Regulated competition among health insurers: the role of consumers’ price/quality trade-offs

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Abstract

We address whether competition on the health insurance market is constructive or destructive, by using an experimental study. This method yields novel insights concerning the impact of the customer preferences on the type of competition. In a simple model, we demonstrate that the willingness of consumers to trade a price increase for a quality increase affects the market outcomes. In the experiments, whether the information on these consumer is available to the insurers trade-offs turns out to have a considerable influence on the type of competition. Under realistic assumptions when insurers face uncertainty with respect to the consumer trade-offs, competition becomes considerably more destructive than when consumer preferences are known. A policy targeted towards addressing consumer preferences is suggested as a solution to mitigate this negative impact of consumer preferences on the type of competition on the health insurance market.

JEL Classification: C72, C92, D74.

Key words: health insurance, liberalization, competition, price/quality trade-offs, laboratory experiment.
1. Introduction

Western countries face increasing health care costs, reduced access, lower quality, and less innovation in the health sector. This prompted several of them, including the Netherlands, Switzerland, and the U.S. to introduce health care reforms. Their goal is to increase the economic efficiency of the health care sector while keeping the welfare of the consumers in mind (Van den Berg et al., 2008, Rosenau & Lako, 2008b, Rosenau, 2010). Following this route, the Netherlands can be named as the best test to date of regulated competition suggested by Alain Enthoven and others (Enthoven and Van de Ven, 2007, Rosenau & Lako, 2008a). The Dutch reform introduced in 2006 includes guaranteed issue, universal coverage, price competition for a standard health insurance benefits package, and community rating. Supplementary insurance can be used by the insurers to compete on the quality, as well as on price.

The basic mechanism stimulating efficiency increase is the right of the consumers to vote by their feet; by switching away from insurers providing low quality, or too expensive health care arrangements, the consumers should generate incentives on the supply side of the market (Van Beest et al., 2008). Evaluating the policy change impact, consumers’ behavior has been identified as in line with these assumptions, to some extent. The price of a health plan is generally an important factor for consumer switching between insurers (Van de Ven & Schut, 2009, Ng et al. 2009). Quality, on the other hand, is more difficult to measure and compare across providers. Avoiding the measurement problems, questionnaire studies support the relevance of both price and quality for consumers in their decisions about switching (van Beest et al., 2008, van Beest et al., 2010, van den Berg et al. 2008, Boonen et al. 2011). But, the extent to which these two aspects are substitutes for each other is not addressed. At the same time, there is a decreasing interest of the consumers to search for better insurance (for the Dutch example in point, Nivel, 2011 report a decrease in switching from almost 20 percent in 2006 to about eight percent in 2011).

The question that remains open is the impact the consumers’ behavior has on the competition on the health insurance market. The desired outcome is the lowering of costs, and the increase of quality of the services to consumers. This is the most optimal situation from the consumer-welfare perspective, improving efficiency in the market as well. We
refer to this outcome as *efficiency-stimulating competition*. Alternatively, competing firms may succeed to coordinate, capturing the consumer surplus for their benefit. They may achieve this through increased prices or lean products. We refer to a competition with such impacts as *constructive competition*. This strategy could be seen as a long-term orientation. Although the consumer welfare is not maximized, the insurers offer reasonable products, make profits, and are able to invest into quality. Finally, competition that stimulates the entry of new players might also result in the short-run oriented strategies like predatory pricing, and in a decrease in the number of market players over time. There is no focus on quality, and the competitive pressure in the short run generates highly anticompetitive outcomes in the long run. We refer to a situation like this as *destructive competition* (Rosenau, 2003).

In this study we point out that there is little known about how the switching behavior of the consumers, and thus the consumer preferences over prices and quality, do affect the type of competition. Clearly, the reforms are instituted with the efficiency-stimulating competition in mind. But, to what extent can we expect this competition to prevail? And what are the threats of experiencing the anticompetitive impact of the consumers’ switching behavior?

Addressing these questions, we face a methodological challenge. The insights concerning the insurance providers’ strategies are more difficult to obtain than data from questionnaire studies of consumer behavior. The measurement of the insurance quality in itself is problematic. And, in order to evaluate the impact of the consumer preferences over quality and prices, we’d need a natural experiment, varying these preferences systematically, while keeping the institutional setup unchanged.

We suggest that the method of experimental economics is a desirable first step in addressing complex issues like these. As Vernon Smith (1994) argues, experiments are helpful for comparing environments so as to investigate the robustness of institutions. In our case, the institution is competition among health insurers. In Smith’s words: “The objective is to stress the theory with extreme environmental conditions under which an institution’s established properties may begin to break down” (p. 115).

