

$$D_i(S_1, S_2) = \begin{cases} \overline{\theta} - \min\left(\overline{\theta},\ \theta_{ind}(S_1, S_2)\right), & S_i > S_j \\ \frac{\overline{\theta} - \theta_1(S_i)}{2}, & S_i = S_j \\ \min\left(\overline{\theta},\ \theta_{ind}(S_1, S_2)\right) - \theta_1(S_i), & S_i < S_j. \end{cases}$$

We define the sensitivity of consumers to quality variation as $\left|\frac{d(\overline{\theta} - \theta_1(S))}{dS}\right| = \theta_1'(S)$. An analogous definition was used by Dorfman & Steiner (1954).[74] Hence, an increasing sensitivity means that the reaction of consumers is inelastic for small qualities while it is elastic for higher qualities, while analogously, a decreasing sensitivity leads to an elastic demand for small qualities and an inelastic demand at the higher qualities as it can be seen in Figure 5.1.

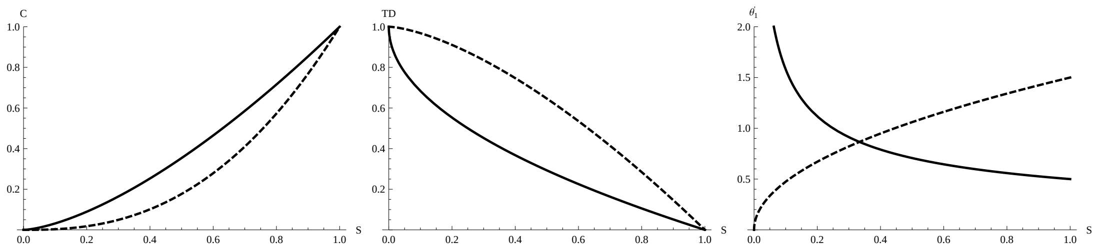

Figure 5.1.: Cost function C_1 of Firm 1, demand-quality function $TD(S) = \overline{\theta} - C(S)/S$, and consumers' sensitivity ($C(S) = S^{\alpha}$, $\alpha = 1.5$ (solid), $\alpha = 2.5$ (dashed))

Lemma 5.2. *If consumers' sensitivity is increasing and firms are homogeneous, no differentiated Two-Firm Solution exists.*

Proof. See Appendix.[75] □

[73] Since now $C_1 \equiv C_2$ we also have $\theta_1 \equiv \theta_2$. We therefore formulate all equations in this section in terms of θ_1.

[74] In our case $d(\overline{\theta} - \theta_1(S))/dS$ is negative, due to the anticipation of the change in price. We therefore use the absolute value to avoid misunderstandings with the terms "increasing" or "decreasing" sensitivity.

[75] To increase readability, all proofs in this Chapter are given in Section 5.8, the Appendix to this Chapter.

According to Lemma 5.2, an increasing consumers' sensitivity makes the firms fight for the same customers. In the low quality area, for instance, the low quality provider has the incentive to increase his own quality and therefore reduces differentiation. For him, it is worth giving up some customers with a weak preference for quality since this is overcompensated by the gain of customers with a stronger preference for quality. Therefore, any stable market outcome has to be nondifferentiated.

Proposition 5.3. *If consumers' sensitivity is increasing and firms are homogeneous, the quality combination* (S^*, S^*) *with* $C_1'(S^*) = (\overline{\theta} + \theta_1(S^*))/2$ *is the unique Two-Firm Solution.*

Proof. See Appendix. □

An increasing consumer sensitivity either means that quality advantages in the low quality area are valued relatively higher by the customers, or it means that the cost increase becomes higher in the high quality area.[76] While both firms provide supplementary health care at a quality level above basic coverage, none of the firms specializes in such segments since there are not enough customers with a willingness to pay for high quality supplementary health insurance.

If consumers' sensitivity is decreasing, the firms' strategies change. In the low quality area, for instance, the low quality provider has the incentive to decrease his own quality and therefore increase differentiation. With a lower quality he gains more customers with a weak preference for quality than he looses customers with strong preference for quality to his competitor. But still, there is no differentiated equilibrium.

Lemma 5.4. *If consumers' sensitivity is decreasing and firms are homogeneous, there is no differentiated Two-Firm Solution.*

Proof. See Appendix. □

However, the change in strategy of the low quality provider leads to a situation in which there is no nondifferentiated equilibrium, either.

Lemma 5.5. *If consumers' sensitivity is decreasing and firms are homogeneous, there is no nondifferentiated Two-Firm Solution.*

Proof. See Appendix. □

[76] The latter explanation is the way consumer sensitivity is modeled here since preferences are assumed to be uniformly distributed.

When consumers react sensitively on quality changes in the low quality are, the sickness funds try to offer only small nonspecific quality improvements and include some additional amenities in their contracts. At some point, a further increase of quality becomes unattractive for the firms and they will drop all improvements and provide mass market products. Then again, each firm will try to include some small quality improvements to slightly differentiate its product from the competitor's. Therefore, when consumers' sensitivity is decreasing, no stable situation exists in which both sickness funds stick to their quality choices after observing the competitor's reaction.

When simultaneous quality choice does not lead to a stable market outcome, the firms might enter the market sequentially.[77] This especially is the case when there is a first mover advantage, since any firm has the incentive to act first and commit itself to a certain quality.

Proposition 5.6. *When qualities are chosen sequentially and consumers' sensitivity is decreasing, a differentiated Two-Firm Solution with a first mover advantage exists.*

Proof. See Appendix. □

So, when consumers' sensitivity is decreasing, one sickness fund will commit itself to a certain quality. This can be done by exclusively cooperating with a physicians' network that contains several experts on various fields and by covering state-of-the-art medical treatments. Then, the competitor who enters the market second will choose to offer some amenities but no additional high quality treatments.

In this section, we analyzed the benchmark case without inefficiency. Entering the market first is a weakly dominant strategy for both firms. This does not have to be the case when firms are heterogeneous.

5.5. Heterogeneous Firms

Now let $\Delta C > 0$. Therefore, Firm 2 now is inefficient and has to differentiate in order to gain positive demand since otherwise the provision of a homogeneous product at a higher price than the competitor leads to zero demand for the inefficient firm. Inefficiency could stem from cumbersome work processes in the indoor services or small bargaining power when negotiating conditions for cooperations with physicians' net-

[77] When there is a Two-Firm Solution in the case of simultaneous quality choice, sequential quality competition leads to the same results.

works or other institutions. The demand for Firm 1 is now given by

$$D_1(S_1,S_2)=\begin{cases}\overline{\theta}-\max\left(\frac{C_1(S_1)}{S_1}\ ,\ \frac{C_1(S_1)-C_2(S_2)}{S_1-S_2}\right), & S_1>S_2\\ \overline{\theta}-\frac{C_1(S_1)}{S_1}, & S_1=S_2\\ \min\left(\overline{\theta}\ ,\ \frac{C_2(S_2)-C_1(S_1)}{S_2-S_1}\right)-\frac{C_1(S_1)}{S_1}, & S_1<S_2\end{cases}$$

and the demand for Firm 2 by

$$D_2(S_1,S_2)=\begin{cases}\max\left(\frac{C_1(S_1)-C_2(S_2)}{S_1-S_2}-\frac{C_2(S_2)}{S_2}\ ,\ 0\right), & S_1>S_2\\ 0, & S_1=S_2\\ \overline{\theta}-\min\left(\overline{\theta}\ ,\ \frac{C_2(S_2)-C_1(S_1)}{S_2-S_1}\right), & S_1<S_2.\end{cases}$$

In the following, we derive the reaction functions in order to analyze the competition.

5.5.1. The Firms' Reactions

For any given quality S_1 chosen by the efficient firm, the inefficient firm can either respond by choosing a higher or a lower quality. Qualities in the neighborhood of S_1 result in an output equal to zero since the inefficient firm's quality-cost-ratio is unattractive compared to its competitor's. Therefore, the inefficient firm has to differentiate itself substantially either by underbidding or overbidding.[78] The first order condition for the optimal overbidding reaction r_2^o

$$\left.\frac{\partial D_2(S_1,S_2)}{\partial S_2}\right|_{S_2>S_1}=\frac{1}{S_2-S_1}\left[\frac{C_2(S_2)-C_1(S_1)}{S_2-S_1}-C_2'(S_2)\right]\overset{!}{=}0$$

can be rearranged to $C_2(S_1)=C_2(S_2)+C_2'(S_2)(S_1-S_2)+\Delta C(S_1)$.

The optimal underbidding reaction of the inefficient firm r_2^u is determined by solving the first order condition

$$\left.\frac{\partial D_2(S_1,S_2)}{\partial S_2}\right|_{S_2<S_1}= \frac{C_2(S_1)-C_2(S_2)-(S_1-S_2)C_2'(S_2)-(\Delta C(S_1)+(S_1-S_2)^2\theta_2'(S_2))}{(S_1-S_2)^2}\overset{!}{=}0.$$

Utilizing the Taylor formula yields a closed form for the optimal overbidding reaction r_2^o of Firm 2.

[78] Firm 2 chooses a quality S_2 out of the union of two disjoint compact subsets of $[\underline{S},\overline{S}]$ and since $D_2(S_1,\cdot)$ is continuous on those subsets, an optimal reaction exists.

Lemma 5.7. *For a given S_1 the optimal overbidding reaction r_2^o of the inefficient Firm 2 is given by*

$$r_2^o(S_1) = F_{S_1}^{-1}(\Delta C(S_1)) + S_1, \tag{5.1}$$

with $F_{S_1}(x) := \int_0^x tC_2''(t+S_1)\,dt$. The optimal underbidding reaction r_2^u is the solution of $(S_1 - S_2)^2\theta_2'(S_2) + \Delta C(S_1) = F_{S_1}(S_2 - S_1)$. The overall reaction function r_2 of the inefficient firm is then given by $r_2(S_1) := \arg\max_{S_2 \in \{r_2^o(S_1), r_2^u(S_1)\}} D_2(S_1, S_2)$.

Proof. See Appendix. □

Note that for increasing inefficiency, represented by ΔC, differentiation increases, since $F_{S_1}^{-1}$ is strictly increasing.[79] The less efficient Firm 2 is, the stronger it has to differentiate in order to attract customers. Depending on the quality choice of its efficient competitor, the inefficient sickness fund either chooses a high quality niche or provide some non-substantial amenities and coverage for certain wellness offers.

Now we analyze the reaction of the efficient Firm 1. For Firm 1, overbidding is always dominated by equalizing, since for $S_1 > S_2$ and strictly convex C_1, we have

$$D_1(S_1, S_2) \le \overline{\theta} - \frac{C_1(S_1)}{S_1} < \overline{\theta} - \frac{C_1(S_2)}{S_2} = D_1(S_2, S_2).$$

Then, no consumers will buy the product of the inefficient Firm 2. Furthermore, underbidding with $\tilde{S}$, where $\tilde{S}$ satisfies $\theta_{ind}(\tilde{S}, S_2) = \overline{\theta}$, dominates equalizing. Although in this situation Firm 2 has a quality advantage, the cost disadvantage is too high and no consumer would prefer the quality cost ratio of Firm 2. Therefore, Firm 1 will choose some underbidding quality $S_1 \in [\underline{S}, \tilde{S}]$. $\tilde{S}$ obviously depends on S_2 and therefore has to be understood as a function of S_2. Thus, Firm 1 reacts with an underbidding quality $S_1 \in [\underline{S}, \tilde{S}(S_2)]$. When the inefficient sickness fund cooperates with a certain physicians' network its competitor could cooperate with the same physicians' network but negotiatie better conditions and provide this offer at a better price. Actually, the efficient sickness fund could cancel some amenities and still its product would be more attractive to all customers. Since the function $S_1 \mapsto D_1(S_1, S_2)$ is continuous on the compact interval $[\underline{S}, \tilde{S}(S_2)]$ an optimal reaction $r_1(S_2) := \arg\max_{S_1 \in [\underline{S}, \tilde{S}(S_2)]} D_1(S_1, S_2)$ exists for every S_2. Partial derivation of D_1 with respect to S_1 yields

$$\left.\frac{\partial D_1(S_1, S_2)}{\partial S_1}\right|_{S_1 < S_2} = \frac{\Delta C(S_2)}{(S_2 - S_1)^2} + \frac{S_2}{S_2 - S_1}\left(\frac{\theta_1(S_2) - \theta_1(S_1)}{S_2 - S_1} - \theta_1'(S_1)\right). \tag{5.2}$$

[79] Also note that $F_{S_1}(S_2 - S_1)$ is negative for $S_2 < S_1$ and $\theta_2'(S_2)$ is also negative for small S_2.

The first order condition $\frac{\partial D_1(S_1,S_2)}{\partial S_1} = 0$ can be rearranged to

$$C_1(S_2) = C_1(S_1) + (S_2 - S_1)C_1'(S_1) - \left(\Delta C(S_2) - (S_2 - S_1)^2\theta_1'(S_1)\right). \tag{5.3}$$

From these equations, we can derive the following result for the reaction of the efficient Firm 1.

Lemma 5.8. *The efficient firm will always respond with a lower quality and for its reaction function the following holds:* $r_1(S_2) \in \{\underline{S}, \tilde{S}(S_2)\}$ *for all* $S_2 \in [\underline{S}, \overline{S}]$.

Proof. See Appendix. □

The intuition behind this reaction is the following. Given the quality S_2 chosen by the inefficient Firm 2, the efficient Firm 1 has to decide whether to fight, choosing $S_1 = \tilde{S}(S_2)$, or not to fight, choosing $S_1 = \underline{S}$. The former results in no output for Firm 2, but Firm 1 leaves a part of the market unserved. Consumers with preference $\theta < \theta_1(\tilde{S}(S_2))$ would suffer a negative net utility and therefore would not buy the product. If Firm 1 does not fight and provides $\underline{S}$, the whole market is covered, but Firm 2 has a positive output. So Firm 1 has to trade-off the potentially unserved consumers against the ones left to Firm 2. Based on the reaction functions, we analyze the competition of the two firms and search for pure Nash equilibria in the next section.

