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Johann Han
Nadja Kairies-Schwarz
Markus Vomhof

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Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
Technische Universität Dortmund, Department of Economic and Social Sciences
Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, e-mail: W.Leininger@wiso.uni-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
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Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Roland Döhrn, Prof. Dr. Manuel Frondel, Prof. Dr. Jochen Kluve
RWI, Phone: +49 (0) 201/81 49-213, e-mail: presse@rwi-essen.de

Editorial Office

Sabine Weiler
RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

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Johann Han, Nadja Kairies-Schwarz, and Markus Vomhof[1]

Quality Competition and Hospital Mergers - An Experiment

Abstract

Based on a Salop model with regulated prices, we investigate quality provision behavior of competing hospitals before and after a merger. For this, we use a controlled laboratory experiment where subjects decide on the level of treatment quality as head of a hospital. We find that the post-merger average quality is significantly lower than the average pre-merger quality. However, for merger insiders and outsiders, average quality choices are significantly higher than predicted for pure profit maximizing hospitals. We show that the upward deviation is potentially driven by altruistic behavior towards patients. Furthermore, we find that in case sufficient cost synergies are realized by the merged hospitals, this yields a significant increase in average quality choices compared to the scenario without synergies. Finally, we find that our results do not change when comparing individual to team decisions.

JEL Classification: C91, C92, I11, L13, L44

Keywords: Hospital mergers; quality competition; altruism; laboratory experiment

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1 All UDE and CINCH. – *We thank Daniel Avdic, Jeannette Brosig-Koch, Martin Karlsson, Johanna Kokot and Lisa Einhaus for valuable comments and Martin Baumgärtner and Jan Thom for excellent research assistance. Financial support provided by the Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research) is gratefully acknowledged. –* *All correspondence to: Nadja Kairies-Schwarz, University of Duisburg-Essen, Faculty of Economics and Business Administration & CINCH, Edmund Körner Platz 2, 45127 Essen, Germany, e-mail: nadja.kairies@ibes.uni-due.de*

1 Motivation

Recent healthcare reforms in various OECD countries have aimed at stimulating competition in hospital markets. Especially, the implementation of payment schemes with regulated prices, such as DRGs (Diagnosis Related Groups), has increased incentives for hospitals to decrease costs and to compete on the quality of care. Consequently, OECD countries have experienced strong consolidation waves in their hospital markets. In particular, there has been a trend towards hospitals being managed in systems or by chains. For the US, Cutler and Morton (2013) report based on numbers in the 2013 AHA Chartbook that the percentage of hospitals being part of health systems has increased by 7 percentage points to 60 percent from a decade ago. This trend can also be observed in European countries. For Germany, Augurzky et al. (2013), for example, show that the number of hospital owners administering all existing hospitals in Germany has decreased form 1,399 in 2003 to 1,121 in 2011.[1]

Typically, antitrust authorities examine these market consolidations. The effect on the quality of care is difficult to assess ex-ante. On the one hand, increased market concentration may lead to an abuse of market power and thus decreasing quality levels. On the other hand, mergers could create cost containment (synergies) leading to increasing quality levels.[2] The theoretical literature on quality competition and profit maximizing agents usually shows a negative relationship between market concentration and quality of care, c.f. Ma and Burguess (1993), Beitia (2003), Nuscheler (2003), Brekke et al. (2006), Karlsson (2007).

However, healthcare providers are usually not assumed to be purely profit maximizing. The importance of altruism in the profession of healthcare providers has already been highlighted by Arrow (1963). Ever since altruism has been a pivotal element in healthcare providers' objective functions, both for individuals like general practitioners and for agglomerations like hospitals, c.f. Ellis and McGuire (1986), Chalkley and Malcomson (1998), Eggleston (2005), Heyes (2005), Jack (2005), Chone and Ma (2011), and Kaarboe and Siciliani (2011). When assuming semi-altruistic healthcare providers Brekke et al. (2011) show that altruism affects provision behavior and more competition among hospitals does not necessarily yield a higher level of quality of care anymore. In a similar framework with semi-altruistic healthcare providers and quality competition, Brekke et al. (2015) demonstrate that while a hospital merger always yields higher cost efficiency, the effect on the quality of care is not straightforward and

[1] For example, in 2014 the biggest hospital acquisition in German history was approved when Fresenius SE acquired 38 hospitals from Rhön Klinikum.

[2] Besides cost synergies, hospital mergers might also be desirable since they mitigate inefficient overutilization of externalities, c.f. Calem (1999).

crucially depends on the strategic nature of quality competition as well as on the degree of provider altruism.

The empirical evidence of hospital mergers on the quality of care is scarce. For hospitals in California for the years 1992 to 1995, Ho and Hamilton (2000) compare different quality indicators before and after a merger. Regarding their quality indicators, they do not find a significant effect on inpatient mortality and only slight increases in readmission rates and early discharges of normal newborn babies. In line with these findings, Romano and Balan (2011) investigate a hospital merger in Illinois and find little evidence that the merger significantly improved quality of care. Gaynor et al. (2012) study 112 mergers initiated by regulators in the UK between 1997 and 2006 and find that besides a few exceptions for which a merger decreases quality, the quality measures such as various readmission or death rates do not change significantly. Finally, empirical evidence on the role of cost-related synergies due to hospital mergers is even more limited. While some studies show at least short-run post-merger cost decreases (Lynk, 1995; Dranove and Lindrooth, 2003; Harrison, 2011), the effects of cost synergies on the quality of care are not clear. Overall, the existing evidence on the effect of hospital mergers, synergies and quality of care is not only scarce but also rather inconclusive. It also lacks in making statements about the role of altruism and team decision processes that are common in hospitals, c.f. Barros and Olivella (2011), and might affect altruistic behavior compared to individual decisions.[3]

The aim of this study is to complement the existing field evidence and investigate the effect of a hospital merger in a competitive market on the quality of care in a controlled laboratory setting. We use a laboratory experiment, as we believe that the scarcity and inconclusiveness of the existing empirical evidence may originate from difficulties to attain suitable data in the field. First, investigating into the role of altruism with non-experimental data is difficult as it is almost impossible to observe in the field. Second, changes in the cost structure are often difficult to attain from field data. Third, quality decisions in hospitals may either be the result of an individual or a team decision process. Yet the type of decision process is difficult to observe in the field. Moreover, in contrast to field studies, laboratory experiments offer control and allow for implementing ceteris paribus conditions, e.g., a systematic variation of market

[3] There is some empirical evidence on team decisions showing that teams decide more rational than individuals in the sense that teams are closer to the game theoretic predictions (Bornstein and Yaniv, 1998; Cooper and Kagel, 2005; Kocher and Sutter, 2005; Charness and Jackson, 2007; Charness and Sutter, 2012; Kugler et al. 2012). Further, the evidence on repeated team decisions in oligopoly games is ambiguous (Bornstein et al., 2008; Raab and Schipper, 2009; Müller and Tan, 2013).

concentration, synergy effects, and the decision process. Finally, most empirical studies concentrate on changes in quality provision or prices of merged hospitals pre- and post-merger. The advantage of laboratory experiments is the possibility to consider the outcome for a whole market, and in particular to disentangle the reaction of the merged entity and the response of the independent competitor.

To the best of our knowledge there is no study analyzing the effects of hospital mergers, cost synergies, and the type of decision process on the quality of care when assuming altruistic healthcare providers. While there are some experimental studies investigating mergers, see e.g. Huck et al. (2007), Fonseca and Normann (2008), or quality competition, see e.g. Henze (2015), in a non-health context, they do neither account for both quality competition and mergers, nor for the particularities of hospital markets such as altruistic providers. On the other hand, there are various health economic experiments investigating the role of altruism or professional norms for medical provision behavior on an individual level (Hennig-Schmidt et al., 2011; Godager and Wiesen, 2013; Brosig-Koch et al., 2015a,b; Kesternich et al., 2015). Yet they do investigate neither quality competition and mergers, nor team decisions, which might affect altruistic behavior in a hospital setting.

We base our experimental design on a theoretical model in the spirit of Brekke et al. (2015). Quality provision of hospitals depends on the degree of market concentration (pre- versus post-merger), on whether the hospital is part of the merger (insider versus outsider), and on the head of hospital's individual degree of altruism. Besides altruistic behavior, we further aim at investigating factors that might affect quality provision behavior, such as cost-synergies and team decisions.

In the experiment, subjects are in the role of a head of hospital and compete for patients by making quality decisions in a repeated game. Each market initially consists of three competing hospitals. Two of the three hospitals are exogenously merged halfway through the experiment. After this merger, one of the two heads of hospitals is randomly chosen to be the sole decision maker and to make quality decisions for both merged hospitals in the remaining rounds while one hospital remains independent. Quality decisions have implications for real patients outside the lab who could otherwise not be treated. To investigate potential drivers of mergers on the effect on the quality of care, we also implement treatment variations with either cost synergies or a team decision process.

We find that the post-merger average quality is significantly lower than the average pre-merger quality. However, average quality choices are significantly higher than predicted for pure profit

maximizing hospitals. We show that the higher than pure profit maximizing average post-merger quality is potentially driven by altruistic behavior towards patients. Our results thus confirm the assumptions about semi-altruistic hospitals made by Brekke et al. (2011) and Brekke et al. (2015) in their theoretical hospital competition frameworks. For empirical and policy analyses they also propose to acknowledge for the existence and individual differences in altruistic behavior. Furthermore, in line with our theoretical predictions, we find that in case of sufficient cost synergies for the merged hospitals, a significant increase in average quality choices compared to the scenario without synergies is yielded. Finally, our results show that quality provision behavior does not change with a team decision process.

2 Theoretical model

The experimental design is based on a theoretical model in the spirit of Brekke et al. (2015). We consider a Salop model with an exogenously fixed number of three hospitals, which compete in terms of treatment quality. In the following, we will briefly present our model framework and the main hypotheses as tested in our experimental design.

2.1 Patients' demand for treatment

A unit mass of patients is uniformly distributed on a circle. Patients receive medical treatment in equidistantly located hospitals. A patient's utility depends on the quality q_i received in hospital i with $i \in \{1,2,3\}$, as well as on the travel distance between the hospital's location x_i and the patient's location z. The disutility from traveling is measured by $t > 0$. Patients are fully insured, i.e. prices for treatment do not affect their utility. Furthermore, it is assumed that "basic" valuation of treatment v is sufficiently large to ensure that receiving treatment is always preferred to remaining untreated. Given the hospital's location x_i and the patient's location z, the patient's utility u_{z,x_i} is given by

$$u_{z,x_i} = v + q_i - t\,|z - x_i| \tag{1}$$

It can be shown that hospital i's demand D_i depends on the quality choices of all three hospitals active in the market and is given by

$$D_i = \frac{1}{3} + \frac{2\,q_i - \sum_{j \neq i} q_j}{2\,t} \tag{2}$$

2.2 Hospital provision behavior

Hospitals compete for patients in terms of quality.[4] Since prices p for treatment are exogenously given by a regulator and marginal costs $c>0$ per quality are constant, hospital i's profit function can be written as

$$\pi_i = (p - c\, q_i)\, D_i \tag{3}$$

2.3 Pre-merger scenario

In the pre-merger scenario, three competing hospitals simultaneously choose their quality in order to maximize their profit function as stated in Eq. (3). The Nash equilibrium qualities are derived by the FOCs, the corresponding quality q_i^* and profit level π_i^* of hospital i is given by

$$q_i^* = \frac{p}{c} - \frac{t}{3} \quad \text{and} \quad \pi_i^* = \frac{c\, t}{9} \tag{4}$$

2.4 Post-merger scenario

In the post-merger scenario, we model an exogenous market consolidation by a merger of two of the three hospitals.[5] Following Brekke et al. (2015), the merger does not result in a hospital closure but implies combined profit maximizing efforts by the merged hospitals.[6] The merged hospitals, hereinafter referred to as insiders, are denoted with the index I and the standalone hospital (hereinafter referred to as the outsider) is denoted by the index O.

In comparison to the pre-merger demands as given in Eq. (2), the market consolidation results in asymmetric demands for the insiders and the outsiders

$$D_I = \frac{2}{3} + \frac{q_I - q_O}{t} \quad \text{and} \quad D_O = \frac{1}{3} + \frac{q_O - q_I}{t} \tag{5}$$

and corresponding profit functions

[4] In our model approach, hospitals cannot endogenously choose locations since their locations are fixed.

[5] Different to many other markets, consolidation in hospital markets often imply integration into consolidated hospital systems where the merged entities continue operating under joined ownership instead of divestiture of the acquired hospitals.

[6] Consolidation in hospital markets does not necessarily imply closure of the acquired hospital. In the US the number of hospitals in Health Systems rose from 2606 to 3144 between 2003 and 2013 while number of total hospitals remained relatively constant (4895 to 4974). So increased market concentration rather stems from change in ownership and creation of asymmetries than the actual number of hospitals (AHA 2015).

$$\pi_I = (p - c\ q_I)\ D_I \quad \text{and} \quad \pi_O = (p - c\ q_O)\ D_O \tag{6}$$

Maximizing the respective profit functions with respect to the insider's and the outsider's quality leads to the FOCs and the Nash equilibrium quality is given by

$$q_I^* = \frac{p}{c} - \frac{5\ t}{9} \quad \text{and} \quad q_O^* = \frac{p}{c} - \frac{4\ t}{9} \quad \text{with} \quad q_i^* > q_O^* > q_I^* \tag{7}$$

Comparing post- and pre-merger qualities without synergies, we find that both insiders and outsiders decrease quality compared to their pre-merger levels. Moreover, the decrease is stronger for the insiders than for the outsiders.

Hypothesis 1 - Merger qualities without synergies: *In an asymmetric post-merger scenario where two out of three hospitals join their profit maximizing efforts, (i) all three hospitals lower their qualities in Nash equilibrium compared to the pre-merger scenario, and (ii) insiders decrease quality levels more than outsiders.*

The Nash equilibrium qualities results in insiders' and outsiders' profit levels of

$$\pi_I^* = \frac{25\ c\ t}{81} \quad \text{and} \quad \pi_O^* = \frac{16\ c\ t}{81} \quad \text{with} \quad \pi_I^* > 2\ \pi_i^*, \qquad \pi_O^* > \pi_i^* \tag{8}$$

Without synergies, both insiders and outsiders benefit from the higher markets concentration but the increase is relatively stronger for the outsiders.