Inviting university students as subjects, and with payoffs of the model represented by real monetary incentives, we expose the institution we study to a stress test. Rather than
claiming an external validity, we suggest that our data serves as a useful proxy for the real-world processes. Instead of capturing the complexity of the market, it allows us to focus on the interaction taking place between the consumers’ preferences for quality and price of the health insurance products, and the type of competition among the insurers. In a stylized model that we present, the consumers’ willingness to pay for quality affects the optimal strategies of the insurers, and hence the market outcomes. We also propose that the choice of the dimension along which a firm chooses to attract its customers poses an information problem and a coordination problem. The information problem lies in understanding which of these dimensions customers are more sensitive to: price or quality. After this issue is addressed, it still remains unclear how the firms adjust their strategies in response to strategies of their competitors. When competitors coordinate on competing only along the dimension with the higher demand-sensitivity, the market may lock into a less efficient equilibrium, i.e. consumers would either pay a higher premium, or obtain or lower quality of the insurance product.

Using the method of experimental economics, we can address both of these problems. On one hand, we set-up experiments in which all information about the consumer preferences is available to the insurers. In these Complete Information (CI) treatments, we can thus focus on how the insurers resolve the coordination problem, and how this depends on the consumer preferences over prices and quality of the insurance product. The complete information refers to the fact that the insurers know whether the consumers are willing to pay a high price for a high quality of an insurance product (CI-quality treatment), or whether they prefer low price and low quality product (CI-price treatment).

Second, we relax the assumption that the insurers know the demand characteristics, and study this more realistic set-up. In the Incomplete Information (II) treatment, we thus identify how sensitive is the institution we study, the competition among the health insurers, to the extent of information they have about the consumer preferences.

To summarize our observations, we find that consumers’ preferences affect the insurer strategies under complete information, and the markets most frequently end up in the efficiency-stimulating competition. This promising feature is lost when information about the demand characteristics is not available. Our main observation is that independent of the insurers’ assessment of the demand, the efficiency-stimulating competition is rare.
under incomplete information. Instead, the markets can either be described as operating under constructive, or destructive competition.

Before presenting our experiments, let us remark that the questions regarding the efficiency-stimulating impact of competition are not misplaced for the Dutch case in point. Looking at the market evolution, undoubtedly, the structure of the Dutch health insurance market has not been conducive to severe price competition. To restore premiums, and create economies of scale, mergers and acquisitions among insurance providers were necessary for becoming viable. In the end, only four big players were left covering over 80 percent of the total market. These big players restored their premiums, resulting in higher monthly contributions for Dutch consumers. Moreover, the monthly contribution strongly converged between insurance companies since 2006 (Atos, 2007). This evidence suggests that the competition taking place in the market has features of a destructive competition rather than efficiency-stimulating competition.

If taking any lesson from our experiments, we would suggest that there is a role for publicly shaping the general populations’ attitudes towards the health insurance products. Public efforts to increase the willingness to pay for quality offered by the health insurers might have an impact on the insurers’ perception of the demand characteristics, as well as on the public information about the demand among the insurers, and finally, stimulate their long-term strategies resulting in the redistribution of the surplus towards the consumers in the market.

2. Methods

2.1 Model and propositions

We study the impact of the consumer preferences over price and quality of the health insurance in a simple duopoly with binary price/quality levels. In this model, the competition between the two insurers results in a coordination problem. One equilibrium of the model corresponds to the outcome generated by an efficiency stimulating competition: the prices the consumers pay are low, and the quality of the products is
high. However, there is always an alternative equilibrium in the duopoly, characteristics of which depend on the price/quality trade-off sensitivity other consumers. When a high share of consumers is more sensitive to price than to quality, then the duopoly also has an equilibrium in which both insurers offer insurance of low quality at a low price. If, on the contrary, a high share of consumers is more sensitive to quality than to price, then the alternative equilibrium is one in which both insurers offer insurance of high quality at a high price. In this way, the demand characteristics shape the nature of the duopoly equilibria, and the coordination problem.

The two insurers simultaneously select the price and the quality of their product. When offered the same quality, then customers choose the insurer with the lower price; and, when offered the same price, then customers choose the provider with the higher quality. Moreover, if the insurers provide an identical product, then each of them supplies one half of the market. The customers, however, are heterogeneous in how they resolve a trade-off between high quality insurance offered at a high price, and low quality insurance offered at a low price. One might imagine, for example, that young, healthy, or low-income individuals would belong to the group of individuals with preference for low price over high quality, while older, chronically ill, or high income individuals might fall into the category of individuals preferring high quality over low price.

Formally, the profit of the insurer \(i=1,2\), choosing price \(p_i\) and quality \(q_i\) is given by \(\pi_i = n(p_i, q_i)(p_i-c(q_i))\), where \(n(p_i, q_i)\) is the demand for insurer \(i\)'s product \((p_i, q_i)\), and \(c(q_i)\) is the cost of quality \(q_i\). We assume that price \(p_i\) is either high (H) or low (L), and quality \(q_i\) is either high (A) or low (B). Here, \(0<L<H\) and \(L>c(A)>c(B)>0\). Under these conditions, an insurer producing at low price \(L\) will not make losses.

On the demand side, we consider \(N\) consumers, and each of them demands one insurance product. Suppose the price of the product chosen by consumer \(k\) is \(p_k\) and its

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1 We will call this equilibrium socially optimal in the sense that it results in low prices and high quality, promoting the consumer welfare, and productive efficiency on the side of the insurers.

