Market Structure and Hospital-Insurer Bargaining in the Netherlands

Halbersma, R.S.; Mikkers, M.C.; Motchenkova, E.; Seinen, I.

TILEC Discussion Paper

Market Structure and Hospital-Insurer bargaining in the Netherlands

R.S. Halbersma, M.C. Mikkers, E. Motchenkova and I. Seinen[1,2,3]

Abstract

In 2005, competition was introduced in part of the hospital market in the Netherlands. Using a unique dataset of transaction and list prices between hospitals and insurers in the years 2005 and 2006, we estimate the influence of buyer and seller concentration on the negotiated prices in the first two years after the institutional change. First, we use a traditional Structure-Conduct-Performance model (SCP-model) along the lines of Melnick et al. (1992) to estimate the effects of buyer and seller concentration on price-cost margins. Second, we model the interaction between hospitals and insurers in the context of a generalized bargaining model (Brooks et al., 1997). In the SCP-model, we obtain that the concentration of hospitals (insurers) has a significantly positive (negative) impact on the hospital price-cost margin. In the bargaining model, we also find a significant negative effect of insurer concentration on the bargaining share of hospital, but no significant effect of hospital concentration on the division of the gains from bargaining. In both models we find a significant impact of idiosyncratic effects on the market outcomes, consistent with the fact that the Dutch hospital sector is not yet in a long-run equilibrium.

JEL-Classification: I11, L1, C7
Keywords: Competition, Market Structure, Hospitals, Insurers, Bargaining

---

1.   Introduction

Reforms in the health care sector in OECD countries come in three 'waves'. As Cutler (2002) describes, in the first wave, equity (in the form of universal access to medical care) rather than efficiency is the most important policy objective. After a rapid increase in cost, most countries respond in the second wave with regulatory limits on costs. Limiting budgets for health care by rationing access is a primary policy tool to control the cost of health care. The increasing dissatisfaction of consumers with rationing leads in the third wave to a movement towards more incentive based systems, including competition.

Hospitals represent an important feature of the modern health care provision. According to Dranove and Satterthwaite (2000), the number and the size of hospitals as essential medical institutions grew since the mid-twentieth century due to the development of new, effective but expensive therapies. Without a hospital, an individual doctor could not employ many of new, often capital-intensive, diagnostic techniques and therapeutic regimes. Hospitals, rather than private offices, were considered to be the workshop of the doctors. Physicians were trusted agents of their patients (see Arrow, 1963) and needed workshops. These developments took place mostly in the first wave of reforms, which lasted roughly until the 1970s and 1980s, after which hospitals became an important feature of the health care sector in most OECD countries.

According to Schut (2003), the current situation in the Netherlands seems to be between the second and third phase. Until very recently, cost containment was the major issue in the institutional design in the health care sector. In 2005, competition has been introduced in some segments in the health care sector (for example some parts of the hospital care and physiotherapy). The Dutch government is also planning to introduce more incentive-based mechanisms in the currently regulated domain.

In this paper, we investigate the effects of buyer and seller concentration on the price of the unregulated part of the Dutch hospital care in 2005 and 2006. We estimate two models describing the interaction between hospitals and insurers in determining the negotiated prices. In the first model, we estimate the price-cost margin as a function of the Herfindahl-Hirschmann Indices (HHI's) and the market shares of hospitals and insurers. We find that a larger supply-side concentration leads to significantly higher price-cost margins for hospitals, and that a larger demand-side concentration has a significant downward effect on hospital's margins.

In the second model, we define the gains from trade to be divided between hospital and insurers as the relative position of the contracted price between the estimated average unit cost and the list price. When we regress the bargaining share of the hospital on the concentration and market shares of both hospitals and insurers, we find that stronger hospital concentration does not lead to a significantly higher bargaining share for hospitals, whereas a larger concentration of insurers does have a significant downward effect on the bargaining share for hospitals.

The paper is organized as follows. In section 2, we give some background on the introduction of price competition between hospitals in the Netherlands. We continue in section 3 with an overview of the literature on the estimation of market power and bilateral negotiations. In section 4, we develop our econometric models. We give a description of our dataset in section 5. In section 6, we give the results of the estimated econometric models. Section 7 contains a discussion of our main results. Our results are summarized in the appendix.

2. Price competition between hospitals in the Netherlands

The Dutch government plans a step by step introduction of price competition between hospitals. The introduction of competition in the Dutch health care sector has been long debated. For a comprehensive overview of the reform process we refer to Helderman *et al.* (2005). In this section, we will shortly describe some of the changes relevant to this paper.

The Dutch reforms are based on a mandatory health insurance system for all Dutch citizens combined with a model of managed competition for hospitals (Enthoven, 1978). The health insurance system consists of a mandatory comprehensive benefits package (including primary medical care and hospital care, but excluding dental and nursing home care), with virtually no co-payments and an optional deductible. Supplementary insurance policies (e.g. for dental and cosmetic care) are optionally available. The mandatory insurance for the basic benefits package ensures risk solidarity and universal health care access for all Dutch citizens

The mandatory insurance is complemented by a mandatory acceptance by health insurers of all enrollees, without room for risk selection (i.e. a refusal to insure) or price discrimination. A sophisticated risk adjustment system is in place to compensate insurance companies for actuarially predictable health expenditure differentials induced by socio-demographic factors, such as age, sex, income, location and prior health care consumption (chronic pharmaceutical dependencies and prior hospitalization). The risk adjustment system levels the playing field for health insurers by enabling price competition on the premium rates (see Schut and Van de Ven, 2005).

The basic idea behind these reforms is that health insurers will start 'managing competition' between health care providers by negotiating price discounts from a selectively contracted network of health care providers. In this way, insurers can compete for enrollees by offering health plans that are both attractively priced, but still give a reasonably broad choice of health care providers.

Two reports by the Dutch Health Care Regulator (CTG/ZAio, 2005 and 2006) monitoring the competitive hospital segment, however, indicated that selective contracting of hospitals has been virtually non-existent since most insurers haven been contracting almost every hospital. Two other characteristic features of managed care in the United States, such as utilization review and patient steering by health insurers are also still in their infancy in the Dutch health care system.

Annual health care expenditures (excluding long-term care) in the Netherlands for 2005 and 2006 amounted to approximately €2,000 per capita, half of which were funded by payroll taxes, the other half being funded by the insurance premiums. Almost half of the health care expenditures was on hospital care. Because of the large share of hospital care in total health care expenditure, the effects of the introduced competition on prices in the hospital care contracting market are of great interests to policy makers trying to create a more effective health care system.

In this paper, we will study the impact of both hospital and insurer concentration and market shares on Dutch hospital prices in the competitive segment. Since measures of concentration or market share require a market definition, we have to define the relevant market (as in anti-trust cases). The relevant market consists of a geographic dimension and a product dimension. We delineate the local geographic markets for hospital care using the Elzinga-Hogarty test using patient flow data.[4] The average local hospital market is strongly concentrated with an average HHI of 2,350.

Defining the geographic market for health insurers is more complicated, since they compete for clients in a national market, whereas the contracting with hospitals is more localized. In the FTC/DOJ (2004) report, for instance, it is

---

[4] The method of defining relevant markets for health care markets is not undisputed. See, for example, Gaynor and Vogt (2000).

mentioned that the relevant market for insurance companies in no larger than the local areas within which the enrollees live or work, because patients generally prefer to receive treatment from providers close to the place where they live or work.

In this paper, we therefore assume the relevant market for health insurers to be identical to hospital market. If we use the definition of the relevant hospital markets as the relevant market for insurance companies, we notice that the local health insurance markets are even stronger concentrated than the hospital markets: all HHI's for the insurance markets are above 2,000, with an average of 4,500. The concentration can be explained by the historically assigned regional legal monopoly positions of the local health plans (these monopolistic legal predecessors of the current health insurers were abolished in 1992, but their remnants nevertheless still prevail to a large extent).