Hypothesis 2 - Merger profits without synergies: *In an asymmetric post-merger scenario where two out of three hospitals join their profit maximizing efforts, (i) all three increase profits compared to the pre-merger scenario, and (ii) outsiders are able to increase profits relatively more.*

In principle, the marginal costs c_I of an insider may differ from the outsider's marginal cost c_O due to cost synergies realized by the merger. In this case, we assume $c_I < c_O = c$ for marginal costs, i.e. merged hospitals can realize exogenously given cost synergies.[7] The insider's and outsider's profit functions are then given by

$$\pi_{Isyn} = (p - c_I\ q_I)\ D_I \quad \text{and} \quad \pi_{Osyn} = (p - c_O\ q_O)\ D_O \tag{9}$$

[7] In our model approach, we do not endogenize hospital costs by allowing for cost-containment efforts as in Brekke et al. (2015).

and FOCs yield Nash equilibrium quality levels of

$$q^*_{Isyn} = \frac{p}{3}\left(\frac{2}{c_I} + \frac{1}{c_O}\right) - \frac{5\,t}{9} \quad \text{and} \quad q^*_{Osyn} = \frac{p}{3}\left(\frac{2}{c_O} + \frac{1}{c_I}\right) - \frac{4\,t}{9} \tag{10}$$

with $q^*_{Isyn} > q^*_I$ and $q^*_{Osyn} > q^*_O$ for all cost synergy levels, i.e. $c_I < c_O$. For sufficiently high cost synergies, i.e. $c_I < (9\,p\,c_O)/(9\,p + c_O\,t)$, the Nash equilibrium quality of the insider is higher compared to the outsider's quality.

Hypothesis 3 - Merger with synergies: *In an asymmetric post-merger scenario where two of three hospitals join their profit maximizing efforts and realize cost synergies all three hospitals provide higher quality than in the case without cost synergies.*

2.5 Altruistic Hospitals

Our theoretical model assumes pure profit maximizing hospitals. The fully-fledged version of the theoretical model as presented in Brekke et al. (2015), however, assumes semi-altruistic hospitals. Thus, hospitals take, to some extent, the medically relevant part (i.e. no travel costs) of patient utility directly into account when deciding on quality.

In the pre-merger scenario, they find that higher degrees of altruism increase the Nash equilibrium qualities. Post-merger, they find that even if endogenous cost containment is not possible (no synergies are realized), a hospital merger can have positive effects on average quality of care (patient benefit) if the hospitals are sufficiently altruistic.

Hypothesis 4 - Altruism*: Altruistic hospitals provide higher quality levels than pure profit maximizing hospitals.*

2.6 Monopoly

We use the monopoly scenario as a robustness check for our experimental analysis. The monopolist demand is equal to one since we ensure a fully covered market. In this case, the profit function of the monopolist simplifies to

$$\pi_M = p - c\,q_M \tag{11}$$

The FOC with respect to the monopolist's quality is negative $\pi'_M = -c < 0$ and the hospital will provide the lowest quality possible ($q_M = 0$).

3 Experimental Design

Our experimental design is based on the theoretical model presented in the previous section. In all of the treatment conditions, subjects are in the role of a head of hospital and participate in two consecutive parts. In part 1, three independent hospitals compete for patients on a Salop circle.[8] In part 2, subjects then either remain in the same competitive scenario – *Competition* - or experience a market intervention in the form of a merger of two randomly determined hospitals. For the merger scenario, we also differentiate between a merger without synergies - *Merger* - , one with cost synergies - *Synergy* -, and one with team decisions - *Merger Team* -, c.f. Table 1 for a treatment overview. Each part consists of 15 sequential decision rounds. An market consists of three randomly matched subjects, who are each in the role of head of their respective hospital. Subjects know that they are once matched in the beginning and remain in this group composition throughout the whole experiment.

3.1 Decision Situation

In each decision situation, subjects simultaneously choose the quality level q_i they want to provide to patients from the strategy set $Q = \{1,2,3, \dots ,13\}$.[9] When making their decisions, subjects have full information about each possible constellation of their and their competitors' quality choices and the resulting profits and patient benefits. This information is available in form of a profit and patient benefit table being handed out with the instructions, c.f. Appendix A.4. for the respective profit and patient benefit tables. Moreover, a calculator is implemented in the computer program.

To create a more realistic decision situation, which allows for altruism towards patients, we implemented a transfer of the monetary equivalent of quality choices similar to Eckel and Grossman (1996), Hennig-Schmidt et al. (2011), and Brosig-Koch et al. (2015a,b).[10] Participants in the experiment knew that the higher the level of quality provided, the more money would go to a charity granting uninsured patients in Germany, who would otherwise not be treated, or have access to health care.

When all hospitals have chosen their quality levels, individual market shares are determined. As patients are no other students present in the lab, each hospital's market share is simulated

[8] Huck et al. (2004) showed that three or more firms typically create a competitive situation in oligopoly experiments.

[9] Note that we implemented a discrete choice set compared to the continuous theoretical framework, in order to decrease complexity for individuals.

[10] Eckel and Grossman (1996) show in a double blind scenario of a dictator game – thus independent of any experimenter demand effect – that when the money goes to a real charity this substantially increases altruistic giving compared to a scenario with student recipients.

based on patients' utility function for the respective quality choices within the market. The decision round is concluded with feedback for each subject about their own quality choice, profits, contribution to patient utility and the according information for their rivals.

3.2 Treatments

In our baseline *Competition* treatment, there is no change in the market setting between part 1 and part 2 and subjects receive the information that the experiment will continue as before.

As previously mentioned, in our main treatments with a merger (*Merger and Synergy*), an intervention occurs after the decision rounds of part 1 and – depending on the treatment – the market situation changes in part 2, c.f. Table 1. Albeit the market situation may change, the hospital structure remains, i.e. no hospital is closed down because of the merger. In part 2 of the *Merger* and *Synergy* treatments, two randomly chosen hospitals are exogenously merged. Then, one of the heads of hospital is randomly determined to make uniform quality choices for both hospitals. The other head of the merged hospitals remains in the lab without an active role, however, receives half of the profits generated by the merged entity. The subject in charge of the third hospital continues to operate on its own. In this asymmetric post-merger structure the subjects associated with the merged entity will henceforth be referred to as (active and passive) insider and the independent competitor as outsider. The two treatments differ in their post-merger cost structure. While in the *Merger* treatment there is no change in the cost structure, in the *Synergy* treatment the insiders are able to realize cost synergies and operate with reduced marginal costs in part 2.[11]

In our *Merger Team* treatment, a hospital consists of a board of three people, instead of one person. This team of three has to jointly decide on quality level. The implemented decision mechanism is a simple majority rule similar to Gillet et al. (2011): The three team members can suggest their preferred quality level and in case two or all members select the same level, it is implemented as the hospital quality level for the respective round. In case of a tie, the process is repeated until a decision is reached. The parameters are identical to the *Merger* treatment.

We control for the competitive scenario by conducting a *Monopoly* treatment. Here, subjects instead of being part of a competitive market make individual treatment decisions about the quality of care for the unit mass of patients. While in the competitive scenario more quality might result in higher profits and patient benefits due to a larger patient share, in the *Monopoly*

[11] We chose parameters such that in line with Hypothesis 3 all hospitals would set a higher quality than in a merger without synergies, insiders would set a higher quality than outsiders, and a higher quality than in the pre-merger Nash equilibrium.

treatment a higher quality always results in lower profits and higher patient benefits. Thus, there is a direct trade-off between profits and patient benefits. However, note that to ensure that the market is fully covered, we have to adjust the basic valuation. Thus, treatments are not quantitatively comparable with each other.

Table 1: Treatment overview

	Part 1	**Part 2**	**Number of subjects**	**Number of markets**
Competition	Competition	Competition	72	24
Merger	Competition	Merger	69	23
Synergy	Competition	Merger Synergies	72	24
Merger Team	Competition Team	Merger Team	117	13
Monopoly	Individual	Individual	23	23
Total			**353**	**107**

Our parameter specifications per treatment are given in Table 2. A basic valuation of $v = 5$ satisfies the participation constraint for patients under minimal quality provision. However, in the *Monopoly* treatment we have to increase it to $v = 17$ to assure that the market is fully covered. To ensure that patients choose one of the two hospitals in their vicinity and do not go any further, we set disutility of traveling to $t = 36$. Regulated prices are at $p = 44$ and marginal cost $c = 2$. As noted before, costs change for insiders in part 2 of our *Synergy* treatment. The parameter specifications in *Merger Team* are the same as in *Merger*.

Table 2: Parameter specification per treatment

	Part 1 and 2			**Part 1**	**Part 2**	
	v	t	p	c	c_I	c_O
Competition	5	36	44	2	2	2
Merger	5	36	44	2	2	2
Synergy	5	36	44	2	1.19	2
Merger Team	5	36	44	2	2	2
Monopoly	17	36	44	2	2	2

3.3 Experimental Procedure

The experiment was conducted at the Essen Laboratory for Experimental Economics (elfe) at the University of Duisburg-Essen, Germany in 2015. In total 353 participants, all being students from the University of Duisburg-Essen, were recruited via the recruiting system ORSEE (Greiner, 2004). Out of all participants, 164 were male and 189 female.[12] The procedure was as follows. Upon arrival, subjects were randomly assigned seats in the laboratory. Previous to each part of the experiment, subjects were given instructions of the corresponding treatment and part. They were given time to read the instructions and to ask comprehension questions, which were answered in private. To assure subjects' understanding of the decision task in each part, they had to answer a set of control questions. The experiment did not start unless all subjects had answered the control questions correctly. At the end of the experiment, subjects were asked to answer a short questionnaire with questions on demographics and questions related to their behavior in the previous decisions.

The experiment was computerized using the software zTree (Fischbacher, 2007). On average, a session lasted 120 minutes. All monetary amounts were given in experimental currency Taler, the exchange rate being 1 Taler = 0.07€ in the *Merger*, *Synergy* and *Competition* treatments, 1 Taler = 0.02€ in the *Monopoly* treatment and 1 Taler = 0.21€ in the *Merger Team* treatment. In the individual treatments the average payoff per subject was 17.75€ and the average contribution to the patient was 8.14€, while the average payoff per subject in *Merger Team* was 18.10€ and the average contribution to the patients was 7.67€. In *Monopoly* the average payoff was 20.36€ and the average contribution to the patient 7.82€.The monetary value of the cumulated contributions to the patient was transferred to "Ärzte der Welt e.V.". We applied a procedure similar to Henning-Schmidt et al. (2011) and Eckel and Grossman (1996) to verify this transfer. After each session, a randomly chosen subject monitored the procedure. This included checking that the correct amount was written on the transfer order to the university's financial department and depositing the order in a sealed envelope in the closest by mailbox. This effort was compensated with an additional 5€.

4 Results

We start by discussing the effect of market concentration on quality of care. For this, we investigate quality choices under a competitive oligopoly decision scenario with three hospitals (*Competition*). We then show how quality levels change when market concentration is

[12] Note that the sample includes 19 medical students as well as 130 business and economics students.

decreased in a post-merger duopoly (*Merger*). Furthermore, we consider factors that could potentially drive the effects of a merger. For this, we investigate further into the role of patient-oriented or altruistic behavior, cost synergies (*Synergy*), and team decisions (*Merger Team*).

4.1 Effect of Market Concentration on Quality

4.1.1 Pre-merger Scenario

We begin by investigating quality choices in the pre-merger scenario part 1. Figure 1 shows the predicted Nash equilibria (dashed lines) and the development of average market quality choices for each round in part 1 and part 2 and for the two treatment conditions *Competition* and *Merger*.[13] See Table 3 for the respective mean quality choices. To account for possible first round and end-game effects, we henceforth exclude the first round in part 1 and the last round in part 2 in all treatments.[14] From Figure 1, one can infer that in part 1 of the two treatment conditions, which are characterized by the same oligopoly competition scenario, average quality choices are initially set below the predicted Nash equilibrium and then quickly converge towards it in both treatments. Average market qualities for part 1 across rounds 2-15 do not differ from the predicted Nash equilibrium for the *Competition* treatment and are weakly significantly above for the *Merger* treatment (Wilcoxon signed-rank test, *Competition* p=0.1839, *Merger* p=0.0636).[15] However, comparing the average market qualities between *Competition* and *Merger* for rounds 2-15, we find no significant differences (Mann Whitney U test, p=0.5727). Thus, we have no selection effect into the different treatments.

[13] We consider simple mean quality choices and not the average weighted by the patient share since we focus on the decision variable quality per subject and not average quality perceived by patients. For a detailed discussion, see Appendix A.1.

[14] An indication for a first round effect is that average quality choice in round 1 significantly differs from the average quality choice across rounds 2 to 15 in part 1. Similar, the last round in part 2 significantly differs from the average quality choices of round 16 to 29 in part 2, which is an indication for a last round effect. In all treatments, there are no significant end-game effects prior to part 2, i.e. there is no significant difference in average quality choice for round 15 compared to round 2 to 14 in part 1. For a more detailed discussion, it is referred to the robustness checks in Section 5.3.3.

[15] The latter might indicate altruistic behavior. Yet, the choice of the Nash equilibrium of 10 is quite high, leaving little room for meaningful interpretations compared to for instance part 2 of the *Merger* treatment. For a more detailed discussion of altruism, see section 4.2.1.

Figure 1: Average market quality levels for *Competition* and *Merger*

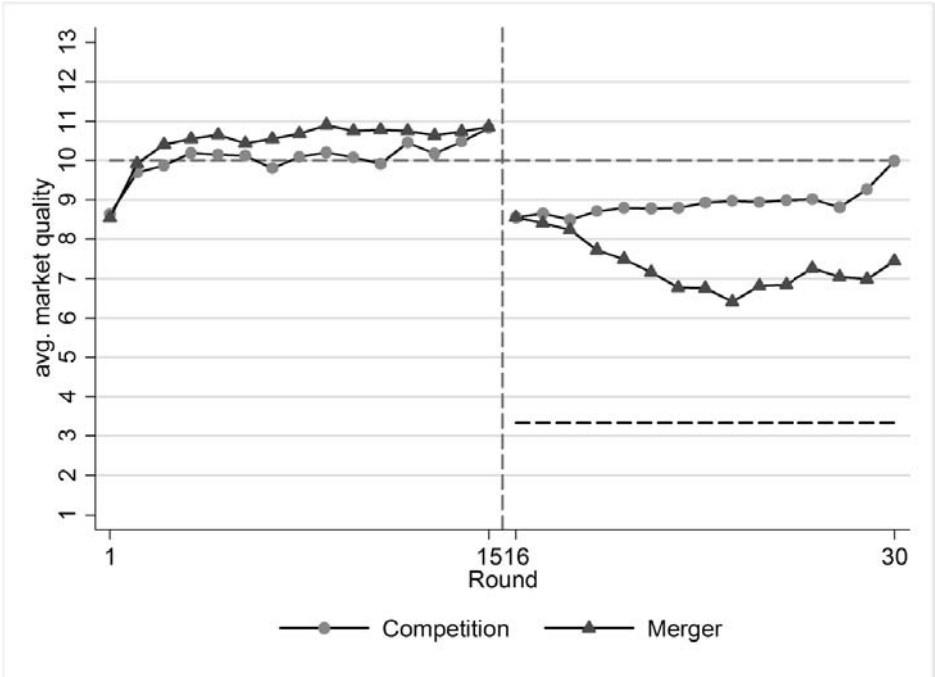


Table 3: Average market quality levels and predictions per part for *Competition* and *Merger*

	Part 1		**Part 2**	
	Average Quality	*Nash Quality*	*Average Quality*	*Nash Quality*
Competition	10.14 (2.27)	10.00	8.84 (3.16)	10.00
Merger	10.61 (1.46)	10.00	7.32 (3.22)	3.33

Note: Standard deviation in brackets. Average market qualities calculated without rounds 1 and 30.

