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Abstract in English

We examine vertical integration and exclusive vertical restraints in health-care markets where insurers and hospitals bilaterally bargain over contracts. We employ a bargaining model in a concentrated health-care market of two hospitals and two health insurers competing on premiums. Without vertical integration, some bilateral contracts will not be concluded only if hospitals are sufficiently differentiated, whereas with vertical integration we find that a breakdown of a contract will always occur. There may be two reasons for not concluding a contract. First, hospitals may choose to soften competition by contracting only one insurer in the market. Second, insurers and hospitals may choose to increase product differentiation by contracting asymmetric hospital networks. Both types raise total industry profits and lower consumer welfare.

Key words: insurer-provider networks, managed care, vertical integration, exclusive contracts
JEL code: G22, G34, I11, L14, L42

Abstract in Dutch

Wij onderzoeken effecten van verticale fusies en exclusieve contracten in de zorg waarbij verzekeraars en ziekenhuizen bilateraal onderhandelen over contracten. In het theoretische model onderhandelen twee ziekenhuizen met twee verzekeraars, waarbij verzekeraars via hun premiestelling concurreren om consumenten. In een model zonder verticale fusies vinden we dat sommige partijen geen contracten afsluiten wanneer de verschillen tussen de twee ziekenhuizen groot zijn. In een model met verticale integratie komt dit echter altijd voor. De contracten worden niet afgesloten om twee redenen. Ten eerste kan het voor beide ziekenhuizen aantrekkelijker zijn om een contract af te sluiten met een en dezelfde verzekeraar. Ten tweede kunnen ziekenhuizen en verzekeraars een grotere differentiatie op de verzekeringsmarkt creëren door de ziekenhuisnetwerken van elkaar te onderscheiden. In beide gevallen gaan de totale industriewinsten omhoog en gaat de consumentenwelvaart omlaag.

Steekwoorden: gezondheidszorg, verticale fusies, exclusieve contracten, onderhandelingstheorie

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Vertical integration and exclusive vertical restraints between insurers and hospitals

Rudy Douven, Rein Halbersma,
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Abstract

We examine vertical integration and exclusive vertical restraints in healthcare markets where insurers and hospitals bilaterally bargain over contracts. We employ a bargaining model in a concentrated health care market of two hospitals and two health insurers competing on premiums. Without vertical integration, some bilateral contracts will not be concluded only if hospitals are sufficiently differentiated, whereas with vertical integration we find that a breakdown of a contract will always occur. There may be two reasons for not concluding a contract. First, hospitals may choose to soften competition by contracting only one insurer in the market. Second, insurers and hospitals may choose to increase product differentiation by contracting asymmetric hospital networks. Both types raise total industry profits and lower consumer welfare.

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1 Introduction

One of the main challenges in health care is to reduce costs by providing health care more efficiently. In the US, and recently also in Europe, market oriented approach has been followed, in which competing health insurers and health care providers should achieve an efficient allocation of production and consumption of health care. This approach may stimulate the appearance of new forms of institutional and contractual arrangements in the health care sector. For example, the growth of managed care in the US has led to tighter vertical arrangements between health insurers and providers in the form of health maintenance organizations (HMO). In these organizations insurers' enrollees typically receive full reimbursement for services from providers within the network, and may face co-payments when visiting providers outside the network. Vertical restraints or integration can be a tool for insurers and providers to gain efficiency but they may also have anticompetitive effects. The question about potential consequences of vertical integration between an insurer and a hospital is currently becoming important in Europe. For instance, this question has been discussed by the Dutch Parliament and the current government in the Netherlands now plans a per se prohibition of vertical integration between an insurer and a hospital.[1]

In this paper, we examine under what market conditions vertical restraints harm competition and what type of restraints are harmful. We study this question with a theoretical bilateral-duopoly model of a competitive health care market in which insurers and hospitals bilaterally bargain over contracts.[2] Our model draws from Gal-Or (1997) and features Hotelling competition in both the hospital and insurer market, with a fixed demand for health care. To test the impact of vertical restraints we deviate from the bargaining concept used in Gal-Or but use a more advanced bargaining concept, that was recently developed by de Fontenay and Gans (2005). Their bargaining concept has two advantages. First, while Gal-Or (1997) considers (inefficient) linear contracts between hospitals and insurers, their concept considers non-linear contracts and assumes that bargaining takes place efficiently. Second, it allows for more different types of vertical relationships, such as vertical integration.

The paper proceeds as follows. We describe the literature and our contribution to it in section 2. We develop our model in section 3, which we use in section 4 to analyze the effects of different types of exclusive vertical contracts and vertical integration on the market outcome. In particular, in section 4.1, we start with the benchmark case of no vertical restraints or integration between insurers and hospitals; and in sections 4.2 we consider exclusive contracts, and in section 4.3 we analyze the effect of vertical integration. Section 5 provides the consumer welfare analysis. In the last section, we draw conclusions and outline directions for further research. We relegate more technical details concerning the justification of the bargaining approach used to the appendix.

[1] Source: The coalition aggreement of the Duch government of September 30, 2010 (http://www.rijksoverheid.nl/regering/het-kabinet/regeerakkoord).

[2] In the sequel of the paper we will use the term hospitals, since we primarily focus on this subject, but a more general term, such as health care providers, would be appropriate as well.

2 Literature and contribution

Managed care organizations use various forms of vertical arrangements to reduce the cost of providing health care and improve the quality of care. There is evidence that a vertically integrated network may enhance consumer welfare by providing health care more efficiently. Many studies on the US have shown that insurance provided by managed care organizations cost 10 to 20 percent less than indemnity insurance. Whether these cost reductions are all efficiency savings is however still unclear; some of these cost reductions may also be related to lower quality of care or selection of low risk enrollees (Getzen, 2007). There is also a welfare loss associated with vertically integrated networks. On the demand side, two recent empirical papers of Capps et al. (2003) and Ho (2006) report welfare losses from a restriction in provider choice. On the supply side, welfare losses are associated with strategic behavior of insurers and providers. Gaynor and Vogt (2000) provide an overview.

The anticompetitive effects of horizontal mergers are well-known, but the literature on vertical restraints is less developed. Bijlsma et al. (2008) present an overview and argue that vertical relationships may result in anticompetitive foreclosure of competitors, but only in the presence of market power in the insurance and/or hospital market. Recently, Ho (2009) provides empirical evidence that in the US, market power of hospitals is sometimes responsible for vertical restraints in the market. Some hospitals may demand high prices that not all insurers are willing to pay. In Europe, these issues play a role in countries with market oriented approaches to health care, such as the Netherlands and Switzerland. In the Netherlands, there was a debate on a per se prohibition of vertical mergers between hospitals and health insurers. The final report by an independent commission concluded that a ban on vertical integration was not necessary and that antitrust policy should assess intended vertical mergers case by case (Baarsma et al., 2009). A related subject in health care concerns the welfare effects of vertical arrangements within the health care provision chain, for example, between physicians and hospitals. Also here the empirical literature is mixed. For example, Cuellar and Gertler (2006) find that in many US markets where managed care grew rapidly, hospital and physician integrated to increase their market power and hospital pricing. Ciliberto and Dranove (2006) find however no evidence in California that vertical activity of hospitals and physicians led to significant changes in hospital prices.