The relevant product market can be defined as the set of all hospital products in the competitive segment. As in most OECD countries, a product and treatment classification is in place in the Netherlands. In 2005, a system of diagnoses treatment combinations ("DBC") was introduced as a *simultaneous* product and treatment structure. A DBC '*includes all activities and services and treatments associated with a patients demand for care from initial consultation or examination to final check-up*' (Schut and Van de Ven, 2005). In total approximately 100.000 DBC's have been developed, of which approximately 33.000 DBC's are used in practice.[5]

Since 2005, prices are not regulated anymore for a competitive segment of uncomplicated, elective outpatient care. This competitive segment consists of 1,376 different DBC's. Since some DBC's are almost identical, the group of DBC's in the competitive segment can be clustered to 145 different products (CTG/ZAio, 2005). The DBC's in the competitive segment cover 15 (out of 24) different specialisms and belong to 28 different diagnoses. See figure 3 in the appendix for an overview of the most frequently performed procedures in the competitive segment.

[Figure 3 about here]

The revenue of the competitive segment is approximately 1.1 billion Euro, which is about 8% of the total expenses on hospital care in the Netherlands. To eliminate the revenue associated with the competitive segment from the prospective budgets for the regulated segment, the Dutch Healthcare Authority estimated cost prices (i.e. average unit cost) for the products, based on a survey of a group of 12 hospitals and multiplied these cost prices with the estimated volumes (see further in section 5).

Apart from hospitals, there are also so-called Independent Treatment Centers (ZBC's) active in the market for hospital care. These ZBC's are small outpatient treatment centers which where allowed to enter the market from 1998. However, ZBC's are only allowed to provide treatments that do not require an overnight stay in the hospitals. In recent years, the proliferation in the number of ZBC's has been in contrast to the steady concentration of hospitals (see Figures 1 and 2 of the appendix).

[Figure 1 about here] [Figure 2 about here]

Since ZBC's contract with insurers at considerably lower prices than hospitals (average ZBC prices are approximately 20 lower than hospital prices), the potential competitive constraint of ZBC's appears to be considerable. However, the total revenue of the entering ZBC's is only a few percent of the market (NZa, 2006). The prevalent reason behind this low prices and low volumes is that most ZBC's were established as subsidiary branches of hospitals (often on the same premises), allowing the latter to circumvent the rationing regime in the regulated domain by shifting production towards ZBC's (which are exempt from the budget regime). Effectively, most ZBC's therefore exercise little competitive constraint on the incumbent hospitals. Finally, we only posses price from ZBC's in 2006. In the remainder of this paper, we will exclude ZBC's from our analysis.

---

[5] The remaining DBC's are merely theoretical combinations of diagnoses and treatments.

The institutional design of the hospital market in the Netherlands described above is in many ways similar to that in the United States.[6] There are however some important differences. First, U.S. citizens are not obliged to have a health insurance and, second, U.S. insurers do not have a mandatory acceptance for any patient at community rating. Finally, almost the entire hospital sector (at least for privately insured patients) has been without direct price regulation for several decades. The stakes in bargaining between insurers and hospitals are therefore currently far greater in the US than in the Netherlands, and US market parties have had more time than their Dutch counterparts to reach a long run equilibrium.

3. Literature review

There is a large amount of literature on the impact of buyer and seller concentration in health care markets. For good reviews see e.g. Dranove and Satterthwaite (2000) and Gaynor and Vogt (2000). Most of the previous literature is concerned with the exercise of market power on only one side of the market: either insurers' monopsony power or hospitals' monopoly power. Most studies follow the structure-conduct-performance (SCP) tradition and estimate a reduced form model in which price or margins are regressed on control variables (mostly cost and demand shifters) and a measure of either buyer or seller concentration.

However, to identify the effects of buyer (seller) concentration with monopsony (monopoly) power, specification of an underlying structural model is required. The new empirical industrial organisation (NEIO) models provide such accurate and direct measures of market power, but the high standards imposed on the available data and estimation methods can often prevent clean tests of these models. For example, in competitive markets, price is exogenous but in markets with monopoly (monospony) power, price is endogenous and has to be instrumented for, e.g. with demand and cost shifters. Furthermore, the proper indentification of the conduct parameter related to monopoly (monopsony) power requires a demand (supply) rotator such as the price of an outside good (or factor prices in outside industries) in order to instrument for the marginal demand (supply) appearing in the pricing equation (Bresnahan, 1989). These requirements are often not fulfilled by the data used in most studies.

There is a large literature on the unilateral impact of buyer concentration on hospital prices. Examples are Feldman and Greenberg (1981), Adamache and Sloan (1983), Frech (1988), and Foreman et al. (1996). These studies analyze the relationship between the market share of Blue Cross/Blue Shield and the hospital discounts from list prices. All find positive relationships between Blue Cross/Blue Shield share and provider discounts. However, Staten et al. (1987, 1988) find no significant relationship between these variables. Melnick et al. (1992) attribute the insignificant results of Staten et al. (1987, 1988) to the relative inexperience with selective contracting of the newly formed Blue Cross Indiana PPO. Using more recent data from the same market, they find a significant negative relation between prices and insurers' market share.

As alluded to above, the negative relation between prices and buyers' concentration as measured by insurers market share is not necessarily an indication of monopsony power (Gaynor and Vogt, 2000). Issues such as the market definition on the buyer's side, endogeneity of insurers' market share with price and the proper measurement of transaction prices (as opposed to list prices) have affected most studies to date. In summary, the bulk of empirical work has been consistent with the exercise of monopsony power by health insurers, but has not tested the monopsony power hypothesis directly.

There is also a large number of studies assessing the unilateral impact of seller concentration on hospital prices. Examples are Noether (1988), Melnick et al. (1992), Dranove et al. (1993), Lynk (1995), Connor et al. (1998), Simpson and Shin (1998), Dranove and Ludwick (1999), Keeler et al. (1999), and Lynk and Neumann (1999). These studies regress hospital price on measure of seller concentration (usually a Herfindahl-Hirschmann index) and other control variables. The vast majority of these studies find that hospital concentration increases prices. Again, as with the impact of buyer concentration, the measured positive impact of

---

[6] See Dranove and Satterthwaite (2000) for an overview of the industrial organization of health care markets in the U.S.

seller concentration on prices has not directly been identified with the exercise of monopoly power by hospitals.

Only Staten et al. (1987), Melnick et al. (1992) and Gaynor et al. (2006) analyze the bilateral exercise of market power. However, the first study focuses on the concentration of insurers and, as discussed above, has some indeterminate results. Melnick et al. (1992) focuses on the concentration of hospitals. In both cases, the measurement of the concentration of the other side is not very precise. For example, Melnick et al. (1992) use the Blue Cross market share of the hospital's inpatient days as a measure of insurer concentration, rather than the share of Blue Cross in the entire local market. This measure is therefore endogenous with hospital price. Gaynor et al. (2006) analyse how both hospitals' and insurers' concentrations, measured by HHIs on both sides of the market, are related to the prices. Their results indicate that increasing concentration of insurers significantly decreases price, while the effect of hospital concentration on price is imprecisely estimated.