4.1.2 Post-merger Scenario

Next, we analyze the effect of a merger on the quality of care. Due to the merger, the Nash equilibrium quality choices for outsiders and insiders decrease resulting in a decrease of the average predicted quality from 10 to 3.33[16] in the latter, c.f. Table 3.

[16] As the two merged hospitals would set a quality of 2 and the standalone hospital a quality of 6 in Nash equilibrium, the simple average quality provided by hospitals would be 3.33.

To control for potential responses arising from round specific effects (e.g. experience or learning), we first compare the change in average quality levels to our baseline condition *Competition*, in which there is no change from part 1 to part 2 and thus no change in the predicted quality levels.[17] Figure 1 however illustrates that there is a drop in quality levels from part 1 to part 2 for both, *Merger* and *Competition*. For part 2, the dashed lines in Figure 1 again mark the respective average quality choices if subjects would play Nash equilibrium strategies. When comparing rounds 2-15 to 16-29, we find a significant drop in quality levels regardless of an actual change in the market setting (Wilcoxon signed-rank test, *Competition* p=0.0184, *Merger* p=0.0001). One explanation for the drop in *Competition* is that a restart may trigger collusion. The end-game effect in this treatment towards the non-cooperative Nash equilibrium supports this argument.

To disentangle the effects of potential collusive behavior and reduced market concentration in part 2, we compare average quality levels in *Merger* to our baseline *Competition* treatment. Table 3 shows that *Merger* markets decrease quality to 7.32 while *Competition* markets only decrease quality to 8.84. The difference in quality reduction between treatments is statistically significant (Mann–Whitney U test, p=0.0136). This supports *Hypothesis 1* that a merger reduces quality levels.

Furthermore, in the *Merger* treatment, the drop in average quality could differ for the insiders and the outsider as predicted by individual Nash equilibrium choices, c.f. *Hypothesis. 1*. In order to disentangle the different post-merger roles, we investigate average quality choices of insiders and outsiders separately, c.f. Figure 2 and Table 4.

To ensure that there are no selection effects of subjects into the respective roles, we first compare the quality choices in part 1 of subjects who will become insiders and those who will become outsiders in part 2 for the *Merger* treatment. We find no significant differences (Wilcoxon signed-rank test, p=0.7609). Figure 2 illustrates that in part 2 of the *Merger* treatment both, insiders and outsider, significantly reduce the average quality choices after the consolidation (Wilcoxon signed-rank test, insiders p=0.0002, outsiders p=0.0006). Our previous result, that the quality decrease is significantly larger in *Merger* compared to *Competition* also holds if we separate by merger insiders and outsiders, and compare their post-merger quality choices to the market average in the *Competition* treatment (Mann-Whitney U test, insiders p=0.0064, outsiders p=0.0867). This further supports *Hypothesis 1*.

[17] Note that to keep the procedure in line with the other treatments, there was a short break between part 1 and 2 where subjects in the *Competition* treatment were informed that the experiment would proceed as before.

Figure 2 Insiders and Outsiders in *Merger*

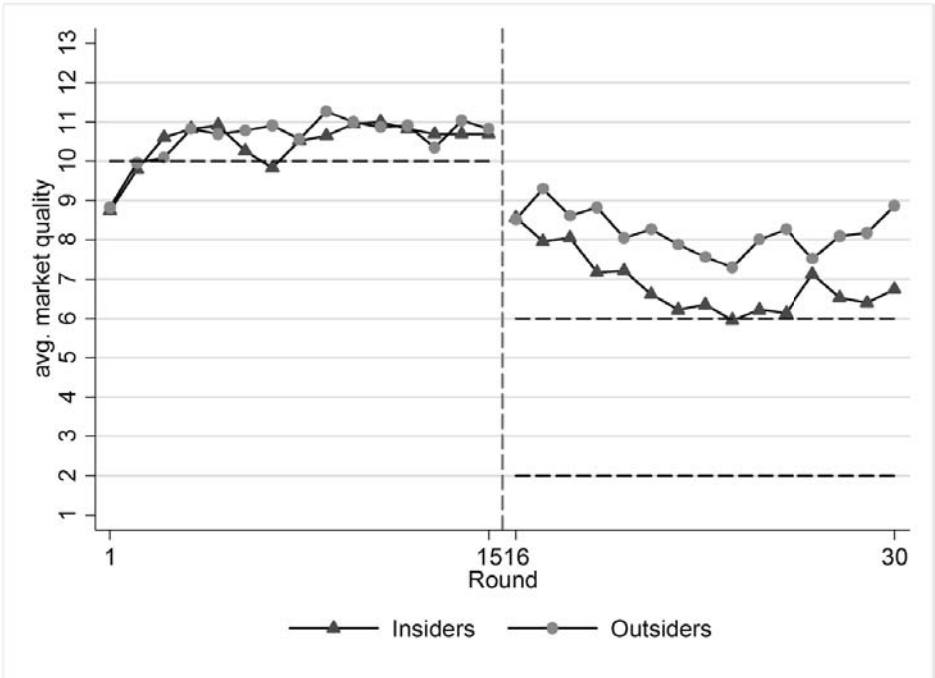


Table 4 Insiders and Outsiders in *Merger* (Rd. 16-29)

Insiders				**Outsiders**			
Nash Quality	*Average Quality*	*Nash Profit*	*Average Profit*	*Nash Quality*	*Average Quality*	*Nash Profit*	*Average Profit*
2	6.89 (3.38)	11.11	9.39 (2.13)	6	8.17 (3.44)	14.22	9.91 (2.29)

Note: Standard deviation in brackets.

Moreover, to get sense of role related behavior in the *Merger* treatment, we take the difference of average quality levels between part 2 and part 1 for insiders and compare it to the difference of outsiders. In particular, while the Nash equilibrium quality for insiders decreases from 10 to 2, it only decreases to 6 for the outsider, c.f. Table 4. In line with the theoretical prediction of *Hypothesis 1* we find that the reduction in quality levels is significantly higher for the insiders than for the outsiders, i.e. -3.70 vs. -2.55 (Wilcoxon signed-rank test, p=0.0184). Thus, as predicted by *Hypothesis 1*, insiders reduce their quality levels more than outsiders.

However, in contrast to the theoretical predictions, many insiders refrain from reducing quality to the predicted levels of 2 for the insiders and 6 for the outsiders. In fact, merger insiders set

significantly higher qualities than predicted by the Nash equilibrium (Wilcoxon signed-rank test p=0.0000), i.e. on average 6.89. Outsiders also set significantly higher quality levels than predicted (Wilcoxon signed-rank test, p=0.0093), i.e. on average 8.17. Moreover, we find that the upward deviation of the quality choice from the predicted Nash equilibrium choice is significantly more pronounced for the merger insiders compared to the merger outsiders (Wilcoxon signed-rank test, p=0.0358).

Result 1 *(corresponding to Hypothesis 1): In an asymmetric post-merger scenario where two out of three hospitals join their profit maximizing efforts: (i) All three hospitals significantly lower their qualities compared to the pre-merger scenario. (ii) Insiders decrease quality choices significantly more than outsiders do. (iii) However, both insiders and outsiders set significantly higher qualities than the predicted Nash equilibrium choices. This upward deviation is significantly higher for the merger insiders.*

4.2 Factors Influencing Post-merger Quality

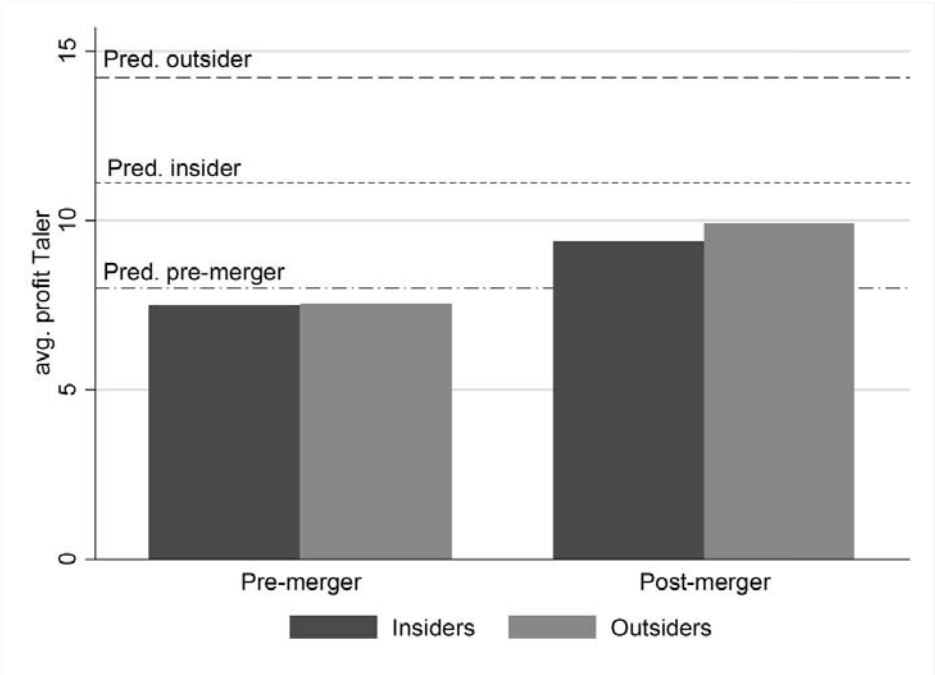
4.2.1 Altruism

In the previous section, we showed that in the *Merger* treatment quality levels significantly decreased from part 1 to part 2 and that insiders tend to decrease quality more than outsiders. However, both the insiders' and outsiders' average quality choices are well above the predicted Nash equilibrium choices. One driving factor of this result could be that subjects are altruistic or patient-oriented in the sense that they consider patient utility in their own objective function. To investigate whether such altruistic behavior plays a role, we focus on the money (in Taler) participants are willing to give up from their own profits to increase patient utility, i.e. the difference to the Nash equilibrium profits.

Figure 3 shows the average market profits of part 1 and 2 of the experiment in the *Merger* treatment for insiders and outsiders, respectively. Average profits in the pre-merger scenario are below the Nash equilibrium prediction for both insiders and outsiders, c.f. Table 4. A Wilcoxon signed-rank test confirms that average profits are significantly lower than the Nash equilibrium predictions for insiders (p=0.0192) and outsiders (p=0.0244). This indicates that even in the symmetric competition case, participants behave more patient-oriented than expected by the Nash equilibrium.

Although post-merger profit predictions increase compared to the pre-merger predictions, we find that both insiders' and outsiders' average profits are significantly below the Nash equilibrium prediction (Wilcoxon signed-rank test, insiders p=0.0021, outsiders p=0.0000).

Figure 3 Average market profits in part 1 and 2 by role in *Merger*



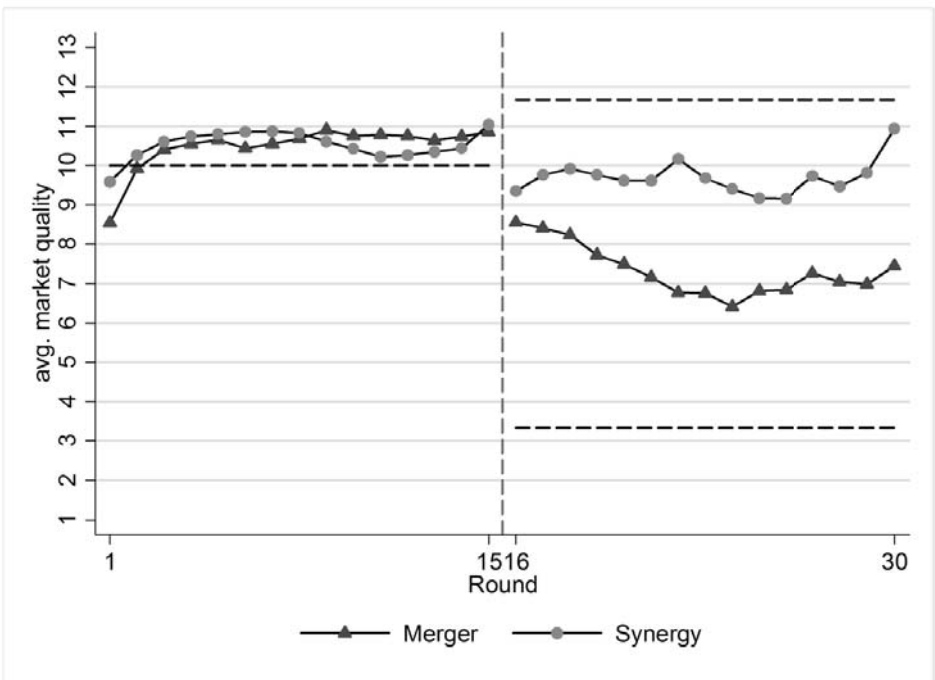
Result 2 *(corresponding to Hypotheses 2 and 4): Pre-merger average profits are significantly lower than the Nash equilibrium levels indicating altruistic behavior. Also in the post-merger scenario, both insiders' and outsiders' average profits are significantly below the Nash equilibrium prediction.*

4.2.2 Cost Synergies

Another factor that might drive the effect of mergers are cost synergies. While we found that in line with the theoretical predictions, a merger decreases quality, albeit less than expected, cost synergies could potentially offset this reduction and even lead to an increase in quality, c.f. *Hypothesis 3*. To systematically investigate the effects of cost synergies, we compare the results of the *Merger* treatment with those of the *Synergy* one. To ensure that there are no selection effects of subjects into one of the three treatments *Competition*, *Merger*, and *Synergy*, we compare average quality choices in part 1 across treatments for rounds 2-15 and find no significant differences (Kruskal-Wallis test, p=0.6348).

For the *Synergy* treatment, Figure 4 illustrates that post-merger quality choices are significantly higher on average compared to the *Merger* treatment (Mann-Whitney U test, p=0.0148).[18] This result still holds if we separate by roles as both insiders and outsiders set significantly higher quality levels in *Synergy* while the absolute difference is bigger for the former. (Mann-Whitney U test, insiders p=0.0100, outsiders p=0.0926). Thus, in line with *Hypothesis 3*, we find that sufficient cost synergies can to some degree offset the negative effects of reduced market concentration. However, both insiders and outsiders provide a significantly lower average quality, i.e. for the 9.48 insiders and 9.88 for the outsiders, than predicted by the Nash equilibrium, i.e. 12 and 11 respectively (Wilcoxon signed-rank test, insiders p=0.0002, outsiders p=0.0555) c.f. Table 5. This might be the case as the Nash equilibrium quality is already quite high. Moreover, we find that quality levels do not significantly differ for insiders and outsiders (Wilcoxon signed-rank test, p=0.5295). In particular, the reduction in quality between part 1 and 2, i.e. -1.07 vs. -0.59, does not significantly differ (Wilcoxon signed-rank test test, p=0.0184). This might be a result of our parameterization in the sense that the ex-post *Synergy* Nash equilibrium quality levels are 11 and 12 and thus quite close to each other.

Figure 4: Average market quality levels for *Merger* and *Synergy*



[18] Note that when comparing average quality levels of *Synergy* and *Competition* we also find no significant differences (Mann-Whitney U test: p=0.3025).