There are a few theoretical papers in the health economics literature that study exclusive contracting and vertical integration between insurers and hospitals in a duopoly setting. Important contributions are papers by Gaynor and Ma (1996), Ma (1997) and Gal-Or (1997, 1999). Gaynor and Ma (1996) study exclusive dealing in a model of two homogeneous insurers and two differentiated hospitals. They assume a situation where insurers can grant an exclusive contract to a single hospital to treat all its enrollees. Gaynor and Ma find that neither insurers nor hospitals have individual incentives for this type of exclusive dealing. If such customer foreclosure of the non-contracted hospital would have occurred, however, the reduced choice would be detrimental to consumer surplus.

Gal-Or (1997) studies a bargaining model of two insurers and two hospitals. Both insurers and hospitals are differentiated along Hotelling lines. On the downstream market, two insurers simultaneously choose the hospital networks that they contract, as well as the premiums for the associated insurance policies. For each pair of insurer strategies in the downstream market, the insurers' profits are determined through simultaneous bilateral Nash bargaining between the various hospital-insurer pairs. Even though hospitals and insurers are treated symmetrically in each bargaining sub-game, only insurers are strategic players that can optimize between the various bargaining subgames. Hospitals, in contrast, take the insurers' choice of the network and premium as given. Gal-Or finds that selective contracting can arise in equilibrium. In particular, foreclosure of a hospital is profitable in a small range of parameters where hospital differentiation is much smaller than insurer differentiation. In this exclusionary outcome, consumers are better off because insurers obtain a more favorable price from offering exclusivity to one hospital and partly transfer these gains to consumers. In a subsequent paper, Gal-Or (1999) extends her model to arbitrary numbers of hospitals and insurers located on Salop circles, largely confirming the results of the bilateral duopoly case.

Similar market behavior as generated by exclusive contracts, can also occur through vertical integration. Ma (1997) analyzes vertical integration in a model of two homogeneous insurers and two differentiated hospitals similar to the one of Gaynor and Ma (1996). He demonstrates that a vertical merger can result in the competing insurer being foreclosed from upstream inputs. Such input foreclosure can subsequently lead to downstream monopolization, in which case Ma (1997) shows that the effect on consumer welfare is ambiguous. Apart from this paper by Ma (1997) the theoretical health economics literature, to the best of our knowledge, focuses on upstream exclusion, in which the insurer is prevented from contracting other hospitals, but in which hospitals can still serve all insurers. We are not aware of any theoretical papers discussing exclusion of an insurer or mutually exclusive arrangements such as the Kaiser-Permanente system.

Since our interest lies in a model that will be applicable to situations with fixed total demand for health insurance, such as under mandatory insurance, we will use the model setup by Gal-Or as starting point. This set-up features a fixed population, distributed on Hotelling line. Mandatory insurance, in combination with a large basic benefit package, is applied in many European countries.[3] In the U.S. there is still a lot of uninsurance, but the proposed health reform by the Obama government is intended to provide insurance to those who currently do not have it.[4]

We contribute to the literature by applying a more advanced bargaining concept than in Gal-Or (1997). This bargaining concept was recently developed by de Fontenay and Gans (2005, 2007). It treats both insurers and hospitals as strategic players and is suitable for modelling of non-cooperative bargaining among multiple parties. It does not impose the restriction of linear contracts

[3] A model with these features is applied in many European countries, for example, in Germany, Switzerland and the Netherlands. Also in the US, the Medicare HMO plans for citizens over 65 years of age form an example of such a system. In health economics terms, this type of arrangements represent a model of managed competition with community rated premiums, open enrolment, and a risk-adjustment system.

[4] Recently two papers appeared that study vertical restraints in a voluntary insurance setting. In Bijlsma et al. (2009) exclusive contracting of hospitals by insurers raises the costs of self-insurance by consumers. In Halbersma en Katona (2010) the total demand for treatments in hospitals is not fixed. Higher prices in their model raises the number of non-insured individuals and lowers hospital demand.

between insurers and hospitals and results in a unique Bayesian-Nash equilibrium. However, we deviate slightly from the original concept of de Fontenay and Gans (2005, 2007) in the sense that in our model the downstream firms (insurers) do not compete on quantities à la Cournot, but they compete in prices on a Hotelling line. Apart from the bargaining phase, our model set-up (specification of consumer preferences and hospital costs) otherwise closely follows Gal-Or (1997). Note also that her model does not incorporate moral hazard or selection effects. Moral hazard and selection effects are prominent in any health care market. Relaxing one of the above assumptions would make our model richer, but also more complex. The incentive structure in our model combines the approaches of Gal-Or (1997) and Ma (1997) since we analyze both individual and joint incentives for exclusive behavior.

By using a more comprehensive bargaining concept and incentive structure, the outcome of our model turns out to be more in line with Ma (1997) than with Gal-Or (1997). In our symmetric health care market model with fixed consumer demand, both health insurers and hospitals can increase their industry profits by foreclosing a competitor. They can improve their market power by vertical integration or by restricting rivals' networks through exclusive contracts. In our model foreclosure of an insurer appears to be a more profitable exclusive strategy than foreclosure of a hospital.

3 Model and the bargaining game

The set-up of our model of the health care market is similar to that considered by Gal-Or (1997). For the bargaining game, we follow de Fontenay and Gans (2005, 2007), who designed a bilateral bargaining framework that is specifically suitable for situations with externalities. In our setup there are various types of externalities. There are externalities resulting from horizontal competition between insurers and hospitals, and from network membership. In this section we describe the model and define the bargaining outcome for the case without vertical restraints or vertical integration.

3.1 General set up

In our model, two health insurers and two hospitals serve a certain population. We assume that each health insurer and each hospital negotiate bilaterally about the amount that the insurer will pay to the hospital for providing health care to its insurees. If the negotiation succeeds, the hospital joins the insurer's network. After the networks are established, the insurers compete for individuals by setting a uniform insurance premium for health insurance that fully covers the care from the respective network.[5]

We designate the insurers by I_1 and I_2 and assume them to be located at the end points of a Hotelling line of unit length. The population is distributed uniformly on the line between the two insurers with transportation cost parameter M reflecting the degree of differentiation between insurers. Consumers know their location $y \in [0, 1]$ at the downstream Hotelling line before buying

[5] Hence, we assume that the individuals do not pay any copayments for receiving care. However, including copayments will not change the results.

insurance. The reason why we assume the insurers to be horizontally differentiated *ex ante* is as follows. Consumers often obtain care through the collective contracts of their employers, and employers may prefer one insurer over the other as the result of additional services offered by that insurer, or as a result of switching costs. In addition, individuals' perceived switching costs, such as status quo bias, may lead to horizontal differentiation of insurers. The presence of horizontal differentiation is consistent with the low cross-price elasticities of demand for health insurance reported by many studies (e.g. Douven et al., 2007; Strombom et al., 2002).