2 These assumptions eliminate the role of reputation, brand name, loyalty, or switching costs from consideration in this study. Note that we do not argue that these aspects do not affect consumers’ decision-making outside of the laboratory. However, eliminating them from the decision processes in the laboratory allows us to study the dynamics of the market as driven by the preferences for the product characteristics only.
quality is \( q_k \), and denote the product chosen by consumer \( k \) by \( (p_k, q_k) \). Upon purchasing the insurance, the consumer experiences a random event (insurance event). With probability \( x \in (0,1) \), the outcome of the event is unfavorable and the consumer is liable to damage \( d > 0 \). With complementary probability \( 1-x \), the event is not unfavorable, and no damage takes place. The payoff of a consumer \( k \) is given by \( u_k = E - p_k - x \delta_{kB} \) where \( E > 0 \) is initial wealth of the consumer, \( \delta_{kB} = 1 \) if \( q_k = B \), and \( \delta_{kB} = 0 \) if \( q_k = A \). Under this specification, the consumer is fully insured against the unfavorable event if (s)he owns an insurance with high quality \( A \), and the consumer is fully liable to pay the damages in case of the unfavorable event if the quality of the purchased product is \( B \) (low quality). Consequently, the consumer will choose (i) product with price \( L \) over product with price \( H \) when both duopolists offer the same quality, (ii) product with quality \( A \) over product with quality \( B \) when both duopolists offer the same price (either \( L \) or \( H \)), (iii) product with price \( L \) and quality \( A \) over a product with price \( H \) and quality \( B \). Finally, (iv), the choice between a product with price \( H \) and quality \( A \) and product with price \( L \) and quality \( B \) depends on the risk preferences of the consumer. A risk neutral consumer will prefer product \( (L, B) \) to product \( (H, A) \) whenever \( E - L - xd \geq E - H \).

The experiment parameterization is given in Table 1. According to this parameterization, a risk neutral consumer will solve the trade-off discussed above by purchasing product \( (H, A) \) over the product \( (L, B) \), i.e. the risk neutral (and hence also risk averse) consumers act as more sensitive to the quality of the insurance than to its price. Sufficiently risk-taking consumers will choose the lower quality-lower price insurance over the higher quality- higher price insurance. Let us denote the fraction of consumers in the population that choose \( (H, A) \) over \( (L, B) \) by \( h \), \( h \in [0,1] \).

**INSERT TABLE 1 ABOUT HERE**

In the experiment, we use two different approaches for characterizing the demand (and thus, the value of \( h \)). In the *Incomplete Information treatment (II)*, the demand is generated by real subjects, and consequently, the value of \( h \) is unknown to the insurers at the moment they set their prices and quality. In the *Complete Information treatments*, we inform the insurers about the consumer preferences, i.e. about the value of
the parameter $h$. We simulate the demand by choosing two distinct values of $h$. They correspond to situations when all consumers solve the price/quality trade-off in favor of quality ($h=1$), or in favor of price ($h=0$). We refer to these two complete information treatments as CI-quality treatment, and CI-price treatment, respectively.

The strategic interaction in the duopoly insurance market is described by the payoff matrix given in Table 2(a). Its experiment parameterization can be found in Table 2(b).

INSERT TABLE 2 ABOUT HERE

Let us now discuss the equilibrium predictions for this game when played one time, and when repeated finitely many times.

**Lemma 1:**

The game in Table 2(b) has the following pure strategy Nash equilibria: (1) $(LA,LA)$, (2a) $(LB,LB)$ if $h<2/5$, (2b) $(HA,HA)$ if $h>2/5$.

Note that independent of the value of $h$, the resulting duopoly game is a coordination game and has two pure strategy Nash equilibria: the efficiency stimulating competition outcome $(LA,LA)$, and an alternative equilibrium the characteristics of which depend on the fraction of consumers preferring high quality to low price in the population: when this is high enough then an equilibrium with high quality and high price exists as well; otherwise, an equilibrium with low price and also low quality exists.

The fact that our model has two possible equilibria for each possible demand characteristics suggests that the insurers have to find ways to solve the arising coordination problem. Applying the payoff-dominance argument as the equilibrium selection principle, we would predict that the insurers do not select the efficiency stimulating competitive outcome $(LA,LA)$, but the alternative equilibrium strategy instead. However, the equilibrium $(LA,LA)$ has another attractive property: it is a risk dominant equilibrium (Harsanyi and Selten, 1988) in a game where the insurers choose between the two alternative equilibrium strategies. The risk dominance implies that if an insurer is totally uncertain about which of the strategies the other insurer would choose,
and thus assigns probability one half to each of them, then strategy LA yields a higher expected payoff to the insurer than the alternative. Previous experimental literature shows that in cases when there is a tension between the payoff and risk dominance (see Batallito et al., 2001), payoff dominance is not predicting well the equilibrium selected. Due to this behaviorally weak prediction for the outcome of the coordination game, the equilibrium selection has to be tested in the laboratory.