Table 5 Insiders and Outsiders in *Synergy* (Rd. 16-29)

Insiders				**Outsiders**			
Nash Quality	*Average Quality*	*Nash Profit*	*Average Profit*	*Nash Quality*	*Average Quality*	*Nash Profit*	*Average Profit*
12	9.48 (2.98)	10.32	10.16 (1.87)	11	9.88 (2.46)	6.72	7.61 (2.18)

Note: Standard deviations in brackets.

In terms of profits, insiders are able to realize higher profits due to their advantageous cost structure (10.16 Taler per round, no significant difference to Nash equilibrium prediction of 10, p=0.9317) while outsiders suffer from the more efficient competitor (7.61 Taler per round, significantly different to Nash equilibrium prediction of 6.72, p=0.0633, Wilcoxon signed-rank tests). We find that insiders' profits are significantly higher compared to the outsiders' in *Synergy* (Wilcoxon signed-rank test p=0.0000) and higher compared to the insiders in the *Merger* treatment condition (Mann-Whitney U test, p=0.0705). In contrast, profits for outsiders are significantly lower in the *Synergy* treatment conditions compared to the *Merger* (Mann-Whitney U test, p=0.0023). All these results are supported by *Hypothesis 3.*

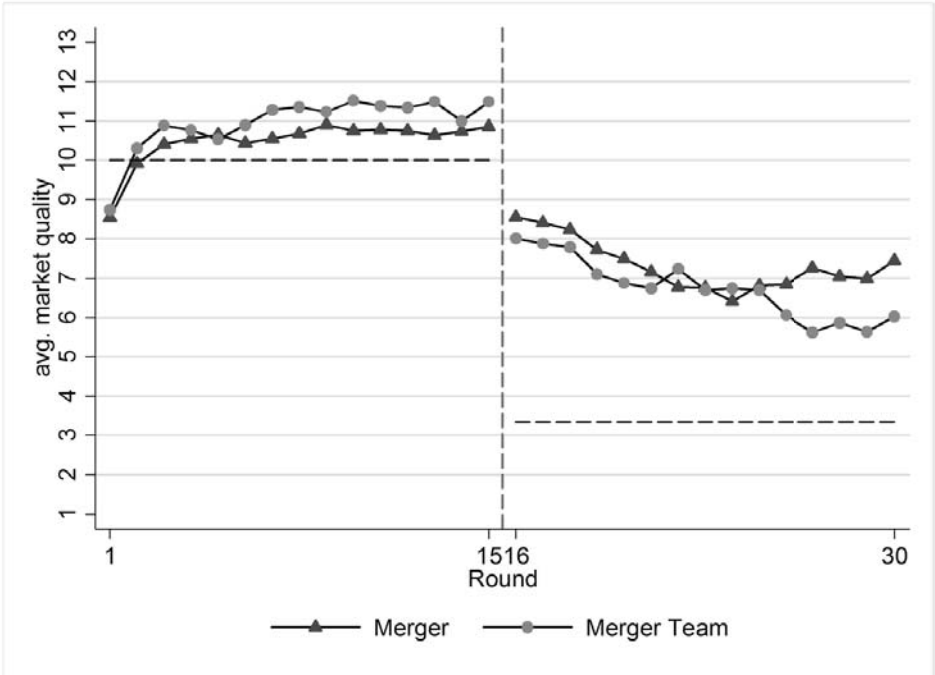
Result 3 *(corresponding to Hypothesis 3): In an asymmetric post-merger scenario where two of three hospitals join their profit maximizing efforts and realize cost synergies all three hospitals provide significantly higher quality than in the case without cost synergies.*

4.2.3 Team Decisions

Concerning altruistic behavior, the way decisions are made, i.e. by an individual or in a team, might affect quality. This especially applies to hospitals, as decisions are often taken within teams, c.f. Barros and Olivella (2011). Studies investigating team decisions show that while teams decide more selfishly than individuals in ultimatum, trust and dictator games (Bornstein and Yaniv, 1998; Kugler et al., 2007; Luhan, 2009) evidence on team decisions in repeated games are mixed (Bornstein et al. 2008; Raab and Schipper, 2009; Müller and Tan, 2013). To check whether altruistic behavior differs in a team decision scenario, we conducted a *Merger Team* treatment, in which one market consists of three hospitals with three decision makers each. In total we have 13 market observations for *Merger Team* treatment. Comparing the average quality levels of these team markets with the 23 individual markets of the *Merger*

treatment neither yields significant differences in part 1 nor part 2 (Mann-Whitney U test, part 1 p=0.3312, part 2 p=0.6806). See Figure 5 for an illustration.

Figure 5 Average quality in *Merger* and *Merger Team*



As an indicator for altruistic behavior, we considered the difference to the Nash equilibrium profits. In both treatments, the pre-merger Nash equilibrium profits are 8 Taler for each hospital. In the experiment, the markets in the individual *Merger* treatments realized average profits of 7.43 Taler, while in the *Merger Team* treatment markets were slightly less profitable with 7.16 Taler on average. Both are significantly different from the predicted Nash equilibrium profits (Wilcoxon signed-rank test, *Merger* p=0.0074, *Merger Team* p=0.0037). This shows that pre-merger teams also show altruistic behavior. Like for the average qualities, the differences in profits are not significantly different between the *Merger* and *Merger Team* treatment (Mann-Whitney U test, p=0.4197).

For the post-merger scenario, we again separate by the roles. We find that outsiders realize post-merger profits of 9.91 in the *Merger* and 10.54 in the *Merger Team* treatment and lie significantly below the predicted 14.22 Nash equilibrium profit (Wilcoxon signed-rank test, *Merger* p=0.000, *Merger Team* p=0.0019). The insiders have profits of 9.39 and of 9.65 in

individual and team treatment, respectively. These profits also lie significantly below the predicted level of 11.11 for *Merger* and *Merger Team* (Wilcoxon signed-rank test, *Merger* p= 0.0021, *Merger Team* p= 0.0277). A possible explanation for this result could be that in a team quality decisions become more visible and subjects may want to uphold a certain social image of being a good healthcare provider, c.f. Bénabou and Tirole (2006) and Andreoni and Bernheim (2009).

Result 4*: We find no significant difference in average quality levels and profits between individual and team decisions.*

4.3 Robustness Checks

4.3.1 Altruistic Behavior

In order to investigate whether altruism also plays a role irrespective of competition or merger induced effects, we conducted the *Monopoly* condition, which is irrespective of competition or post-merger effects. Similar to the other treatment conditions, yet more extreme, head of hospitals face a trade-off between pure profit maximizing quality of 1 and patient optimal quality of 13, c.f. *Hypothesis 4*. Hence, any deviation from the profit maximizing quality can be referred to as altruistic behavior. In Figure A.2.1 in the Appendix *Monopoly*, we see that the majority of subjects in the monopoly condition consider patient benefits to at least some degree. Thus, without competition altruistic behavior also seems to play a prominent role. This result is in line with previous studies where participants in medically framed experiments show patient-oriented behavior towards real patients outside the laboratory, c.f. Hennig-Schmidt et al. (2011), Godager and Wiesen (2013), and Brosig-Koch et al. (2015a,b).

In order to investigate whether altruistic behavior is stable across both parts in case market conditions do not change, we investigate the correlation between quality choices as well as the correlation between the deviations to the maximum profits in part 1 and 2 in the *Monopoly* treatment. We find a very high correlation (0.98) in quality levels as well as in the deviations to maximum profits (0.98) between both parts.

4.3.2 First Round and End-Game Effects

Table 6 provides the average quality choices across treatments. In the previous analysis, we have excluded the first round of part 1 and the last round of part 2 to account for first round and end-game effects. As shown in Table 6, the average quality choices across treatments deviate from the first round to round 2-15 and round 30 to round 16-29. Except for the end-game effect

in *Merger* and *Merger Team*, all first-round and end-game effects are statistically significant.[19] The first-round effect reflects behavior without feedback and previous experience. The end-game effects are in line with observed collusive behavior as subjects deviate to non-cooperative levels in the final round.

Table 6: Average quality across decision rounds per part and treatment

	Part 1		**Part 2**	
	Round 1	*Round 2-15*	*Round 16-29*	*Round 30*
Competition	8.64 (2.30)	10.14 (2.27)	8.84 (3.16)	9.99 (3.49)
Merger	8.54 (2.30)	10.61 (1.46)	7.32 (3.32)	7.45 (3.33)
Synergy	9.58 (1.97)	10.59 (2.03)	9.61 (2.71)	10.93 (2.48)
Merger Team	8.74 (1.03)	11.10 (0.98)	6.78 (3.11)	6.02 (3.17)

Note: Standard deviations in brackets.

4.3.3 Individual Characteristics

In the Appendix A.3, we provide regression results for gender as well as types of academic studies. We do not find significant differences between medical students and non-medical students. Moreover, although women have shown to be less competitive (Gneezy et al., 2003; Gneezy and Rustichini, 2004; Niederle and Vesterlund, 2007; Antonovics et al., 2009), we find no significant differences between male and female students.

5 Conclusion

In this study, we investigate the effect of a hospital merger in a competitive market on the quality of care in a controlled laboratory setting. In particular, we analyze the drivers of potential effects such as market concentration, altruistic behavior, merger induced efficiency gains due to cost synergies, and the form of the decision process. We base our experimental design on a theoretical model in the spirit of Brekke et al. (2015).

In line with theoretical predictions, we find that the post-merger average quality is significantly lower than the average pre-merger quality. However, especially for merger insiders but also for outsiders, average quality choices are significantly higher than predicted for pure profit maximizing hospitals. These results are robust to the decision making process, i.e. whether

[19] Wilcoxon-Sign-Rank test within markets: *Competition:* first-round effect p=0.0018, end-game p=0.0058; *Merger*: first-round: p=0.0003 end-game: p=0.8433; *Synergy* first-round: p=0.0099, end-game: p=0.0099; *Merger Team*: first-round: p= 0.0015, end-game: p= 0.1961

individuals as head of hospital or teams decide on the quality of care. This contradicts existing empirical evidence stating that teams are more selfish than individuals (Bornstein and Yaniv, 1998; Kugler et al., 2007; Luhan, 2009). A possible explanation could be that in a team quality decisions become more visible and team members may want to uphold a certain social image of being a good healthcare provider, c.f. Bénabou and Tirole (2006) and Andreoni and Bernheim (2009).

Our experimental design relates to the recent developments in hospital markets showing a tendency for decreasing numbers of hospital owners and consequently situations where hospital chains and independent hospitals serve the same market, cf. Augurzky et al. (2013) for Germany. For such situations, our results suggest that merger induced market power asymmetries lead to smaller quality provision discrepancies between the merged hospitals and the standalone hospital than predicted for pure profit maximizing hospitals.

We show that the upward deviation is potentially driven by semi-altruistic behavior towards patients as in Hennig-Schmidt et al. (2011), Godager and Wiesen (2013), and Brosig-Koch et al. (2015a). In particular, heads of hospital are willing to give up parts of their own profits to increase patient benefits, resulting in the negative effects of mergers due to increased market concentration being less severe than in markets with profit maximizing agents only. This finding underlines the importance of considering the healthcare providers' respective degrees of altruism in the hospital market when analyzing the effects of a merger on the quality of care. Our results thus confirm the assumptions about semi-altruistic hospitals made by Brekke et al. (2011) and Brekke et al. (2015) in their theoretical frameworks. For empirical and policy analyses they propose to acknowledge for differences in altruistic behavior. Evidence for for-profit and not-for-profit hospitals for instance indicates that the latter are more altruistic and provide better quality, c.f. Schlesinger et al. (1997), Sloan (2000), and Eggleston et al. (2008).

Furthermore, we find that although quality levels after a merger are higher than predicted, sufficient cost synergies of the merged hospitals yield a significant increase in average quality choices compared to the merger scenario without cost synergies. This is in line with our theoretical predictions and stresses the importance of cost synergies for the overall success of a merger. However, cost synergies are exogenous in our experimental design. Future research should investigate more into individual behavior and endogenous decisions to invest into cost synergies.

Literature

AHA (American Health Association), 2015. Trendwatch Chartbook 2015. [online]. Available: http://www.aha.org/research/reports/tw/chartbook/2015/table2-1.pdf [Accessed: September 1, 2015].

Andreoni, J., Bernheim, D., 2009. Social image and the 50–50 norm: a theoretical and experimental analysis of audience effects. *Econometrica*, 77, 1607–1636.

Antonovics, K., Arcidiacono, P., Walsh, R., 2009. The effects of gender interactions in the lab and in the field. *Review of Economics and Statistics* 91(1), 152–163.

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

Augurzky, B., Krolop, S., Hentschker, C., Pilny, A., Schmidt, C.M., 2013. Krankenhaus Rating Report 2013. medhochzwei Verlag.

Barros, P.P., Olivella, P., 2011. Hospitals: Teaming Up!. In Glied, S. and Smith, P.C. (Eds.) The Oxford Handbook of Health Economics. 432-462. Oxford University Press.

Beitia, A., 2003. Hospital quality choice and market structure in a regulated duopoly. *Journal of Health Economics* 22(6), 1011-1036.

Bénabou, R., Tirole, J., 2006. Incentives and prosocial behavior. *American Economic Review* 96, 1652–1678.

Bornstein, G., Yaniv, I., 1998. Individual and Group Behavior in the Ultimatum Game: Are Groups More 'Rational' Players? *Experimental Economics*, 1(1), 101-108.

Bornstein, G., Kugler, T., Budescu, D. V., Selten, R., 2008. Repeated Price Competition between Individuals and between Teams. *Journal of Economic Behavior & Organization*, *66*(3-4), 808-821.

Brekke, K. R., Nuscheler, R., Rune Straume, O., 2006. Quality and location choices under price regulation. *Journal of Economics & Management Strategy*, 15(1), 207-227.

Brekke, K.R., Siciliani, L., Straume, O.R., 2011. Hospital competition and quality with regulated prices. *Scandinavian Journal of Economics*, 113, 444-469.

Brekke, K. R., Siciliani, L., Straume, O. R., 2015. Hospital mergers with regulated prices. *Working Paper (May 2015)*.

Brosig-Koch, J., Hennig-Schmidt, H., Kairies, N., Wiesen, D., 2015a. The Effects of Introducing Mixed Payment Systems for Physicians–Experimental Evidence. *Health Economics.*

Brosig-Koch, J., Hennig-Schmidt, H., Kairies-Schwarz, N., Wiesen, D., 2015b. Using artefactual field and lab experiments to investigate how fee-for-service and capitation affect medical service provision. *Journal of Economic Behavior & Organization*.

Calem, P. S., Dor, A., Rizzo, J. A., 1999. The welfare effects of mergers in the hospital industry. *Journal of Economics and Business* 51(3), 197-213.

Chalkley, M., Malcomson, J. M., 1998. Contracting for health services when patient demand does not reflect quality. *Journal of Health Economics*, 17(1), 1-19.

Charness, G., Jackson, M. O., 2007. Group Play in Games and the Role of Consent in Network Formation. *Journal of Economic Theory*, 136(1), 417-445.

Charness, G., Sutter, M., 2012. Groups Make Better Self-Interested Decisions. *Journal of Economic Perspectives*, 26(3), 157-176.