After buying insurance, a consumer falls ill with fixed probability θ ($0 < \theta < 1$) and learns his illness. In the upstream market, two hospitals, H_A and H_B, offer medical services. To ease the exposition, we consider a symmetric case in which both hospitals have zero fixed costs and constant marginal costs, and hence the same average treatment cost $c_A = c_B = c$.[6] Although both hospitals are able to treat all types of diseases, they are differentiated in their effectiveness for treating different diseases. We model the differentiation between hospitals by using a Hotelling model. The hospitals are located at the end points of the upstream Hotelling line of unit length. The patients are uniformly distributed between them with the transportation cost parameter t, which reflects the degree of ex-post differentiation between hospitals. The transportation parameter t is larger, when there are large differences between hospitals in their effectiveness for treating different diseases. The location of a patient on the upstream Hotelling line is denoted by $x \in [0, 1]$. While the downstream location y is known ex-ante, already at the moment of buying health insurance, the upstream location x is revealed only later, after the consumer has become ill. Therefore, the product that consumers buy is essentially a bundle of options for access to the various services of the two hospitals that are contracted by the insurer (Capps et al., 2003).

Both transportation parameters, M and t, are considered fixed in the short run, during which contracts are concluded and service delivery takes place. However, they can change in the long run. For example, in the long run, hospitals can extend or narrow their specialization, insurers can adjust their policies, etc.

The two hospitals and the two insurers bargain bilaterally over contracts. In the case of a successful negotiation, the hospital enters insurer I_i's network, $G_i \subseteq \{H_A, H_B\}$. The two networks can overlap with each other. Individuals who buy insurance from insurer I_i have access only to hospitals that are in the network G_i. Both insurers engage in price competition in the downstream market by setting insurance premiums F_i for consumers to access the respective insurance network G_i. If $G_i = \varnothing$, then insurer I_i has no contracts and the consumers buy their health insurance from the other health insurer. We assume that in the latter case, the remaining insurer cannot set monopoly prices, but a regulator will cap the premium to a maximum of $\overline{F}$ that guarantees a certain minimum expected utility level to consumers. We assume the regulation to be light-handed in the sense that the regulated monopoly premium cannot be less than the equilibrium premium in the case of insurance duopoly (which will be derived in section 3.4). The assumption that the monopoly premiums will be regulated at an affordable level is realistic and ensures that our model is still applicable for the analysis of the markets with mandatory insurance, in which

[6] The model can be also generalized for assymmetric costs.

the complete population needs to be covered by health insurance.

3.2 Consumer preferences

We specify consumer preferences by the same consumer indirect utility function as in Gal-Or (1997). The individual ex-ante expected utility depends on the insurance premium, the hospital network to which the individual will have access, and consumer location y at the Hotelling line between the two insurers. In particular, a consumer who buys health insurance from insurer I_i (offering access to network G_i at price F_i) derive an ex-ante expected utility of:

$$U_i = \theta(v - T(G_i)) - (F_i + My_i). \tag{1}$$

The first term represents the ex-ante expected indirect utility from the treatment in one of the hospitals from the insurer's network. Here v is a fixed parameter that reflects the utility from being treated, and $T(G_i)$ reflects the expected transportation cost to the hospital. We discuss the term $T(G_i)$ in more detail below. The last term reflects the insurance premium F_i and the transportation cost My_i between the consumer and insurer I_i, where $y_1 = y$ and $y_2 = 1 - y$.

As explained, the individual falls ill with fixed probability θ, after which he learns his location x on the Hotelling line between the two hospitals. Therefore, the individual's ex-post transportation costs to hospitals H_A and H_B are expressed as tx and $t(1-x)$ respectively. If network G_i includes both hospitals, then the individual will select the one which is closer to his location x (i.e. hospital H_A if $x \in [0, \frac{1}{2}]$ and H_B if $x \in [\frac{1}{2}, 1]$), whereas if network G_i consists of only one hospital, there is no choice and the individual goes to that hospital. Therefore the expected transportation costs $T(G_i)$ in expression (1) are the following:

$$\begin{aligned} T(\{H_A, H_B\}) &= t\left(\int_0^{1/2} x\mathrm{d}x + \int_{1/2}^{1} (1-x)\mathrm{d}x\right) = \frac{t}{4}, \\ T(\{H_A\}) &= T(\{H_B\}, x) = t\int_0^1 x\mathrm{d}x = \frac{t}{2}. \end{aligned}$$

We assume that v is a fixed value and that it is large enough, so that the ex-ante expected utility in equilibrium will be always positive. Our model is now totally determined by the exogenous parameters M, t, θ, c, and $\overline{F}$.

3.3 Total industry profits

In this section we consider all potential alternative configurations of insurer-hospital contractual relationships that may arise in this industry and derive total industry profits for each configuration. Since each insurer's network may include none, one, or both hospitals, there are fifteen different (not empty) configurations possible, shown in Appendix 1. Six configurations correspond to an insurer monopoly in which one insurer is out of business and the other insurer contracts one or two hospitals. Nine networks represent the duopoly case, where both insurers contract either one or two hospitals. Due to symmetry, some of these networks result in the same total profits. Hence, there are only six different configurations to consider; they correspond to different rows in Table 5 from Appendix 1.

We start with the insurer duopoly case, in which insurer I_1 contracts network G_1 and insurer I_2 contracts network G_2. In a Hotelling setup insurer I_i's demand is determined by the marginal consumer who is indifferent between the two insurers. It is easy to show that insurer I_i's demand, q_i, is expressed as:

$$q_i(F_i, F_{-i}|G_i, G_{-i}) = \frac{1}{2} + \frac{F_{-i} - F_i}{2M} + \frac{\theta\,[T(G_{-i}) - T(G_i)]}{2M}.$$

Here the labeling $-i$ denotes the other insurer. The expression is symmetric for both insurers. Insurers can increase demand by lowering their premium F or by increasing transportation cost to their network $T(G)$. We assume efficient bargaining (this assumption will be discussed in section 3.5), which means that the insurers pay hospitals two-part tariffs with the variable part equal to the marginal cost, so that the profit maximizing insurers set premiums to maximize their revenue minus production cost. Since the marginal costs of both hospitals are assumed to be the same[7], this yields the following condition on optimal monopoly premiums F_i^*:

$$F_i^* = \arg\max_{F_i} q_i(F_i, F_{-i}|G_i, G_{-i})(F_i - \theta c).$$

A straightforward calculation yields that in any fully symmetric duopoly configuration, the premiums are $M + \theta c$ and the total industry profits are M. The intuition behind this result is that in a symmetric case the indifferent consumer on the insurance market is located in the middle of the Hotelling line and total industry profits are equal to the transportation cost M, as in the standard Hotelling model (Tirole, 1998). For an asymmetric duopoly networks, in which one insurer has a contract with one hospital and the other one with two hospitals, our model generates the respective insurers' premiums $\theta c + M - \frac{\theta t}{12}$ and $\theta c + M + \frac{\theta t}{12}$. The total profits equal $M + \frac{(\theta t/12)^2}{M}$. Since the insurer that contracts both hospitals becomes more attractive for consumers the indifferent consumer on the insurance market is now located closer to the insurer with a smaller network. As a result the insurer that contracts both hospitals is able to charge a higher premium and this results in higher total industry profits. The additional profits relate positively to the degree of hospital differentiation, t (as compared to the degree of insurer differentiation M), and to the probability of contracting illness, θ.