Another stream of literature directly models the bargaining process between insurers and hospitals. Brooks et al. (1997) considers a potential gain from bargaining divided by insurers and hospitals, and identifies the exercises of bargaining power by both sides. They specify and estimate a cooperative Nash bargaining model of hospital-insurer bargaining over prices. Their model is inspired by Svejnar (1986), a generalization of Harsanyi-Nash-Zeuthen bargaining model. Brooks et al. report that hospitals have relatively more bargaining power (as indicated by the magnitude of the estimated bargaining parameter) than insurers. They did not include a measure of insurers' concentration, although they find that a greater enrolment of the population in HMOs has a positive impact on hospital bargaining power with respect to fee for service plans. There are some methodological issues with the study, however, as the authors do not take into account the censored nature of their dependent variable, raising concerns for the consistency of their estimation results. Furthermore, the model of Brooks et al. (1997), is one of bilateral monopoly, rather than a bilateral oligopoly. To the best of our knowledge, for markets with bilateral market power, there are no well-specified generalizations of the Nash bargaining model for the bilateral monopoly. This potentially reduces the applicability of the model of Brooks et al. (1997) to real word healthcare markets. Nevertheless, the intuitive results of this paper are very appealing.

Most the studies cited above were either cross-sectional or panel studies of industry-level data. Brooks et al. (1997) and Gaynor et al. (2006) use patient-level data. In the more recent literature, consumer-choice models have also been employed to investigate the impact of concentration on prices. Examples are Town and Vistnes (2001) and Capps et al. (2003). Town and Vistnes equate a hospital's bargaining with the value a hospital adds to a network and find a positive impact of bargaining power on prices. Capps et al. (2003) model a similar situation and measure each hospital's market power by an aggregation of consumer's willingness to pay to the hospital. They find a similar positive link between willingness to pay and prices. Such consumer-level studies can be used to directly simulate the impact on prices following hospital mergers, making these models relevant in anti-trust cases.

In this paper, we employ a traditional empirical approach in industrial organization research: the structure-conduct-performance (SCP) approach. The idea is that market structure determines the conduct of firms and that conduct then yields market performance. As a consequence, our analysis is best thought of as an empirical investigation of the intuitive idea that more concentrated markets have less price competition that is reflected in prices (higher for more concentrated sellers, lower for more concentrated buyers). We do not currently posses consumer demand data and are limited to aggregate industry data. In the near future, we do expect to obtain complete patient level data of the entire Dutch hospital sector, opening the possibilities to go beyond the reduced form models in this paper.

The contributions of this paper are fourfold. First, we analyze the effect of both hospital concentration and insurer concentration on prices in a period just after the introduction of price competition in the Netherlands. This provides valuable insights into the workings of an "emerging market" where market parties have little or no prior experience with bargaining and selective contracting. We expect that Dutch market parties will exhibit a steep learning curve as they adjust their terms over time and become more astute at balancing the tradeoffs in their efforts to improve their bargaining strength. As time pro-

gresses and more data becomes available, it will be possible to model the convergence from short run price dynamics to a long run equilibrium.

Second, we cover a market outside the United States. As far as we know, the existing literature has an exclusive focus on competition in the U.S., while we focus on the Netherlands. The institutional design of competition in the Netherlands is different from the United States, so that insurers and hospitals operate under more regulation. In the near future, the competitive segment will most likely be expanded so that our paper provides a starting point for studying the interaction between competition and regulation in an emerging market.

Third, we improve the estimation of both Melnick et al. (1992) and the bargaining model based on Brooks et al. (1997). Compared to Melnick et al. (1992), we use an exogenous measure of insurers concentration and incorporate the effects of buyer and seller concentration in a more symmetric fashion. In the bargaining model, we improve on the estimation method by regressing the 'relative bargaining share' instead of the 'absolute bargaining share' (thereby correcting for heteroskedasticity) and by employing a Tobit regression rather than OLS (taking into account the censored nature of the dependent variable).

Finally, we use a dataset that contains information about *both* contracted prices (i.e. the actual transaction prices) and the list prices over a number of products for a period of two years. To the best of our knowledge, all other papers in the literature have either list prices or transaction prices, but not both.

4. Model

4.1 SCP-Model
SCP-models are based on Chamberlin's (1993) monopolistic competition theory and seek to explain firm performance through market structure conditions, such as number and size distribution of firms and entry condition in the market. The SCP-hypothesis explains the performance of firms by the structure of the market and is based on the premise that a more concentrated market indicates higher market power and consequently higher profits for all hospitals in the market.

The basic SCP-model can be formulated as follows (where *i* is a product, firm, or time index):
$$P_i = f(M_i, D_i, C_i) \tag{1}$$
where P is a performance measure, M a (set of) market structure variables, D a (set of) demand variables, and C a set of firm/product-specific control variables.[7]

A number of traditional concentration ratios have been used as market structure indices. The most common indicator is the Hirschman-Herfindahl index which gives extra weight to those hospitals that dominate the market. In a Cournot model for homogenous products, the HHI is related to the industry averaged price-cost margin and buyer demand elasticity. In SCP-models, price-cost margins are taken from the data and conduct is already determined (by the assumption of Cournot behavior), so that the coefficient of the HHI coefficient measures the buyer demand elasticity. In structural models aimed at measuring market power directly, both price-cost margins and conduct (i.e. the exercise of market power) are to be estimated. We lack the necessary data to directly estimate the conduct parameter, so that the coefficient of HHI can only serve to back up the intuition that higher hospital concentration leads to higher prices.

The main equation to be estimated on the basis of per hospital, per product and per year data is as follows (where *h,i* and *t* index hospitals, insurers and time):
$$\ln \frac{(p_{hit} - c_h)}{p_{hit}} = a + s\ln(M_{hi}) + d\ln(D_i) + c\ln(C_h) + d \bullet t + \varepsilon_{hit} \tag{2}$$

---

[7] In the health economics literature, D are often demand shifters and C are cost shifters.

If we take hospital market share as the only market structure variable M_{hi}, then the Cournot oligopoly prediction is $s=1$. In case of perfect competition, an increase in hospital market share has no impact on performance and $s=0$. Therefore, in interpreting the coefficient s, we will focus on its sign and significance rather than its magnitude.[8]

If collusive behavior on the part of sellers exists, then the impact of hospital market share on performance is more than proportional and one would expect $s>1$. An intuitive way to test the hypothesis of coordinated market power (i.e. collusion) against the hypothesis of unilateral market power (i.e. bargaining power), would be to include both the HHI and the market share in the regression equation (2). If collusion is the dominant driver behind price-cost margins, one would expect this to be picked by the coefficient of the HHI, since even small firms in concentrated market would profit from the collusion. If, on the other hand, firms only exercise their individual market power, one would expect the coefficient of market share to prevail.[9]

We therefore include both HHI and market share in our model. To avoid collinearity, we center market shares around the HHI (since the HHI is a weighted averaged market share). With this linear transformation of our data, the coefficient of the centered market share measures the impact of an above average market share on market performance and half the difference of the coefficients of the HHI and the centered market share measures the impact of the market concentration on the price-cost margin.

4.2 Extension of the SCP-model to estimate effects of demand-side and supply-side concentration

In this section, we describe the model that can help to identify the effects of both buyer and seller concentration on the price of hospital care. We therefore symmetrize equation (2) across insurers and hospitals by including measures of concentration in both the insurance market and in the hospital market in the regression equation (2) described above. The resulting equation is as follows (where h, i and t index hospitals, insurers and time):

$$\ln\frac{(p_{hit}-c_h)}{p_{hit}}=a+s\ln(M_h)+b\ln(M_i)+d\ln(D_i)+c\ln(C_h)+d\bullet t+\varepsilon_{hit} \qquad (3)$$

Here the variables M_h and M_i define measures of the market structure of the hospitals and insurers in the relevant hospital care market. D_i again is a (set of) demand shifters (ranging over all insurers), and C_h is a set of hospital product-specific control variables (cost shifters).