Finally, let us now briefly comment on equilibria when this duopoly interaction is finitely many times repeated. Next to equilibria that only repeated the stage game equilibria, are there other (collusive) equilibria that would yield a higher payoff to the insurers?

**Lemma 2:**

The following strategy $\sigma$, constitutes a subgame perfect Nash equilibrium strategy for any $\tau \geq T-t_{\text{pun}}$: (1) choose strategy HB in period $t<\tau$ if the observed strategy combination was $(HB,HB)$ in any period $t', t'<t$; (2) choose strategy LB (HA) in period $t>\tau$ if (i) $h<2/5$ ($h>2/5$) and (ii) in any period $t \leq \tau$, the observed strategy combination was $(HB,HB)$, (3) choose strategy LA in any other case. Given $T=15$, the value $t_{\text{pun}}=2$ for $t<2/5$ and $t_{\text{pun}}=3$ for $t>2/5$.

Hence, collusion in which both insurers offer at least for a certain period of time a product of low quality at high price can be rational and supported by a subgame perfect Nash equilibrium of the repeated game. The collusive equilibrium is sustained by threatening the play of the (LA,LA) Nash equilibrium of the one-shot game in the last couple of periods, instead of the alternative equilibrium, which yields a higher payoff to the insurers.

**2.2 Experiment design**

We investigate the duopoly market described above by incentivized economic experiments. In total 82 student subjects participated in ten experimental sessions conducted in the NSM DecisionLab at Radboud University Nijmegen, the Netherlands. The language of the experiments was English (see appendix). Participants interacted anonymously via computers; the software was programmed using z-Tree (Fischbacher,
2007). They also answered a short understanding test. The sessions took around 1 hour, and subjects were paid on average 12.60 Euro (including 3 Euro participation fee).

We implement two experimental treatments. In the *Incomplete Information treatment*, the consumers were real experimental subjects and the consumer’s preferences over the price/quality trade-off were not known to the producers. In the *Complete Information treatments*, we simulated consumers’ decisions, and informed the insurers about the characteristics of the demand; either that all consumers prefer the high quality to the low price (*CI-quality treatment*), or, vice versa (*CI-price treatment*). See Table 3 for an overview.

**INSERT TABLE 3 ABOUT HERE**

The subjects remained in the same duopoly market for 15 rounds, either in the role of insurance provider or in the role of consumer (in the Incomplete information treatment). In the *Incomplete Information treatment*, we additionally collected the insurers’ beliefs with respect to the consumer preferences, and use this information later to interpret the product positioning of the insurers.

### 3. Results

Let us first present the evolution of the strategy choices by the insurers over time for the *Complete Information (CI) treatments*. This allows us to address whether the insurers react systematically to the demand characteristics. By comparing Figures 1(a) and 1(b), i.e. the strategy choices in the CI-price treatment (8 markets) and CI-quality treatment (9 markets), we find that the socially desirable action (LA) prevails over time, although it is more frequent in the CI-quality treatment. In both complete information treatments, the alternative equilibrium strategy (HA in CI-quality treatment and LB in CI-price treatment, respectively), occurs mostly in the initial stages of the competition.

In order to address outcomes of the competition per market, we present Tables 4(a) and 4(b) (summarizing over all periods, and groups).

**INSERT TABLE 4 ABOUT HERE**
In more than 50% of the cases, the most desirable outcome from a consumer perspective occurs, i.e. the equilibrium with low price and high quality. The other half of the time is nearly equally divided between coordinating on the alternative equilibrium (HA,HA, or LB,LB, respectively) and on the collusive outcome (HB,HB).

The fact that the efficiency stimulating competition governs the markets, is confirmed when looking at each market separately, see table 5. Here, the individual markets are characterized by the type of behaviour the producers demonstrate, and by the most frequent market outcome in the given market. The column denoted "BR" (best response) contains information on the average number of strategy choices in a given market that could be characterized as myopic best-response behaviour. We say that a subject behaves as myopic best responder, if (s)he chooses a strategy that is the best response against the strategy of his/her co-player in their duopoly market in the previous period. Best response behaviour prevents collusion, but does not prevent coordination on the socially less desirable equilibrium. Because of that, we also indicate, in the column "most frequent outcome", the strategy pair that is observed most frequently in a particular market - conditional on this outcome occurring in at least 12 out of the 15 rounds the subjects played. If strategies are used less consistently, we indicate such mix of strategies by the word "mix".

To summarize these observations, we can state that in about half of the markets, subjects mostly behave as myopic best-responders (the number in the column "BR" is at least 75%), suggesting that they were trying to sustain a stable equilibrium outcome in the market. Moreover, consulting the column "type of outcome" we observe, rather encouragingly (from the social welfare perspective), that about half of such markets (5/9 in CI-quality and 4/8 in CI=price treatment) converge convincingly to the socially desirable equilibrium.