Next, we consider insurer monopoly configurations. With only one insurer being present in the market, say insurer I_i, the demand function and the optimal

[7] The model can be generalized to the case of asymmetric costs. For a given network state, hospital H_j's demand q_{ij} from the insured by insurer I_i equals $q_{ij} = \theta q_i(F_i, F_{-i}|G_i, G_{-i}) s_j(G_i)$, where $s_j(G_i)$ is the expected share of consumers at hospital H_j from insurer I_i. and the condition on optimal insurance premiums F_i^* becomes $F_i^* = \arg\max_{F_i} q_i(F_i, F_{-i}|G_i, G_{-i})(F_i - \theta \sum_{j \epsilon G_i} c_j s_j(G_i))$.

premium are the following:

$$q_i(F_i|G_i) = \frac{\theta(\upsilon - T(G_i)) - F_i}{M},$$
$$F_i^* = \arg\max_{F_i} q_i(F_i|G_i)(F_i - \theta c).$$

As explained in section 2.1, to avoid the possibility that the health insurer monopoly rations demand, we assume that in this case, a regulator caps the premium level. Therefore, the regulated monopoly premiums for one- and two-hospital networks are $\overline{F}$, and the corresponding profits are $\Pi = \overline{F} - \theta c$. The regulation is light-handed in the sense that the regulated premium cannot be less than the minimum premium earned in a duopoly setting, i.e., $\Pi \geq M$. The latter assumption agrees with the general insight from industrial organization models that prices are lower in less concentrated markets. Note that for the sake of simplicity we assume that the total industry profits in the insurer monopoly case do not depend on the number of hospitals in the insurer's network. This assumption matches with the symmetric duopoly cases, in which less hospital choice does not influence total industry profits either. However, our results will still hold if we assume that the regulatory cap depends on the number of hospitals contracted by the insurer.

3.4 Timing

When modelling the bargaining process and the outcome, we use the insight of de Fontenay and Gans (2005, 2007). The timeline of the game consists of three stages.

- **Stage 0:** Ownership of assets and the set of all potential contractual relations among four players are determined. We consider only vertical contractual relations, in the sense that insurers buy services produced by hospitals (and not services produced by the other insurers, also hospitals do not buy services of other hospitals). The distribution of ownership rights is assumed to be exogenous. In the remainder of this section and in sections 4.1 and 4.2, we assume that health insurers and hospitals are separately owned by their respective asset managers. In section 4.3 that focuses on vertical integration between an insurer and a hospital, the ownership rights will be allocated to one of the two parties.
- **Stage 1:** Bargaining takes place; the equilibrium network and payoff allocation are established. We discuss this stage in more detail in the next subsection.
- **Stage 2:** Insurers set premiums and offer insurance to consumers. Consumers choose an insurer. After this they may get ill with probability θ and then choose the closest hospital from their insurer's hospital network, and receive treatment. The insurers transfer the respective payments to the hospitals.

3.5 Bargaining and payoff allocation

Several recent studies have applied cooperative game theory concepts to determine the payoff allocation among players in the context of bilateral bargaining.

Most of these studies adopt axiomatic approach to derive the equilibrium payoffs in the form of Shapley value (Stole and Zwiebel, 1996, and Inderst and Wey, 2003). Gans and Fontenay (2005, 2007) have shown that Shapley-value outcomes can also be derived based on the explicit extensive form game among players. Furthermore, they extended the model to the case with externalities in the downstream market and proved that in this case, the payoff allocation takes the form of the generalized Myerson-Shapley value. The generalized Myerson-Shapley value extends the concept of Shapley value to games in which the value of a coalition depends on action of other players. In other words, while the Shapley value reflects the average marginal contribution of the player to various coalitions which do not impose externalities on each other, the generalized Myerson-Shapley value extends this concept to games in which the coalition value may depend on the partition of players into coalitions. Similarly to the Shapley value, the generalized Myerson-Shapley value can be justified on axiomatic grounds, as well as can be obtained from an extensive form game. Not to complicate the exposition with the detailed description of the extensive form bargaining game, we choose here for axiomatic approach and relegate the extensive form game and all formal assumptions supporting it to Appendix 2.

Following axiomatic approach, we impose the requirement that the individual payoffs resulting from the bargaining satisfy the axioms of efficiency and fairness (which can be derived from the game described in Appendix 2). Here *efficiency* means that the intermediate tariffs are set efficiently to maximize the joint surplus of the two players. To meet this requirement, we assume two-part tariffs in which the variable part is set equal to marginal cost of production c.[8] In such a case the insurers will internalize the production cost when choosing their optimal policies. Therefore, the total industry profits on each configuration are equal to those computed in the previous section. *Fairness* means that the net surplus derived from each bilateral relationship is split equally between the two players. Since the relationship is only feasible when it is profitable, the contract can only be concluded if it generates a non-negative net surplus. We analyze this *feasibility* condition in more detail in the next section.

The application of these axioms leads to the system of bargaining equations, which we solve iteratively to obtain the individual payoffs in each configuration. The resulting payoff allocation is equivalent to the generalized Myerson-Shapley value (since this value represents the unique allocation satisfying our axioms, according to Myerson (1977a,b)). We start with the simplest configurations (no contracts and every players yields a zero payoff), after which we consider configurations with only one contract, using the previous configuration as the outside option. We continue in this way, until we reach the most complete configuration of four contracts. Table 1 summarizes the results of this procedure in the case of symmetric production costs and consumer preferences. As explained above, the assumption of symmetry implies that we need to consider only six different configurations. The first column of the table shows all the different

[8] This is the same as to assume a two-part tariff with a regulated per-unit price set at the level of marginal costs. Without this restriction, the bilateral insurer-hospital profit maximization is ill-defined for the case of symmetric insurer duopoly with two hospitals, as the total demand for each hospital is fixed in this case and cannot be affected by the insurer payment to the hospital. A regulatory constraint that sets the variable part of the two-part tariff equal to marginal costs eliminates double marginalization and generates bilateral efficiency. This simplification is reasonable as long as we focus on the effect of vertical relations on profit division between firms rather than on the actual size of the industry profits.

configurations possible. The second column shows the respective total industry profits. These profits were computed in section 2.4. They depend on the industry configuration, and can take three values: Π, M, and $M + \Delta M$, where $\Delta M = \frac{(\theta t/12)^2}{M}$. The third column presents the resulting individual payoffs, Φ_i, computed by solving the bargaining equations iteratively.

Several general results follow from the outcomes in Table 1:

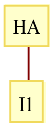
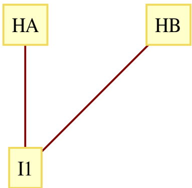
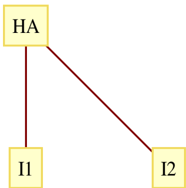
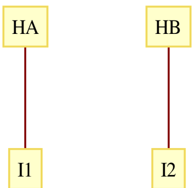
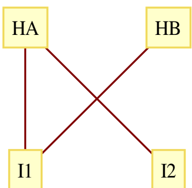
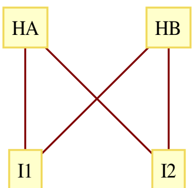
- A hospital or an insurer with more links in a given network yield higher profits, since establishing more links improves the bargaining position of the firm by improving its outside option.