5.5.2. Quality Competition

In the previous section, we derived the reaction functions r_1 of the efficient Firm 1 and r_2 of the inefficient Firm 2. Now we analyze whether and under which conditions a Two-Firm Solution exists. An equilibrium quality is a fixed point of the composition of the two reaction functions, i.e. $r_1(r_2(S_1)) = S_1$ or, equivalently, $r_2(r_1(S_2)) = S_2$. The simple structure of r_1 as derived in section 5.5.1 puts the focus on the former formulation $r_1(r_2(S_1)) = S_1$. According to Lemma 5.8, the efficient firm reacts either with the minimum quality $\underline{S}$ or with the quality $\tilde{S}(S_2)$, which leaves no output for the inefficient Firm 2. It is clear that Firm 2 has no incentive to enter the market and provide a quality to which Firm 1 reacts with $\tilde{S}$, since the resulting demand D_2 is zero. Thus, Firm 1 necessarily provides the minimum quality $\underline{S}$ in any equilibrium.

Two factors determine whether an equilibrium exists. First, the extent of the cost difference between the two firms and, second, the sensitivity of consumers to variations of quality. Figure 5.2 shows the reaction functions of the two firms. If the sensitivity of consumers to a quality variation is increasing in quality, Firm 1 reacts with $\tilde{S}(S_2)$ for any S_2. This is due to the fact that Firm 1 only has to give up a few consumers with a low preference for quality in order to gain the demand that would have been left to Firm 2 as can be seen in (5.2). An increasing consumers' sensitivity is represented by θ_1 being convex and according to the proof of Lemma 5.8, the reaction function of Firm 1 then is $r_1(S_2) = \tilde{S}(S_2)$ for all S_2. As already stated earlier, in this case a Two-Firm Solution does not exist since $r_2(\tilde{S}(S_2)) \neq S_2$ for all S_2. So Firm 2 would not enter the market in the first stage. Therefore, a necessary condition for the existence of a Two-Firm Solution is a decreasing consumers' sensitivity. Furthermore, equation $r_1(r_2(\underline{S})) = \underline{S}$ has to hold. From Lemma 5.7 with $S_1 = \underline{S}$ we yield that Firm 2 chooses its quality $r_2(\underline{S})$ according to $C_2'(S_2) = \theta_2(S_2)$.

The inequality $D_1(\underline{S}, r_2(\underline{S})) \geq D_1(\tilde{S}(r_2(\underline{S})), r_2(\underline{S}))$, so that $r_1(r_2(\underline{S})) = \underline{S}$ holds, is a sufficient condition for the existence of a pure Nash equilibrium.[80] Figure 5.2 shows the ratio $D_1(\tilde{S}(r_2(\underline{S})), r_2(\underline{S}))/D_1(\underline{S}, r_2(\underline{S}))$ plotted against an increasing inefficiency and for varying consumers' sensitivity. An equilibrium exists if this quotient is smaller than one. For a given sensitivity, the inefficiency needs to be sufficiently high and a higher sensitivity allows a lower inefficiency.[81]

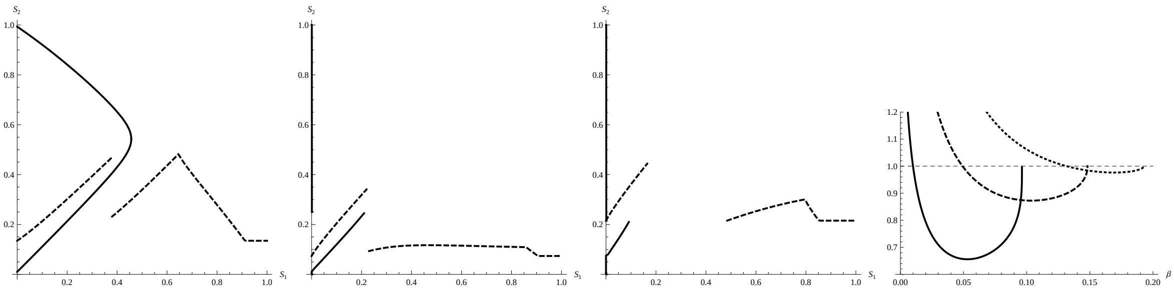

Figure 5.2.: Reaction functions and the interdependence between α, β, and the existence of an equilibrium

Note: In this figure, the cost function is given by $C_1(S) = S^\alpha$ and $\Delta C \equiv \beta$. The first figure shows the reaction functions of the firms for $\alpha = 2.5$ and $\beta = 0.01$. Here $r_1(S_2) = \tilde{S}(S_2)$ for all S_2 and thus the reaction functions do not intersect. The second figure shows the reaction functions of the firms for $\alpha = 1.5$ and $\beta = 0.01$. Here the inefficiency is not sufficiently high so that the reaction functions do not intersect. The third figure shows the reaction functions of the firms for $\alpha = 1.5$ and $\beta = 0.05$. Here the inefficiency is sufficiently high and therefore the reaction functions do intersect. The last figure shows $D_1(\tilde{S}(r_2(\underline{S})), r_2(\underline{S}))/D_1(\underline{S}, r_2(\underline{S}))$ plotted against β with $\alpha = 1.3$ (solid), $\alpha = 1.5$ (dashed), and $\alpha = 1.7$ (dotted).

[80] The inequality is equivalent to $\bar{\theta}S_2/(\tilde{S}(S_2) + S_2) \leq \theta_2(S_2)$. The greater $\theta_2(S_2)$, the more likely it is that Firm 1 will react with $\underline{S}$ and that we will have an equilibrium. Keep in mind that the consumers' sensitivity influences $S_2 = r_2(\underline{S})$, which was determined by solving $\theta_2(S_2) = C_2'(S_2)$. Further, the consumers' sensitivity influences $\tilde{S}$. Both these qualities, S_2 and $\tilde{S}$, are also heavily dependent on ΔC. Note that ceteris paribus a higher ΔC leads to the existence of an equilibrium since $r_2(\underline{S})$ is increasing in ΔC and Firm 1 has less incentive to fight.

[81] Of course, the inefficiency must not be too high. For our example, β must be lower than $\alpha^{-1/(\alpha-1)}(1-\alpha^\alpha)$ and a higher sensitivity is represented by a smaller α.

Proposition 5.9. *If consumers react sufficiently sensitive on quality changes (in the low quality area) and the cost inefficiency is sufficiently high, a unique Two-Firm Solution exists.*

Proof. See Appendix. □

So far, we have seen that the existence of an equilibrium highly depends on consumers' sensitivity and the degree of inefficiency. If the firms choose their qualities simultaneously, there are many situations without a stable market solution in which the inefficient firm would gain any demand. In the next section, we therefore analyze whether a sequential quality competition enables the inefficient firm to obtain a positive demand.

5.6. Entry Deterrence and Strategies of the Inefficient Firm

In the sequential quality competition, the inefficient firm can try to act either as the first or the second mover. If it is the first mover, it needs to choose a quality so that the efficient firm has no incentive to put the inefficient firm out of the market. If it is the second mover, the inefficient firm needs to find a niche.

5.6.1. The Inefficient Firm as the First Mover

We know that once Firm 2 has decided to provide a certain quality S_2, Firm 1 will choose either $\underline{S}$ or $\tilde{S}(S_2)$. If now the consumers' sensitivity to quality variations is increasing, Firm 1 will still react with $\tilde{S}(S_2)$ as it was the case with the simultaneous competition. Obviously, Firm 2 then obtains zero demand, as can be seen in the left part of figure 5.6.1. Hence, the inefficient firm will not be the first mover if consumers' sensitivity is increasing in quality. If consumers' sensitivity is decreasing it might be optimal for Firm 1 to provide the minimum quality $\underline{S}$, as we have already seen in section 5.5.2. This is a necessary condition in order to make sure that Firm 2 can gain a positive demand. For a given consumers' sensitivity, the existence of an equilibrium depends on the degree of inefficiency in the simultaneous competition. If the inefficiency is sufficiently high and an equilibrium exists in the simultaneous competition, the same qualities are provided when the inefficient firm enters the market first.

Let us now discuss the case with no equilibrium in the simultaneous competition. Firm 2 has to make sure that the efficient Firm 1 provides $\underline{S}$ and therefore provides a

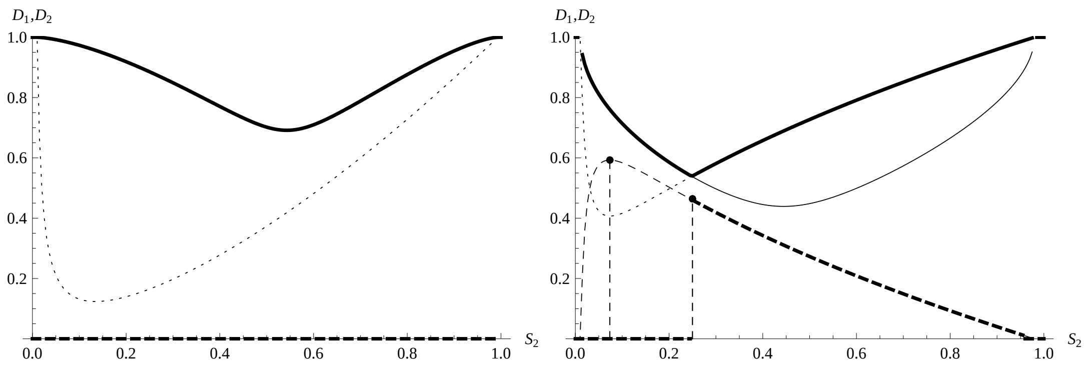

Figure 5.3.: Demand of the firms when the inefficient firm chooses its quality first

Note: For given S_2, this figure shows the demand for Firm 1 when choosing $\underline{S}$ (dotted), $\tilde{S}(S_2)$ (solid), and the optimal reaction $r_1(S_2)$ (solid, thick), and it shows the resulting demand for Firm 2 (dashed, thick) given the optimal reaction of Firm 1. On the right hand side we also see $D_2(\underline{S}, S_2)$ (dashed). The cost function is given by $C_1(S) = S^\alpha$ and $\Delta C \equiv \beta = 0.01$, with $\alpha = 2.5$ (left) and $\alpha = 1.5$ (right).

quality S_2, maximizing $D_2(r_1(S_2), S_2)$ under the constraint $D_1(\underline{S}, S_2) \geq D_1(\tilde{S}(S_2), S_2)$. This constraint is binding and Firm 2 will choose its quality S_2 according to $D_1(\underline{S}, S_2) = D_1(\tilde{S}(S_2), S_2)$, which is indicated by the right dashed vertical line in the right part of figure 5.6.1. One can see that this quality is higher than $r_2(\underline{S})$, which is indicated by the left dashed vertical line. So Firm 2 gives up some market share in order to avoid competition and to ensure that Firm 1 provides $\underline{S}$.

Proposition 5.10. *If the consumers' sensitivity is decreasing and the inefficient firm is the first mover, the inefficient firm always gains a positive demand.*

Proof. Clear from the above. □

We now take a look at the case in which the inefficient firm is the second mover.

5.6.2. The Inefficient Firm as the Second Mover

The efficient firm, as the first mover, anticipates the optimal reaction of the inefficient Firm 2. Hence, Firm 1 will choose the quality S_1 that maximizes $D_1(S_1, r_2(S_1))$. If the inefficiency ΔC is sufficiently high, it can be possible for Firm 1 to deter entry. Yet, this does not have to be the optimal choice for the efficient firm. If entry is not deterred, the inefficient firm can choose either a higher or a lower quality according to its reaction function r_2. If Firm 2 responds with a higher quality, the resulting demand for the firms can be written as $D_2(S_1, r_2^o(S_1)) = \overline{\theta} - C_2'(r_2^o(S_1))$ and $D_1(S_1, r_2^o(S_1)) = C_2'(r_2^o(S_1)) - \theta_1(S_1)$, respectively. When ΔC is sufficiently small and S_1 sufficiently high, Firm 2 could also respond with a lower quality according to $r_2^u(S_1)$, which results in $D_2(S_1, r_2^u(S_1)) = S_1\theta_2'(r_2^u(S_1))$ and $D_1(S_1, r_2^u(S_1)) = \overline{\theta} - \theta_2(r_2^u(S_1)) - S_1\theta_2'(r_2^u(S_1))$. Which of these two reactions is optimal and, subsequently, which quality will be chosen by Firm 1, depends on the consumers' sensitivity and the degree of inefficiency, as can be seen in figure 5.6.2. If consumers' sensitivity is decreasing, represented by $\alpha = 3/2$

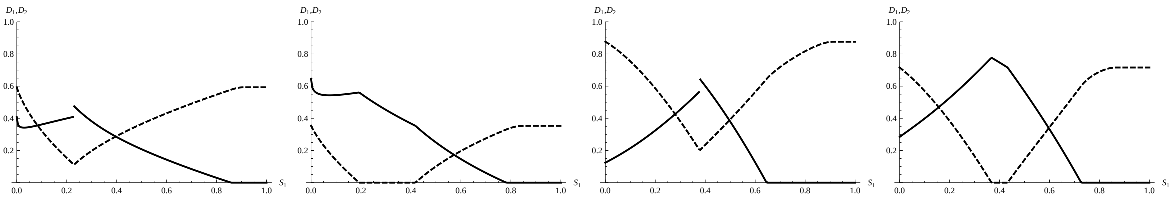

Figure 5.4.: Demand of the firms when the efficient firm chooses its quality first

Note: In this figure, the cost function is given by $C_1(S) = S^\alpha$ and $\Delta C \equiv \beta$. The figures show the output of Firm 1 (solid) and Firm 2 (dashed) plotted against the quality chosen by Firm 1 with optimal reaction of Firm 2. In the first figure, we have $\alpha = 3/2$ and $\beta = 0.01$. In the second figure, we have $\alpha = 3/2$ and $\beta = 0.04$. In the third figure, we have $\alpha = 5/2$ and $\beta = 0.01$. In the last figure, we have $\alpha = 5/2$ and $\beta = 0.04$.

in figure 5.6.2, and the inefficiency is low, entry cannot be deterred. Firm 1 as the first mover will then be the high quality provider. Firm 1 chooses S_1 so that Firm 2 is indifferent between underbidding with $r_2^u(S_1)$ and overbidding with $r_2^o(S_1)$. We assume that Firm 2 then underbids since otherwise Firm 1 would choose a only marginally higher quality $S_1 + \epsilon$ with $r_2(S_1 + \epsilon) = r_2^u(S_1 + \epsilon)$. While Firm 2 is indifferent between $r_2^u(S_1)$ and $r_2^o(S_1)$, the demand of Firm 1 is higher if Firm 2 chooses $r_2^u(S_1)$ since then market coverage is higher. If consumers' sensitivity is still decreasing but the inefficiency is sufficiently high, represented by $\Delta C \equiv \beta = 0.04$ in figure 5.6.2, entry deterrence is possible. However, it does not have to be optimal for Firm 1 to deter entry, as can be seen in figure 5.6.2. Instead, Firm 1 provides the lowest quality and the inefficient firm is the high quality provider. The market then is fully covered and Firm 1 gains a higher demand than Firm 2. If consumers' sensitivity is increasing, represented by $\alpha = 5/2$ in figure 5.6.2, and the inefficiency is low, entry deterrence is not possible and the situation is essentially the same as in the first case with $\alpha = 3/2$ and $\beta = 0.01$. If the inefficiency is sufficiently high, Firm 1 deters entry and therefore is the sole provider, leaving the market partially uncovered.