Choné, P. and Ma, C.T.A., 2011. Optimal health care contract under physician agency. *Annals of Economics and Statistics/Annales d'Économie et de Statistique*, 229-256.

Cooper, D. J., Kagel, J. H., 2005. Are Two Heads Better than One? Team versus Individual Play in Signaling Games. *American Economic Review*, 95(3), 477-509.

Cutler, D. M., Morton, F. S., 2013. Hospitals, market share, and consolidation. *JAMA* 310(18), 1964-1970.

Dranove, D. and Lindrooth, R., 2003. Hospital consolidation and costs: another look at the evidence. *Journal of Health Economics*, 22(6), 983-997.

Eggleston, K., 2005. Multitasking and mixed systems for provider payment. *Journal of Health Economics*, 24(1), 211-223.

Eggleston, K., Shen, Y.-C., Lau, J., Schmid, C.H., Chan, J., 2008. Hospital Ownership and Quality of Care: What Explains the Different Results?, *Health Economics*, 17, 1345-1362.

Eckel, C. C., Grossman, P. J., 1996. Altruism in anonymous dictator games. *Games and Economic Behavior*, 16(2), 181-191.

Ellis, R. P., McGuire, T. G. 1986. Provider behavior under prospective reimbursement: Cost sharing and supply. *Journal of Health Economics*, 5(2), 129-151.

Fischbacher, U., 2007. z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2), 171-178.

Fonseca, M. A., Normann, H. T., 2008. Mergers, asymmetries and collusion: Experimental evidence. *The Economic Journal* 118(527), 387-400.

Gaynor, M., Town, R.J., 2012. Competition in health care markets. In McGuire, T. G., Pauly, M. V., and Pita Barros, P., editors, Handbook of Health Economics, volume 2, chapter 9. Elsevier North-Holland, Amsterdam and London.

Gillet, J., Schram, A., Sonnemans, J. 2011. Cartel formation and pricing: The effect of managerial decision-making rules. *International Journal of Industrial Organization*, 29(1), 126-133.

Gneezy, U., Niederle, M., Rustichini, A., 2003. Performance in competitive environments: gender differences. *Quarterly Journal of Economics*, 118, 1049–1074.

Gneezy, U., Rustichini, A., 2004. Gender and competition at a young age, *American Economic Review Papers and Proceedings*, 94, 377–381.

Godager, G., Wiesen, D., 2013. Profit or patients' health benefit? Exploring the heterogeneity in physician altruism. *Journal of Health Economics*, 32(6), 1105-1116.

Greiner, B., 2004. An online recruitment system for economic experiments. V. M. Kurt Kremer (ed.), Forschung und Wissenschaftliches Rechnen 2003. GWDG Bericht 63, Gesellschaft für Wissenschaftliche Datenverarbeitung, 79-93.

Harrison, T.D., 2011. Do mergers really reduce costs? Evidence from hospitals. Economic Inquiry, 49(4), 1054-1069.

Hennig-Schmidt, H., Selten, R., Wiesen, D., 2011. How payment systems affect physicians' provision behavior - an experimental investigation. *Journal of Health Economics*, 30(4), 637-646.

Henze, B., Schuett, F., Sluijs, J. P., 2015. Transparency in markets for experience goods: experimental evidence. *Economic Inquiry*, 53(1), 640-659.

Heyes, A., 2005. The economics of vocation or 'why is a badly paid nurse a good nurse'?. *Journal of Health Economics*, 24(3), 561-569.

Ho, V., Hamilton, B. H., 2000. Hospital mergers and acquisitions: does market consolidation harm patients? *Journal of Health Economics*, 19(5), 767-791.

Huck, S., Normann, H.T. and Oechssler, J., 2004. Two are few and four are many: number effects in experimental oligopolies. *Journal of Economic Behavior & Organization*, 53(4), 435-446.

Huck, S., Konrad, K. A., Müller, W., Normann, H.-T., 2007. The merger paradox and why aspiration levels let it fail in the laboratory. *The Economic Journal*, 117(522), 1073-1095.

Jack, W., 2005. Purchasing health care services from providers with unknown altruism. *Journal of Health Economics*, 24(1), 73-93.

Kaarboe, O. and Siciliani, L., 2011. Multi-tasking, quality and pay for performance. *Health Economics*, 20(2), 225-238.

Karlsson, M., 2007. Quality incentives for GPs in a regulated market. *Journal of Health Economics*, 26(4), 699-720.

Kesternich, I., Schumacher, H., Winter, J., 2015. Professional norms and physician behavior: homo oeconomicus or homo hippocraticus? *Journal of Public Economics*, 131, 1-11.

Kocher, M. G., Sutter, M., 2005. The Decision Maker Matters: Individual versus Group Behaviour in Experimental Beauty-Contest Games. *Economic Journal*, 115(500), 200-223.

Kugler, T., Bornstein, G., Kocher, M. G., Sutter, M., 2007. Trust between individuals and groups: Groups are less trusting than individuals but just as trustworthy. *Journal Of Economic Psychology*, *28*(6), 646-657.

Kugler, T., Kausel, E., Kocher M., 2012. Are Groups more Rational than Individuals? A Review of Interactive Decision Making in Groups. *Wiley Interdisciplinary Reviews: Cognitive Science*, 3(4): 471–82.

Luhan, W. J., Kocher, M. G., Sutter, M., 2009. Group Polarization in the Team Dictator Game Reconsidered. *Experimental Economics*, 12(1), 26-41.

Lynk, W. J., 1995. The creation of economic efficiencies in hospital mergers. *Journal of Health Economics*, 14(5), 507-530.

Ma, C. A., Burgess Jr., J. F. 1993. Quality Competition, Welfare and Regulation. *Journal of Economics*, 58(2), 153-173.

Müller, W., Tan, F., 2013. Who Acts More Like a Game Theorist? Group and Individual Play in a Sequential Market Game and the Effect of the Time Horizon. *Games and Economic Behavior*, *82*658-674.

Niederle, M., Vesterlund, L., 2007. Do women shy away from competition? Do men compete too much? *Quarterly Journal of Economics*, 122, 1067–1101.

Nuscheler, R., 2003. Physician reimbursement, time consistency, and the quality of care. *Journal of Institutional and Theoretical Economics (JITE)/Zeitschrift für die gesamte Staatswissenschaft*, 302-322.

Raab, P., Schipper, B. C., 2009. Cournot Competition between Teams: An Experimental Study. *Journal of Economic Behavior & Organization*, *72*(2), 691-702.

Romano, P. S., Balan, D. J., 2011. A retrospective analysis of the clinical quality effects of the acquisition of highland park hospital by evanston northwestern healthcare. *International Journal of the Economics of Business*, 18(1), 45-64.

Schlesinger, M., Dowart, R., Hoover, C., Epstain, S., 1997. Competition, Ownership, and Access to Hospital Services: Evidence from Pschiatric Hospitals. *Medial Care*, 35, 974-992.

Sloan, F. A., 2000. Not-For-Profit Ownership and Hospital Behavior, in A. Cuyler and J. Newhouse (eds.), Handbook of Health Economics, Chapter 21, North-Holland, Amsterdam, 1141-1174

Appendix

A.1 Average market quality weighted by patient shares

Figure A.1 Market qualities weighted with patient shares

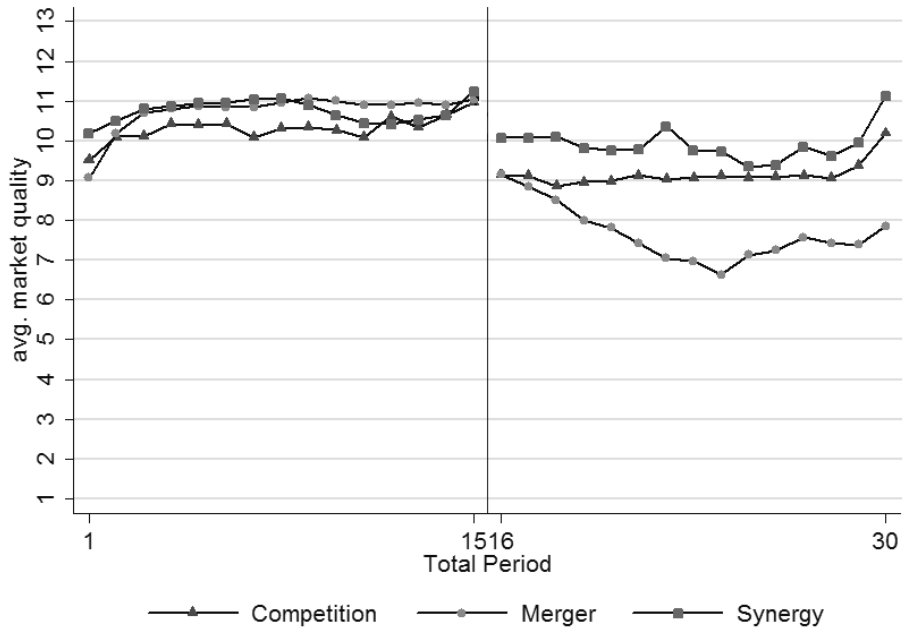


Table A.1 Average market qualities weighted by patient shares

	Part 1		**Part 2**	
	Round 2-15	*Nash*	*Round 16-29*	*Nash*
Competition	10.37 (2.22)	10.00	9.08 (3.18)	10.00
Merger	10.86 (1.37)	10.00	7.65 (3.17)	3.76
Synergy	10.79 (1.95)	10.00	9.83 (2.60)	11.69

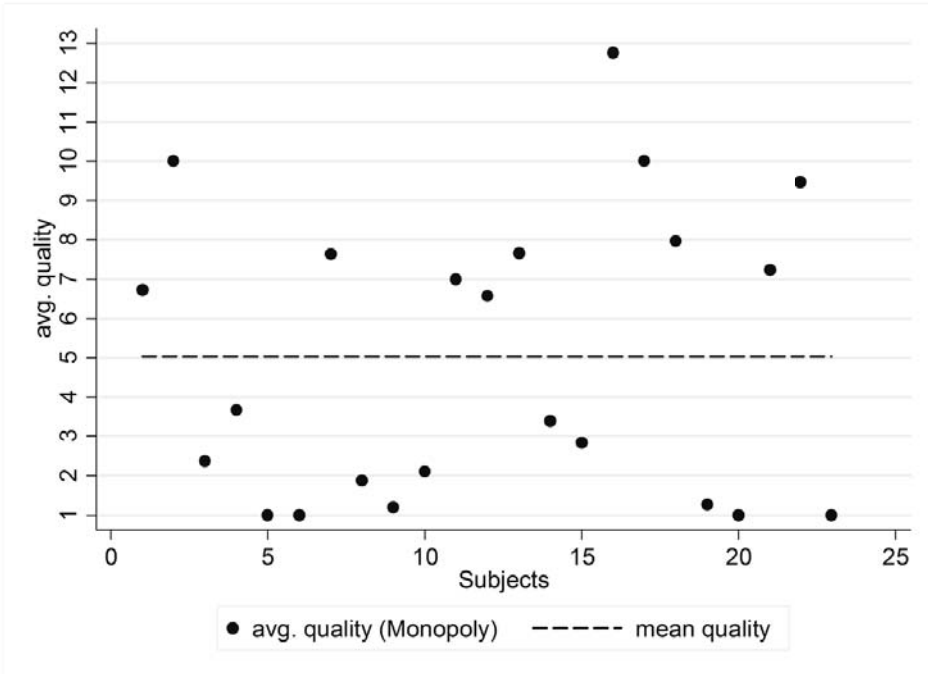
Note: Standard deviation in brackets.

If we consider quality choices weighted by patient shares, the differences in terms of market quality are only nuanced compared to the results in Section 4.1. There is a slight upward bias because higher qualities will results in a higher share of patients. This is also reflected in the

post-merger Nash-equilibrium quality as the outsiders would capture a bigger share by setting a higher quality.

A.2 Average quality levels per hospital in Monopoly

Figure A.2 Average quality levels across part 1 and 2 in *Monopoly*



A.3 Regression results, robustness checks med versus non-med students

To disentangle the effects of gender and studies on decision quality, we run an OLS regression. Exclusively, pre-merger average qualities are used to avoid side-effects on quality choices by mergers or roles in the Post-merger case. Furthermore, since all individual oligopoly treatments are identical in the first part of the experiment, the number of observation is sufficiently high to get plausible results. Gender (1 for women and 0 for men) and studies variables enter the regression as dummies. The studies variables are related to economic students, which are excluded to avoid collinearity. We cluster the standard errors in the regression on market IDs. Women do not provide significantly higher quality than men. Furthermore, the effect of studies is not significant.

Table A.3: OLS regression results

	Coefficient	Std. Err.
Gender	0.395	0.319
Studies		
Medicine	-0.108	0.523
Health care administration	0.083	0.943
Educational science	0.386	0.419
Humanities	0.373	0.409
Natural science	0.295	0.423
Engineering	-0.134	0.486
Other studies	0.297	0.479
Constant	10.082***	0.465
Observations	213	
R^2	0.0237	

Note: standard errors clustered at market IDs (* p<0.1, ** p<0.05, *** p<0.01)