- Only in an insurer duopoly with an asymmetric network, the hospital differentiation parameter t enters the profit expression. The reason is that in symmetric networks hospital choice by a consumer is independent of its insurer choice.

- In an insurer duopoly with two hospitals in both insurers' networks, an increase in Π increases hospital profits but decreases insurer profits. The reason is that the outside option of eliminating one insurer becomes more attractive for hospitals.

- In an insurer duopoly with an asymmetric hospital networks, the additional profit ΔM arises because of the increased differentiation of insurer policies, because the indifferent consumer on the insurance market is not located in the middle of the Hotelling line. The bargaining game allocates the additional profits $\Delta M = \frac{(\theta t/12)^2}{M}$ equally among the four players. Important is the notion that total and individual profits increase if consumers perceive more differences between hospitals and less differences between insurers.

Table 1. Network configuration, total industry profits, and individual payoffs in the non-integrated case

Network configuration	Total profit $\widehat{v}$	Individual payoffs
	$\Pi = \overline{F} - \theta c$	$\Phi_A = \frac{1}{2}\Pi$ $\Phi_1 = \frac{1}{2}\Pi$
	$\Pi = \overline{F} - \theta c$	$\Phi_A = \Phi_B = \frac{1}{6}\Pi$ $\Phi_1 = \frac{2}{3}\Pi$
	M	$\Phi_A = \frac{1}{3}(M + \Pi)$ $\Phi_1 = \Phi_2 = \frac{1}{6}(2M - \Pi)$
	M	$\Phi_A = \Phi_B = \frac{1}{4}M$ $\Phi_1 = \Phi_2 = \frac{1}{4}M$
	$M + \Delta M =$ $M + \frac{(\theta t/12)^2}{M}$	$\Phi_A = \frac{1}{12}(4M + 3\Delta M)$ $\Phi_B = \frac{1}{12}(3\Delta M + 2\Pi)$ $\Phi_1 = \frac{1}{12}(4M + 3\Delta M)$ $\Phi_2 = \frac{1}{12}(4M + 3\Delta M - 2\Pi)$
	M	$\Phi_A = \Phi_B = \frac{1}{12}(M + 2\overline{\Pi})$ $\Phi_1 = \Phi_2 = \frac{1}{12}(5M - 2\overline{\Pi})$

4 Incentive for exclusion

In this section, we formulate the conditions under which the complete industry configuration can arise, in which both hospitals deliver health care to clients of both insurers; and the conditions under which less than four contracts are concluded in equilibrium. In the latter case some firm may exit from the market. The analysis is done for three different allocations of ownership rights, which are specified in stage 0 of the game. We start with the case, in which each firm is owned by its asset manager and there are no vertical restraints in contracts (section 4.1). In section 4.2, we assume that one insurer-hospital pair engages in an exclusive contract. Finally, in section 4.3, we consider the case of vertical integration between an insurer and a hospital. The vertical arrangements are modelled according to the approach of de Fontenay and Gans (2005) and de Fontenay et al. (2009), which allows us to distinguish different types of exclusive contracts and vertical integration. We will argue that mainly the exclusion of an insurer from contracting some hospital(s) is a concern in this market and that certain types of exclusive contracts and vertical integration make this exclusion more likely.

4.1 Benchmark: no integration and no vertical restraints

Suppose that each firm is owned by its asset manager and there are no vertical restraints. The payoff allocations for this case are shown in Table 1. The complete industry configuration (the last row in Table 1) is feasible, if and only if each firm benefits from signing each contract under each possible subconfiguration. Denote the complete configuration by G, and any part of this configuration by $K \subseteq G$. Then the feasibility condition means that for all K, any two firms i and j that have a relationship in K should benefit from this relationship:

$$\Phi_i(K) \geq \Phi_i(K \backslash (ij)) \text{ and } \Phi_j(K) \geq \Phi_j(K \backslash (ij)), \text{ where } K \subseteq G,\ (ij) \in K. \quad (2)$$

For example, let us check these conditions for $K = G$. From symmetry, it is sufficient to check the condition for one link, say link between H_B and I_2. Moreover, since the two firms share the net surplus equally, it is sufficient to check for one firm only, say for hospital H_B. Link $(H_B I_2)$ is only profitable for hospital H_B if $\Phi_B(G) \geq \Phi_B(G \backslash (H_B I_2))$. Based on Table 1, this is equivalent to $\frac{1}{12}(M + 2\Pi) \geq \frac{1}{12}(3\Delta M + 2\Pi)$, which reduces to $M \geq 3\Delta M$. Applying this procedure for all subgraphs and links yields the complete set of the feasibility conditions for graph G.

Proposition 1 *As long as conditions (3)-(4) hold, the bargaining game results is a unique equilibrium in which both insurers contract with both hospitals.*

$$2M \geq \Pi, \quad (3)$$

$$\frac{\theta t}{M} \leq 4\sqrt{3}, \quad (4)$$

A violation of the first condition leads to elimination of one insurer in equilibrium. If the first condition holds, while the second condition is violated, the number of contractual relationships decreases by one.

The proof of Proposition 1 follows directly after eliminating the overlapping feasibility conditions and filling in the value $\Delta M = 3\frac{(\theta t/12)^2}{M}$. If one of these conditions is not satisfied then at least one player has no incentive to enter a contract. This may result in less than four contracts and some players may be even excluded from the market. This may occur for two reasons.

First, if feasibility condition (3) is violated, it is individually rational for hospitals to contract with a single insurer and to eliminate the other insurer from the market. This is because in such a case hospital's loss from weakening its outside options is compensated through the gains from the increased total industry profit when the insurance market becomes monopoly instead of duopoly. The exclusion occurs when monopoly profits $\Pi = \overline{F} - \theta c$ are at least twice as high as duopoly profits M.

Second, if only condition (4) is violated, then after three contractual relations have been established, it is not profitable anymore for the remaining two players to establish the last one. This results in a three-link configuration, in which one insurer contracts both hospitals and the other insurer contracts one hospital. On the insurer market, the indifferent consumer is no longer located in the middle of the Hotelling line but closer to the insurer which contracts only one hospital. The insurer with two hospitals exploits the fact that the consumers value choice, and raises the insurance premium. This generates extra industry profits that are allocated among all the players in such a way that the profits for the hospital and insurer with one contract are higher than they would be with an additional contract. Thus, the fourth relationship does not arise. Note that each of the four possible three-link networks is equally likely to occur due to our symmetry assumption. All the four firms are still active in the market in this case.