INSERT TABLE 5 ABOUT HERE

On the other hand, however, the other half of the markets is characterised by an effort to "escape" from the socially desirable outcome, and to coordinate on the
alternative equilibrium, which increases the profits of the producers, and decreases the consumer surplus. Even worse for consumers, we observe two markets in line with collusion, where insurers offer a low quality product for a high price.

Essentially, we may conclude that the data collected in the complete information treatments supports the proposition that the consumer preferences affect the strategy choices of the insurers; this is the case in half of the markets we observe, either resulting in a high price, or low quality. However, competition does support the socially desirable outcome in the other half of the markets operating under complete information, and promotes thus efficiency.

What if we now relax the assumption that the competing insurers have complete information about the demand characteristics? Our main observation is as follows: unlike the competition under complete information, the competition under incomplete information does not universally converge to the socially desirable outcome with low prices and high quality. Instead, this socially desirable strategy LA co-exists with a frequently observed strategy HA, see Figure 1(c).

In order to appreciate the impact of the survival of a mix of strategies over time, let us first focus on Table 4(c), which provides an overview of the individual market outcomes in the Incomplete Information treatment. Note that the equilibrium outcomes (LA,LA or HA,HA or LB,LB) are less frequent in this treatment than it was the case under Complete Information (34% vs. 65% of all outcomes). Moreover, the equilibrium (LA,LA) is only found in 11% of all cases, compared to more than 50% of all outcomes in the Complete Information treatments. Clearly, the uncertainty about the price/quality trade-off preferences of the consumers has a strong impact on the market outcomes.

Interestingly, insurers in our experimental markets do not succeed to sustain collusion that might arise due to the repeated interaction. In only 3% of the cases, they actually coordinated on the most profitable, collusive market outcome (HB,HB), see Table 4(c). In that sense, the impact of competition on the welfare of the consumers seems to be "positive" at the first sight.

However, the inability to settle on one strategy and to coordinate implies many strategy adjustments and situations when at any particular period of interaction, one firm captures the full demand. Although the socially desirable outcome determines the welfare
of the consumers in 49/90 (54%) of all cases (including all market outcomes in which at least one of both firms chooses an LA strategy) in only 10/49 (21%) of these markets it is the case that both insurers coordinate on this outcome, and share the market, see Table 4. In the other cases, only one firm provides this outcome, while the other firm is excluded from the market. In reality, this loss of market share might have dire consequences up to the exit from the market, i.e. destructive competition. On the individual market level (see Table 5) only one markets converges, and is characterized by the high quality/high price. The type of competition we observe under Incomplete Information is thus destructive, or constructive, rather than efficiency-stimulating.

Finally, the demand uncertainty under the incomplete information affects the insurers beyond needing to estimate the demand privately; it also creates strategic uncertainty which further affects the product placement of the insurers. To show this, we use the information about the insurers perceptions of the consumer preferences in order to study whether the assessed demand characteristics affect behavior in the same way as the information about the demand in the Complete Information treatments, see Table 6(a). For comparison purposes, Table 6(b) presents the respective strategy choices in the Complete Information treatments.

In order identify differences in behavior in the two information treatments, we now focus only on the insurers that can be described as myopic best responders. Given their beliefs, do the insurers in the Incomplete Information treatment choose the same strategy as the insurers in the corresponding Complete Information treatment?

The impact of the information incompleteness is strong when insurers hold the beliefs that high quality is preferred to low prices by most of the consumers. In this case, the insurers uncertain about the consumers’ preferences settle on equilibria that are more costly for the consumers than when the preferences are known (and high quality is preferred to low prices). In particular, the socially desirable equilibrium with low price and high quality obtains most of the time in the CI-quality treatment (78% of all best-responding actions: see Table 6b). But, in the II treatment, the best-responding insurers
holding the belief that quality is preferred over price prevalently choose another strategy, namely the high price/high quality strategy (in 78% of cases in the II treatment: see Table 6b, as compared 22% of the cases in the CI-quality treatment: see Table 6a).

It is interesting to observe that also the insurers that deviate from the myopic best response often use the high quality and high price strategy, and this even when it is not a best response given their stated beliefs (they choose strategy HA in 54% of the cases after reporting the belief that the consumers do not prefer quality over price). It seems that the insurers consider the strategy of increasing price (in order to increase insurer payoffs) as more attractive (or acceptable), than the strategy of decreasing quality.

In summary, we have learned in the Complete Information treatments that the nature of consumer preferences affects the strategy choices of the insurers. In the long run, however, the low price high quality strategy prevails, which is socially desirable from a consumer’s perspective. Competition thus results in a high extent of coordination, and high consumer welfare. However, when the information about the preferences of the consumers is not available to the insurers, a different picture arises. We find a high share of miscoordination in the market, suggesting negative forces of competition, with long run consequences such as the elimination of firms from the market. Moreover, we observe that insurers increase prices above the level obtained in the most competitive equilibrium in situations in which privately held perceptions of the insurers about the preferences of the consumers suggest that quality is valued highly by the consumers. While decreasing quality from the level obtained in the most competitive equilibrium seems not to be considered an acceptable strategy by the insurers, the price increases are used frequently.