A.4 Profit and patient utility tables pre-merger and post-merger for both roles

Profit table

quality level of the other two hospitals	1|1	2|2	3|3	4|4	5|5	6|6	7|7	8|8	9|9	10|10	11|11	12|12	13|13
own quality level													
1	**14.00** 14.00 14.00	**12.83** 13.89 13.89	**11.67** 13.72 13.72	**10.50** 13.50 13.50	**9.33** 13.22 13.22	**8.17** 12.89 12.89	**7.00** 12.50 12.50	**5.83** 12.06 12.06	**4.67** 11.56 11.56	**3.50** 11.00 11.00	**2.33** 10.39 10.39	**1.17** 9.72 9.72	**0.00** 9.00 9.00
2	**14.44** 13.42 13.42	**13.33** 13.33 13.33	**12.22** 13.19 13.19	**11.11** 13.00 13.00	**10.00** 12.75 12.75	**8.89** 12.44 12.44	**7.78** 12.08 12.08	**6.67** 11.67 11.67	**5.56** 11.19 11.19	**4.44** 10.67 10.67	**3.33** 10.08 10.08	**2.22** 9.44 9.44	**1.11** 8.75 8.75
3	**14.78** 12.83 12.83	**13.72** 12.78 12.78	**12.67** 12.67 12.67	**11.61** 12.50 12.50	**10.56** 12.28 12.28	**9.50** 12.00 12.00	**8.44** 11.67 11.67	**7.39** 11.28 11.28	**6.33** 10.83 10.83	**5.28** 10.33 10.33	**4.22** 9.78 9.78	**3.17** 9.17 9.17	**2.11** 8.50 8.50
4	**15.00** 12.25 12.25	**14.00** 12.22 12.22	**13.00** 12.14 12.14	**12.00** 12.00 12.00	**11.00** 11.81 11.81	**10.00** 11.56 11.56	**9.00** 11.25 11.25	**8.00** 10.89 10.89	**7.00** 10.47 10.47	**6.00** 10.00 10.00	**5.00** 9.47 9.47	**4.00** 8.89 8.89	**3.00** 8.25 8.25
5	**15.11** 11.67 11.67	**14.17** 11.67 11.67	**13.22** 11.61 11.61	**12.28** 11.50 11.50	**11.33** 11.33 11.33	**10.39** 11.11 11.11	**9.44** 10.83 10.83	**8.50** 10.50 10.50	**7.56** 10.11 10.11	**6.61** 9.67 9.67	**5.67** 9.17 9.17	**4.72** 8.61 8.61	**3.78** 8.00 8.00
6	**15.11** 11.08 11.08	**14.22** 11.11 11.11	**13.33** 11.08 11.08	**12.44** 11.00 11.00	**11.56** 10.86 10.86	**10.67** 10.67 10.67	**9.78** 10.42 10.42	**8.89** 10.11 10.11	**8.00** 9.75 9.75	**7.11** 9.33 9.33	**6.22** 8.86 8.86	**5.33** 8.33 8.33	**4.44** 7.75 7.75
7	**15.00** 10.50 10.50	**14.17** 10.56 10.56	**13.33** 10.56 10.56	**12.50** 10.50 10.50	**11.67** 10.39 10.39	**10.83** 10.22 10.22	**10.00** 10.00 10.00	**9.17** 9.72 9.72	**8.33** 9.39 9.39	**7.50** 9.00 9.00	**6.67** 8.56 8.56	**5.83** 8.06 8.06	**5.00** 7.50 7.50
8	**14.78** 9.92 9.92	**14.00** 10.00 10.00	**13.22** 10.03 10.03	**12.44** 10.00 10.00	**11.67** 9.92 9.92	**10.89** 9.78 9.78	**10.11** 9.58 9.58	**9.33** 9.33 9.33	**8.56** 9.03 9.03	**7.78** 8.67 8.67	**7.00** 8.25 8.25	**6.22** 7.78 7.78	**5.44** 7.25 7.25
9	**14.44** 9.33 9.33	**13.72** 9.44 9.44	**13.00** 9.50 9.50	**12.28** 9.50 9.50	**11.56** 9.44 9.44	**10.83** 9.33 9.33	**10.11** 9.17 9.17	**9.39** 8.94 8.94	**8.67** 8.67 8.67	**7.94** 8.33 8.33	**7.22** 7.94 7.94	**6.50** 7.50 7.50	**5.78** 7.00 7.00
10	**14.00** 8.75 8.75	**13.33** 8.89 8.89	**12.67** 8.97 8.97	**12.00** 9.00 9.00	**11.33** 8.97 8.97	**10.67** 8.89 8.89	**10.00** 8.75 8.75	**9.33** 8.56 8.56	**8.67** 8.31 8.31	**8.00** 8.00 8.00	**7.33** 7.64 7.64	**6.67** 7.22 7.22	**6.00** 6.75 6.75
11	**13.44** 8.17 8.17	**12.83** 8.33 8.33	**12.22** 8.44 8.44	**11.61** 8.50 8.50	**11.00** 8.50 8.50	**10.39** 8.44 8.44	**9.78** 8.33 8.33	**9.17** 8.17 8.17	**8.56** 7.94 7.94	**7.94** 7.67 7.67	**7.33** 7.33 7.33	**6.72** 6.94 6.94	**6.11** 6.50 6.50
12	**12.78** 7.58 7.58	**12.22** 7.78 7.78	**11.67** 7.92 7.92	**11.11** 8.00 8.00	**10.56** 8.03 8.03	**10.00** 8.00 8.00	**9.44** 7.92 7.92	**8.89** 7.78 7.78	**8.33** 7.58 7.58	**7.78** 7.33 7.33	**7.22** 7.03 7.03	**6.67** 6.67 6.67	**6.11** 6.25 6.25
13	**12.00** 7.00 7.00	**11.50** 7.22 7.22	**11.00** 7.39 7.39	**10.50** 7.50 7.50	**10.00** 7.56 7.56	**9.50** 7.56 7.56	**9.00** 7.50 7.50	**8.50** 7.39 7.39	**8.00** 7.22 7.22	**7.50** 7.00 7.00	**7.00** 6.72 6.72	**6.50** 6.39 6.39	**6.00** 6.00 6.00

Patient utlity table

quality level of the other two hospitals	1|1	2|2	3|3	4|4	5|5	6|6	7|7	8|8	9|9	10|10	11|11	12|12	13|13
own quality level													
1	**1.00** 1.00 1.00	**0.99** 1.34 1.34	**0.97** 1.71 1.71	**0.94** 2.09 2.09	**0.89** 2.50 2.50	**0.83** 2.93 2.93	**0.75** 3.38 3.38	**0.66** 3.84 3.84	**0.56** 4.33 4.33	**0.44** 4.84 4.84	**0.31** 5.38 5.38	**0.16** 5.93 5.93	**0.00** 6.50 6.50
2	**1.35** 1.00 1.00	**1.33** 1.33 1.33	**1.30** 1.69 1.69	**1.25** 2.07 2.07	**1.19** 2.47 2.47	**1.11** 2.89 2.89	**1.02** 3.33 3.33	**0.92** 3.79 3.79	**0.80** 4.27 4.27	**0.67** 4.78 4.78	**0.52** 5.30 5.30	**0.36** 5.85 5.85	**0.19** 6.41 6.41
3	**1.75** 0.99 0.99	**1.72** 1.32 1.32	**1.67** 1.67 1.67	**1.60** 2.04 2.04	**1.53** 2.43 2.43	**1.44** 2.84 2.84	**1.33** 3.28 3.28	**1.22** 3.73 3.73	**1.08** 4.21 4.21	**0.94** 4.70 4.70	**0.78** 5.22 5.22	**0.60** 5.76 5.76	**0.42** 6.32 6.32
4	**2.19** 0.97 0.97	**2.14** 1.29 1.29	**2.08** 1.64 1.64	**2.00** 2.00 2.00	**1.91** 2.39 2.39	**1.81** 2.79 2.79	**1.69** 3.22 3.22	**1.56** 3.67 3.67	**1.41** 4.14 4.14	**1.25** 4.63 4.63	**1.08** 5.14 5.14	**0.89** 5.67 5.67	**0.69** 6.22 6.22
5	**2.67** 0.94 0.94	**2.60** 1.26 1.26	**2.53** 1.60 1.60	**2.44** 1.95 1.95	**2.33** 2.33 2.33	**2.22** 2.73 2.73	**2.08** 3.15 3.15	**1.94** 3.59 3.59	**1.78** 4.06 4.06	**1.60** 4.54 4.54	**1.42** 5.04 5.04	**1.22** 5.57 5.57	**1.00** 6.11 6.11
6	**3.19** 0.91 0.91	**3.11** 1.22 1.22	**3.02** 1.55 1.55	**2.92** 1.90 1.90	**2.80** 2.27 2.27	**2.67** 2.67 2.67	**2.52** 3.08 3.08	**2.36** 3.51 3.51	**2.19** 3.97 3.97	**2.00** 4.44 4.44	**1.80** 4.94 4.94	**1.58** 5.46 5.46	**1.35** 6.00 6.00
7	**3.75** 0.88 0.88	**3.66** 1.18 1.18	**3.56** 1.50 1.50	**3.44** 1.84 1.84	**3.31** 2.21 2.21	**3.16** 2.59 2.59	**3.00** 3.00 3.00	**2.83** 3.43 3.43	**2.64** 3.88 3.88	**2.44** 4.34 4.34	**2.22** 4.83 4.83	**1.99** 5.34 5.34	**1.75** 5.88 5.88
8	**4.35** 0.83 0.83	**4.25** 1.13 1.13	**4.13** 1.44 1.44	**4.00** 1.78 1.78	**3.85** 2.14 2.14	**3.69** 2.51 2.51	**3.52** 2.91 2.91	**3.33** 3.33 3.33	**3.13** 3.77 3.77	**2.92** 4.24 4.24	**2.69** 4.72 4.72	**2.44** 5.22 5.22	**2.19** 5.75 5.75
9	**5.00** 0.78 0.78	**4.88** 1.07 1.07	**4.75** 1.38 1.38	**4.60** 1.70 1.70	**4.44** 2.06 2.06	**4.27** 2.43 2.43	**4.08** 2.82 2.82	**3.88** 3.23 3.23	**3.67** 3.67 3.67	**3.44** 4.12 4.12	**3.19** 4.60 4.60	**2.94** 5.09 5.09	**2.67** 5.61 5.61
10	**5.69** 0.72 0.72	**5.56** 1.00 1.00	**5.41** 1.30 1.30	**5.25** 1.63 1.63	**5.08** 1.97 1.97	**4.89** 2.33 2.33	**4.69** 2.72 2.72	**4.47** 3.13 3.13	**4.24** 3.55 3.55	**4.00** 4.00 4.00	**3.74** 4.47 4.47	**3.47** 4.96 4.96	**3.19** 5.47 5.47
11	**6.42** 0.65 0.65	**6.27** 0.93 0.93	**6.11** 1.22 1.22	**5.94** 1.54 1.54	**5.75** 1.88 1.88	**5.55** 2.23 2.23	**5.33** 2.61 2.61	**5.10** 3.01 3.01	**4.86** 3.43 3.43	**4.60** 3.87 3.87	**4.33** 4.33 4.33	**4.05** 4.82 4.82	**3.75** 5.32 5.32
12	**7.19** 0.58 0.58	**7.03** 0.85 0.85	**6.85** 1.14 1.14	**6.67** 1.44 1.44	**6.47** 1.77 1.77	**6.25** 2.13 2.13	**6.02** 2.50 2.50	**5.78** 2.89 2.89	**5.52** 3.30 3.30	**5.25** 3.74 3.74	**4.97** 4.19 4.19	**4.67** 4.67 4.67	**4.35** 5.16 5.16
13	**8.00** 0.50 0.50	**7.83** 0.76 0.76	**7.64** 1.04 1.04	**7.44** 1.34 1.34	**7.22** 1.67 1.67	**6.99** 2.01 2.01	**6.75** 2.38 2.38	**6.49** 2.76 2.76	**6.22** 3.17 3.17	**5.94** 3.59 3.59	**5.64** 4.04 4.04	**5.33** 4.51 4.51	**5.00** 5.00 5.00

Profit table for merged hospitals

quality level of standalone hospital	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**28.00**	**26.83**	**25.67**	**24.50**	**23.33**	**22.17**	**21.00**	**19.83**	**18.67**	**17.50**	**16.33**	**15.17**	**14.00**
	14.00	14.44	14.78	15.00	15.11	15.11	15.00	14.78	14.44	14.00	13.44	12.78	12.00
2	**27.78**	**26.67**	**25.56**	**24.44**	**23.33**	**22.22**	**21.11**	**20.00**	**18.89**	**17.78**	**16.67**	**15.56**	**14.44**
	12.83	13.33	13.72	14.00	14.17	14.22	14.17	14.00	13.72	13.33	12.83	12.22	11.50
3	**27.44**	**26.39**	**25.33**	**24.28**	**23.22**	**22.17**	**21.11**	**20.06**	**19.00**	**17.94**	**16.89**	**15.83**	**14.78**
	11.67	12.22	12.67	13.00	13.22	13.33	13.33	13.22	13.00	12.67	12.22	11.67	11.00
4	**27.00**	**26.00**	**25.00**	**24.00**	**23.00**	**22.00**	**21.00**	**20.00**	**19.00**	**18.00**	**17.00**	**16.00**	**15.00**
	10.50	11.11	11.61	12.00	12.28	12.44	12.50	12.44	12.28	12.00	11.61	11.11	10.50
5	**26.44**	**25.50**	**24.56**	**23.61**	**22.67**	**21.72**	**20.78**	**19.83**	**18.89**	**17.94**	**17.00**	**16.06**	**15.11**
	9.33	10.00	10.56	11.00	11.33	11.56	11.67	11.67	11.56	11.33	11.00	10.56	10.00
6	**25.78**	**24.89**	**24.00**	**23.11**	**22.22**	**21.33**	**20.44**	**19.56**	**18.67**	**17.78**	**16.89**	**16.00**	**15.11**
	8.17	8.89	9.50	10.00	10.39	10.67	10.83	10.89	10.83	10.67	10.39	10.00	9.50
7	**25.00**	**24.17**	**23.33**	**22.50**	**21.67**	**20.83**	**20.00**	**19.17**	**18.33**	**17.50**	**16.67**	**15.83**	**15.00**
	7.00	7.78	8.44	9.00	9.44	9.78	10.00	10.11	10.11	10.00	9.78	9.44	9.00
8	**24.11**	**23.33**	**22.56**	**21.78**	**21.00**	**20.22**	**19.44**	**18.67**	**17.89**	**17.11**	**16.33**	**15.56**	**14.78**
	5.83	6.67	7.39	8.00	8.50	8.89	9.17	9.33	9.39	9.33	9.17	8.89	8.50
9	**23.11**	**22.39**	**21.67**	**20.94**	**20.22**	**19.50**	**18.78**	**18.06**	**17.33**	**16.61**	**15.89**	**15.17**	**14.44**
	4.67	5.56	6.33	7.00	7.56	8.00	8.33	8.56	8.67	8.67	8.56	8.33	8.00
10	**22.00**	**21.33**	**20.67**	**20.00**	**19.33**	**18.67**	**18.00**	**17.33**	**16.67**	**16.00**	**15.33**	**14.67**	**14.00**
	3.50	4.44	5.28	6.00	6.61	7.11	7.50	7.78	7.94	8.00	7.94	7.78	7.50
11	**20.78**	**20.17**	**19.56**	**18.94**	**18.33**	**17.72**	**17.11**	**16.50**	**15.89**	**15.28**	**14.67**	**14.06**	**13.44**
	2.33	3.33	4.22	5.00	5.67	6.22	6.67	7.00	7.22	7.33	7.33	7.22	7.00
12	**19.44**	**18.89**	**18.33**	**17.78**	**17.22**	**16.67**	**16.11**	**15.56**	**15.00**	**14.44**	**13.89**	**13.33**	**12.78**
	1.17	2.22	3.17	4.00	4.72	5.33	5.83	6.22	6.50	6.67	6.72	6.67	6.50
13	**18.00**	**17.50**	**17.00**	**16.50**	**16.00**	**15.50**	**15.00**	**14.50**	**14.00**	**13.50**	**13.00**	**12.50**	**12.00**
	0.00	1.11	2.11	3.00	3.78	4.44	5.00	5.44	5.78	6.00	6.11	6.11	6.00