The outcome that one hospital is fully excluded never occurs in equilibrium in our model. Each insurer has as incentive to deviate from such an outcome, because contracting more hospitals increases its profit by improving its bargaining position vis-a-vis each hospital. This is an important insight that contrasts with the result of Gal-Or (1997). She considers a similar model, but a different (inefficient) bargaining procedure featuring linear contracts between hospitals and insurers. In her model, if $\frac{\theta t}{M}$ is sufficiently small, both insurers have an incentive to contract one hospital and exclude the other one from the market, because "if a payer chooses to exclude one of the hospitals from its approved list, its bargaining position vis-a-vis the remaining hospital is improved, since this hospital may be willing to accept lower reimbursement rates in return for a larger volume of patients that such an exclusion guarantees" (Gal-Or, 1997, p.6.). However, since in our case the bargaining is efficient, the bargaining position of an insurer always deteriorates when a hospital is excluded from its network.

4.2 Exclusive contract

Any restriction or clause that is imposed by one member of the vertical relationship on the other member is called a vertical restraint. In this section we consider the effect of exclusive clauses in contracts between insurers and hospitals. These clauses restrict one or both parties from having a relationship with some of the other market participants, which affects the bargaining outcome. Similarly to de Fontenay et al. (2009), we model this restriction as exogenously given in stage 0, but we assume that the exclusive clause is not renegotiable during the bargaining game in stage 1.[9] We distinguish three types of exclusive contracts between insurer I_1 and hospital H_A, referred to as E1, E2 and E3 respectively. First, an exclusive clause between insurer I_1 and hospital H_A can restrict the hospital H_A in its ability to sell its output to insurer I_2. Second, it can restrict insurer I_1 in its ability to buy from hospital H_B. Third, it can be mutual: both parties signing the contract agree to refrain from having contracts with other parties. Table 2 shows how the network configuration changes in the presence of such clauses between H_A and I_1. Since in our context, exclusive clauses simply restrict the network configuration, the total industry profits $\widehat{v}$ and the payoff allocations can be easily derived from Table 1. In particular, the total industry profits under E1, E2 and E3 are the same as in the respective restricted networks shown in Table 1:

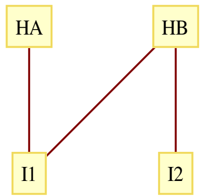
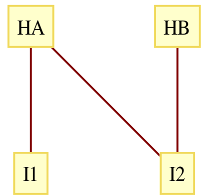
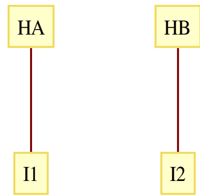
$$\begin{aligned} \widehat{v}_{E1} &= \widehat{v}_{E2} = M + \Delta M, \\ \widehat{v}_{E3} &= M. \end{aligned}$$

The three restricted graphs are shown in Table 3. These graphs are feasible as long as condition (3) of section 4.1 holds. The resulting payoff allocations are shown in Table 2, where we report the joint payoff of H_A and I_1 and individual payoffs of the other players. The insurer-hospital pair $H_A I_1$ has incentive to engage into an exclusive relationship if the joint profits of the insurer-hospital pair with the exclusivity clause are larger than without the exclusive clause. Although in such a case the exclusive contract may still decrease the individual bargaining outcome for one of these market players, the gains of the other player are sufficient to compensate for this loss.[10]

[9] De Fontenay et al. (2009) models exclusive contracts as allocation of residual rights. They assume that exclusivity clauses can be renegotiated in the bargaining stage, therefore, an exclusivity clause has merely impact on the division of surplus among players. It shifts the surplus towards the player who is the residual claimant of exclusivity rights. Differently from De Fontenay et al. (2009), our analysis focuses on the circumstances under which an exclusive clause is not renegotiable, resulting in an incomplete network configuration (the so-called 'naked exclusion'). We also considered the possibility of renegotiation of the exclusive clause. However, for all three excluse clauses the full graph turned out to be infeasible anyway, at least for $\Delta M > 0$.

[10] It is known that characteristic values such as the generalized Myerson-Shapley value are not fully stable under joint incentives (pairwise, or more generally, coalition-wise) in the presence of competitive externalities. The core is the cooperative equilibrium concept that is stable under all individual as well as all group deviations. However, the core is in general not unique, and we are also not aware of a framework that, even in the presence of competitive externalities, generates a unique payoff vector within the core.

Table 2. Payoff allocation with exclusive clauses between H_A and I_1

E1: Restriction on H_A	E2: Restriction on I_1	E3: Mutual
		
$\Phi_A + \Phi_1 = \frac{1}{12}(4M + 6\Delta M + 2\Pi)$ $\Phi_B = \frac{1}{12}(4M + 3\Delta M)$ $\Phi_2 = \frac{1}{12}(4M + 3\Delta M - 2\Pi)$	$\Phi_A + \Phi_1 = \frac{1}{12}(8M + 6\Delta M - 2\Pi)$ $\Phi_B = \frac{1}{12}(3\Delta M + 2\Pi)$ $\Phi_2 = \frac{1}{12}(4M + 3\Delta M)$	$\Phi_A + \Phi_1 = \frac{1}{2}M$ $\Phi_B = \frac{1}{4}M$ $\Phi_2 = \frac{1}{4}M$

Therefore, in the further analysis we compare the joint payoff of H_A and I_1 under the exclusivity clause to their joint payoff without this clause, to see if the exclusivity clause increases the joint payoff. Furthermore, we check whether the graph is robust with respect to possible counteractions of the other two players.

- E1: $\Phi_{1,E1} + \Phi_{A,E1} = \frac{1}{12}(4M + 6\Delta M + 2\Pi) \geq \frac{M+\Delta M}{2} \geq \frac{M}{2}$. This means that as long as $\Delta M > 0$ (and $\Pi \geq M$) there is an incentive for exclusive clause E1. Note that the insurer I_2 and hospital H_B are not able to undertake a counter-action for example by eliminating the link $I_1 H_B$. Under E1, hospital H_B's profit becomes $\Phi_{B,E1} = \frac{1}{12}(4M + 3\Delta M) > \frac{M}{4}$. So H_B is better off without the link. Insurer I_2 could tempt hospital H_B to eliminate the link $I_1 H_B$ by paying him an amount of $\tau \geq \frac{1}{12}(4M+3\Delta M) - \frac{M}{4} = \frac{1}{12}(M + 3\Delta M)$. However, this is infeasible for insurer I_2, because this would result in a negative payoff for himself: $\Phi_2 - \tau = \frac{1}{6}(M - \Pi) \leq 0$.

- E2: A comparison of the joint profits $\Phi_1 + \Phi_A$ with and without E2 shows that E2 is only profitable for the pair if $M + 3\Delta M > \Pi$. Therefore this contract is profitable under a smaller range of parameters than contract E1. Furthermore, $\Phi_{1,E2} + \Phi_{A,E2} \leq \frac{M+\Delta M}{2}$. Therefore, this contract is also less profitable for the pair than contract E1.

- E3: $\Phi_{1,E3} + \Phi_{A,E3} = \frac{M}{2}$. Hence, hospital H_A and insurer I_1 do not gain from exclusivity clause E3.

  We conclude that there is always incentive for an exclusive contract E1. This observation yields the following proposition.