Our prior hypothesis is that that a higher concentration or market share of hospitals increases price mark-up, while insurer concentration or market share decreases the mark-up on prices for hospital care. As in the previous section, we include both the HHI and the centered market shares as measures of concentration.

In Table 3 we provide estimation results for this model. Following Gaynor et al. (2006), we like to stress that there is no theoretical consensus on what should be a structural model for a bilateral oligopoly. Therefore these kind of models are based on the intuition that a higher concentration of hospitals (insurers) would lead to higher (lower) prices.

4.3 Hospital-insurer bargaining model

The Svejnar's (1986) generalization of the Harsanyi-Nash-Zeuthen bargaining model implies that the potential gain from bargaining to be divided among the players is given by the following expression:

$$V = (U_i - \overline{U}_i)^{\gamma(Z)}(U_j - \overline{U}_j)^{1-\gamma(Z)}, \qquad (4)$$

---

[8] A similar interpretation of the regression coefficients is employed in Bos (2004), who studies the effect of concentration in Dutch banking market on banks' performance. Bos (2004) also provides a formal theoretical model that connects regression coefficient of market share (M) to the conjectural variation parameter in Cournot model.

[9] The direct estimation of collusion is not possible with our data set and would also require an underlying structural model. To the best of our knowledge, there is no existing literature that directly tests the hypothesis of collusion versus bargaining power.

where U_i and U_j define utilities from bargaining to players *i* and *j* respectively. Point $(\overline{U_i}, \overline{U_j})$ is a disagreement outcome, i.e. utilities for both players if an agreement is not reached. $\gamma(Z)$ represents bargaining power of the player as a function of a set of variables Z, which reflects the set of exogenous characteristics such as market structure.

Brooks et al. (1997) discussed an application of this model to the situation of hospital-insurer bargaining. In their setup, the hospital and insurer bargain over a discount from the hospital list price and arrive at a mutually agreed transaction price. Both the hospital and the insurer are assumed to be profit maximizers. The bargaining outcome is the transaction price that maximizes

$$V = (\Pi_H - \overline{\Pi_H})^{\gamma} (\Pi_I - \overline{\Pi_I})^{1-\gamma}, \tag{5}$$

where $\overline{\Pi_H}$ and $\overline{\Pi_I}$ are the hospital and insurer disagreement profit levels, respectively, and $\Pi_H - \overline{\Pi_H}$ and $\Pi_I - \overline{\Pi_I}$ are their corresponding net gains from bargaining.

The net profit (gain) of the insurer can be written:

$$\Pi_I - \overline{\Pi_I} = (R - K - PN) - (R - K - P_T N), \tag{6}$$

where R is the insurer revenue, K is its cost of production, P is the contracted price , N is the number of patients insured by this insurance company and P_T is the price the insurer must pay for an episode of inpatient care if the insurer has no bargaining power.[10] In our case, this monopoly price is equal to the list price.

The net gain of the hospital can be written:

$$\Pi_H - \overline{\Pi_H} = [N(P - C)] - [N(P_L - C)], \tag{7}$$

where C is the average cost per episode of care, P and N are as previously defined, and P_L the minimum price that the hospital would accept to provide a privately-insured episode of inpatient care. In our case, this monopsony price is equal to the average unit cost.

Substituting equations (6) and (7) into equation (5) and maximizing the resulting equation with respect to P yields:

$$P = \gamma P_T + (1 - \gamma) P_L. \tag{8}$$

From this we see that the negotiated price is a weighted combination of the monopoly and monopsony prices, with the bargaining power as the weight. We can solve this equation for the bargaining power:

$$\gamma = \frac{P - P_L}{P_T - P_L}. \tag{9}$$

Note that $P_T - P_L$ is the potential absolute gain (in euro's) from bargaining to be divided between the hospital and the insurer, and $P - P_L$ is the margin gained by the hospital. The measure of relative bargaining share, γ, is the share of the potential gain that a hospital keeps as a result of bargaining. If γ equals one, the hospital has complete bargaining power. On the other hand, if γ equals zero, the insurer has complete bargaining power and is able to extract a maximum discount from the hospital.

To explore how bargaining power is influenced by observable exogenous characteristics Z, we can parameterize γ:

$$\frac{P - P_L}{P_T - P_L} = (\alpha + \beta Z). \tag{10}$$

---

[10] P_T, the price that the insurer pays for an episode of inpatient care if the insurer has no bargaining power, can also be viewed as the maximum price that can be asked by the hospital in case it has monopoly power in the relevant market. This price represents the upper bound of the interval of gains from trade between hospital and insurer. We believe that the list price in our sample can be a good approximation for this upper bound of the gains from trade, since the list price represents the price that can be asked by the hospital from a consumer who does not have an option to bargain for a reduced price.

If β equals zero, then a equals γ. In this case bargaining power does not vary with Z. When γ is zero, perfect competition exists (insurers are able to extract all rents). When γ is one, the hospital uses monopoly pricing (suppliers are able to extract all rents). The Nash bargaining solution is represented by a γ of 0.5.

The model (10) resembles the model of Brooks et al (1997). However, they estimated the absolute gain from bargaining rather than the relative gain from bargaining, thereby introducing heteroskedasticity, since a larger hospital with average bargaining power will have both a higher absolute gain and a higher margin. Moreover, the estimation of the empirical counterparts to equations (8) and (9) require data on contracted prices P, estimates of P_L and P_T, and data on exogenous factors, Z, that are theoretically related to the bargaining power underlying each transaction. Since the bargaining power has to lie within the unit interval, ordinary least squares is an inconsistent estimation method and censored regression techniques (such as a Tobit regression) have to be employed.

For the empirical estimation of the model described by equation (10), we use the same covariates as in the estimation of equation (3):

$$\frac{(p_{hit} - c_h)}{(l_{ht} - c_h)} = a + s\ln(M_h) + b\ln(M_i) + d\ln(D_i) + c\ln(C_h) + d \bullet t + \varepsilon_{hit} \qquad (11)$$

Here, we have denoted the list price with l_{ht}.

Estimation results for this model are presented in Table 3.

5. Data

5.1. Data-sources

In this section, we describe the various data sources that we employed for our estimations. Table 1 shows the different sources.

[Table 1 about here]

Per DBC, we have three price-related components: the average total costs, the contracted price, and the list price (i.e. the price that uninsured patients and patients from non-contracted insurers have to pay). We also have estimates of the associated volumes per DBC.

Because of the administrative difficulties associated with the newly introduced DBC-system, many hospitals were not yet able to calculate their own average total costs. We therefore used cost data from a sample of 12 so-called "front-runner" hospitals to estimate the average cost per DBC.

The DBC-volumes in 2004 for the 12 "front-runner" hospitals were used to translate the number of outpatient admissions in 2004 (an administrative measure used in the previous registration system) into estimates for the DBC-volumes in 2005. We currently do not posses the actually realized DBC-volumes of 2005 or 2006.

Contracted prices were submitted by health insurers. Some smaller insurers did not or could not supply all their contracted prices. Since it is hard to distinguish between DBCs which were not contracted at all and contracts that were closed but not submitted, we cannot make definite statements about the coverage of our database. However, from background interviews with hospitals and health insurers (CTG/ZAio, 2005), we learned that in 2005 most insurers contracted almost every hospital for their entire range of product. As the 10 largest insurers submitted approximately 95% of their contracted prices, we estimate to have about 75% of all contract prices in our database. Virtually all hospitals complied with the mandatory supply of list prices to CTG/ZAio. Hospitals are also obliged to post these list prices on publicly accessible places such as in waiting rooms or on their website.