Patient utility table merged hospitals

quality level of standalone hospital	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**2.00**	**1.99**	**1.97**	**1.94**	**1.89**	**1.83**	**1.75**	**1.66**	**1.56**	**1.44**	**1.31**	**1.16**	**1.00**
	1.00	1.35	1.75	2.19	2.67	3.19	3.75	4.35	5.00	5.69	6.42	7.19	8.00
2	**2.69**	**2.67**	**2.63**	**2.58**	**2.52**	**2.44**	**2.35**	**2.25**	**2.13**	**2.00**	**1.85**	**1.69**	**1.52**
	0.99	1.33	1.72	2.14	2.60	3.11	3.66	4.25	4.88	5.56	6.27	7.03	7.83
3	**3.42**	**3.38**	**3.33**	**3.27**	**3.19**	**3.10**	**3.00**	**2.88**	**2.75**	**2.60**	**2.44**	**2.27**	**2.08**
	0.97	1.30	1.67	2.08	2.53	3.02	3.56	4.13	4.75	5.41	6.11	6.85	7.64
4	**4.19**	**4.14**	**4.08**	**4.00**	**3.91**	**3.81**	**3.69**	**3.56**	**3.41**	**3.25**	**3.08**	**2.89**	**2.69**
	0.94	1.25	1.60	2.00	2.44	2.92	3.44	4.00	4.60	5.25	5.94	6.67	7.44
5	**5.00**	**4.94**	**4.86**	**4.77**	**4.67**	**4.55**	**4.42**	**4.27**	**4.11**	**3.94**	**3.75**	**3.55**	**3.33**
	0.89	1.19	1.53	1.91	2.33	2.80	3.31	3.85	4.44	5.08	5.75	6.47	7.22
6	**5.85**	**5.78**	**5.69**	**5.58**	**5.47**	**5.33**	**5.19**	**5.03**	**4.85**	**4.67**	**4.47**	**4.25**	**4.02**
	0.83	1.11	1.44	1.81	2.22	2.67	3.16	3.69	4.27	4.89	5.55	6.25	6.99
7	**6.75**	**6.66**	**6.56**	**6.44**	**6.31**	**6.16**	**6.00**	**5.83**	**5.64**	**5.44**	**5.22**	**4.99**	**4.75**
	0.75	1.02	1.33	1.69	2.08	2.52	3.00	3.52	4.08	4.69	5.33	6.02	6.75
8	**7.69**	**7.58**	**7.47**	**7.33**	**7.19**	**7.03**	**6.85**	**6.67**	**6.47**	**6.25**	**6.02**	**5.78**	**5.52**
	0.66	0.92	1.22	1.56	1.94	2.36	2.83	3.33	3.88	4.47	5.10	5.78	6.49
9	**8.67**	**8.55**	**8.42**	**8.27**	**8.11**	**7.94**	**7.75**	**7.55**	**7.33**	**7.10**	**6.86**	**6.60**	**6.33**
	0.56	0.80	1.08	1.41	1.78	2.19	2.64	3.13	3.67	4.24	4.86	5.52	6.22
10	**9.69**	**9.56**	**9.41**	**9.25**	**9.08**	**8.89**	**8.69**	**8.47**	**8.24**	**8.00**	**7.74**	**7.47**	**7.19**
	0.44	0.67	0.94	1.25	1.60	2.00	2.44	2.92	3.44	4.00	4.60	5.25	5.94
11	**10.75**	**10.60**	**10.44**	**10.27**	**10.08**	**9.88**	**9.67**	**9.44**	**9.19**	**8.94**	**8.67**	**8.38**	**8.08**
	0.31	0.52	0.78	1.08	1.42	1.80	2.22	2.69	3.19	3.74	4.33	4.97	5.64
12	**11.85**	**11.69**	**11.52**	**11.33**	**11.13**	**10.92**	**10.69**	**10.44**	**10.19**	**9.92**	**9.63**	**9.33**	**9.02**
	0.16	0.36	0.60	0.89	1.22	1.58	1.99	2.44	2.94	3.47	4.05	4.67	5.33
13	**13.00**	**12.83**	**12.64**	**12.44**	**12.22**	**11.99**	**11.75**	**11.49**	**11.22**	**10.94**	**10.64**	**10.33**	**10.00**
	0.00	0.19	0.42	0.69	1.00	1.35	1.75	2.19	2.67	3.19	3.75	4.35	5.00

Profit table for standalone hospital

quality level of merged hospitals	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**14.00**	**12.83**	**11.67**	**10.50**	**9.33**	**8.17**	**7.00**	**5.83**	**4.67**	**3.50**	**2.33**	**1.17**	**0.00**
	28.00	27.78	27.44	27.00	26.44	25.78	25.00	24.11	23.11	22.00	20.78	19.44	18.00
2	**14.44**	**13.33**	**12.22**	**11.11**	**10.00**	**8.89**	**7.78**	**6.67**	**5.56**	**4.44**	**3.33**	**2.22**	**1.11**
	26.83	26.67	26.39	26.00	25.50	24.89	24.17	23.33	22.39	21.33	20.17	18.89	17.50
3	**14.78**	**13.72**	**12.67**	**11.61**	**10.56**	**9.50**	**8.44**	**7.39**	**6.33**	**5.28**	**4.22**	**3.17**	**2.11**
	25.67	25.56	25.33	25.00	24.56	24.00	23.33	22.56	21.67	20.67	19.56	18.33	17.00
4	**15.00**	**14.00**	**13.00**	**12.00**	**11.00**	**10.00**	**9.00**	**8.00**	**7.00**	**6.00**	**5.00**	**4.00**	**3.00**
	24.50	24.44	24.28	24.00	23.61	23.11	22.50	21.78	20.94	20.00	18.94	17.78	16.50
5	**15.11**	**14.17**	**13.22**	**12.28**	**11.33**	**10.39**	**9.44**	**8.50**	**7.56**	**6.61**	**5.67**	**4.72**	**3.78**
	23.33	23.33	23.22	23.00	22.67	22.22	21.67	21.00	20.22	19.33	18.33	17.22	16.00
6	**15.11**	**14.22**	**13.33**	**12.44**	**11.56**	**10.67**	**9.78**	**8.89**	**8.00**	**7.11**	**6.22**	**5.33**	**4.44**
	22.17	22.22	22.17	22.00	21.72	21.33	20.83	20.22	19.50	18.67	17.72	16.67	15.50
7	**15.00**	**14.17**	**13.33**	**12.50**	**11.67**	**10.83**	**10.00**	**9.17**	**8.33**	**7.50**	**6.67**	**5.83**	**5.00**
	21.00	21.11	21.11	21.00	20.78	20.44	20.00	19.44	18.78	18.00	17.11	16.11	15.00
8	**14.78**	**14.00**	**13.22**	**12.44**	**11.67**	**10.89**	**10.11**	**9.33**	**8.56**	**7.78**	**7.00**	**6.22**	**5.44**
	19.83	20.00	20.06	20.00	19.83	19.56	19.17	18.67	18.06	17.33	16.50	15.56	14.50
9	**14.44**	**13.72**	**13.00**	**12.28**	**11.56**	**10.83**	**10.11**	**9.39**	**8.67**	**7.94**	**7.22**	**6.50**	**5.78**
	18.67	18.89	19.00	19.00	18.89	18.67	18.33	17.89	17.33	16.67	15.89	15.00	14.00
10	**14.00**	**13.33**	**12.67**	**12.00**	**11.33**	**10.67**	**10.00**	**9.33**	**8.67**	**8.00**	**7.33**	**6.67**	**6.00**
	17.50	17.78	17.94	18.00	17.94	17.78	17.50	17.11	16.61	16.00	15.28	14.44	13.50
11	**13.44**	**12.83**	**12.22**	**11.61**	**11.00**	**10.39**	**9.78**	**9.17**	**8.56**	**7.94**	**7.33**	**6.72**	**6.11**
	16.33	16.67	16.89	17.00	17.00	16.89	16.67	16.33	15.89	15.33	14.67	13.89	13.00
12	**12.78**	**12.22**	**11.67**	**11.11**	**10.56**	**10.00**	**9.44**	**8.89**	**8.33**	**7.78**	**7.22**	**6.67**	**6.11**
	15.17	15.56	15.83	16.00	16.06	16.00	15.83	15.56	15.17	14.67	14.06	13.33	12.50
13	**12.00**	**11.50**	**11.00**	**10.50**	**10.00**	**9.50**	**9.00**	**8.50**	**8.00**	**7.50**	**7.00**	**6.50**	**6.00**
	14.00	14.44	14.78	15.00	15.11	15.11	15.00	14.78	14.44	14.00	13.44	12.78	12.00

Patient utility for standalone hospital

quality level of merged hospitals	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**1.00**	**0.99**	**0.97**	**0.94**	**0.89**	**0.83**	**0.75**	**0.66**	**0.56**	**0.44**	**0.31**	**0.16**	**0.00**
	2.00	2.69	3.42	4.19	5.00	5.85	6.75	7.69	8.67	9.69	10.75	11.85	13.00
2	**1.35**	**1.33**	**1.30**	**1.25**	**1.19**	**1.11**	**1.02**	**0.92**	**0.80**	**0.67**	**0.52**	**0.36**	**0.19**
	1.99	2.67	3.38	4.14	4.94	5.78	6.66	7.58	8.55	9.56	10.60	11.69	12.83
3	**1.75**	**1.72**	**1.67**	**1.60**	**1.53**	**1.44**	**1.33**	**1.22**	**1.08**	**0.94**	**0.78**	**0.60**	**0.42**
	1.97	2.63	3.33	4.08	4.86	5.69	6.56	7.47	8.42	9.41	10.44	11.52	12.64
4	**2.19**	**2.14**	**2.08**	**2.00**	**1.91**	**1.81**	**1.69**	**1.56**	**1.41**	**1.25**	**1.08**	**0.89**	**0.69**
	1.94	2.58	3.27	4.00	4.77	5.58	6.44	7.33	8.27	9.25	10.27	11.33	12.44
5	**2.67**	**2.60**	**2.53**	**2.44**	**2.33**	**2.22**	**2.08**	**1.94**	**1.78**	**1.60**	**1.42**	**1.22**	**1.00**
	1.89	2.52	3.19	3.91	4.67	5.47	6.31	7.19	8.11	9.08	10.08	11.13	12.22
6	**3.19**	**3.11**	**3.02**	**2.92**	**2.80**	**2.67**	**2.52**	**2.36**	**2.19**	**2.00**	**1.80**	**1.58**	**1.35**
	1.83	2.44	3.10	3.81	4.55	5.33	6.16	7.03	7.94	8.89	9.88	10.92	11.99
7	**3.75**	**3.66**	**3.56**	**3.44**	**3.31**	**3.16**	**3.00**	**2.83**	**2.64**	**2.44**	**2.22**	**1.99**	**1.75**
	1.75	2.35	3.00	3.69	4.42	5.19	6.00	6.85	7.75	8.69	9.67	10.69	11.75
8	**4.35**	**4.25**	**4.13**	**4.00**	**3.85**	**3.69**	**3.52**	**3.33**	**3.13**	**2.92**	**2.69**	**2.44**	**2.19**
	1.66	2.25	2.88	3.56	4.27	5.03	5.83	6.67	7.55	8.47	9.44	10.44	11.49
9	**5.00**	**4.88**	**4.75**	**4.60**	**4.44**	**4.27**	**4.08**	**3.88**	**3.67**	**3.44**	**3.19**	**2.94**	**2.67**
	1.56	2.13	2.75	3.41	4.11	4.85	5.64	6.47	7.33	8.24	9.19	10.19	11.22
10	**5.69**	**5.56**	**5.41**	**5.25**	**5.08**	**4.89**	**4.69**	**4.47**	**4.24**	**4.00**	**3.74**	**3.47**	**3.19**
	1.44	2.00	2.60	3.25	3.94	4.67	5.44	6.25	7.10	8.00	8.94	9.92	10.94
11	**6.42**	**6.27**	**6.11**	**5.94**	**5.75**	**5.55**	**5.33**	**5.10**	**4.86**	**4.60**	**4.33**	**4.05**	**3.75**
	1.31	1.85	2.44	3.08	3.75	4.47	5.22	6.02	6.86	7.74	8.67	9.63	10.64
12	**7.19**	**7.03**	**6.85**	**6.67**	**6.47**	**6.25**	**6.02**	**5.78**	**5.52**	**5.25**	**4.97**	**4.67**	**4.35**
	1.16	1.69	2.27	2.89	3.55	4.25	4.99	5.78	6.60	7.47	8.38	9.33	10.33
13	**8.00**	**7.83**	**7.64**	**7.44**	**7.22**	**6.99**	**6.75**	**6.49**	**6.22**	**5.94**	**5.64**	**5.33**	**5.00**
	1.00	1.52	2.08	2.69	3.33	4.02	4.75	5.52	6.33	7.19	8.08	9.02	10.00

Profit table for merged hospitals [Synergy Treatment]

quality level of standalone hospital	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**28.54**	**27.35**	**26.16**	**24.97**	**23.78**	**22.59**	**21.41**	**20.22**	**19.03**	**17.84**	**16.65**	**15.46**	**14.27**
	14.00	14.44	14.78	15.00	15.11	15.11	15.00	14.78	14.44	14.00	13.44	12.78	12.00
2	**28.90**	**27.75**	**26.59**	**25.44**	**24.28**	**23.12**	**21.97**	**20.81**	**19.65**	**18.50**	**17.34**	**16.19**	**15.03**
	12.83	13.33	13.72	14.00	14.17	14.22	14.17	14.00	13.72	13.33	12.83	12.22	11.50
3	**29.20**	**28.08**	**26.95**	**25.83**	**24.71**	**23.59**	**22.46**	**21.34**	**20.22**	**19.09**	**17.97**	**16.85**	**15.72**
	11.67	12.22	12.67	13.00	13.22	13.33	13.33	13.22	13.00	12.67	12.22	11.67	11.00
4	**29.43**	**28.34**	**27.25**	**26.16**	**25.07**	**23.98**	**22.89**	**21.80**	**20.71**	**19.62**	**18.53**	**17.44**	**16.35**
	10.50	11.11	11.61	12.00	12.28	12.44	12.50	12.44	12.28	12.00	11.61	11.11	10.50
5	**29.60**	**28.54**	**27.48**	**26.43**	**25.37**	**24.31**	**23.26**	**22.20**	**21.14**	**20.08**	**19.03**	**17.97**	**16.91**
	9.33	10.00	10.56	11.00	11.33	11.56	11.67	11.67	11.56	11.33	11.00	10.56	10.00
6	**29.70**	**28.67**	**27.65**	**26.62**	**25.60**	**24.58**	**23.55**	**22.53**	**21.50**	**20.48**	**19.46**	**18.43**	**17.41**
	8.17	8.89	9.50	10.00	10.39	10.67	10.83	10.89	10.83	10.67	10.39	10.00	9.50
7	**29.73**	**28.74**	**27.75**	**26.76**	**25.77**	**24.77**	**23.78**	**22.79**	**21.80**	**20.81**	**19.82**	**18.83**	**17.84**
	7.00	7.78	8.44	9.00	9.44	9.78	10.00	10.11	10.11	10.00	9.78	9.44	9.00
8	**29.70**	**28.74**	**27.78**	**26.82**	**25.86**	**24.91**	**23.95**	**22.99**	**22.03**	**21.08**	**20.12**	**19.16**	**18.20**
	5.83	6.67	7.39	8.00	8.50	8.89	9.17	9.33	9.39	9.33	9.17	8.89	8.50
9	**29.60**	**28.67**	**27.75**	**26.82**	**25.90**	**24.97**	**24.05**	**23.12**	**22.20**	**21.27**	**20.35**	**19.42**	**18.50**
	4.67	5.56	6.33	7.00	7.56	8.00	8.33	8.56	8.67	8.67	8.56	8.33	8.00
10	**29.43**	**28.54**	**27.65**	**26.76**	**25.86**	**24.97**	**24.08**	**23.19**	**22.30**	**21.41**	**20.51**	**19.62**	**18.73**
	3.50	4.44	5.28	6.00	6.61	7.11	7.50	7.78	7.94	8.00	7.94	7.78	7.50
11	**29.20**	**28.34**	**27.48**	**26.62**	**25.77**	**24.91**	**24.05**	**23.19**	**22.33**	**21.47**	**20.61**	**19.75**	**18.89**
	2.33	3.33	4.22	5.00	5.67	6.22	6.67	7.00	7.22	7.33	7.33	7.22	7.00
12	**28.90**	**28.08**	**27.25**	**26.43**	**25.60**	**24.77**	**23.95**	**23.12**	**22.30**	**21.47**	**20.65**	**19.82**	**18.99**
	1.17	2.22	3.17	4.00	4.72	5.33	5.83	6.22	6.50	6.67	6.72	6.67	6.50
13	**28.54**	**27.75**	**26.95**	**26.16**	**25.37**	**24.58**	**23.78**	**22.99**	**22.20**	**21.41**	**20.61**	**19.82**	**19.03**
	0.00	1.11	2.11	3.00	3.78	4.44	5.00	5.44	5.78	6.00	6.11	6.11	6.00