Proposition 2 *As long as hospital products are not perfect substitutes and regulated monopoly profits are at least as large as duopoly profits, the most profitable strategy for an insurer-hospital pair is to adopt an exclusive clause that binds the hospital not to sell its output to the other insurer. Moreover, the other parties will not respond to it by signing their own exclusive contract.*

Exclusive clause E1 increases the total industry profit as well as the joint profit of the insurer-hospital pair, thus enabling both players to gain more than under the complete graph.[11] However, the other insurer is worse off for two reasons. First, the product that this insurer sells becomes less valuable to consumers; and second, the bargaining position of this insurer worsens because of the reduced outside option. The joint profit from the exclusive contract increases, when $\Delta M = \frac{(\theta t/12)^2}{M}$ increases. Thus, both an increase of the hospital differentiation parameter t and a decrease in the insurer differentiation parameter M increase the joint profit made by exclusive clause E1.

4.3 Vertical integration

In this section, we follow the approach proposed by de Fontenay and Gans (2005) for the analysis of payoff allocation in the case of vertical integration. They consider two types of integration, forward (FI) and backward integration (BI). The decision of the two parties to integrate is modeled as exogenous. This decision is determined in stage 0 and it affects both the allocation of the asset ownership and the set of potential contractual links. After the set of potential contractual links has been determined in stage 0, the parties bargain over the payoff allocation in stage 1.

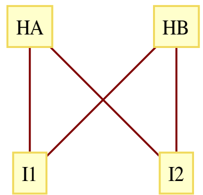
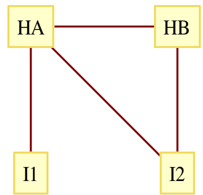
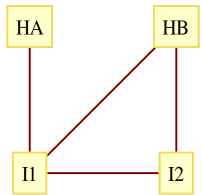
In the case of forward integration, the hospital takes over the insurer and becomes the owner of the integrated firm, while the insurer firm's manager becomes an employee. We focus on integration between hospital H_A and insurer I_1. Table 3 (column FI) shows the new configuration of contractual relationships after hospital H_A takes over insurer I_1. When H_A acquires the ownership rights, it takes over the premium-setting decision of its insurer I_1 and represents this insurer in negotiations with the other hospital. Insurer I_1 receives a transfer payment from hospital H_A for managing the insurance firm, while all the profits accrue to H_A. This changes the graph, because insurer I_1 can no longer negotiate with hospital H_B directly, but it does it via hospital H_A. Therefore, they now need a consent of H_A to include hospital H_B in the network of insurer I_1. When hospital H_A bargains with the insurer I_1 or hospital H_B, then in the event of a breakdown in negotiation no arrangements will occur between insurer I_1 and hospital H_B. The essential difference with the benchmark case (section 4.1) is that under forward integration a breakdown between hospital H_A and insurer I_1 has a deeper impact, because after such a breakdown insurer I_1 would exit the market, while without integration insurer I_1 would still be able to send its enrollees to hospital H_B.

When backward integration takes place between insurer I_1 and hospital H_A, the logic is similar, but the insurer gets all the ownership rights. The graph changes as shown in Table 3 (column BI) and all the profit of the integrated firm accrue to the insurer.

As long as the complete sets of contractual relationships shown in columns FI and BI are feasible, both insurers are able and willing to buy from both hospitals. Solving bargaining equations for this case results in payoff allocation shown in Table 3 below the graphs.

[11] See Bernheim and Whinston (1998) on the relation between the joint and individual profits and incentives for exclusive conracts.

Table 3. Payoffs with vertical integration

<table>
<tr><th>NI: No integration</th><th>FI: Forward integration</th><th>BI: Backward integration</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td>$\Phi_A = \frac{1}{12}(M + 2\Pi)$
$\Phi_B = \frac{1}{12}(M + 2\Pi)$
$\Phi_1 = \frac{1}{12}(5M - 2\Pi)$
$\Phi_2 = \frac{1}{12}(5M - 2\Pi)$</td><td>$\Phi_A = \frac{1}{12}(4M)$
$\Phi_B = \frac{1}{12}(2\Pi)$
$\Phi_1 = \frac{1}{12}(4M - 2\Pi)$
$\Phi_2 = \frac{1}{12}(4M)$</td><td>$\Phi_A = \frac{1}{12}(M + \Pi)$
$\Phi_B = \frac{1}{12}(M + 3\Pi)$
$\Phi_1 = \frac{1}{12}(5M - \Pi)$
$\Phi_2 = \frac{1}{12}(5M - 3\Pi)$</td></tr>
</table>

Computing the feasibility conditions shows that the complete graph for FI is only feasible if $2M \geq \Pi$ and $0 \geq \Delta M$. The latter constraint implies that the complete graph is only feasible if there is no differentiation between hospitals ($t = 0$). Our interest, however, lies in the case of differentiated hospitals ($t > 0$). In that case, the full graph collapses. The most restrictive feasibility condition arises for the link $H_A H_B$, which implies that the owner of the vertically integrated firm, hospital H_A, breaks the negotiation with hospital H_B to ensure that the enrollees of his insurer I_1 will only visit H_A. If the vertically integrated owner H_A decides to follow this strategy and does not negotiate with H_B, the graph FI reduces to E2 (see Tables 2-3). Since E2 can increase the joint payoff of H_A and I_1 only if $M + 3\Delta M > \Pi$. Therefore, FI can only arise if this condition holds. FI is accompanied by foreclosure of H_B.

A similar result is found for the case of BI. If we compute the feasibility conditions, we obtain conflicting inequalities, implying that the full graph for BI is never feasible for $t > 0$ and will collapse into a graph with fewer links. Various links may be broken depending on the exact parameter configuration. One can show that, in particular, link $I_1 I_2$ is not profitable to the owner of the vertically integrated firm.[12] Without this link its profit is higher than with this link: $\frac{1}{12}(4M + 3\Delta M) > \frac{1}{12}(5M - \Pi)$. Breaking the link $I_1 I_2$ will restrict the enrollees of insurer I_2 to obtain treatments in hospital H_A. If the owner decides to restrict the graph and does not negotiate with I_2, the payoff allocation becomes the same as for exclusive contract E1. This strategy will always increase the joint payoff of the pair. Similarly to the exclusivity case E1 in section 4.2, insurer I_2 will not be able to undertake a counteraction to restore its weakened position in the insurance market. Note also that in this case BI is more profitable than FI.

We conclude that vertical integration creates circumstances under which at least one pair of firms does not reach a contractual agreement, leading to an incomplete graph. In the case of FI, the hospital, as the owner of the vertically

[12] In particular, suppose that $2M \geq \Pi$, so that it is feasible to have two insurers. Then link $I_1 I_2$ becomes unfeasible if eiher $M \geq 3\Delta M$ or $M + 3\Delta M \geq \Pi$. However, there are also other links that are infeasible on the BI graph. Detailed computations of all payoffs and all the feasibility conditions on all subgraphs of BI and FI (not included here) are available upon request.

integrated firm, will ensure that the enrollees of his insurer will not visit the competing hospital. While in the case of BI the insurer, as the owner of the vertically integrated firm, will prevent the enrollees of the competing insurer to obtain access to its own hospital.