5.6.3. Discussion

As we have seen in Section 5.5.2, there are many situations in which no equilibrium exists if competition is simultaneous. However, a stable market outcome could often be obtained if one of the firms commits itself to a certain quality, leading to a sequential competition. In fact, in the market for supplementary health insurance competition might tend to be sequential since insurance policies, once sold, cannot be easily withdrawn by the sickness fund unless they are short term policies. Furthermore, permanently adjusting the own policies accrues high administration costs and distorts the building of homogeneous groups in the group-balance concept. If consumers' sensitivity is increasing, waiting is a credible commitment made by the inefficient firm.[82] If the inefficiency is high, entry is deterred. If the inefficiency is sufficiently low, Firm 2 can find a niche in the low quality segment. If consumers' sensitivity is decreasing, Firm 2 can always obtain a positive demand by entering the market as the first mover, as seen in figure 5.6.1.

In the case of low inefficiency, the inefficient firm has a first mover advantage and the efficient firm has a second mover advantage.[83] Hence, the incentives regarding the entry order are congruent. However, there are situations in which the incentives regarding the entry order might be contrary. For $\alpha = 3/2$ and $\beta = 0.03$, we have $D_1 = 0.605405$ and $D_2 = 0.394595$ if the inefficient firm acts as the first mover and $D_1 = 0.58723$ and $D_2 = 0.41277$ if the efficient firm acts as the first mover, as illustrated in figure 5.6.3. Therefore, both firms have a second mover advantage. Such a situation is known as the chicken game.

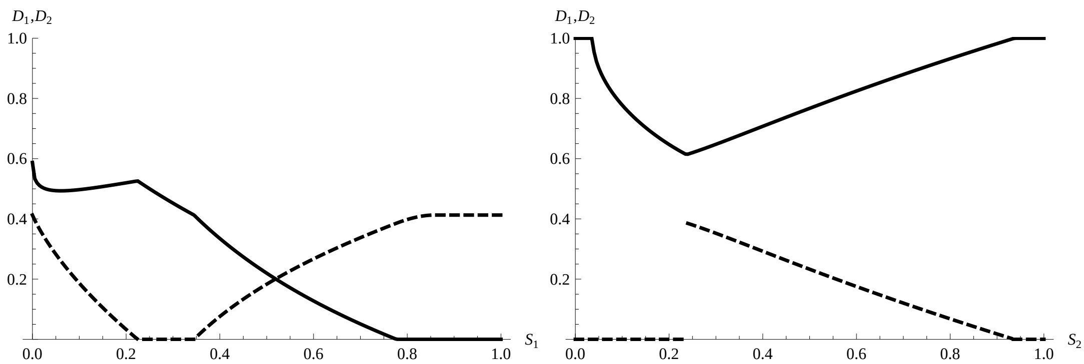

Figure 5.5.: Chicken game situation

Note: In this figure we have $C_1(S) = S^{3/2}$ and $\Delta C \equiv \beta = 0.03$. The left figure shows the resulting demand when the efficient firm acts as the first mover and Firm 2 reacts according to r_2. The right figure shows the resulting demands when the inefficient firm acts as the first mover and Firm 1 reacts according to r_1.

[82]If Firm 2 as the first mover chooses S_2, Firm 1 always reacts with $\tilde{S}(S_2)$ leaving Firm 2 with no demand.

[83]Compare the right-hand side of figure 5.6.1 and the left part of figure 5.6.2, where $\alpha = 3/2$ and $\beta = 0.01$.

5.7. Conclusion

In this paper, we analyze a duopolistic competition with quality differentiation in the market for supplementary health care in order to determine the strategies of the firms. As an example, an efficient firm might try to deter entry or an inefficient firm might try position itself in a niche. In an output maximizing framework in which the firms try to attract as many costumers as possible, we show that the strategies of the firms and the market outcome highly depend on the consumers' sensitivity and the degree of inefficiency.

In a benchmark case, the firms face the same cost function. An increasing consumers' sensitivity makes the firms fight for the same customers. In the low quality area, for instance, the low quality provider has the incentive to increase its own quality and therefore reduce differentiation. For him, it is worth giving up some customers with a weak preference for quality since this is overcompensated by the gain of customers with a stronger preference for quality. We show that there is a unique Two-Firm Solution in which both firms provide the same quality. If consumers' sensitivity is decreasing, the firms' strategies change. In the low quality area, for instance, the low quality provider has the incentive to decrease its own quality and therefore increase differentiation. With a lower quality, he gains more customers with a weak preference for quality than he loses customers with strong preference for quality to his competitor. For a decreasing consumers' sensitivity, there is neither a differentiated nor a nondifferentiated equilibrium in the case of simultaneous competition. However, when qualities are chosen sequentially, a differentiated Two-Firm Solution with a first mover advantage exists.

If inefficiency occurs, the inefficient firm has to differentiate in order to gain positive demand since otherwise, the provision of a homogeneous product at a higher price than the competitor leads to zero demand for the inefficient firm. Two factors determine whether an equilibrium exists or not. First, the extent of cost difference between the two firms and, second, the sensitivity of consumers to variations of quality. If consumers' sensitivity is increasing and the firms enter the market simultaneously, the efficient firm always chooses a quality that results in zero demand for the inefficient firm. This is due to the fact that the efficient firm has to give up only a few consumers with a low preference for quality in order to gain the demand that would have been left to the inefficient firm. Hence, a necessary condition for the existence of a Two-Firm Solution in a simultaneous competition is a decreasing consumers' sensitivity.

In the sequential competition, we analyze under which conditions a stable Two-Firm Solution exists. Each firm can try to be either the first or the second mover. If the inefficient firm is the first mover, it needs to choose a quality so that the efficient firm has no incentive to put the inefficient firm out of the market. If the inefficient firm is the second mover, it needs to find a niche. We find that the inefficient firm never acts as a first mover if consumers' sensitivity is increasing in quality. However, if the consumers' sensitivity is decreasing and the inefficient firm is the first mover, it always gains a positive demand.

The inefficient firm might also act as a second mover. If consumers' sensitivity is decreasing and the inefficiency is low, entry cannot be deterred. If consumers' sensitivity is decreasing but the inefficiency is high, entry can be deterred. However, it does not have to be optimal for the efficient firm to deter entry. If consumers' sensitivity is increasing and the inefficiency is low, entry deterrence is not possible. If the inefficiency is sufficiently high, the efficient firm deters entry and therefore is the sole provider, leaving the market partially uncovered.

The results of our analysis are in contrast to the results of entry deterrence of profit maximizing firms. In the case of profit maximization, entry deterrence is possible if and only if fixed costs are sufficiently high. For output maximizing firms, entry deterrence even is possible if there are no fixed costs at all. In some situations, even a small difference in variable costs leads to entry deterrence. Furthermore, the analysis has shown that there are many situations in which no equilibrium exists if the competition is simultaneous. However, a stable market outcome could often be obtained if one of the firms committed itself to a certain quality, leading to a sequential competition. In the case of sequential competition, the incentives regarding the entry order might be congruent or contrary. There are scenarios in which both firms have an incentive to wait. In such a situation, a welfare loss might occur due to the fact that non of the firms might enter the market.

There are two main conclusions a sickness fund can draw from our study. First, understanding consumer behavior is crucial for assessing the right strategy. Therefore, the firms need to identify how sensitive consumers react in certain market segments. Clearly, demand characteristics might be different when analyzing patients with diabetes or patients in need of an artificial hip joint. Second, firms need to analyze their cost structure for each segment individually since a certain degree of inefficiency has different consequences, depending on the consumers' sensitivity. Even a slight difference in efficiency might result in entry deterrence; especially in important segments with a high strategic value, firms need to know how to position themselves.

5.8. Appendix to Chapter 5

Proof of Lemma 5.2. Assume (S_1^*, S_2^*) equilibrium strategy combination with $S_1^* \neq S_2^*$ and without loss of generality $S_2^* < S_1^*$. Then $\frac{\partial D_2(S_1^*,S_2)}{\partial S_2}\Big|_{S_2=S_2^*} = 0$ has to hold. If now θ_1 is strictly convex, the equation

$$\theta_1'(S_2) < \frac{\theta_1(S_1) - \theta_1(S_2)}{S_1 - S_2}$$

holds for all $S_2 < S_1$, which is equivalent to $\frac{\partial D_2(S_1,S_2)}{\partial S_2} > 0$. This is a contradiction. Thus, any equilibrium will be non-differentiated. □

Proof of Proposition 5.3. (I) First, it is shown that $S^* = \arg\max_{S_2 \in [\underline{S},\overline{S}]} D_2(S^*, S_2)$ with S^* satisfying $C_1'(S^*) = (\overline{\theta} + \theta_1(S^*))/2$.

i) Let $S_2 > S^*$:

$$D_2(S^*, S_2) = \overline{\theta} - \frac{C_1(S_2) - C_1(S^*)}{S_2 - S^*} < \overline{\theta} - C_1'(S^*) = \frac{\overline{\theta} - \theta_1(S^*)}{2} = D_2(S^*, S^*)$$

ii) Let $S_2 < S^*$:

$$D_2(S^*, S_2) = \frac{S^*\theta_1(S^*) - S_2\theta_1(S_2)}{S^* - S_2} - \theta_1(S_2) = S^*\frac{\theta_1(S^*) - \theta_1(S_2)}{S^* - S_2}$$
$$< S^*\theta_1'(S^*) = C_1'(S^*) - \theta_1(S^*) = \frac{\overline{\theta} - \theta_1(S^*)}{2} = D_2(S^*, S^*)$$

(II) Now the uniqueness of S^* is shown.

i) $\forall S_1 > S^*\ \exists S_2 < S_1 : D_2(S_1, S_2) > D_2(S_1, S_1)$.
Let $\epsilon := C_1'(S_1) - \frac{\overline{\theta}+\theta_1(S_1)}{2} > 0$ and $S_2 := \theta_1'^{-1}(\theta_1'(S_1) - \frac{\epsilon}{S_1}) < S_1$, then

$$D_2(S_1, S_2) = S_1\frac{\theta_1(S_1) - \theta_1(S_2)}{S_1 - S_2} > S_1\theta_1'(S_2) = S_1\theta_1'(S_1) - \epsilon$$
$$= C_1'(S_1) - \theta_1(S_1) - \epsilon = \frac{\overline{\theta} - \theta_1(S_1)}{2} = D_2(S_1, S_1).$$

ii) $\forall S_1 < S^*\ \exists S_2 > S_1 : D_2(S_1, S_2) > D_2(S_1, S_1)$.

Let $\epsilon := \frac{\overline{\theta}+\theta_1(S_1)}{2} - C_1'(S_1) > 0$ and $S_2 := C_1'^{-1}(C_1'(S_1)+\epsilon) > S_1$, then

$$\begin{aligned} D_2(S_1,S_2) &= \overline{\theta} - \frac{C_1(S_2)-C_1(S_1)}{S_2-S_1} > \overline{\theta} - C_1'(S_2) = \overline{\theta} - C_1'(S_1) - \epsilon \\ &= \overline{\theta} - \frac{\overline{\theta}+\theta_1(S_1)}{2} = \frac{\overline{\theta}-\theta_1(S_1)}{2} = D_2(S_1,S_1). \end{aligned}$$

□

Proof of Lemma 5.4. Assume (S_1^*, S_2^*) equilibrium strategy combination with $S_1^* \neq S_2^*$ and without loss of generality $S_2^* < S_1^*$. Let $\underline{\mathcal{S}} := \{S \mid \overline{\theta} - C_1'(S) > \theta_1(S)\}$ and $\overline{\mathcal{S}} := \{S \mid \overline{\theta} - C_1'(S) \leq \theta_1(S)\}$. We split the proof into three parts:

(*i*) Assume $S_1^* \in \underline{\mathcal{S}}$ and $0 < S_2^* < S_1^*$: $\exists S_2 > S_1^* : D_2(S_1^*, S_2) > D_2(S_1^*, S_2^*)$
Let $S_2 > S_1^*$ so that $\theta_1(S_2) = \theta_1(S_1^*) + (1 - S_1^*/S_2)\theta_1(S_2^*)$, then

$$\begin{aligned} D_2(S_1^*,S_2^*) &= \frac{C_1(S_1^*)-C_1(S_2^*)}{S_1^*-S_2^*} - \theta_1(S_2^*) < C_1'(S_1^*) - \theta_1(S_2^*) \\ &\overset{S_1^*\in\underline{\mathcal{S}}}{<} \overline{\theta} - \theta_1(S_1^*) - \theta_1(S_2^*) \\ &= \overline{\theta} - \theta_1(S_1^*) - \frac{S_2}{S_2-S_1^*}(\theta_1(S_2)-\theta_1(S_1^*)) \\ &= \overline{\theta} - \frac{C_1(S_2)-C_1(S_1^*)}{S_2-S_1^*} = D_2(S_1^*,S_2). \end{aligned}$$

(*ii*) Assume $S_1^* \in \overline{\mathcal{S}}$ and $0 < S_2^* < S_1^*$: $D_2(S_1^*, 0) > D_2(S_1^*, S_2^*)$
We have for all $S_2 < S_1$

$$\begin{aligned} \frac{\partial D_2(S_1,S_2)}{\partial S_2} &= \frac{-C_1'(S_2)(S_1-S_2)+C_1(S_1)-C_1(S_2)}{(S_1-S_2)^2} - \theta_1'(S_2) \\ &= \frac{S_1\theta_1(S_1)-S_2\theta_1(S_2)}{(S_1-S_2)^2} - \frac{C_1'(S_2)}{S_1-S_2} - \theta_1'(S_2) \\ &= \frac{S_1\theta_1(S_1)-S_1\theta_1(S_2)+S_1\theta_1(S_2)-S_2\theta_1(S_2)}{(S_1-S_2)^2} - \frac{C_1'(S_2)}{S_1-S_2} - \theta_1'(S_2) \\ &= \frac{S_1}{S_1-S_2}\cdot\frac{\theta_1(S_1)-\theta_1(S_2)}{S_1-S_2} + \underbrace{\frac{\theta_1(S_2)-C_1'(S_2)}{S_1-S_2}}_{=-S_2\theta_1'(S_2)} - \theta_1'(S_2) \\ &= \frac{S_1}{S_1-S_2}\left(\frac{\theta_1(S_1)-\theta_1(S_2)}{S_1-S_2} - \theta_1'(S_2)\right) < 0 \end{aligned}$$

since θ_1 is (strictly) concave. So especially $D_2(S_1^*, S_2)$ is decreasing in S_2 and due to continuity, $D_2(S_1^*, 0) > D_2(S_1^*, S_2)$ for all $0 < S_2 < S_1^*$.