Patient utility table merged hospitals

quality level of standalone hospital	1	2	3	4	5	6	7	8	9	10	11	12	13
Own quality level													
1	**2.00**	**1.99**	**1.97**	**1.94**	**1.89**	**1.83**	**1.75**	**1.66**	**1.56**	**1.44**	**1.31**	**1.16**	**1.00**
	1.00	1.35	1.75	2.19	2.67	3.19	3.75	4.35	5.00	5.69	6.42	7.19	8.00
2	**2.69**	**2.67**	**2.63**	**2.58**	**2.52**	**2.44**	**2.35**	**2.25**	**2.13**	**2.00**	**1.85**	**1.69**	**1.52**
	0.99	1.33	1.72	2.14	2.60	3.11	3.66	4.25	4.88	5.56	6.27	7.03	7.83
3	**3.42**	**3.38**	**3.33**	**3.27**	**3.19**	**3.10**	**3.00**	**2.88**	**2.75**	**2.60**	**2.44**	**2.27**	**2.08**
	0.97	1.30	1.67	2.08	2.53	3.02	3.56	4.13	4.75	5.41	6.11	6.85	7.64
4	**4.19**	**4.14**	**4.08**	**4.00**	**3.91**	**3.81**	**3.69**	**3.56**	**3.41**	**3.25**	**3.08**	**2.89**	**2.69**
	0.94	1.25	1.60	2.00	2.44	2.92	3.44	4.00	4.60	5.25	5.94	6.67	7.44
5	**5.00**	**4.94**	**4.86**	**4.77**	**4.67**	**4.55**	**4.42**	**4.27**	**4.11**	**3.94**	**3.75**	**3.55**	**3.33**
	0.89	1.19	1.53	1.91	2.33	2.80	3.31	3.85	4.44	5.08	5.75	6.47	7.22
6	**5.85**	**5.78**	**5.69**	**5.58**	**5.47**	**5.33**	**5.19**	**5.03**	**4.85**	**4.67**	**4.47**	**4.25**	**4.02**
	0.83	1.11	1.44	1.81	2.22	2.67	3.16	3.69	4.27	4.89	5.55	6.25	6.99
7	**6.75**	**6.66**	**6.56**	**6.44**	**6.31**	**6.16**	**6.00**	**5.83**	**5.64**	**5.44**	**5.22**	**4.99**	**4.75**
	0.75	1.02	1.33	1.69	2.08	2.52	3.00	3.52	4.08	4.69	5.33	6.02	6.75
8	**7.69**	**7.58**	**7.47**	**7.33**	**7.19**	**7.03**	**6.85**	**6.67**	**6.47**	**6.25**	**6.02**	**5.78**	**5.52**
	0.66	0.92	1.22	1.56	1.94	2.36	2.83	3.33	3.88	4.47	5.10	5.78	6.49
9	**8.67**	**8.55**	**8.42**	**8.27**	**8.11**	**7.94**	**7.75**	**7.55**	**7.33**	**7.10**	**6.86**	**6.60**	**6.33**
	0.56	0.80	1.08	1.41	1.78	2.19	2.64	3.13	3.67	4.24	4.86	5.52	6.22
10	**9.69**	**9.56**	**9.41**	**9.25**	**9.08**	**8.89**	**8.69**	**8.47**	**8.24**	**8.00**	**7.74**	**7.47**	**7.19**
	0.44	0.67	0.94	1.25	1.60	2.00	2.44	2.92	3.44	4.00	4.60	5.25	5.94
11	**10.75**	**10.60**	**10.44**	**10.27**	**10.08**	**9.88**	**9.67**	**9.44**	**9.19**	**8.94**	**8.67**	**8.38**	**8.08**
	0.31	0.52	0.78	1.08	1.42	1.80	2.22	2.69	3.19	3.74	4.33	4.97	5.64
12	**11.85**	**11.69**	**11.52**	**11.33**	**11.13**	**10.92**	**10.69**	**10.44**	**10.19**	**9.92**	**9.63**	**9.33**	**9.02**
	0.16	0.36	0.60	0.89	1.22	1.58	1.99	2.44	2.94	3.47	4.05	4.67	5.33
13	**13.00**	**12.83**	**12.64**	**12.44**	**12.22**	**11.99**	**11.75**	**11.49**	**11.22**	**10.94**	**10.64**	**10.33**	**10.00**
	0.00	0.19	0.42	0.69	1.00	1.35	1.75	2.19	2.67	3.19	3.75	4.35	5.00

Profit table for standalone hospital [Synergy Treatment]

quality level of merged hospitals	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**14.00**	**12.83**	**11.67**	**10.50**	**9.33**	**8.17**	**7.00**	**5.83**	**4.67**	**3.50**	**2.33**	**1.17**	**0.00**
	28.54	28.90	29.20	29.43	29.60	29.70	29.73	29.70	29.60	29.43	29.20	28.90	28.54
2	**14.44**	**13.33**	**12.22**	**11.11**	**10.00**	**8.89**	**7.78**	**6.67**	**5.56**	**4.44**	**3.33**	**2.22**	**1.11**
	27.35	27.75	28.08	28.34	28.54	28.67	28.74	28.74	28.67	28.54	28.34	28.08	27.75
3	**14.78**	**13.72**	**12.67**	**11.61**	**10.56**	**9.50**	**8.44**	**7.39**	**6.33**	**5.28**	**4.22**	**3.17**	**2.11**
	26.16	26.59	26.95	27.25	27.48	27.65	27.75	27.78	27.75	27.65	27.48	27.25	26.95
4	**15.00**	**14.00**	**13.00**	**12.00**	**11.00**	**10.00**	**9.00**	**8.00**	**7.00**	**6.00**	**5.00**	**4.00**	**3.00**
	24.97	25.44	25.83	26.16	26.43	26.62	26.76	26.82	26.82	26.76	26.62	26.43	26.16
5	**15.11**	**14.17**	**13.22**	**12.28**	**11.33**	**10.39**	**9.44**	**8.50**	**7.56**	**6.61**	**5.67**	**4.72**	**3.78**
	23.78	24.28	24.71	25.07	25.37	25.60	25.77	25.86	25.90	25.86	25.77	25.60	25.37
6	**15.11**	**14.22**	**13.33**	**12.44**	**11.56**	**10.67**	**9.78**	**8.89**	**8.00**	**7.11**	**6.22**	**5.33**	**4.44**
	22.59	23.12	23.59	23.98	24.31	24.58	24.77	24.91	24.97	24.97	24.91	24.77	24.58
7	**15.00**	**14.17**	**13.33**	**12.50**	**11.67**	**10.83**	**10.00**	**9.17**	**8.33**	**7.50**	**6.67**	**5.83**	**5.00**
	21.41	21.97	22.46	22.89	23.26	23.55	23.78	23.95	24.05	24.08	24.05	23.95	23.78
8	**14.78**	**14.00**	**13.22**	**12.44**	**11.67**	**10.89**	**10.11**	**9.33**	**8.56**	**7.78**	**7.00**	**6.22**	**5.44**
	20.22	20.81	21.34	21.80	22.20	22.53	22.79	22.99	23.12	23.19	23.19	23.12	22.99
9	**14.44**	**13.72**	**13.00**	**12.28**	**11.56**	**10.83**	**10.11**	**9.39**	**8.67**	**7.94**	**7.22**	**6.50**	**5.78**
	19.03	19.65	20.22	20.71	21.14	21.50	21.80	22.03	22.20	22.30	22.33	22.30	22.20
10	**14.00**	**13.33**	**12.67**	**12.00**	**11.33**	**10.67**	**10.00**	**9.33**	**8.67**	**8.00**	**7.33**	**6.67**	**6.00**
	17.84	18.50	19.09	19.62	20.08	20.48	20.81	21.08	21.27	21.41	21.47	21.47	21.41
11	**13.44**	**12.83**	**12.22**	**11.61**	**11.00**	**10.39**	**9.78**	**9.17**	**8.56**	**7.94**	**7.33**	**6.72**	**6.11**
	16.65	17.34	17.97	18.53	19.03	19.46	19.82	20.12	20.35	20.51	20.61	20.65	20.61
12	**12.78**	**12.22**	**11.67**	**11.11**	**10.56**	**10.00**	**9.44**	**8.89**	**8.33**	**7.78**	**7.22**	**6.67**	**6.11**
	15.46	16.19	16.85	17.44	17.97	18.43	18.83	19.16	19.42	19.62	19.75	19.82	19.82
13	**12.00**	**11.50**	**11.00**	**10.50**	**10.00**	**9.50**	**9.00**	**8.50**	**8.00**	**7.50**	**7.00**	**6.50**	**6.00**
	14.27	15.03	15.72	16.35	16.91	17.41	17.84	18.20	18.50	18.73	18.89	18.99	19.03

Patient utility table for standalone hospital

quality level of merged hospitals	1	2	3	4	5	6	7	8	9	10	11	12	13
own quality level													
1	**1.00**	**0.99**	**0.97**	**0.94**	**0.89**	**0.83**	**0.75**	**0.66**	**0.56**	**0.44**	**0.31**	**0.16**	**0.00**
	2.00	2.69	3.42	4.19	5.00	5.85	6.75	7.69	8.67	9.69	10.75	11.85	13.00
2	**1.35**	**1.33**	**1.30**	**1.25**	**1.19**	**1.11**	**1.02**	**0.92**	**0.80**	**0.67**	**0.52**	**0.36**	**0.19**
	1.99	2.67	3.38	4.14	4.94	5.78	6.66	7.58	8.55	9.56	10.60	11.69	12.83
3	**1.75**	**1.72**	**1.67**	**1.60**	**1.53**	**1.44**	**1.33**	**1.22**	**1.08**	**0.94**	**0.78**	**0.60**	**0.42**
	1.97	2.63	3.33	4.08	4.86	5.69	6.56	7.47	8.42	9.41	10.44	11.52	12.64
4	**2.19**	**2.14**	**2.08**	**2.00**	**1.91**	**1.81**	**1.69**	**1.56**	**1.41**	**1.25**	**1.08**	**0.89**	**0.69**
	1.94	2.58	3.27	4.00	4.77	5.58	6.44	7.33	8.27	9.25	10.27	11.33	12.44
5	**2.67**	**2.60**	**2.53**	**2.44**	**2.33**	**2.22**	**2.08**	**1.94**	**1.78**	**1.60**	**1.42**	**1.22**	**1.00**
	1.89	2.52	3.19	3.91	4.67	5.47	6.31	7.19	8.11	9.08	10.08	11.13	12.22
6	**3.19**	**3.11**	**3.02**	**2.92**	**2.80**	**2.67**	**2.52**	**2.36**	**2.19**	**2.00**	**1.80**	**1.58**	**1.35**
	1.83	2.44	3.10	3.81	4.55	5.33	6.16	7.03	7.94	8.89	9.88	10.92	11.99
7	**3.75**	**3.66**	**3.56**	**3.44**	**3.31**	**3.16**	**3.00**	**2.83**	**2.64**	**2.44**	**2.22**	**1.99**	**1.75**
	1.75	2.35	3.00	3.69	4.42	5.19	6.00	6.85	7.75	8.69	9.67	10.69	11.75
8	**4.35**	**4.25**	**4.13**	**4.00**	**3.85**	**3.69**	**3.52**	**3.33**	**3.13**	**2.92**	**2.69**	**2.44**	**2.19**
	1.66	2.25	2.88	3.56	4.27	5.03	5.83	6.67	7.55	8.47	9.44	10.44	11.49
9	**5.00**	**4.88**	**4.75**	**4.60**	**4.44**	**4.27**	**4.08**	**3.88**	**3.67**	**3.44**	**3.19**	**2.94**	**2.67**
	1.56	2.13	2.75	3.41	4.11	4.85	5.64	6.47	7.33	8.24	9.19	10.19	11.22
10	**5.69**	**5.56**	**5.41**	**5.25**	**5.08**	**4.89**	**4.69**	**4.47**	**4.24**	**4.00**	**3.74**	**3.47**	**3.19**
	1.44	2.00	2.60	3.25	3.94	4.67	5.44	6.25	7.10	8.00	8.94	9.92	10.94
11	**6.42**	**6.27**	**6.11**	**5.94**	**5.75**	**5.55**	**5.33**	**5.10**	**4.86**	**4.60**	**4.33**	**4.05**	**3.75**
	1.31	1.85	2.44	3.08	3.75	4.47	5.22	6.02	6.86	7.74	8.67	9.63	10.64
12	**7.19**	**7.03**	**6.85**	**6.67**	**6.47**	**6.25**	**6.02**	**5.78**	**5.52**	**5.25**	**4.97**	**4.67**	**4.35**
	1.16	1.69	2.27	2.89	3.55	4.25	4.99	5.78	6.60	7.47	8.38	9.33	10.33
13	**8.00**	**7.83**	**7.64**	**7.44**	**7.22**	**6.99**	**6.75**	**6.49**	**6.22**	**5.94**	**5.64**	**5.33**	**5.00**
	1.00	1.52	2.08	2.69	3.33	4.02	4.75	5.52	6.33	7.19	8.08	9.02	10.00

Note that given hospital i's quality choices, the pre-merger patient benefit is calculated according to $B_i = \int_0^{\hat{z}_i^{i+1}} v + q_i - t\,s\,\mathrm{ds} + \int_0^{\hat{z}_i^{i-1}} v + q_i - t\,s\,\mathrm{ds}$. The term $\hat{z}_i^j$ denotes the indifferent patient located between hospital i and hospital j. Post-merger patient benefit is given by $B_I = 2\int_0^{\frac{1}{6}} v + q_I - t\,s\,\mathrm{ds} + \int_0^{\frac{1}{6}+\frac{q_I-q_O}{2t}} v + q_I - t\,s\,\mathrm{ds}$ and $B_O = 2\int_0^{\frac{1}{6}+\frac{q_O-q_I}{2t}} v + q_O - t\,s\,\mathrm{ds}$ for insiders and outsiders, respectively.