4. Discussion

Previous studies (see for instance Beaulieu, 2002; Atherly, 2004; Abraham, 2006; Hendriks et al. 2010) of competition among health insurers have mainly focused on the role of consumers’ choices. We suggest to study the impact of the consumer preferences on the health insurance market by using experiments.

In our theoretical model, we identify a coordination problem, but also that the competitive outcome, corresponding to a low price and a high quality product offered by
the insurers, is always a possible equilibrium outcome. The presence of such desirable outcome across scenarios with various consumer preferences allows us to evaluate the impact of these preferences on the competition.

To summarize our findings, consumer preferences indeed affect the market outcomes initially, but the efficiency stimulating competition prevails when the consumer preferences are known. When we remove the information about the preferences of the consumers, the competition becomes severe. The competing firms use the high price/high quality action equilibrium frequently, capturing consumer surplus for their benefit. However, they also miscoordinate often, suggesting a threat of a destructive competition. The lack of information on the consumer preferences, a rather realistic assumption, thus goes hand in hand with the negative consequences of the competition, an aspect which should be addressed in policies targeted towards the socially desirable outcomes in the liberalized markets.

Drawing on our results, we would suggest that communication concerning the consumer preferences and their role might be desirable, and the importance of quality next to low prices should be addresses by the governments when popularizing their reforms towards to consumers. We are careful at drawing more far-reaching conclusions, as this study is only a first step towards understanding the topic. Our work itself is subject to several limitations. First, we only included price and quality into our experiment, whereas other variables allowing for loyalty and switching costs effects are not included into our model. Secondly, the experiment was developed using only two health insurers, whereas a typical market (e.g. the Dutch example in point) holds several players. Finally, we used university students for the experiment. This may limit generalizability. Future research should further explore the interaction of consumers and insurers in the health insurance market, possibly using actual market data on price, quality and market share.
References


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<td></td>
<td>8</td>
</tr>
<tr>
<td>L</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>c(A)</td>
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<tr>
<td>c(B)</td>
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<tr>
<td>d</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>E</td>
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Table 2: Payoff matrix

(a) General payoff matrix

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<th>LB</th>
<th>HA</th>
<th>HB</th>
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<td>LA</td>
<td>((L-c(A))/2)</td>
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<td>L-c(A)</td>
<td>L-c(A)</td>
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<tr>
<td>LB</td>
<td>0</td>
<td>((L-c(B))/2)</td>
<td>((L-c(B))(1-h))</td>
<td>L-c(B)</td>
</tr>
<tr>
<td>HA</td>
<td>0</td>
<td>(H-c(A))h</td>
<td>(H-c(A))/2</td>
<td>H-c(A)</td>
</tr>
<tr>
<td>HB</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>((H-c(B))/2)</td>
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(b) Experiment payoff matrix

<table>
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<th>LB</th>
<th>HA</th>
<th>HB</th>
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<tbody>
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<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>LB</td>
<td>0,2</td>
<td>2,2</td>
<td>4(1-h),5h</td>
<td>4</td>
</tr>
<tr>
<td>HA</td>
<td>0,2</td>
<td>5h,4(1-h)</td>
<td>5/2,5/2</td>
<td>5</td>
</tr>
<tr>
<td>HB</td>
<td>0,2</td>
<td>0,4</td>
<td>0,5</td>
<td>7/2,7/2</td>
</tr>
</tbody>
</table>
Table 3: Sessions.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Information about demand</th>
<th>Demand generated by</th>
<th>Price-quality trade-off resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>incomplete</td>
<td>subjects' decisions</td>
<td>depends on subjects' preferences</td>
</tr>
<tr>
<td>CI-price</td>
<td>complete</td>
<td>simulation</td>
<td>in favor of price over quality</td>
</tr>
<tr>
<td>CI-quality</td>
<td>complete</td>
<td>simulation</td>
<td>in favor of quality over price</td>
</tr>
</tbody>
</table>
Figure 1: Evolution of strategy choices over time per treatment.

(a) CI-price treatment (h=0)

(b) CI-quality treatment (h=1)

(c) II treatment (h unknown)
Table 4: Market outcomes per treatment.

(a) CI-price treatment

<table>
<thead>
<tr>
<th>LA</th>
<th>LB</th>
<th>HA</th>
<th>HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>55%</td>
<td>0%</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>6%</td>
<td>3%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>0%</td>
<td>2%</td>
<td>12%</td>
</tr>
</tbody>
</table>

(b) CI-quality treatment

<table>
<thead>
<tr>
<th>LA</th>
<th>LB</th>
<th>HA</th>
<th>HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>53%</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>2%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td>0%</td>
<td>1%</td>
<td>10%</td>
</tr>
</tbody>
</table>