(*iii*) Assume $S_2^* = 0$: $D_1(S_1, 0)$ is decreasing in S_1 and therefore, $\left.\frac{\partial D_1(S_1,0)}{\partial S_1}\right|_{S_1=S_1^*} = 0$ does not hold for any S_1^*. Thus, $(S_1^*, 0)$ cannot be a Nash equilibrium.

The parts (i)-(iii) show the proposition. □

Proof of Lemma 5.5. (*i*) Let $S_1 \in \overline{\mathcal{S}}$ (i.e. $\overline{\theta} - \theta_1(S_1) < C_1'(S_1)$). Since θ_1 is concave, we have $\theta_1'(S) \leq \theta_1(S)/S$ for all S. This is equivalent to $C_1'(S)/2 \leq \theta_1(S)$ since

$$S\theta_1'(S) \leq \theta_1(S) \Leftrightarrow C_1'(S) - \theta_1(S) \leq \theta_1(S) \Leftrightarrow C_1'(S) \leq 2\theta_1(S) \Leftrightarrow \frac{C_1'(S)}{2} \leq \theta_1(S).$$

Thus,

$$D_2(S_1, S_1) = \frac{\overline{\theta} - \theta_1(S_1)}{2} < \frac{C_1'(S_1)}{2} \leq \theta_1(S_1) = D_2(S_1, 0).$$

(*ii*) Let $S_1 \in \underline{\mathcal{S}}$ (i.e. $\overline{\theta} - \theta_1(S_1) > C_1'(S_1)$) and $S_2 := C_1'^{-1}((\overline{\theta} + \theta_1(S_1))/2)$. Since θ_1 is concave and therefore $C_1'(S_1)/2 + \theta_1(S_1) \geq C_1'(S_1)$, we have

$$C_1'(S_2) = \frac{\overline{\theta} + \theta_1(S_1)}{2} = \frac{\overline{\theta} - \theta_1(S_1)}{2} + \theta_1(S_1) > \frac{C_1'(S_1)}{2} + \theta_1(S_1) \geq C_1'(S_1).$$

So $S_2 > S_1$, from which follows

$$\frac{\overline{\theta} + \theta_1(S_1)}{2} = C_1'(S_2) > \frac{C_1(S_2) - C_1(S_1)}{S_2 - S_1}.$$

This yields

$$D_2(S_1, S_2) = \overline{\theta} - \frac{C_1(S_2) - C_1(S_1)}{S_2 - S_1} > \frac{\overline{\theta} - \theta_1(S_1)}{2} = D_2(S_1, S_1).$$

□

Proof of Proposition 5.6. Let $S_1^* = \inf \overline{\mathcal{S}}$. For all $S_1 \in \overline{\mathcal{S}}$ Firm 2 responds with $S_2 = 0$ and $D_1(S_1^*, 0) > D_1(S_1, 0)$ for all $S_1 \in \overline{\mathcal{S}} \setminus \{S_1^*\}$. For every $S_1 \in \underline{\mathcal{S}}$, Firm 2 can choose $S_2 > S_1$ with $D_2(S_1, S_2) = \theta_1(S_1^*)$ due to continuity. Then, $D_1(S_1, S_2) = \overline{\theta} - \theta_1(S_1) - \theta_1(S_1^*) < D_1(S_1^*, 0)$. Therefore, Firm 1, as the first mover, chooses $S_1^* = \inf \overline{\mathcal{S}}$ and Firm 2 chooses $S_2^* = 0$. This yields

$$D_1(S_1^*, S_2^*) = \overline{\theta} - \theta_1(S_1^*) > \overline{\theta} - C_1'(S_1^*) = \theta_1(S_1^*) = D_2(S_1^*, S_2^*),$$

which shows the first mover advantage. □

Proof of Lemma 5.7. Rearranging the first order condition $\frac{\partial D_2(S_1,S_2)}{\partial S_2}\Big|_{S_2>S_1} = 0$ yields

$$C_2(S_1) = C_2(S_2) + C_2'(S_2)(S_1 - S_2) + \Delta C(S_1).$$

Therefore, $\Delta C(S_1)$ has to be equal to the remainder of the first order Taylor approximation of $C_2(S_1)$ in S_2, which is

$$\int_0^{S_2-S_1} tC_2''(t+S_1)\,dt.$$

So with $F_{S_1}(x) := \int_0^x tC_2''(t+S_1)\,dt$ from $\Delta C(S_1) = F_{S_1}(S_2 - S_1)$ it follows that

$$S_2 = F_{S_1}^{-1}\left(\Delta C(S_1)\right) + S_1.$$

Since C_2 is strictly convex, F_{S_1} is strictly increasing with $F_{S_1}^{-1}(0) = 0$ and also $F_{S_1}^{-1}$ strictly increasing.[84] Therefore, the solution of the first order condition is unique a gives the global maximum since

$$\begin{aligned}\frac{\partial^2 D_2(S_1,S_2)}{\partial S_2^2}\Big|_{S_2=r_2(S_1)} &= -\frac{C_2''(S_2)}{S_2-S_1} + \frac{C_2'(S_2) + \frac{\partial\theta_{ind}(S_1,S_2)}{\partial S_2}(S_2-S_1) - \theta_{ind}(S_1,S_2)}{(S_2-S_1)^2} \\ &= -\frac{C_2''(S_2)}{S_2-S_1} + 2\cdot\underbrace{\frac{\frac{\partial\theta_{ind}(S_1,S_2)}{\partial S_2}}{S_2-S_1}}_{=0} = -\frac{C_2''(S_2)}{S_2-S_1} < 0.\end{aligned}$$

So r_2^o, according to (5.1), is the well-defined overbidding reaction function of Firm 2. Applying the Taylor formula on the first order condition for the optimal underbidding reaction yields $(S_1 - S_2)^2\theta_2'(S_2) + \Delta C(S_1) = F_{S_1}(S_2 - S_1)$. Unfortunately, there is no closed form solution for r_2^u, but given the optimal underbidding reaction, the resulting demand for Firm 2 is $D_2(S_1, r_2^u(S_1)) = S_1\theta_2'(r_2^u(S_1))$. □

For the proof of Lemma 5.8, we need the following result:

Lemma 5.11. *For strictly concave θ_1 and given S_2 the unique solution of* (5.3) *is the global minimum.*

Proof. Using the first order Taylor formula for given S_2, the interior solution S_1 needs to satisfy

$$\Delta C(S_2) - (S_2 - S_1)^2\theta_1'(S_1) \overset{!}{=} -\int_{S_1}^{S_2}(S_2 - t)C_1''(t)\,dt$$

[84] Note that $F_{S_1}(S_2 - S_1)$ is strictly decreasing in S_1.

and substituting with $S_2 - t$ and switching the integration limits yields

$$-\int_{S_1}^{S_2} (S_2 - t) C_1''(t)\, dt = -\int_0^{S_2 - S_1} t C_1''(S_2 - t)\, dt.$$

With G_{S_2} denoting the antiderivative of $tC_1''(S_2 - t)$ this yields

$$\Delta C(S_2) \overset{!}{=} -G_{S_2}(S_2 - S_1) + (S_2 - S_1)^2 \theta_1'(S_1) =: H_{S_2}(S_1).$$

H_{S_2} is strictly decreasing in S_1 if θ_1 is concave since

$$\frac{\partial H_{S_2}(S_1)}{\partial S_1} < 0 \Leftrightarrow \underbrace{C_1''(S_1) - 2\theta_1'(S_1)}_{=:(*)} + \underbrace{(S_2 - S_1)\theta_1''(S_1)}_{<0} < 0$$

and $(*) < 0$ directly follows from $\theta_1''(S_1) < 0$. Thus H_{S_2} is invertable and it follows with $G_{S_2}(0) = 0$

$$S_1 = H_{S_2}^{-1}(\Delta C(S_2)).$$

The second partial derivative of D_1 with respect to S_1 yields

$$\begin{aligned}\left.\frac{\partial^2 D_1(S_1, S_2)}{\partial S_1^2}\right|_{S_1 = H_{S_2}^{-1}(\Delta C(S_2))} &= \frac{-S_2\theta_1'(S_1) - S_2^2\theta_1''(S_1) + S_2\theta_1'(S_1) + S_2 S_1 \theta_1''(S_1)}{(S_2 - S_1)^2} \\ &\quad + \underbrace{\frac{\partial D_1(S_1, S_2)}{\partial S_1}}_{=0} \frac{2}{S_2 - S_1} \\ &= -\frac{S_2}{S_2 - S_1}\theta_1''(S_1) > 0.\end{aligned}$$

The uniqueness of the solution of the first order condition ensures that this is a local and global minimum. □

Proof of Lemma 5.8. For convex θ_1, the term in brackets in (5.2) is always positive and therefore $D_1(S_1, S_2)$ is strictly increasing in S_1 on $[\underline{S}, \tilde{S}(S_2)]$. In this case, the reaction function r_1 of Firm 1 is $r_1(S_2) = \tilde{S}(S_2)$ for all S_2. For strictly concave θ_1, the term in brackets in (5.2) is always negative and therefore a unique interior solution satisfying the first order condition might exist. According to Lemma 5.11, this interior solution gives a local and global minimum. Therefore, the optimal reaction will again be a corner solution, i.e. $r_1(S_2) \in \{\underline{S}, \tilde{S}(S_2)\}$ for all $S_2 \in [\underline{S}, \overline{S}]$. □

Proof of Proposition 5.9. Let S_2 be given by $\theta_2(S_2) = C_2'(S_2)$ with $\theta_2(S_2) < \overline{\theta}$ and $\tilde{S}$

by $(C_2(S_2) - C_1(\tilde{S}))/(S_2 - \tilde{S}) = \overline{\theta}$. A necessary condition for the existence of a Two-Firm Solution is a decreasing consumers' sensitivity, which yields a high sensitivity for small qualities. For a given sensitivity, the existence depends only on ΔC. The higher inefficiency ΔC is, the less incentive Firm 1 has to enforce quality competition, and thus the more likely $r_1(r_2(\underline{S})) = \underline{S}$ holds. Of course, ΔC must not be too high, i.e. $\theta_2(S_2) < \overline{\theta}$ has to hold, since otherwise Firm 2 cannot gain any demand. □

6. Who Should Provide Supplementary Health Care? Comparison of a Public, Private, and Mixed System

Joint work with Alexander Ellert.

6.1. Introduction

This study targets the research question of how the market for supplementary health care should be organized. The answer to this question is crucial for countries all over the world.[85] This is due to the fact that many countries need to face the challenge of rapidly increasing health care expenditures. One way to cope with this problem is rationing so that a compulsory health insurance provides basic coverage only. People then need to have the opportunity to buy supplementary health care. Products for the market of supplementary health care are, for instance, the access to certain physicians' networks or high cost technologies.[86] Competing firms are therefore enabled to provide

[85] Although we focus on the competition in the market for supplementary health care in our study, our analysis is most suitable for countries with competition also in the compulsory health insurance sector. Why competition in the compulsory health insurance sector is important for our study will be explained later.

[86] Already today some medical treatments are not covered by compulsory health insurance and the legal foundations of many countries state that compulsory health insurance has to provide basic coverage only. In Germany, for instance, legislation states that compulsory health care coverage must not exceed the necessary health care (§12 German Social Security Code). Either a medical area is completely excluded from basic coverage, such as alternative medicine or dental health services, or the method of treatment covered by the compulsory health insurance is not the best possible. In Germany, for instance, magnetic resonance imaging for diagnosing breast cancer is only covered by compulsory health insurance if a lump was discovered via mammography or breast ultrasound before. Medical research shows that MRI can discover lumps at an earlier stage and is therefore the better medical treatment (Kuhl et al., 2005). Another example is the dual-energy X-ray absorptiometry scan. It is not covered by compulsory health insurance if it is used as a preventive medical examination. Due to the demographic change, the epidemiological transition and the rapid technological

supplementary health care of different quality.[87] In order to organize this market efficiently, the countries' governments need to know how the competition works. Analyzing the latter is the core of our paper.

The competition in the market for supplementary health care may be very different compared to other markets. This is due to the fact that non-profit public sickness funds play an important role in the health care market. One major difference is that non-profit public sickness funds might not fear price competition. Hence, they do not necessarily mind providing homogeneous products. In fact, it can be shown that the only possible equilibrium is a non-differentiated equilibrium.[88] This is in contrast to the competition of for-profit organizations, which use differentiation in order to relax price competition.[89] The provision of homogeneous products would lead to a zero profit equilibrium. The government therefore knows how the competition in the market for supplementary health care works if the products are only provided either by non-profit sickness funds or by for-profit health insurance companies.[90] As long as customers have different preferences for quality, the answer to the question of how the market should be organized is not that simple since there is a trade-off between product differentiation and taking a mark-up. People appreciate differentiation but there is no differentiation if supplementary health care is provided by sickness funds. But people appreciate low prices as well and as long as the health insurance companies can differentiate, they are able to take a mark-up. So, at a first glance, it is not clear at all how the market for supplementary health care should be organized.