In principle, average total costs are expected to be lower than contracted prices, which in turn should lie below the list prices. However, in our database, we observe all six possible permutation from the expected pattern. Below cost price contracting (4.5% of our sample) can occur because hospitals offer cost-heterogeneous but medically related DBC-packages for a single-price (e.g. all DBCs related to a single diagnosis). Above list price contracting (9.1% of all observations) also occur, possibly because insurers with a small but non-negligible revenue share might not have enough bargaining power to get much of a reduction from the list price. However, they still might want to contract the hospital to avoid the expensive administrative task of processing insurance claims from individual consumers. These extra administrative costs might induce a willingness to pay towards the hospital that lies slightly above the list price. Other explanations for such odd patterns in the price data might be administrative difficulties with the relatively new DBC-system, and the inexperience in the bargaining process.

We treat these data problems by performing a multivariate outlier analysis, along the lines of Hadi (1994) Furthermore, for the remaining observations with transaction price below cost or above the list price, we use the following censoring procedure. When price is below cost, we conclude that the hospital has no bargaining power. When price is above the list price, including the rather bewildering sequence of list price < contracted price < cost price, we conclude that the hospital has all the bargaining power. This is equal to the treatment in table 1 of Brooks *et al.* (1997*)*. Finally, we aggregate the price-cost margins and bargaining share across all hospital products to an overall price-cost margin and bargaining. The level of analysis is therefore all 1235 unique hospital-insurers pairs for a period of two years.

5.2. Market concentration and market shares
In the near future, as the DBC-system will overcome the early administrative difficulties, more complete micro-level data will become available, including cost prices from all hospitals and zipcode locations of patients. However, since our current dataset does not contain such micro-level data, we were unable to determine the relevant product and geographic market from first principles.

On behalf of the Dutch Ministry of Health, a private company (Prismant B.V.) performed such a market analysis based on micro-level data from the previous medical registration system (Prismant, 2004). There are two important dimensions for the relevant market: the product market definition and the geographic market definition. Prismant distinguishes the following product markets for hospital care:
- Acute care versus elective care
- Inpatient care versus outpatient care
- Uncomplicated care versus complicated care

The competitive segment in 2005 is restricted to uncomplicated, elective outpatient care.

We used published market share data based on patient flows (Elzinga-Hogarty (EH) test (Prismant, 2004)).[11] This test takes a geographic market to be the area in which most citizens consume locally produced healthcare, and where locally produced healthcare is also mostly consumed by local citizens. The determination of geographic market by the EH-test have been subject to a lot of research and debate. For an overview of the method and the debate, we refer to Gaynor and Vogt (2003) and to the FTC/DOJ report (2004).

The results from the Prismant analysis include for every hospital in our database a list of hospitals that are in the same geographic market, and for all these hospitals their market share in the relevant product market of uncomplicated, elective outpatient care. The resulting market shares have been used to compute the Herfindahl-Hirschman-Index of market concentration for each geographic hospital market.

---

[11] Their analysis is based on micro-level data from the previous medical registration and performed for different product markets. We used the analysis for uncomplicated, elective, outpatient care products. The Prismant analysis is based on patient locations indexed by zipcode areas. For some metropolitan areas, we had to correct these results for adjacent hospitals located in the same zipcode area, which would otherwise result in completely overlapping geographic markets.

From another private data source (Vektis, 2004) we obtain the national market shares of health insurers. From this, we could in principle compute the HHI for the national market for health insurance. However, in our application we do not study the health *insurance* market per se (where insurers compete for consumers), but rather the health *contracting* market (where hospitals compete for insurers). We therefore need to compute the market share of insurers in contracted health care in each geographic hospital market.

The distribution of contracted health care per hospital over the various health insurers is obtained from a database by CTZ. This dataset contains the number of nursing days per hospital each insurer bought in the *regulated* segment. Assuming that the relative shares of insurers per hospital are the same in the *competitive* segment, we computed the relative shares of insurers in the estimated DBC-volumes obtained from the first data source in table 1, and subsequently the HHI of insurers within the geographic hospital market.

All in all, we have the following variable indicating market concentration and market share:
- the HHI of hospitals in the relevant market
- the HHI of insurers in the relevant market.
- the centered market share of a hospital in the relevant market.
- the centered market share of an insurer in the relevant market.

In our models, we simultaneously include the HHI and the market share of hospitals and insurers. To avoid problems with multicollinearity, we first center the market shares towards a zero mean by substracting the HHI.

Following Melnick et al. (1992), we also interact market share with concentration to capture possible diminishing effects of competing firms on a given firms market power. We construct 4 dummy variables which divide the HHI along the levels of 2,000; 3,333; and 5,000.

5.3   Control variables
From our basic database, we construct the following demand and cost shifters. To capture demand shifters, we construct indicators for the relative importance of the competitive segment for a specific hospital or insurer. For a hospitals, this is calculated as the ratio between the revenue of the competitive segment and the regulated segment. For insurers, this is calculated as the revenue of the insurer in a local hospital market compared to its national turnover. We also include dummies labelling the different geographic areas (provinces), and we finally also include a dummy to capture possible time effects. To avoid the basic dummy variable trap, we use the general hospitals, the province of Zuid-Holland and the year 2005 as the reference groups in the regressions.

As cost shifters we include the following variables. First, we include dummies for hospital type (general hospitals, tertiary care hospitals and teaching hospitals). Second, we compute a proxy for casemix of the hospital production. Normally, a casemix index is created by calculating the ratio between (total) expenditures and the number of patients. Since we do not have data on the number of patients in the competitive segment, we first calculated the unit cost of an average DBC as the ratio between the aggregate DBC-expenditures (DBC-volumes priced and average unit cost) and the aggregate DBC-volume, and index this variable such that the national average is 100. We also construct size indicators that might capture economies of scale for a specific hospital or insurer. For a hospitals, this is calculated as total the revenue of the competitive and regulated segment combined. For insurers, this is calculated as its national total of nursing days.

We log-transformed most of our continuous variables (except for the bargaining share, the casemix index and the importance measures) since preliminary regressions indicated that the residuals were characterized by a very skewed distribution.

6. Estimation Results

6.1 Estimation of the SCP-model

As a performance measure in the SCP-model, we use a price mark-up derived from the price and cost data as a ratio of list price less estimated costs to list price. See Table 2 that provides an overview of descriptive statistics. The average price-cost margin in our sample was 6,5%. Descriptive statistics of the dependent variables and explanatory variables that have been discussed in section 5.2 are also provided in Table 2.

[Table 2 about here]

For the estimation of the SCP-model, we regressed price-cost margins on indicators of industry performance and on the set of explanatory variables using OLS regression. The estimation results are summarized in the column Model I of Table 3. The model explains 28% of the variation of the price-cost margin. We rejected the hypothesis that we omitted variables (using Ramsey's RESET test).[12]

[Table 3 about here]

The model also indicates that the concentration measures have the expected *signs* since the concentration of hospitals (insurers) has a significant positive (negative) impact on the price-cost mark-up that hospitals are able to charge for their products in the competitive domain. The *magnitude* of the impact of an increased HHI on the price-cost margin however is about an order of magnitude smaller than the results in Melnick et al. (1992). Furthermore, teaching hospitals are able to charge significantly higher price-cost margins than general hospitals, as they get about 14% higher mark-ups than general hospitals. See Table 3.

Interestingly, the coefficients for the HHI on the hospital's and insurer's market are almost identical to the coefficients for their centered market shares. This means that the *net* impact of the HHI on either side of the market is not significantly different from zero.[13] As we conjectured in section 4, this might indicate that there is no coordinated market power present in our data set. Intuitively, the estimation results suggests that only unilateral market power is being exercised since higher market shares rather than a higher HHI influence the price-cost margins. It would be interesting for future research to construct more structural models that can distinguish between coordinated and unilateral market power.