(c) II treatment

<table>
<thead>
<tr>
<th>LA</th>
<th>LB</th>
<th>HA</th>
<th>HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>11%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td>14%</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>3%</td>
<td>1%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>h</td>
<td>Treatment Group</td>
<td>BR</td>
<td>Most frequent outcome</td>
</tr>
<tr>
<td>---</td>
<td>----------------</td>
<td>-----</td>
<td>-----------------------</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 1</td>
<td>96%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 2</td>
<td>75%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 3</td>
<td>86%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 4</td>
<td>4%</td>
<td>HB, HB</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 5</td>
<td>82%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 6</td>
<td>96%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 7</td>
<td>64%</td>
<td>mix LA, HA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 8</td>
<td>89%</td>
<td>HA, HA</td>
</tr>
<tr>
<td>1</td>
<td>CI-quality 9</td>
<td>50%</td>
<td>mix LA, HA</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 1</td>
<td>14%</td>
<td>HB, HB</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 2</td>
<td>86%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 3</td>
<td>71%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 4</td>
<td>71%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 5</td>
<td>54%</td>
<td>mix LA, LB</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 6</td>
<td>54%</td>
<td>mix LA, LB</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 7</td>
<td>100%</td>
<td>LA, LA</td>
</tr>
<tr>
<td>0</td>
<td>CI-price 8</td>
<td>82%</td>
<td>LB, LB</td>
</tr>
<tr>
<td>unknown</td>
<td>II 1</td>
<td>27%</td>
<td>mix, HB</td>
</tr>
<tr>
<td>unknown</td>
<td>II 2</td>
<td>20%</td>
<td>mix, HB</td>
</tr>
<tr>
<td>unknown</td>
<td>II 3</td>
<td>47%</td>
<td>mix, HA, LA</td>
</tr>
<tr>
<td>unknown</td>
<td>II 4</td>
<td>27%</td>
<td>mix, HA</td>
</tr>
<tr>
<td>unknown</td>
<td>II 5</td>
<td>73%</td>
<td>HA, HA</td>
</tr>
<tr>
<td>unknown</td>
<td>II 6</td>
<td>33%</td>
<td>mix HB, HA</td>
</tr>
</tbody>
</table>
Table 6(a): Incomplete information treatment: Insurer’s action depending on the stated belief, and on taking myopic best response actions, or other actions.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Stated belief: Consumers mostly...</th>
<th>Myopic best response</th>
<th>Action chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LB</td>
<td>HB</td>
</tr>
<tr>
<td>II</td>
<td>... are indifferent between quality and price</td>
<td>No</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td>.. prefer quality to price</td>
<td>No</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 6(b): Complete information: Insurer’s action depending on the demand characteristics, and on into myopic best response actions, and other actions.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Known demand: All consumers...</th>
<th>Myopic best response</th>
<th>Action chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.. prefer price to quality</td>
<td>LB</td>
<td>HB</td>
</tr>
<tr>
<td>CI-price</td>
<td>No</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(25%)</td>
<td>(40%)</td>
<td>(21%)</td>
</tr>
<tr>
<td></td>
<td>(21%)</td>
<td>(0%)</td>
<td>(77%)</td>
</tr>
<tr>
<td></td>
<td>(21%)</td>
<td>(0%)</td>
<td>(77%)</td>
</tr>
<tr>
<td></td>
<td>(21%)</td>
<td>(0%)</td>
<td>(77%)</td>
</tr>
<tr>
<td>CI-quality</td>
<td>Yes</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>(3%)</td>
<td>(37%)</td>
<td>(34%)</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(0%)</td>
<td>(78%)</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(0%)</td>
<td>(78%)</td>
</tr>
</tbody>
</table>

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Appendix 1: Proof of Lemma 1

Proof of Lemma 1: Let us denote by \( \sigma = (\sigma_{LA}, \sigma_{LB}, \sigma_{HA}, \sigma_{HB}) \) a mixed strategy that gives weight \( \sigma_s \) to the pure strategy \( s \in \{LA, LB, HA, HB\} \). First, it is useful to realize that strategy HB is strictly dominated by a mixed strategy that gives a weight higher than 0.5 to strategy HA, and the complementary weight to strategy LA, i.e. strategy \((p,0,1-p,0)\) with \( p < 0.5 \) strictly dominates strategy \( (0,0,0,1) \). We can hence eliminate strategy HB and proceed with iteratively deleting strictly dominated strategies. By doing that, we now have to take into account preferences of the consumers, i.e. the value of \( h \).

Case: \( h < 2/5 \)

If \( h < 2/5 \), strategy HA is strictly dominated by a mix of strategies LA and LB where the mixed strategy gives a weight of at least \((3-8h)/(4-8h)\) to strategy LA and complementary weight to strategy LB, i.e. strategy \((p,1-p,0,0)\) with \( p > (3-8h)/(4-8h) \) strictly dominates strategy \((0,0,1,0)\). After eliminating HA, the problem the players face is reduced to a simple coordination game with two pure strategy Nash equilibria \((LA,LA)\) and \((LB,LB)\).