Another possible way of organizing this market might be allowing a mixed competition.[91] We then have a competition between non-profit and for-profit organizations. In such a situation we obviously need to have differentiation since a non-differentiated situation will never be optimal for the for-profit organization and therefore cannot be a

progress in medicine, the importance of supplementary health care will be even higher in the future.

[87] E.g. one firm provides access to a small physicians' network while the competitor provides access to a large physicians' network with many specialist doctors.

[88] Compare Chapter 5.

[89] Differentiation by quality was first analyzed by Gabszewicz & Thisse (1979), Shaked & Sutton (1982), and Tirole (1988) for profit maximizing firms. They show that differentiation takes place in order to relax price competition even if quality improvement is costless. If quality improvement turns out to be costly, differentiation is still a valuable tool for profit maximizing firms (Ronnen, 1991; Motta, 1993; Boom, 1995; Aoki & Prusa, 1997; Lehmann-Grube, 1997, among others).

[90] In contrast to Chapter 5, in this chapter the term *sickness fund* refers firms that aim for output maximization while the term *health insurance company* solely refers to profit maximizing firms.

[91] A mixed competition is defined as competition in a market in which two or more firms with different objectives co-exist. For surveys of the literature on mixed oligopolies compare De Fraja & Delbono (1990) or Nett (1993). We can observe a mixed competition in the German health care market, for instance. In 2007, the Social Health Insurance Competition Strengthening Act was adopted. One main part of this act was that supplementary health care can now be provided by private health insurance companies as well as by non-profit sickness funds.

Nash equilibrium. Furthermore, not all the firms take a mark-up.

We therefore need to compare the resulting welfare of three scenarios in order to answer the question of how the market for supplementary health care should be organized. These scenarios are either competing sickness funds, competing health insurance companies, or a mixed competition. To compare them, we need to get a more detailed impression of the competition in the market for supplementary health care. First of all, we need to establish the objective function of the sickness funds. This is not straightforward since the countries' organization of compulsory health insurance where people are insured by non-profit organizations varies widely.

However, there are three major types of organization: the Beveridge Model (e.g. UK), the Bismarck Model (e.g. Germany), or a privately organized model (e.g. USA). Our study focuses on the Bismarck Model where we often observe competing *(non-profit)* health insurance companies, i.e. sickness funds. There are many counties that use the Bismarck Model, like Belgium, Germany, Netherlands, Switzerland, Austria, France, Japan, Luxembourg, Romania, and, to a degree, Latin America.[92]

The core business of the sickness funds in a Bismarck Model can be divided into two parts. The first part is the market for compulsory health insurance where the firms provide a homogeneous product. The second part is the market for supplementary health care where the firms have the possibility to differentiate by providing different qualities. Special kinds of products in the market for supplementary health care might be the access to the best physicians' network or to high cost technologies. The broader coverage can also include the level of care, the number of accessible doctors, the waiting time, and other amenities. These assumptions about the quality components are in line with Che & Gale (1997).

While the market for compulsory health insurance has a high volume but a low strategic potential[93] the market for supplementary health care has a low volume but a high strategic potential. Hence, the goals of those business segments are different.[94] It is

[92]In Germany, for instance, there are more than 200 sickness funds and people are allowed to switch between those sickness funds independent of their health care status, their income or their profession. Therefore the market is highly competitive. In France, there are only four major sickness funds and a few minor sickness funds and the switching possibility depends on the citizens' profession. In the Netherlands, as another example, there are private operating health insurance companies. Even though this is uncommon for the Bismarck Model, the health care system of the Netherlands still belongs to the Bismarck system. Due to the one-sided cross selling potential in the market for supplementary health care (which will be explained later in detail) our model is applicable the for health care system of the Netherlands as well, but a few modifications are necessary.

[93]The competition in the market for compulsory health insurance can be described in a simple way: In the case of a homogeneous product the price is the sole strategic variable. Hence, the health insurance companies try to provide compulsory health insurance as cheap as possible (e.g by providing Disease Management Programs).

[94]The goal in the market for compulsory health insurance might be some kind of profit maximization

very likely that the goal in the market for supplementary health care is output maximization which can be explained as follows: if people are allowed to switch between health insurance companies, a company only gets new customers if it provides products with a high quality-cost ratio which can be done by quality differentiation in the market for supplementary health care. There is a one-sided complementarity in the market for supplementary health care which results in a high (one-sided) cross-selling potential.[95] One reason for the cross-selling potential is that the possibility of purchasing the supplementary health care can be conditional on being primary insured by the same health insurance company as well. Another reason is that the insured prefers to deal with only one firm instead of two. Due to the fact that people buying those high quality services might switch to the same firm for their compulsory health insurance we assume that the firms are trying to sell as many supplementary health care policies as possible which means they are output maximizers.[96]

As a result, the strategy of output maximizing in the market for supplementary health care can be used strategically[97] to supplement the main goal in the market for compulsory health insurance (with its high monetary volume) which might be, for instance, budget maximization.[98]

(even though they are officially not allowed to make any profits), budget maximization, sales maximization, market share maximization or maybe the managers' income. For literature that focus on these goals see (Lackman & Craycraft, 1974; Niskanen, 1968; Fershtman, 1985; Sklivas, 1987; Gannon, 1973; Denzau et al., 1985; Hansmann, 1987; Xu & Birch, 1999; Newhouse, 1970; Merrill & Schneider, 1966, among others).

[95] It is worth mentioning that a health insurance company is a priori indifferent between high and low risk people due to the implemented risk adjustment schemes. In countries that have organized the basic health care coverage via competing non-profit health insurance companies we often have community rating insurers. Since these community rating insurers must charge a uniform premium from all individuals, one could argue that there is a high incentive to get the low risk people only. But this argument is only valid, as long as there is no risk adjustment scheme that is sufficient to remove the cause of risk selection by closing the gap between expected cost and premium income. Since this problem is well known, governments have developed very comprehensive risk adjustment schemes. In Germany, for instance, the risk adjustment scheme relies on age, gender and 80 costly diseases. It is therefore very difficult for a health insurance company to discriminate between good and bad risks. Hence, if the risk adjustment scheme is sufficient to close the gap a health insurance company is a priori indifferent between high and low risk people. For papers that deal with cream skimming see Kifmann (2002), (Kifmann, 2006), Hansen & Keiding (2002), or Danzon (2002).

[96] Assuming output maximization as the goal of non-profit organizations is not uncommon. Xu & Birch (1999), for instance, show that almost two out of three non-profit firms aim for output maximization facing a maximum loss constraint.

[97] Using the goal of output maximization strategically to supplement the main goal in the market for compulsory health insurance is closely related to the strategic delegation literature. As an example, Fershtman & Judd (1987) consider a mixture of profits and sales, while Jansen et al. (2007) and Ritz (2008) focus on profits and market share in the context of strategic incentivization.

[98] Steinberg (1986) shows that budget maximization is the main goal of health care companies. However, the major goal in the market for compulsory health insurance does not affect the strategy in the market for supplementary health care as long as more customers are helpful for achieving the goal in the market for compulsory health insurance. More costumers are helpful if the firm maximizes its

In contrast to standard economic theory of complementary goods (Telser, 1979), supplementary health care cannot be sold below costs due to two reasons. First, in many countries this is prohibited by regulation.[99] Second, due to the fact that there is only a one-sided cross selling potential[100] a cross-subsidization from compulsory health insurance to supplementary health care does not make sense. As long as not everyone who is primary insured by the company does have the same supplementary health care as well, a cross-subsidization leads to an exit of all customers who do not have supplementary health care to a company that calculates without cross-subsidization. Hence, the supplementary health care business has to be self-financing and therefore the firms are facing a no loss constraint.[101] To keep the model as simple as possible, we further assume that there are only two firms in the market (i.e. either two private health insurance companies, two public sickness funds, or one private health insurance company and on public sickness fund). Of course, this is a simplification but it still captures a very important fact: we can model competition. The two competing firms need to position themselves in a targeted customer segment. This means that if a firm wants to be the high quality provider, it cannot provide a product that is below the quality of its competitor. To capture this point, we assume that each firm provides only one quality.

We further simplify our model by omitting risk aversion.[102] At a first glance this might seem unusual for an insurance related paper but it is justified for supplementary health care. Supplementary health care has to be seen rather as a product or service than a financial contract where there is a simple money transfer in the case of a loss event. Those high quality products (e.g. the level of care, the number of accessible doctors, the waiting time, and other amenities) are bought because they generate a positive utility to the consumer and not because the consumer wants to minimize risk. Despite the fact that there might be risk neutrality in the market for supplementary health care there are some arguments why we observe a high demand for supplementary health care instead of

budget, its sales or its profits (as long as a costumer does not have a negative contribution margin which is reasonable to assume due to the fact that there are sophisticated risk adjustment schemes in the health care market.)

[99] E.g. in Germany, see §53(9) German Social Security Code.

[100] If people have bought supplementary health care from a firm it is very likely that they have primary insurance at the same company as well. However, just because a person is primary insured by a company does not have to mean that this person buys supplementary health care from that company as well.

[101] We could assume a maximum loss constraint as well. This might be appropriate if a consumer has a positive contribution margin in the basic health insurance. Since this assumption does not change the results in a qualitative way we stick to the assumption that there is a no loss constraint.

[102] The paper nevertheless is an insurance related paper but in the case of supplementary health care the insurance companies are rather producers or service providers than financial intermediaries.

an out of pocket market. The most important one is the transaction cost argument.[103] Another argument is that supplementary health care might be sold exclusively by a health insurance company. Hence, a consumer buys the product if the individual quality-cost ratio is sufficiently high. This rather depends on his preference parameter (e.g. his income) than on his risk attitude. By assuming risk neutral consumers we can omit uncertainty about the health status as well.

The results of our analysis are the following. For a special cost function it is shown that the market for supplementary health care should be organized via competing for-profit health insurance companies. Comparing this to the competition of two non-profit sickness funds, we find that the positive effect of differentiation outweighs the negative effect of taking a mark-up. Comparing it to mixed competition, we find that in mixed competition the sickness fund provides a quality that is too low while the health insurance company takes a mark-up that is too high. The results are robust against slight variations of the cost function. We want to be careful with any policy implications since there are many factors that influence welfare, as the total cost of quality, the marginal cost of quality improvement, or the distribution of the preference parameter. Still, our paper points out a very important fact: allowing a mixed competition might be Pareto-inferior. This result has strong implications for countries such as Germany that have organized the market for supplementary health care via non-profit firms as well as for-profit firms.

The rest of this article proceeds as follows. The next section gives a literature review and states the main distinctions to our article. Section 6.3 introduces our model framework. Section 6.4 examines the quality price combinations in the three scenarios of private profit-maximizing duopoly, non-profit duopoly, and mixed duopoly. Then, in section 6.5, we derive the social optimum and compare the corresponding welfare levels. The concluding section, section 6.6, summarizes our main results and briefly discusses future research.

6.2. Literature Review

Related literature can be found in different research areas. Studies dealing with hospital competition often assume a mixed duopoly in which one hospital maximizes its

[103] First of all, a health insurance company has an information advantage concerning the optimal treatment possibilities and therefore lower search costs. Second, and even more important, having bought supplementary health insurance (instead of paying the high quality treatment out of pocket) is beneficial. This is due to the fact that, in case of illness, the customer's bargaining position is much worse (this especially holds for all acute diseases) and the acquisition costs are higher (especially the non-monetary costs).

profits while the other hospital maximizes either social surplus (Matsushima & Matsumura, 2003; Cremer et al., 1991; De Fraja & Delbono, 1989; Grilo, 1994) or its output facing a budget constraint (Newhouse, 1970; Merrill & Schneider, 1966, among others). The first contributions in this domain focused on a homogeneous good market (Newhouse, 1970; De Fraja & Delbono, 1989). Since most markets are in fact differentiated, further research was done on horizontal product differentiation (Cremer et al., 1991; Matsushima & Matsumura, 2003; Matsumura & Matsushima, 2004) as well as on vertical product differentiation (Grilo, 1994; Herr, 2011). Many studies show that welfare can be improved by allowing a public firm to enter the market (Cremer et al., 1991; Nishimori & Ogawa, 2002; Grilo, 1994).

Many studies analyze the efficiency of health care systems focusing on the interaction between public and private health care provision in general. Brekke & Sørgard (2007) and Rickman & McGuire (1999), for instance, analyze the organization of the National Health Service. They consider the physicians' incentives if they are allowed to work in the public sector as well as in the private sector. Other studies analyze the effects of physician dual practice applying a principal-agent framework (Gonzalez, 2004; Barros & Olivella, 2005; Biglaiser & Ma, 2007; Barros & Martinez-Giralt, 2002). These papers focus on potential moral hazard problems in public provision such as an increase in waiting time, cream skimming or variations in quality that might arise due to physicians' activities in the private sector.[104] The interaction between public and private providers when consumers differ in income has been analyzed by Jofre-Bonet (2000).[105] She considers a consumer who allocates his income between a single composite good and health services.

In contrast to our analysis, studies dealing with the efficiency of the health care market often assume free public care, costly private care and focus on health care in general instead of supplementary health care only. In studies of hospital competition, it is often assumed that prices are regulated and firms therefore compete in quality or location rather than in price. Furthermore, these studies often assume a covered market. Since not every person wants to buy supplementary health care, we neither assume a covered market nor price regulation except for a no loss condition. [106] We further alter the public

[104] There also has been research on the desirability of mixed health care systems when distributional aspects matter (Besley & Coate, 1991; Marchand & Schroyen, 2005). The research assesses the equity grounds for a mixed health care system. Public provision can work as such a sorting device if low income citizens choose the publicly provided good while high income citizens go private.

[105] The differentiation of consumers' income is equivalent to our assumption of different taste parameters. Both assumptions result in a vertical differentiation framework, since the preference parameter can be seen as the inverse of the rate of marginal substitution between income and quality (Tirole, 1988, p. 96).

[106] In Germany, §53(9) of German Social Security Code states that supplementary health care provided

firm's objective function. While budget maximization or social surplus maximization might be reasonable objectives for the hospital market, this does not hold for sickness funds in the market for supplementary health care if people can choose between different sickness funds for their basic health care coverage. Since selling supplementary health care does have a high cross-selling potential, we assume that output maximization is the dominant objective for the non-profit sickness funds. This substantially changes the results.