Since our results indicate that market structure has only weak (though significant) impact on price-cost margins in the competitive segment of hospital care, the implications for the welfare effects of e.g. hospital or insurers mergers are to be interpreted rather carefully. For a merger of 2 out of 5 equally sized hospitals (insurers), we predict a modest 1,5% price increase (decrease), whereas the predicted price-cost difference for a merger of 2 out of 3 equally sized market parties would amount to about 1,8%.

6.2 Estimation of the hospital-insurer bargaining model

For estimation of hospital-insurer bargaining model we constructed a dependent variable denoting the bargaining share of the hospital. It is defined as the relative location of the contracted price on the interval between the estimated cost price and the list price for non-insured consumers. In other words, it is determined as a fraction of the total gains from trade between hospitals and insures that goes to hospitals. The average share a hospital gets from the total gains of trade is 47%. See Table 2 (Descriptive Statistics). This would mean, that on average the insurers have slightly more bargaining power, if we can reject the hypothesis that hospitals and insurers reach the Nash bargaining solution of 0.5 (see section 4.3 for theoretical background). Following a formal t-test based on our data, we reject the hypothesis that hospitals and insurers reached a Nash-bargaining solution.

It should also be stressed that this dependent variable is limited between 0 and 1 by construction (see section 5). This structure of the dependent variable calls for application of limited dependent variable econometric techniques, rather than the ordinary least squares techniques of Brooks et al.

---

[12] As was done by Melnick et al. (1992).
[13] In a regression with on the RHS b1 * HHI + b2 * (market share – HHI), the net impact of the HHI is (b1– b2) * HHI. In our estimation, b1 does not significantly differ from b2, so the net impact of the HHI is not significantly different from zero.

(1997). The hospital-insurer bargaining model is estimated using the censored regression Tobit model. We report the estimation results for hospital-insurer bargaining model in the column Model II in Table 3.

From these results, we conclude that a higher concentration of the HHI of insurers leads to a significant increase in the insurer's bargaining share. This impact of insurer concentration is purely picked up by the insurers HHI, with no significant coefficient for the centered market share. This would suggest that insurers bargain in a somewhat coordinated way with hospitals since a higher HHI on the insurer market leads to a higher bargaining share for the insurers.

For hospitals, however, only the centered market share has a significant coefficient, but with a negative sign. We interpret this as follows. The net coefficient of the hospital HHI is significantly positive. This would suggest that hospitals also coordinate their bargaining with insurers. However, this coordinated bargaining power is significantly adjusted downward by the hospital's own market share. This is consistent with the fact that smaller hospitals profit more from the coordinated bargaining that larger hospitals.

On average, teaching hospitals are able to obtain a better market outcome as they get about 17% more of the bargaining share than general hospitals. But the regression coefficient for the teaching dummy is not significant. This implies that although academic hospitals are able to charge significantly higher prices, they do bargain not significantly better compared to other types of hospitals.

6.3 Estimation of idiosyncratic effects in the bargaining process

As Melnick et al. observe based on papers describing the situation in California just after the introduction of competition in hospital care, the market might not be in a long-run equilibrium. This suggests that idiosyncratic effects might have a sizeable impact on the market outcomes. However, direct inclusion of fixed effects per hospital and insurer in our model did not improve our initial estimation results (because of the severe reduction in degrees of freedom). To test this hypothesis, we therefore performed an ANOVA analysis on the residuals of our initial regression. See Table 4.

[Table 4 about here]

We find that in the SCP-model approximately 28% of the residual variation can be explained by idiosyncratic effects of the individual hospitals and insurers, 11% by insurer specific effects and 17% by hospital specific effects.

We also perform an ANOVA analysis on the residuals of our initial regression. See Table 4. We find that approximately 41% of the residual variation of the bargaining model can be explained by idiosyncratic effects, 12% by insurer specific effects and 29% by hospital specific effects.

7. Conclusion

In this paper we estimate the impact of concentration and bargaining power on the negotiation results in the first two years after the institutional change in the Dutch hospital sector. First, we use a traditional Structure-Conduct-Performance model (SCP-model) along the lines of Melnick et al. (1992) to estimate the effects of buyer and seller concentration on price mark-ups. Second, we model the interaction between hospitals and insurers in the context of a generalized bargaining model (Brooks et al., 1997). In the SCP-model, we obtain that the concentration of hospitals (insurers) has a significantly positive (negative) impact on hospital price-cost margin.

The *magnitude* of the impact of an increased HHI on the price-cost margin however is about an order of magnitude smaller than the results in Melnick et al. (1992). Furthermore, teaching hospitals are able to charge a significantly higher price-cost margins than general hospitals as they get about 14% higher mark-ups than general hospitals.

In the bargaining model, we also find a significant negative effect of insurer concentration on the bargaining share, but no significant effect of hospital concentration on the division of the gains from bargaining. The average share

a hospital gets from the total gains of trade is 47%. This would mean, that on average the insurers have slightly more bargaining power, since we can not reject the hypothesis that hospitals and insurers reached a Nash-bargaining solution. Academic hospitals again are able to charge significantly higher prices, but they do not significantly better bargain, compared to other types of hospitals.

In both models we find a significant impact of idiosyncratic effects on the market outcomes, consistent with the fact that the Dutch hospital sector is not yet in a long run equilibrium.

Since our results indicate that market structure has only weak (though significant) impact on price-cost margins in the competitive segment of hospital care, the implications for the welfare effects of e.g. hospital or insurers mergers are to be interpreted rather carefully.

Our results from the SCP-model seem to indicate that the negotiations were not coordinated between both the hospitals and insurers. However, the bargaining model suggests that some coordination between both hospitals and insurers. Our estimated models do not allow us to draw any hard conclusions on the distinction between coordinated and unilateral effects.

We expect to have more and better data in the near future. Especially we expect to gather data on the treatment volumes and patient level data (some characteristics like sex, age, diagnosis and zip-code), which will allow us to extend the estimated models along the lines of Capps et al. (2003) and Antwi et al. (2006). These approaches will allow us to estimate a structural model of hospital competition. These structural models might also allow us to distinguish between coordination and unilateral market power.

8. References.

Adamache, K.W. and F. A. Sloan (1983) *Competition between non-profit and for-profit health insurers*, Journal of Health Economics, 2, 225-243

Antwi, Y.D.A., M. Gaynor, and W.B. Vogt (2006) *A Competition Index for Differentiated Product Oligopoly With an Application to Hospitals,* unpublished manuscript, Carnegie Mellon University.

Arrow, K.J. (1963), *Uncertainty and the Welfare Economics of Medical Care*, American Economic Review 53 (5), pp. 941-973

Bain, J.S. (1951) *Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940*, Quarterly Journal of Economics, Vol. 65 (3), pp. 293-324

Bain J. S (1956) *Barriers to New Competition*, Harvard Univ. Press, Cambridge, Mass. 1956.

Boone, J. and Weigand, J. (2000). *Measuring competition: How are cost differentials mapped into profit differentials?*, Working Paper CPB Netherlands Bureau for Economic Policy, The Hague.