Case: \( h > 2/5 \)

If \( h > 2/5 \), strategy LB is strictly dominated by a mix of strategies LA and HA where the mixed strategy gives a weight of not more that \(8h-3\) to strategy LA and complementary weight to strategy LB, i.e. strategy \((p,0,1-p,0)\) with \( p < 8h-3 \) dominates strategy \((0,1,0,0)\). After eliminating LB, the problem the players face is reduced to a simple coordination game with two pure strategy Nash equilibria \((LA,LA)\) and \((HA,HA)\).
Appendix 2:

Experiment instructions: Complete Information treatment

Introduction
You will now participate in an experiment on economic decision–making. The experiment will last approximately 1.5 hours. You will be paid 3 Euro participation fee immediately after the experiment PLUS any additional earnings you will make in the experiment. How much you earn crucially depends on your and others’ decisions in the experiment.

During the whole experiment, you are not allowed to talk to other participants. Disobeying this rule will result in your exclusion from the experiment. In the experiment, you will earn points and they translate into real money that will be paid to you after the experiment. The exchange rate of points into Euro is given in the instructions below.

Description of the experiment:
The experiment consists of 15 rounds. In each round, you will make a decision. Depending on your decision and the decision of the other participant, you will collect points in every round and the sum of the points collected in all 15 rounds represents your earnings in the experiment.

In this experiment, you will be randomly matched to one other participant of the experiment. You will both make simultaneously a proposal to 10 responders. The response of the responders is programmed by the computer, and affects your payoff. We will explain how responders respond to you and to the other proposer, in the text below.

Let us now describe the events of one round:
In each round, each of the two proposers proposes one insurance product to the responders. Each proposer has to choose the quality of the proposed product (either quality A or quality B) and the price to ask for it (either price 8 or price 5). That means, each proposer has to propose one of the following four products:

- insurance with quality A for price 5
- insurance with quality B for price 5
- insurance with quality A for price 8
insurance with quality B for price 8

Note that quality A costs 4 points per one responder, and quality B costs 1 point per one responder.

After the two proposers submitted their proposals, the computer will assign 10 responders to the two proposers by the following rule:

- In case both proposers make the same proposal, half of the responders will be allocated to buy the insurance from one proposer, and half from the other proposer.
- In case both proposers make different proposals, the 10 responders will be assigned to the “better” proposal. That means,
  - if both proposals ask the same price, then all 10 responders will be assigned to the proposer who offered the higher quality A.
  - if both proposals offer the same quality, then all 10 responders will be assigned to the proposer who asked the lower price 5.
  - If one proposer proposes price 8 and quality A, and the other proposer proposes price 5 and quality B, then all 10 responders will be assigned to the proposer with price 8 and quality A.

Earnings:

Your earnings from selling your insurance product to one responder are equal to the price of the product you offer MINUS the cost of the quality that you offer. That means, your earnings in on round of the experiment are:

$$(\text{price} \text{ MINUS cost of quality}) \times \text{number of responders assigned to you.}$$

Recall that price can be either 8 or 5, and quality A costs 4 points per one responder, and quality B costs 1 point per one responder.

The exchange rate is:

1 point = 2 Cents

100 points = 2 Euro

Let us now explain how the computer screens look like.

SCREEN 1 (this screen appears only in period 1)
Here you enter your student number. We use this information to be able to pay you your earnings at the end of the experiment.

**SCREEN 2**

Here you select price and quality that you want to propose and then click OK.

After having pressed OK, you will be asked to wait until all experiment participants have done the same. The experiment continues only after all experiment participants pressed OK. We therefore kindly ask you not to delay your decision too much. After all experiment participants have pressed OK, Screen 3 will appear.

**SCREEN 3**

In this screen, the you learn the proposal made by the other proposer, as well as how many responders were assigned to you by the rule, and the number of points earned in this round.

A table containing the history of all proposals made in all periods until the current period will be visible as well on this screen.

Please click OK after viewing the information.

Please, raise your hand if you have any questions at this moment.

The experiment now starts with a short test to make sure that everybody understands how you earn your points. After all experiment participants answered all the questions correctly, the experiment will begin.

**Understanding Test**

(Please, circle the correct answer.)

1. If you choose price 5 and quality B in some round, and 5 responders will be assigned to you by the computer in that round, then your earnings in that round will be:
   a. 5
   b. $(5 - 1) \times 5 = 20$
   c. $5 \times 5 = 25$

2. If you choose price 8 and quality A in some round, and the other proposer chooses price 8 and quality A, how many responders will be assigned to you?
   a. 5
   b. 0
3. If you choose price 5 and quality A in some round, and the other proposer chooses price 5 and quality B, how many responders will be assigned to you?
   a. 5
   b. 0
   c. 10

4. If you choose price 8 and quality A in some round, and the other proposer chooses price 5 and quality A, how many responders will be assigned to you?
   a. 5
   b. 0
   c. 10

5. If you choose price 8 and quality A in some round, and the other proposer chooses price 5 and quality B, how many responders will be assigned to you?
   a. 5
   b. 0
   c. 10

Please raise your hand when you are finished with the understanding test. We will come to you to check it privately.