There are also some interesting papers dealing with supplementary health care, for instance by Kifmann (2002), who presents a model of a competitive health insurance market with two risk types and two exogenously given health benefits where individuals have to buy a basic benefit package from a community rating insurer. The aim of his paper is to show the incentive of cream skimming.[107] Due to the fact that community rating insurers must charge a uniform premium for all individuals, there is a high incentive to get the low risk people only. One way to avoid cream skimming is to regulate the benefit package so that community rating insurers are not allowed to provide any additional benefits. Therefore, in a benchmark situation, Kifmann assumes that community rating insurers offer the basic benefit only while risk rating insurers provide supplementary health care. It is shown that low risk types can only be better off at the expense of high risk types if community rating insurers are allowed to offer the additional benefit and no additional regulations are taken. Both risk types can only be made better off at the same time if community rating health insurers offering the additional benefit are subsidized while those selling only the basic benefit are taxed.

A closely related paper concerned with asymmetric information is Hansen & Keiding (2002). Even though the question is similar to the question of Kifmann (2002), the conclusion of this paper is very different. It concludes that the compulsory scheme with voluntary supplementation is likely to be welfare superior to the pure compulsory scheme. These contradictory findings are possible because the two papers differ in their basic assumptions. For a thorough comparison see Danzon (2002).

In Kifmann (2002) and Hansen & Keiding (2002), the authors concentrate on cream skimming due to asymmetric information. To focus on cream skimming is reasonable if the health insurance companies must charge a uniform premium for all individuals and risk adjustment schemes are not sufficient to remove the cause of risk-selection by

by sickness funds needs to be self-financing, to give an example.

[107] In 2006, Kifmann compares the integration approach to the separation approach in the market for supplementary health care in order to show the incentives to cream skimming (Kifmann, 2006). It is shown that under the integration approach insurers cream skim by selling supplementary health care to low risks at a discount. The integration approach still can be Pareto-superior if the cost savings due to the integration of basic and supplementary health care are sufficiently large.

closing the gap between expected costs and premium income. Our focus is different. We concentrate on a homogeneous group with a strong preference for quality. In our special case, concentration on a homogeneous group is reasonable for two reasons. First, risk adjustment schemes are becoming more and more sophisticated, making it more difficult for the firms to discriminate between good and bad risks.[108] Second, people with a high preference for costly supplementary health care are most likely those who might need treatment.

Pauly (2004) reviews the concept of optimal quality in medical care from an economic viewpoint. This paper is in line with our assumption that there might be a trade-off between price and quality, and that people have different needs.[109] In our study, we continue to analyze this trade-off. Since this trade-off is solely between price and quality, we will not allow for the possibility of horizontal differentiation.

6.3. Model

Our model framework builds on the following basic assumptions. There are two firms, Firm 1 and Firm 2, competing in a duopolistic market. Each firm is either a profit maximizing health insurance company or an output maximizing sickness fund.[110] At the first stage of the game, the firms simultaneously choose their respective qualities S_1 and S_2 for their supplementary health care products. At the second stage of the game, the firms simultaneously choose their prices P_1 and P_2 under the constraint of nonnegative profits and with full information about the chosen qualities. The interval $[\underline{S}, \overline{S}] = [0, 1]$ gives the possible qualities the firms can choose for their supplementary health care products, where the lowest possible quality $\underline{S}$ can be interpreted as a mass market product. The consumers are described via their valuation of quality $\theta \in [\underline{\theta}, \overline{\theta}] = [0, 1]$. It is important to note that θ is not a risk parameter since we assume the consumers to be homogeneous regarding their risk type.[111]

[108] If the risk adjustment schemes are sufficient to remove the cause of risk-selection by closing the gap between expected costs and premium income, the sickness funds are a priori indifferent between high and low risk people. Hence, even though high quality supplementary health care might attract high risk people only, this does not mean that these high risk people are not attractive for the sickness funds for basic health care coverage.

[109] He gives the example that the best hospital in town does not have to be the cheapest or vice versa and he claims that it is certain that the optimal level of quality, given quantity, will be different for different people, depending on the value they attach to quality. Therefore he states that "just because people prefer more of some characteristic to less does not necessarily mean that the market will or should maximize quality in that dimension" (Pauly, 2004, p. 114).

[110] Why sickness funds might tend to be output maximizing firms when it comes to the provision of supplementary health care is discussed extensively in Section 6.1 and Chapter 5.

[111] As mentioned before, the valuation of quality can be interpreted as the inverse of the marginal rate of substitution between income and supplementary health care.

Obviously, there are high costs for R & D in the health care market, but the firm that provides health insurance only has to pay per application. We therefore focus on variable costs of quality improvement. The unit costs C of supplementary health care are independent of the number of insured and given by $C(S) = S^3$. The cost function is exogenous and identical for both firms.[112] Furthermore, we assume that supplementary health care has to be self-financing.[113] The net utility of a consumer with preference parameter θ from buying supplementary health care with quality S at price P is given by the utility function $u_\theta(S, P) = \theta \cdot S - P$.[114] Consumers maximize their individual utility and buy one supplementary health care at most.[115] Only if the utility is nonnegative, the consumer buys the product which means we might be facing an uncovered market. If a consumer is indifferent between two products, he buys the one with the higher quality. The marginal consumer who has utility zero from buying supplementary health care with quality S at price P is given by

$$\theta_0(S, P) = \frac{P}{S}. \tag{6.1}$$

The consumer with preference θ_{ind} who is indifferent between the two products with $S_1 \neq S_2$ is determined by solving $u_{\theta_{ind}}(S_1, P_1) = u_{\theta_{ind}}(S_2, P_2)$. This leads to

$$\theta_{ind}(S_1, S_2, P_1, P_2) = \frac{P_1 - P_2}{S_1 - S_2}. \tag{6.2}$$

For $S_1 = S_2$ and $P_1 = P_2$ we assume $\theta_{ind}(S_1, S_2, P_1, P_2) = \theta_0(S_1, P_1)$. The demand for

[112] We assume this special cost function in order to keep the analysis simple. Our results remain valid also for cost functions $C(S) = S^\alpha$ with α between 2 and 3.2. We choose $\alpha = 3$ since it is the only integer with solutions robust against variations of α in both directions.

[113] In Germany, for instance, cross-subsidization is forbidden by law. If this was not the case, a health insurance company would have an incentive to provide supplementary health care below its costs (Telser, 1979).

[114] This so-called Mussa-Rosen utility function is commonly used in industrial organization literature (Mussa & Rosen, 1978; Tirole, 1988, among others).

[115] Of course, consumers can buy more than one supplementary health care for different segments. Buying more than one supplementary health care for the same segment obviously does not make any sense and the competition has to be analyzed for each segment individually.

the product of Firm i, with $i \in \{1,2\}$ and $j \in \{1,2\}\backslash\{i\}$, is described by[116]

$$D_i(S_1,S_2,P_1,P_2) := \begin{cases} \overline{\theta} - \max(\theta_{ind}(S_1,S_2,P_1,P_2), \theta_0(S_i,P_i)), & S_i > S_j \\ \frac{\overline{\theta}-\theta_0(S_i,P_i)}{2}, & S_i = S_j \\ \theta_{ind}(S_1,S_2,P_1,P_2) - \theta_0(S_i,P_i), & S_i < S_j. \end{cases} \tag{6.3}$$

The profit of Firm i, $i \in \{1,2\}$, is then given by

$$\pi_i(S_1,S_2,P_1,P_2) := D_i(S_1,S_2,P_1,P_2) \cdot (P_i - C(S_i)) . \tag{6.4}$$

The resulting maximization problem highly depends on the firms' objective functions and is therefore described in the respective sections.

6.4. The Provision of Supplementary Health Care

6.4.1. Two competing sickness funds

In this section, let Firm 1 and Firm 2 be output maximizing non-profit sickness funds. The optimization problem is then given by

$$\begin{aligned} D_1(S_1,S_2,P_1,P_2) &\overset{S_1,P_1}{\longrightarrow} \max \qquad & & P_1 \geq C(S_1), \\ & & s.t. \quad & \\ D_2(S_1,S_2,P_1,P_2) &\overset{S_2,P_2}{\longrightarrow} \max & & P_2 \geq C(S_2). \end{aligned} \tag{6.5}$$

Game (6.5) can be solved via backward induction. The solution of the second stage price competition yields $P_1^*(S_1) = C(S_1)$ and $P_2^*(S_2) = C(S_2)$. The first stage quality competition is analyzed based on the reduced form objective functions $D_i(S_1,S_2,P_1^*(S_1),P_2^*(S_2))$, where the two sickness funds can react on a given quality choice of the competitor by overbidding, underbidding or providing a supplementary health care with the same quality. The reaction functions are visualized in figure 6.1. On 1, marginal overbidding[117] is the optimal reaction. On 2, marginal underbidding is optimal, while on 3, Firm 2 reacts with underbidding such that Firm 1 is left with no demand. The black dot between 1 and 2 emphasizes the equilibrium where both sickness funds provide supplementary

[116]For $S_i = S_j$, the mathematical correct notation is $\left(1 + 1_{\{P_i<P_j\}} - 1_{\{P_i>P_j\}}\right)(\overline{\theta} - \theta_0(S_i,P_i))/2$. The formula in (6.3) assumes $P_i = P_j$ since for $S_i = S_j$ and $P_i < P_j$ Firm j is left with no demand. For technical reasons let $\theta_0(S,P) = \min(P/S,1)$ and $\theta_{ind}(S_1,S_2,P_1,P_2) = \min\left(\max\left((P_1-P_2)/(S_1-S_2),0\right),1\right)$ in (6.3). If the two firms provide the same quality at the same price, the total demand is split between the firms in equal parts.

[117]The concept of marginal overbidding as a limit strategy optimizing the reaction in case of overbidding allows a graphical illustration of reaction functions.

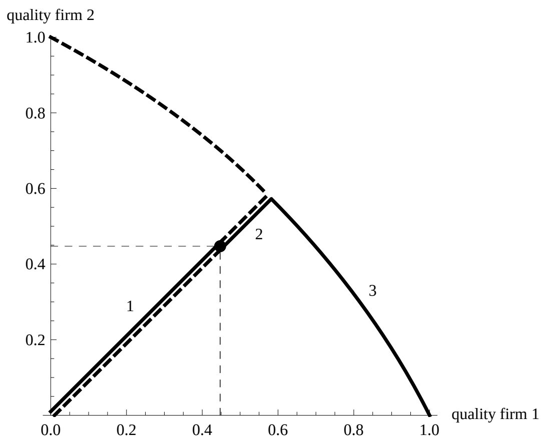

Figure 6.1.: Reaction functions of Firm 1 (dashed) and Firm 2 (solid).

health care with the equilibrium quality S^*. For a general derivation of the unique equilibrium quality and a broader discussion of the competition of sickness funds see Chapter 5.[118] As the solution of the maximization problem (6.5), we obtain for $i = 1, 2$

$$S_i^* = \frac{1}{\sqrt{5}}, \qquad P_i^* = \frac{1}{\sqrt{125}}, \qquad D_i^* = 0.4, \qquad \pi_i^* = 0. \tag{6.6}$$

While we have a non differentiated equilibrium in the competition of two output maximizing sickness funds, it is well known that profit maximizing firms differentiate to relax price competition (Gabszewicz & Thisse, 1979).

6.4.2. Two competing health insurance companies

In this section, let Firm 1 and Firm 2 be profit maximizing private health insurance companies. Since basic coverage is offered by sickness funds and not by private health insurance companies there is no cross-selling from supplementary to primary health care. Therefore, it is reasonable to assume that the health insurance companies try to maximize their profits rather than their output. Thus, the optimization problem is then given by

$$\begin{aligned} &\pi_1(S_1, S_2, P_1, P_2) \xrightarrow{S_1, P_1} \max \\ &\pi_2(S_1, S_2, P_1, P_2) \xrightarrow{S_2, P_2} \max \end{aligned} \qquad s.t. \qquad \begin{aligned} P_1 &\geq C(S_1), \\ P_2 &\geq C(S_2). \end{aligned} \tag{6.7}$$

[118]The derivation of the equilibrium quality is given in Proposition 5.3 and its proof.

If without loss of generality Firm 1 is the high quality provider, the solution of the second stage price competition is[119]

$$\begin{aligned} P_1^*(S_1,S_2) &= \frac{S_1(C(S_2)+2(C(S_1)-S_2+S_1))}{4S_1-S_2} \\ P_2^*(S_1,S_2) &= \frac{C(S_1)S_2-S_2^2+(2C(S_2)+S_2)S_1}{4S_1-S_2}. \end{aligned} \tag{6.8}$$

The reduced form objective functions for the special cost function are then given by

$$\begin{aligned} \pi_1^*(S_1,S_2) &= \frac{S_1^2(S_1-S_2)[2S_1^2-2+S_1S_2+S_2^2]^2}{(4S_1-S_2)^2} \\ \pi_2^*(S_1,S_2) &= \frac{S_1S_2(S_1-S_2)[1+S_1^2+S_1S_2-S_2^2]^2}{(4S_1-S_2)^2}. \end{aligned} \tag{6.9}$$

To analyze the first stage quality competition, we take a look at the firms' reaction functions. Figure 6.2 shows the reaction functions of the two health insurance companies. On 1, providing supplementary health care with a higher quality is dominant. If

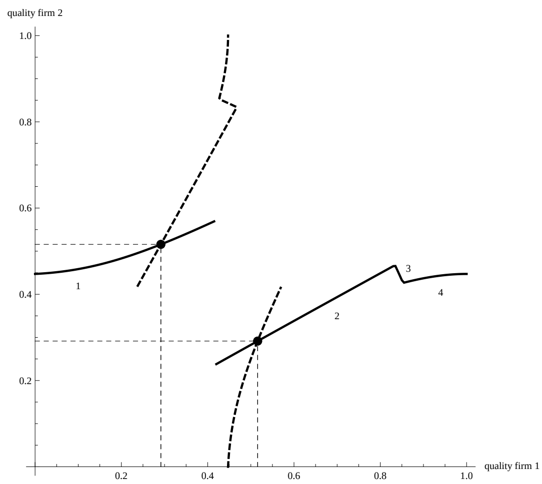

Figure 6.2.: Reaction functions of Firm 1 (dashed) and Firm 2 (solid).