Bos, J.W.B. (2004), *Does market power affect performance in the Dutch banking market? A comparison of reduced form market structure models*, De Economist, 152, pp. 491-512

Bresnahan, T.F. (1982). *The oligopoly solution concept is identified.* Economics Letters 10, pp87-92

Bresnahan, T.F., (1989) *Empirical Studies of Industries with Market Power*, Chapter 17 in the Handbook of Industrial Organization, Volume II, Edited by R. Schmalensee and R.D. Willig, Elsevier, Amsterdam the Netherlands, Seventh impression

Brooks, J.M, A. Dor, H.S. Wong (1997), *Hospital-Insurer Bargaining: an Empirical Investigation of Appendectomy Pricing*, Journal of Health Economics 16, pp. 417-434

Capps, C., D. Dranove and M. Satterthwaite (2003) *Competition and Market Power in Option Demand Markets,* Rand Journal of Economics 34 (4), pp. 737-763

Chamberlin, E.H. (1933) *The Theory of Monopolistic Competition*, Harvard University Press, Cambridge, MA

Collins N.R., L.E. Preston (1969) *Price-Cost Margins and Industry Structure*, Review of Economics and Statistics, Vol. 51 (3) , pp. 271-286

Connor, R., R. Feldman and B. Dowd (1998), *The Effects of Market Concentration and Horizontal Mergers on Hospital Costs and Prices,* International Journal of the Economics of Business, 5, 159-180

Cowling, K. (1976), *On the Theoretical Specification of Industrial Structure-Performance Relationship*, European Economic Review, Vol. 8, pp.1-14

Cowling, K. and M. Waterson (1976), *Price-cost margins and market structure*, Economica, 43 (171), pp. 267-274

CTG-Zaio (2005), *Oriënterende monitor Ziekenhuiszorg*, http://www.ctg-zaio.nl/apus/render.php?type=18&id=224&template=default

Cutler, D. (2002), *Equality, Efficiency, and Market Fundamentals: The Dynamics of International Medical-Care Reform*, Journal of Economic Literature 60, pp. 881-906

Dranove, D., M. Shanley and W.D. White (1993) *Price and Concentration in Local Hospital Markets: the switch from patient-driven to payer-driven competition*, Journal of Law and Economics, 36, 179-204

Dranove, D., and R. Ludwick (1999) *Competition and Pricing by Nonprofit Hospitals: A reassessment of Lynk's Analysis*, Journal of Health Economics, 18, 87-98.

Dranove, D. and MA Satterthwaite (2000), *The Industrial Organization of Health Care Markets*, Chapter 20 in the Handbook of Industrial Organization, Volume II, Edited by R. Schmalensee and R.D. Willig, Elsevier, Amsterdam the Netherlands, Third impression

Enthove, A. (1978) *Consumer Choice Health Plan*, New England Journal of Medicine 298 (12) pp. 650-658

Federal Trade Commission (FTC) and the Department of Justice (DOJ) (2004), *Improving Health Care: A dose of competition.* http://www.ftc.gov/opa/2004/07/healthcarerpt.htm

Feldman, R. and W. Greenberg (1981), *The relation between the Blue Cross share and the Blue Cross 'discount' on hospital charges*, Journal of Risk and Insurance, 48, 235-246.

Foreman, S. E., J.A. Wilson and R.M. Scheffler (1996) *Monopoly, monopsony, and contestability in health insurance: a study of Blue Cross plans*, Economic Inquiry, 34, 662-677.

Frech III, H. E. (1988), *Monopoly health insurance: The economics of Kartell v. Blue Shield of Massachusetts*, in: H.E. Frech III, ed., *Health Care in America: The Political Economy ofHospitals and Health Insurance* (Pacific Research Institute for Public Policy, San Francisco, CA) 299-322.

Gaynor, M.S. and D. Haas-Wilson (1999) *Change, Consolidation, and Competition in Health Care Markets,* Journal of Economic Perspectives 13(1) pp. 141-164

Gaynor M.S., A. Shimazaki, and W.B Vogt (2006), Bilateral Market Power: Evidence from Hospital Markets, mimeo

Gaynor M.S. and W.B. Vogt (2003) *Competition among Hospitals,* Rand Journal of Economics 34(4) 764-785

Gaynor, M.S. and W.B. Vogt (2000), *Antitrust and Competition in Health Care Markets,* Chapter 27 in the Handbook of Industrial Organization, Volume II, Edited by R. Schmalensee and R.D. Willig, Elsevier, Amsterdam the Netherlands, Third impression

Hadi, A. S. (1994), *A Modification of a Method for the Detection of Outliers in Multivariate Samples*, Journal of the Royal Statistical Society, Series (B), 56, 393-396.

Helderman, J. F.T. Schut T.E. D. van der Grinten and W.P. M. M. van de Ven (2005), *Market-Oriented Health Care Reforms and Policy Learning in the Netherlands*, Journal of Health Politics, Policy and Law, Vol. 30, Nos. 1–2

Huckman, R.S. (2006) *Hospital Integration and Vertical Consolidation, an Analysis of Acquisitions in New York State,* Journal of Health Economics 25 (1) pp. 58-80

Keeler, E., G. Melnick and J. Zwanziger (1999), *The changing effects of competition on non-profit and for-profit hospital pricing behavior*, Journal of Health economics 18, 69-86

Klein, M.A. (1971), *A theory of the banking firm*, Journal of Money, Credit, and Banking, 3, pp. 205-218

Lynk, W. J. (1995), *Nonprofit hospital mergers and the exercise of market power*, Journal of Law and Economics, 38, 437-461.

Lynk, W. J. and L. R. Neumann (1999), *Price and Profit*, Journal of Health Economics, 18, 99-105.

Martin, S. (1988) *The Measurement of Profitability and the Diagnosis of Market Power*, International Journal of Industrial Organization, 6(3), pp. 301-321

Melnick, G.A., J. Zwanziger, A. Bamezai and R. Pattison (1992) *The effects of Market Structure and Bargaining Position on Hospital Pricing,* Journal of Health Economics 11(3) pp. 217-233

Noether, M. (1988), *Competition among Hospitals*, Journal of Health Economics, 7, 259-284.

Prismant (2004), *Prestatie-indicator aanbodconcentraties ziekenhuisdiensten*, Publicatienummer 204.15, Utrecht, the Netherlands

Salop S.C. (1979), *Monopolistic Competition with Outside Goods*, Bell Journal of Economics, The RAND Corporation, vol. 10(1), pp. 141-156.

Schut, F.T. (2003), *De zorg is toch geen markt? Laveren tussen marktfalen en overheidsfalen in de gezondheidszorg*, inaugural address, https://dspace.ubib.eur.nl/bitstream/1765/7284/1/2003_Schut-FT.pdf

Schut, F.T. and W.P.M.M. van de Ven (2005) *Rationing and Competition in the Dutch Health-care System*, Health Economics, 14, pp. 59-74

Simpson, J., and R. Shin (1998), *Do Nonprofit Hospitals Exercise Market Power?,* International 21Journal of the Economics of Business, 5, 141-158.

Sorensen A.T, *Insurer-Hospital Bargaining: Negotiated Discounts in Post-Deregulation Connecticut*, Journal of Industrial Economics, 2001

Steen, F. and . Salvanes (1999) *Testing for market power using a dynamic oligopoly model*, International Journal of Industrial Organization 17, 147-177.

Staten, M., W. Dunkelberg and J. Umbeck (1987), *Market share and the illusion of power: Can Blue Cross force hospitals to discount?,* Journal of Health Economics, 6, 43-58.

Staten, M., and W. Dunkelberg and J. Umbeck (1988), *Market share/market power revisited, a new test for an old theory*, Journal of Health Economics, 7, 73-83.