$S_1 = 0$, Firm 2 chooses the monopoly quality-price-combination. Otherwise, the optimally chosen overbidding quality is higher than the monopoly quality.[120] On 2, the provision of a lower quality is dominant. The optimal underbidding quality is increasing in S_1. Interestingly, the underbidding quality at the right end of 2 is higher than the monopoly quality. This is due to competition for the customers with a high preference

[119] These solutions, derived by solving the first order condition, hold for the pairs (S_1, S_2) where $P_1^*(S_1, S_2)$ is greater than $C(S_1)$. We focus on these pairs since any other pair cannot be a pure Nash equilibrium.

[120] An optimal quality higher than the monopoly quality is plausible since the accessible part of the market is shifted to the right. This is due to the low quality provided by the competitor.

for quality.[121] On 3, Firm 2 chooses its underbidding quality so that it forces Firm 1 to choose $P_1^*(S_1,S_2) = C(S_1)$.[122] On 4, Firm 2 increases its underbidding quality again until the monopoly quality is reached.[123] Due to the symmetry of the game, the reaction functions of the two firms are identical. As we clearly see, the reaction functions intersect twice. If we again assume Firm 1 to be the high quality provider, the solution of the first stage quality competition is

$$\begin{aligned} S_1^* &\approx 0.515784 & S_2^* &\approx 0.291495 \\ P_1^* &\approx 0.217703 & P_2^* &\approx 0.073901 \\ D_1^* &\approx 0.358856 & D_2^* &\approx 0.387619 \\ \pi_1^* &\approx 0.028883 & \pi_2^* &\approx 0.019045. \end{aligned} \tag{6.10}$$

We now have analyzed the competition for the cases in which the two firms aim for the same goal. While two output maximizing sickness funds do not differentiate in equilibrium, profit maximizing health insurance companies do differentiate. In the following section, we analyze the competition when the firms have different objectives.

6.4.3. Competition in a mixed duopoly

In this section, let Firm 1 be a profit maximizing health insurance company and Firm 2 an output maximizing sickness fund. The optimization problem is given by

$$\begin{aligned} \pi_1(S_1,S_2,P_1,P_2) &\overset{S_1,P_1}{\longrightarrow} \max & & & P_1 &\geq C(S_1), \\ & & s.t. & & & \\ D_2(S_1,S_2,P_1,P_2) &\overset{S_2,P_2}{\longrightarrow} \max & & & P_2 &\geq C(S_2). \end{aligned} \tag{6.11}$$

In the second stage price competition, the sickness fund chooses $P_2^*(S_2) = C(S_2)$. The health insurance company chooses its price according to

$$P_1^*(S_1,S_2) = \begin{cases} \frac{(S_1-S_2)\overline{\theta}+C(S_2)+C(S_1)}{2}, & S_1 \geq S_2 \\ \frac{S_1C(S_2)+S_2C(S_1)}{2S_2}, & S_1 < S_2. \end{cases}$$

[121] Here, a slight intensification of the second stage price competition is optimal for the underbidding firm.

[122] Obviously, we again have $\theta_{ind}(S_1,S_2,P_1^*(S_1,S_2),P_2^*(S_1,S_2)) = \overline{\theta}$.

[123] On 4, the constraint $P_1 \geq C(S_1)$ is binding and the optimal price of Firm 2 at the second stage is $P_2^*(S_1,S_2) = S_1(\theta_0(S_1)+\theta_0(S_2))/2$.

In the first stage quality competition, we can now take a look at the reduced form objective functions. The reduced form profit is

$$\pi_1^*(S_1,S_2)=\begin{cases}\frac{(S_1-S_2)\left(\overline{\theta}-\theta_{ind}(S_1,S_2,C(S_1),C(S_2))\right)^2}{4}, & S_1\geq S_2\\ \frac{(S_2-S_1)\prod_{i=1}^{2}(\theta_{ind}(S_1,S_2,C(S_1),C(S_2))-\theta_0(S_i,C(S_i)))}{4}, & S_1<S_2.\end{cases}$$

and the reduced form demand is

$$D_2^*(S_1,S_2)=\begin{cases}\frac{\overline{\theta}+\theta_{ind}(S_1,S_2,C(S_1),C(S_2))}{2}-\theta_0(S_2,C(S_2)), & S_2\leq S_1\\ \overline{\theta}-\frac{\theta_{ind}(S_1,S_2,C(S_1),C(S_2))+\theta_0(S_2,C(S_2))}{2}, & S_2>S_1.\end{cases}$$

For $C(S)=S^3$, this yields

$$\pi_1^*(S_1,S_2)=\begin{cases}\frac{S_1-S_2}{4}\left(1-S_1^2-S_1S_2-S_2^2\right)^2, & S_1\geq S_2\\ \frac{S_1S_2(S_2-S_1)(S_2+S_1)^2}{4}, & S_1<S_2\end{cases}$$

$$D_2^*(S_1,S_2)=\begin{cases}\frac{1-S_2^2+S_1S_2+S_1^2}{2}, & S_2\leq S_1\\ \frac{2-2S_2^2-S_2S_1-S_1^2}{2}, & S_2>S_1\end{cases}$$

Figure 6.3 shows the reaction functions of the two firms derived from the reduced form objective functions.

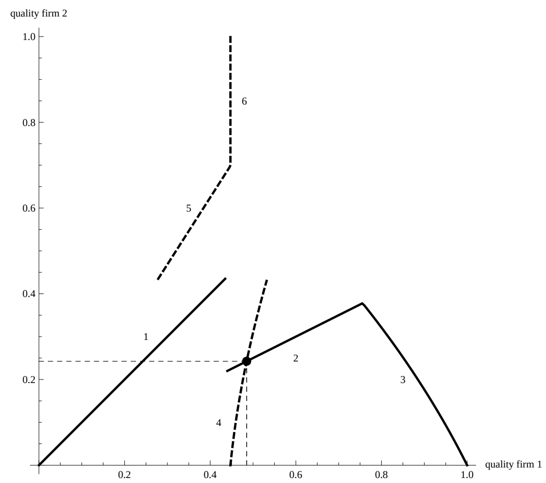

Figure 6.3.: Reaction functions of the health insurance company (dashed) and the sickness fund (solid).

Describing the reaction functions, we begin with the sickness fund. On 1, the provision of a supplementary health care with a marginally higher quality is dominant. On 2 and 3, underbidding is the dominant strategy. On 2, the optimal underbidding strategy is determined by solving $\frac{\partial D_2^*}{\partial S_2} = 0$ and on 3, the underbidding quality S_2 is chosen so that $P_1^*(S_1, S_2) = C(S_1)$, which leaves the health insurance company with no profit. 4, 5 and 6 show the reaction of the health insurance company on a given quality of the sickness fund. On 4, overbidding is dominant. Starting with the monopoly quality, the optimal overbidding quality increases in S_2, similar to the respective reaction in section 6.4.2. On 5, underbidding is dominant. The higher S_2 is, the higher S_1 until S_1 reaches the monopoly quality.[124] On 6, underbidding with the monopoly quality is the optimal reaction. Since the sickness fund still gains a positive demand, the optimal price is lower than the monopoly price but increases in S_2. For $S_2 = \overline{S} = 1$, the monopoly price is reached again. As the solution of (6.11), we obtain a differentiated subgame perfect Nash equilibrium in pure strategies with

$$\begin{aligned} S_1^* &\approx 0.485071 & S_2^* &\approx 0.242536 \\ P_1^* &\approx 0.185468 & P_2^* &\approx 0.014267 \\ D_1^* &\approx 0.294118 & D_2^* &\approx 0.647059 \\ \pi_1^* &\approx 0.020981 & \pi_2^* &= 0. \end{aligned} \tag{6.12}$$

So in equilibrium, the health insurance company provides a higher quality than the sickness fund. The fact that the two firms aim for different objectives relaxes competition so that the goals of the firms are reached to a higher degree compared with the results from sections 6.4.1 and 6.4.2.

6.5. Welfare Analysis

We assume a social planner whose objective is the maximization of the gross benefit of the consumers reduced by the costs of the supplementary health care.[125] For any given combination of S_1, S_2, P_1 and P_2 with $S_2 < S_1$ and $P_2 < P_1$ the total surplus is described by

$$W(S_1, S_2, P_1, P_2) = \int_{\theta_0(S_2,P_2)}^{\theta_{ind}(S_1,S_2,P_1,P_2)} u_\theta(S_2, C(S_2))\, d\theta + \int_{\theta_{ind}(S_1,S_2,P_1,P_2)}^{\overline{\theta}} u_\theta(S_1, C(S_1))\, d\theta. \tag{6.13}$$

[124] Note that due to $P_1 > C(S_1)$, the sickness fund gains a positive demand in this situation. Only for $P_1 = C(S_1)$ would we have $\theta_{ind}(S_1, S_2, P_1, C(S_2)) = \overline{\theta}$.

[125] Ghosh & Morita (2007) also used this definition of welfare in their work. In our case, this is equivalent to the maximization of the sum of consumer surplus and profits.

As one can see in (6.13), the chosen prices do not occur in the integrand, but of course they influence the term via the integration limits. In the following we denote $\theta_0 = \theta_0(S_2, P_2)$ and $\theta_{ind} = \theta_{ind}(S_1, S_2, P_1, P_2)$.

The social optimum

As a benchmark, we derive the first best solution which is given by maximizing

$$W_{soc}(S_1, S_2, C(S_1), C(S_2)) = \int_{\theta_0}^{\theta_{ind}} u_\theta(S_2, C(S_2))\, d\theta + \int_{\theta_{ind}}^{\overline{\theta}} u_\theta(S_1, C(S_1))\, d\theta. \tag{6.14}$$

Maximizing (6.14) with respect to S_1 and S_2 yields

$$\begin{aligned} S_1^* &\approx 0.503186 & S_2^* &\approx 0.322234 \\ P_1^* &\approx 0.127404 & P_2^* &\approx 0.033459 \\ D_1^* &\approx 0.480826 & D_2^* &\approx 0.415339 \\ \pi_1^* &= 0 & \pi_2^* &= 0. \end{aligned}$$

The social optimum then is

$$W_{soc}(S_1^*, S_2^*, P_1^*, P_2^*) \approx 0.150312.$$

Welfare in the different scenarios

In the competition of two sickness funds, there is no differentiation in equilibrium. S_1^*, S_2^*, P_1^* and P_2^* are given in (6.6) and welfare is

$$W_o(S_1^*, S_2^*, P_1^*, P_2^*) = \int_{\theta_0}^{\overline{\theta}} u_\theta(S_2^*, C(S_2^*))\, d\theta \approx 0.143108.$$

In the competition of two health insurance companies, the firms differentiate too much in equilibrium. S_1^*, S_2^*, P_1^* and P_2^* are given in (6.10) and the welfare is

$$W_\pi(S_1^*, S_2^*, P_1^*, P_2^*) = \int_{\theta_0}^{\theta_{ind}} u_\theta(S_2^*, C(S_2^*))\, d\theta + \int_{\theta_{ind}}^{\overline{\theta}} u_\theta(S_1^*, C(S_1^*))\, d\theta \approx 0.143584.$$

In the mixed duopoly, S_1^*, S_2^*, P_1^* and P_2^* are given in (6.12) and the welfare is

$$W_{mix}(S_1^*, S_2^*, P_1^*, P_2^*) = \int_{\theta_0}^{\theta_{ind}} u_\theta(S_2^*, C(S_2^*))\, d\theta + \int_{\theta_{ind}}^{\overline{\theta}} u_\theta(S_1^*, C(S_1^*))\, d\theta \approx 0.138892.$$

So in a non-cooperative framework, the provision of supplementary health care by two competing profit maximizing health insurance companies is second best. The mixed competition, which is observed e.g. in Germany in the market for supplementary health care, yields the lowest welfare.

6.6. Conclusion and Outlook

In this paper, we analyzed duopolistic competition with quality differentiation in the market for supplementary health care in order find out how this market should be organized. We separately examined the competition of two output maximizing sickness funds, two profit maximizing health insurance companies, and a mixed competition. We further distinguished between a cooperative and a non-cooperative framework.

In the non-cooperative framework, two sickness funds do not differentiate in equilibrium while two health insurance companies differentiate too much in order to relax price competition. In the mixed duopoly, the firms also differentiate. In equilibrium, the health insurance company is the high quality provider and both firms achieve their respective objective at a higher degree compared to the competition with a firm aiming for the same goal.

After having derived the different price-quality combinations, we analyzed their welfare implications. Welfare highly depends on the type of competition. The competition of two profit maximizing health insurance companies is second best. It dominates the competition of two sickness funds since the positive welfare effect of differentiation overcompensates the dead weight loss due to the fact that some customers choose the low quality product instead of the high quality product or choose not to buy at all because of the taken mark-ups. Surprisingly, it also dominates the mixed competition. In the latter setting, the firms differentiate as well and only one firm takes a mark-up. But the provided qualities are lower than in the competition of two health insurance companies and the firms differentiate not only too much, but also on the wrong level. The two health insurance companies provide qualities close to the social optimum. This overcompensates the negative welfare effect due to the mark-up of the low quality provider mentioned above.

Based on our analysis, supplementary health care should be provided by health insurance companies only. A mixed competition, as it is present in Germany, might be inefficient. As a consequence, the parts of the Social Health Insurance Competition Strengthening Act which allow sickness funds to provide high quality supplementary health care should be reviewed since this instrument of competition might make the consumers worse off. Of course, further research has to be done to verify this policy implication. While our results are robust against changes in the cost function to some extent, it needs to be analyzed whether they still hold if market entrance is allowed and numerous firms compete. Also, in this paper, the firms were assumed to be homogeneous. Results might change if firms have different cost functions or can differentiate horizontally as well. The introduction of quality uncertainty could be a further extension. All mentioned aspects can also be analyzed for fixed costs of quality improvement, different consumer utility, or changes in the distribution of preferences.

Bibliography

Akerlof, G. A. (1970). The market for lemons: Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, 84(3), 488–500.

Akin, S. N. & Platt, B. C. (2013). Insurance, consumer search, and equilibrium price distributions. *The Journal of Risk and Insurance*, forthcoming.

Aoki, R. & Prusa, T. (1997). Sequential versus simultaneous choice with endogenous quality. *International Journal of Industrial Organization*, 15(1), 103–121.

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *The American Economic Review*, 53(5), 941–973.

Barros, P. P. & Martinez-Giralt, X. (2002). Public and private provision of health care. *Journal of Economics and Management Strategy*, 11(1), 109–133.

Barros, P. P. & Olivella, P. (2005). Waiting lists and patient selection. *Journal of Economics and Management Strategy*, 14(3), 623–646.

Besley, T. & Coate, S. (1991). Public provision of private goods and the redistribution of income. *The American Economic Review*, 81(4), 979–984.

Biglaiser, G. & Ma, C.-t. A. (2007). Moonlighting: public service and private practice. *The RAND Journal of Economics*, 38(4), 1113–1133.

Bockstael, N. E. (1984). The welfare implications of minimum quality standards. *Amercian Journal of Agricultural Economics*, 66(4), 466–471.

Boom, A. (1995). Asymmetric international minimum quality standards and vertical differentiation. *The Journal of Industrial Economics*, 43(1), 101–119.

Bouckaert, J. (2000). Monopolistic competition with a mail order business. *Economics Letters*, 66, 303–310.

Brekke, K. R. & Sørgard, L. (2007). Public versus private health care in a national health service. *Health Economics*, 16(6), 579–601.

Che, Y.-K. & Gale, I. (1997). Buyer alliances and managed competition. *Journal of Economics and Management Strategy*, 6(1), 175–200.

Cremer, H., Marchand, M., & Thisse, J.-F. (1991). Mixed oligopoly with differentiated products. *International Journal of Industrial Organization*, 9, 43–53.

Cummins, J. D. & Doherty, N. A. (2006). The economics of insurance intermediaries. *Journal of Risk and Insurance*, 73, 359–396.

Danzon, P. M. (2002). Welfare effects of supplementary insurance: a comment. *Journal of Health Economics*, 21, 923–926.

De Fraja, G. & Delbono, F. (1989). Alternative strategies of a public enterprise in oligopoly. *Oxford Economic Papers*, 41, 302–311.

De Fraja, G. & Delbono, F. (1990). Game theoretic models of mixed oligopoly. *Journal of Economic Surveys*, 4(1), 1–17.

Denzau, A., Kats, A., & Slutsky, S. (1985). Multi-agent equilibria with market share and ranking objectives. *Social Choice and Welfare*, 2, 95–117.

Devletoglou, N. E. & Demetriou, P. A. (1967). Choice and threshold: A further experiment in spatial duopoly. *Economica*, 34(136), 351–371.

Dorfman, R. & Steiner, P. O. (1954). Optimal advertising and optimal quality. *The American Economic Review*, 44(5), 826–836.

Fershtman, C. (1985). Managerial incentives as a strategic variable in duopolistic environment. *International Journal of Industrial Organization*, 3, 245–253.

Fershtman, C. & Judd, K. (1987). Equilibrium incentives in oligopoly. *The American Economic Review*, 77, 927–940.

Finkelstein, A. (2007). The aggregate effect of health insurance: Evidence from the introduction of Medicare. *Quarterly Journal of Economics*, 122, 1–37.

Focht, U., Richter, A., & Schiller, J. (2013). Intermediation and (mis-)matching in insurance markets - who should pay the insurance broker? *Journal of Risk and Insurance*, 80(2), 329–250.

Frank, R. G. & Salkever, D. S. (1997). Generic entry and the pricing of pharmaceuticals. *Journal of Economics and Management Strategy*, 6(1), 75–90.

Gabszewicz, J. J. & Thisse, J. F. (1979). Price competition, quality and income disparities. *Journal of Economic Theory*, 20(3), 340–359.

Gannon, C. (1973). Optimization of market share in spatial competition. *Southern Economic Journal*, 40(1), 66–79.

Gans, N. (2002). Customer loyalty and supplier quality competition. *Management Science*, 48, 207–221.

GDV (2012). Statistisches Taschenbuch 2012. Gesamtverband der deutschen Versicherungswirtschaft.

Ghosh, A. & Morita, H. (2007). Free entry and social efficiency under vertical oligopoly. *RAND Journal of Economics*, 38(3), 541–554.

Gonzalez, P. (2004). Should physician's dual practice be limited? an incentive approach. *Health Economics*, 13, 505–524.

Grilo, I. (1994). Mixed duopoly under vertical differentiation. *Annales d'Économie et de Statistique*, 33, 91–112.

Guberman, A. & Corman, C. (2000). Generic substitution for brand name antiepileptic drugs: a survey. *Canadian Journal of Neurological Sciences*, 27, 39–43.

Hansen, B. O. & Keiding, H. (2002). Alternative health insurance schemes: A welfare comparison. *Journal of Health Economics*, 21, 739–756.

Hansmann, H. (1987). Economic theories of nonprofit organization. In W. W. Powell (Ed.), *The Nonprofit Sector: A Research Handbook*. New Haven: Yale University Press.

Herr, A. (2011). Quality and welfare in a mixed duopoly with regulated prices: The case of a public and a private hospital. *German Economic Review*, 12(4), 422–437.

Hofmann, A. & Nell, M. (2011). Information cost, broker compensation, and collusion in insurance markets. *Schmalenbach Business Review*, 63, 287–307.

Hotelling, H. (1929). Stability in competition. *The Economic Journal*, 39(153), 41–57.

Hung, N. M. & Schmitt, N. (1988). Quality competition and threat of entry in duopoly. *Economics Letters*, 27, 287–292.

Hung, N. M. & Schmitt, N. (1992). Vertical product differentiation, threat of entry and quality changes. In J. M. A. Gee & G. Norman (Eds.), *Market Strategy and Structure* chapter 16, (pp. 289–308). Harvester Wheatsheaf.

Inderst, R. & Ottaviani, M. (2009). Misselling through agents. *The American Economic Review*, 99(3), 883–908.

Inderst, R. & Ottaviani, M. (2012a). Competition through commissions and kickbacks. *The American Economic Review*, 102(2), 780–809.

Inderst, R. & Ottaviani, M. (2012b). How (not) to pay for advice: A framework for consumer financial protection. *Journal of Financial Economics*, 105, 393–411.

Jansen, T., van lier, A., & van Witteloostuijn, A. (2007). A note on strategic delegation: the market share case. *International Journal of Industrial Organization*, 25, 531–539.

Jofre-Bonet, M. (2000). Health care: private and/or public provision. *European Journal of Political Economy*, 16, 469–489.

Kanavos, P., Costa-Font, J., & Seeley, E. (2008). Competition in off-patent drug markets: Issues, regulation and evidence. *Economic Policy*, July 2008, 499–544.

Kifmann, M. (2002). Community rating in health insurance and different benefit packages. *Journal of Health Economics*, 21, 719–737.

Kifmann, M. (2006). Risk selection and complementary health insurance: The swiss approach. *International Journal of Health Care Finance and Economics*, 6, 151–170.

Kuhl, C. K., Schrading, S., Leutner, C. C., Morakkabati-Spitz, N., Wardelmann, E., Fimmers, R., Kuhn, W., & Schild, H. H. (2005). Mammography, breast ultrasound, and magnetic resonance imaging for surveillance of women at high familial risk for breast cancer. *Journal of Clinical Oncology*, 23(33), 8469–8476.

Lackman, C. L. & Craycraft, J. L. (1974). Sales maximization and oligopoly: A case study. *The Journal of Industrial Economics*, 23(2), 81–95.

Lambertini, L. (1996). Choosing roles in a duopoly for endogenously differentiated products. *Australian Economic Papers*, 35, 205–224.

Lehmann-Grube, U. (1997). Strategic choice of quality when quality is costly: The persistence of the high-quality advantage. *The RAND Journal of Economics*, 28(2), 372–384.

Lutz, S. (1997). Vertical product differentiation and entry deterrence. *Journal of Economics*, 65(1), 79–102.

Madden, P. & Pezzino, M. (2011). Oligopoly on a salop circle with centre. *The B.E. Journal of Economic Analysis and Policy*, 11(1), Article 2, 1–28.

Marchand, M. & Schroyen, F. (2005). Can a mixed health care system be desirable on equity grounds? *Scandinavian Journal of Economics*, 107(1), 1–23.

Matsumura, T. & Matsushima, N. (2004). Endogenous cost differentials between public and private enterprises: A mixed duopoly approach. *Economica*, 71, 671–688.

Matsushima, N. & Matsumura, T. (2003). Mixed oligopoly and spacial agglomeration. *The Canadian Journal of Economics*, 36(1), 62–87.

Merrill, W. C. & Schneider, N. (1966). Government firms in oligopoly industries: A short-run analysis. *The Quarterly Journal of Economics*, 80(3), 400–412.

Motta, M. (1993). Endogenous quality choice: Price vs. quantity competition. *The Journal of Industrial Economics*, 41(2), 113–131.

Mussa, M. & Rosen, S. (1978). Monopoly and product quality. *Journal of Economic Theory*, 18(2), 301–317.

Nell, M., Richter, A., & Schiller, J. (2009). When prices hardly matter: Incomplete insurance contracts and markets for repair goods. *European Economic Review*, 53, 343–354.

Nett, L. (1993). Mixed oligopoly with homogeneous goods. *Annals of Public and Cooperative Economics*, 64(3), 367–393.

Newhouse, J. (1970). Toward a theory of nonprofit institutions: An economic model of a hospital. *The American Economic Review*, 60(1), 64–74.

Nishimori, A. & Ogawa, H. (2002). Public monopoly, mixed oligopoly and productive efficiency. *Australian Economic Papers*, 41(2), 185–190.

Niskanen, Jr., W. A. (1968). The peculiar economics of bureaucracy. *The American Economic Review*, 58(2), 293–305.

Noh, Y.-H. & Moschini, G. (2006). Vertical product differentiation, entry-deterrence strategies, and entry qualities. *Review of Industrial Organization*, 29, 227–252.

OECD (2009). *OECD Health Data 2009*. Paris.

Pauly, M. V. (1968). The economics of moral hazard: Comment. *American Economic Review*, 58(3), 531–537.

Pauly, M. V. (2004). Competition in medical services and the quality of care: Concepts and history. *International Journal of Health Care Finance and Economics*, 4, 113–130.

Pavcnik, N. (2002). Do pharmaceutical prices respond to potential patient out-of-pocket expenses? *RAND Journal of Economics*, 33(3), 469–487.

Raviv, A. (1979). The design of an optimal insurance policy. *The American Economic Review*, 69, 84–96.

Rickman, N. & McGuire, A. (1999). Regulating providers' reimbursement in a mixed market for health care. *Scottish Journal of Political Economy*, 46(1), 53–71.

Riordan, M. H. (1986). Monopolistic competition with experience goods. *Quarterly Journal of Economics*, 101, 265–279.

Ritz, R. A. (2008). Strategic incentives for market share. *International Journal of Industrial Organization*, 26, 586–597.

Ronnen, U. (1991). Minimum quality standards, fixed costs, and competition. *The RAND Journal of Economics*, 22(4), 490–504.

Rothschild, M. & Stiglitz, J. E. (1976). Equilibrium in competitive insurance markets: An essay on the economics of imperfect information. *Quarterly Journal of Economics*, 90, 629–649.

Salop, S. C. (1979). Monopolistic competition with outside goods. *Bell Journal of Economics*, 10, 141–156.

Schlesinger, H. & Schulenburg, J.-M. G. v. d. (1991). Search costs, switching costs and product heterogeneity. *Journal of Risk and Insurance*, 58(1), 109–119.

Schmalensee, R. (2011). Entry deterrence in the ready-to-eat breakfast cereal industry. *Bell Journal of Economics*, 9, 305–327.

Schreyögg, J. (2004). Demographic development and moral hazard: Health insurance with medical savings accounts. *The Geneva Papers on Risk and Insurance: Issues and Practice*, 29(4), 689–704.

Shaked, A. & Sutton, J. (1982). Relaxing price competition through product differentiation. *The Review of Economic Studies*, 49(1), 3–13.

Sharp, B. & Dawes, J. (2001). What is differentiation and how does it work? *Journal of Marketing Management*, 17, 739–759.

Shavell, S. (1979). On moral hazard and insurance. *The Quarterly Journal of Economics*, 93(4), 541–562.

Sklivas, S. D. (1987). The strategic choice of managerial incentives. *The RAND Journal of Economics*, 18(3), 452–458.

Smith, W. R. (1956). Product differentiation and market segmentation as alternative marketing strategies. *Journal of Marketing*, 21(1), 3–8.

Sonnenholzner, M., Friese, S., & Graf v.d. Schulenburg, J.-M. (2009). Reinsurance brokers and advice quality: Is there a need for regulation? *Geneva Risk and Insurance Review*, 34, 20–46.

Spence, M. (1978). Product differentiation and performance in insurance markets. *Journal of Public Economics*, 10, 427–447.

Steinberg, R. (1986). The revealed objective functions of nonprofit firms. *The RAND Journal of Economics*, 17(4), 508–526.

Telser, L. G. (1979). Theory of monopoly of complementary goods. *The Journal of Business*, 52(2), 211–230.

Tirole, J. (1988). *The Theory of Industrial Organization*. Cambridge: MIT Press.

Urmann, O. (2012). Insurance in vertically differentiated repair markets. *Economics Letters*, 116(1), 121–123.

VG FFM (2011). Urteil vom 24. Oktober 2011 - Aktenzeichen 9 K 105/11.F. Verwaltungsgericht Frankfurt am Main.

Wang, X. H. (2003). A note on the high-quality advantage in vertical differentiation models. *Bulletin of Economic Research*, 55, 91–99.

Wilner, A. N. (2004). Therapeutic equivalency of generic antiepileptic drugs: results of a survey. *Epilepsy & Behavior*, 5, 995–998.

Xu, Z. & Birch, M. H. (1999). The economic performance of state-owned enterprises in Argentina an empirical assessment. *Review of Industrial Organization*, 14, 355–375.

Eidesstattliche Versicherung

Hiermit erkläre ich, Oliver Urmann, an Eides statt, dass ich die Dissertation mit dem Titel:

"Quality Differentiation and the Insurance Industry: Essays on Quality Competition and its Welfare Effects in Markets for Repair Goods, Insurance Mediation, and Health Care"
selbständig und ohne fremde Hilfe verfasst habe.

Andere als die von mit angegebenen Quellen und Hilfsmittel habe ich nicht benutzt. Die den herangezogenen Werken wörtlich oder sinngemäß entnommenen Stellen sind als solche gekennzeichnet.

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