Svejnar J. (1986) *Bargaining Power, Fear of Disagreement, and Wage Settlements: Theory and Evidence from U.S. Industry*, Econometrica, Vol. 54 (5), pp. 1055-1078

Town, R. and G. Vistnes (2001) *Hospital Competition in HMO networks,* Journal of Health Economics, Vol 20, pp 733-753

Varkevisser, M., N. Polman en S.A. van der Geest (2006), *Zorgverzekeraars moeten patiënten kunnen 'sturen'*, Economisch Statistische Berichten, pp.38-40

Ven, W.P.M.M van de and R.P. Ellis Vogt (2000) *Risk Adjustment in Competitive Health Plan Marktets,* Chapter 14 in the Handbook of Industrial Organization, Volume II, Edited by R. Schmalensee and R.D. Willig, Elsevier, Amsterdam the Netherlands, Third impression.
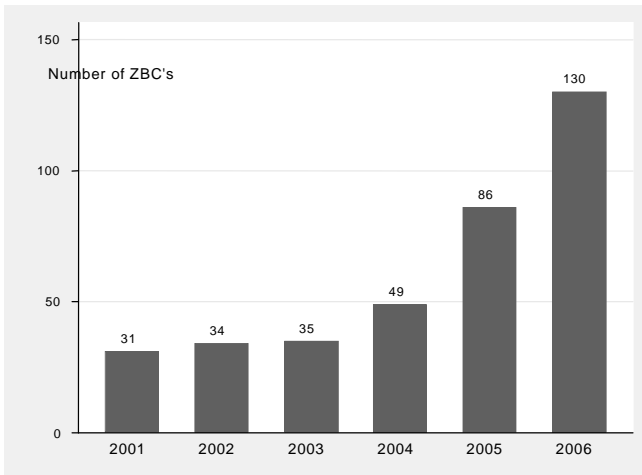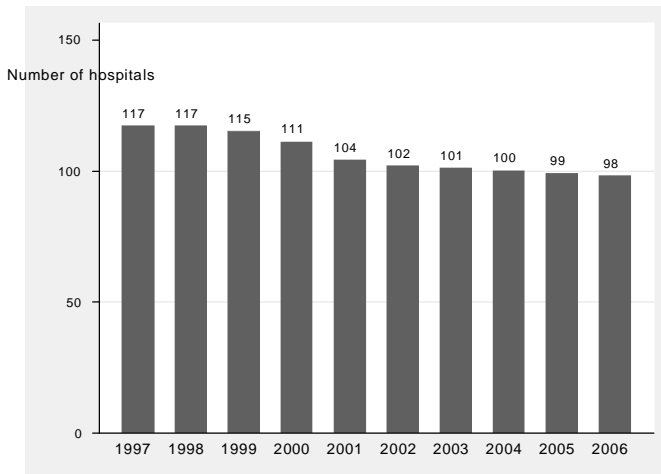
Figure 1: Total number of ZBC's
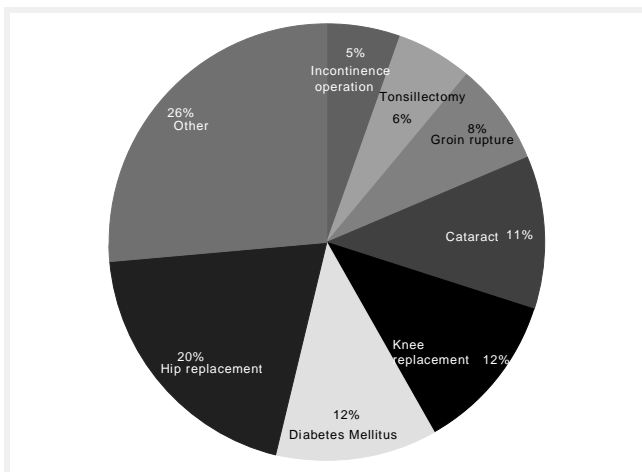

Figure 2: Total number of hospitals

Figure 3: Most frequently performed procedures in the competitive segment

Table 1: Data sources that were employed for estimations

Information	Source (years)	Remarks
Estimated cost prices and volumes per DBC in the competitive segment	CTG/ZAio (2004)	Information submitted by a sample of 12 hospitals. The associated revenues have been subtracted from the hospital budgets in the regulated segment
Contract prices per DBC	CTG/ZAio (2005, 2006)	Information submitted by health insurers (coverage 75% of the national market)
List prices per DBC	CTG/ZAio (2005, 2006)	Information submitted by hospitals (almost complete coverage)
Relevant geographic markets for hospitals	Prismant B.V. (2004)	Elzinga-Hogarty test applied to hospital and patient zipcode locations
National market shares of health insurers	Vektis B.V. (2005)	Information submitted by health insurers for the risk adjustment system
Mutual shares of hospitals and insurers in each other's portfolios	CTZ[14] (2004)	Based on the number of nursing days bought by the public health insurers, rescaled to include private insurers

Table 2 – Descriptive statistics

Variable	Mean	Std. Deviation	Min	Max
Price-cost markup	1.065	0.052	0.832	1.351
Hospital's bargaining share	0.474	0.293	0.000	1.000
HHI hospitals	0.250	0.156	0.071	0.914
HHI insurers	0.466	0.149	0.241	0.812
market share hospital	0.267	0.191	0.022	0.956
market share insurer	0.013	0.044	0.000	0.760
relative importance for hospital	0.117	0.020	0.055	0.167
relative importance for insurer	0.049	0.116	0.000	0.862
hospital size	0.866	0.473	0.301	2.183
insurer size	1.391	0.942	0.080	3.130
casemix index	1.010	0.019	0.971	1.076

---

[14] CTZ was the Health Insurers Regulator and merged in October 2006 with CTG/ZAio into the Dutch Healthcare Authority.

Table 3 - Estimation results

	Model I		Model II	
	Coefficient	Std. Error	Coefficient	Std. Error
HHI hospitals	0.015*	0.005	-0.048	0.037
HHI insurers	-0.015***	0.008	-0.115***	0.061
centered market share hospital	0.014*	0.004	-0.115*	0.032
centered market share insurer	-0.014*	0.005	0.033	0.035
interaction of hospital's market share in local market				
with HHI hospitals (<0.2)	-0.009**	0.004	0.050***	0.030
with HHI hospitals (0.2-0.33)	-0.007	0.004	0.048	0.033
with HHI hospitals (0.33-0.5)	-0.003	0.005	0.078**	0.039
interaction of insurer's market share in local market				
with HHI insurers (0.2-0.33)	0.004	0.005	-0.083**	0.034
with HHI insurers (0.33-0.5)	0.003	0.005	-0.108*	0.035
with HHI insurers (>0.5)	0.005	0.005	-0.103*	0.036
relative importance for hospital	-0.249*	0.087	-0.454	0.643
relative importance for insurer	0.036**	0.014	0.285*	0.106
hospital size	-0.005	0.005	0.042	0.038
insurer size	0.013*	0.002	0.076*	0.013
teaching hospital	0.137*	0.014	0.166	0.102
tertiary care	0.002	0.005	0.054	0.034
casemix index	0.140***	0.072	-0.501	0.527
regional dummies				
Groningen	-0.001	0.007	-0.111**	0.052
Friesland	0.036*	0.007	0.166*	0.053
Drenthe	-0.013**	0.006	0.172*	0.048
Overijssel	-0.006	0.006	-0.120*	0.046
Gelderland	0.022*	0.005	0.019	0.037
Limburg	-0.020*	0.006	0.116*	0.045
Noord-Holland	-0.004	0.004	0.013	0.031
Utrecht	-0.012***	0.007	0.116**	0.051
Noord-Brabant	0.010**	0.005	0.049	0.034
Zeeland	-0.006	0.008	-0.044	0.059
Flevoland	0.020**	0.009	0.317*	0.070
year==2005	-0.016*	0.002	-0.084*	0.018
constant	-0.165	0.141	-1.208	1.032
Adjusted R2	0.28			
Pseudo R2			0.29	

Table 4 – Idiosyncratic effects in the residual variance

	Model I		Model II	
idiosyncratic effects in the residual variance (ANOVA R2)		hospital effects		hospital effects
		0.17		0.29
insurer effects	0.11	0.28	0.12	0.41