Proposition 3 *As long as hospital products are not perfect substitutes and regulated monopoly profits are at least as large as duopoly profits, vertical integration will always result in an incomplete industry configuration. It is always profitable for the owner of the vertically integrated firm to break the negotiation with its competitor. Therefore, forward vertical integration will be accompanied by preventing access of the own enrollees to the competing hospital, while backward vertical integration will be accompanied by preventing access of the enrollees of the competing insurer to visit the hospital of the vertically integrated pair.*

In section 4.2 and in this section, we considered various types of vertical arrangements. We have shown that exclusive contracts and vertical integration can be used by a hospital-insurer pair to increase their profits by eliminating profitable contracting options for the competing insurer or hospital. In the next section, we show that these restraints will always reduce consumer welfare they are not accompanied by gains in production efficiency.

5 Consumer welfare

In this section we study how changes in the industry configuration affect consumer welfare. In our model consumer welfare depends on the number of hospitals in each insurer's network and the premiums paid to the insurers. Therefore, we need to consider only three different cases: all consumers travel to one hospital, one part of the consumers travels to both hospitals while the other part visits only one hospital, and all consumers can travel to both hospitals. Table 4 provides information about premiums and consumer surplus for these three configurations. Note, that the total industry profits depend only on the final industry configuration. For example, it is not important whether a particular network state arises as a result of an exclusive clause or vertical integration.

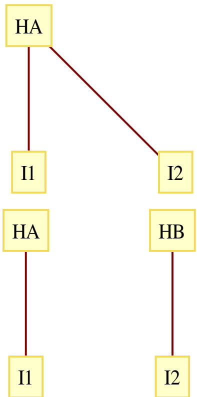
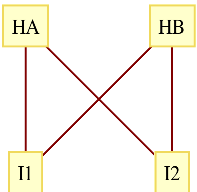
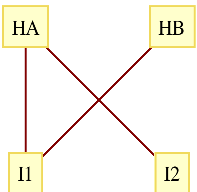
In the monopoly case, we have assumed that the regulated premium cap stays the same irrespectively on the number of hospitals in the insurer's network. Therefore, when the hospitals are imperfect substitutes, consumer surplus increases with the inclusion of more hospitals in the network.

In the case of insurer duopoly, consumer welfare is the highest when both insurers contract both hospitals, since consumers value both lower premiums and the possibility of hospital choice.[13]. Therefore, we conclude with the following proposition.

Proposition 4 *As long as regulated monopoly profits are at least as large as duopoly profits, hospital products are not perfect substitutes, and hospitals do not differ in cost efficiency, exclusive clauses binding a hospital from contracting another insurer and vertical integration between an insurer and a hospital reduce consumer welfare.*

[13] More formally, it follows from Table 4 that the consumer surplus for the complete configuration (four contractual relations) exceeds the consumer surplus for an assymmetric network (three links) if and only if $\theta t/M < 36$. However, this must hold, because the state with three links becomes infeasible only if $\theta t/M < 12$.

Table 4. Welfare analysis

	Insurer premiums	Consumer surplus
	$\theta c + M, \theta c + M$	$\frac{1}{2}(\theta v - \theta c - M - \frac{\theta t}{2})$
	$\theta c + M, \theta c + M$	$\frac{1}{2}(\theta v - \theta c - M - \frac{\theta t}{4})$
	$\theta c + M + \frac{\theta t}{12}, \theta c + M - \frac{\theta t}{12}$	$\frac{1}{2}(\theta v - \theta c - M - \frac{3\theta t}{8} + \frac{1}{2M}\left(\frac{\theta t}{12}\right)^2)$

6 Conclusions

We have shown that insurers and hospitals may find it profitable to adopt vertical restraints or integrate vertically to increase their profits but that these strategies lower consumer welfare. Even if consumer preferences over hospitals and insurers are symmetric and both hospitals are equally efficient, we find that under some circumstances, insurers and hospitals may choose to contract selectively in order to secure more favorable contractual terms. The first exclusive strategy that follows from our theoretical duopoly model is that hospitals may choose to exclude some insurer from the market. This strategy will eliminate competition on the insurer market and raise total industry profits. Removing one insurer from the market, however, implies a loss of hospitals' bargaining power. Therefore, total industry profits must be substantially higher in the new situation (in our duopoly model, at least twice as high) to compensate the hospitals for this loss. The second strategy that can be adopted by market players is an increase of differentiation on the insurance market by differentiating hospital networks of the insurers. We find that if hospitals' differentiation is much larger than insurers' differentiation (see the conditions in section 4.1), one hospital-insurer pair will not enter a contract voluntarily. The idea behind this mechanism is that the insurer that contracts two hospitals benefits the most from its premium increase, and he is willing to share these gains with the other players via bargaining to compensate the hospital-insurer pair that does not enter a contract.

We show that exclusive clauses and vertical integration improve the opportunities for using this mechanism. We find that the most profitable exclusive contract of a hospital-insurer pair is a contract that prevents the access of the competing insurer to their hospital. This raises profits for the hospital-insurer pair because the competing insurer becomes less attractive for consumers. We obtain a similar exclusive strategy if the hospital-insurer pair vertically integrates. Another exclusive strategy of a vertically integrated hospital-insurer pair is to prevent the access of their own enrollees to the competing hospital. This strategy introduces asymmetry on the insurance market which raises total industry profits. Furthermore, this strategy reduces the outside option of the competing hospital, thereby weakening its bargaining power.

Our results provide guidance for the policy debate in countries that are moving towards a more market-oriented health care market. As the role of competition increases, these markets tend to reveal more information about the performance of individual hospitals, especially about the quality differences between hospitals. If consumers start to perceive more differentiation among hospitals, this could trigger insurers and providers to adopt exclusive strategies with possible anticompetitive effects. However, provider and insurer competition also has important efficiency effects, which could outweigh the possible anticompetitive effects of exclusive vertical restraints.

The introduction of more competition in health care also stimulates providers and insurers to search for new organizational forms. For example, in the US this has led to the appearance of a variety of managed care organizations, featuring selective networks, that are based on vertical arrangements such as integration or exclusive restraints between insurers and providers. Our model suggests that these exclusionary networks could reduce consumer welfare, unless these disadvantages are compensated by the efficiencies of integrated health care delivery.

We stress some limitations of our analysis and outline directions for further research. The analysis in this paper covers a symmetric bilateral-duopoly model with fixed consumer demand for insurance and health care. In other words, there is market power both upstream and downstream. As our analysis shows, this means that any exclusionary equilibrium is (likely to be) anticompetitive.

Our model can be extended to incorporate a consumer demand that is not fixed (see e.g. Halbersma en Katona (2010)) and asymmetries across both insurers and hospitals. Cost differences across hospitals and potential efficiency gains may be the reason for exclusive relations, providing a positive argument in favour of these relations (see e.g. Glied (2000)). Furthermore, we do not consider capacity constraints and vertical quality differences in the hospital sector that can also play a role in the bargaining outcome. The model can be also extended to incorporate these features. The extension of our framework towards more flexible empirically viable frameworks recently emerging in the empirical literature (e.g. Capps et al. 2003 and Ho, 2009) would be another possible direction for further research.

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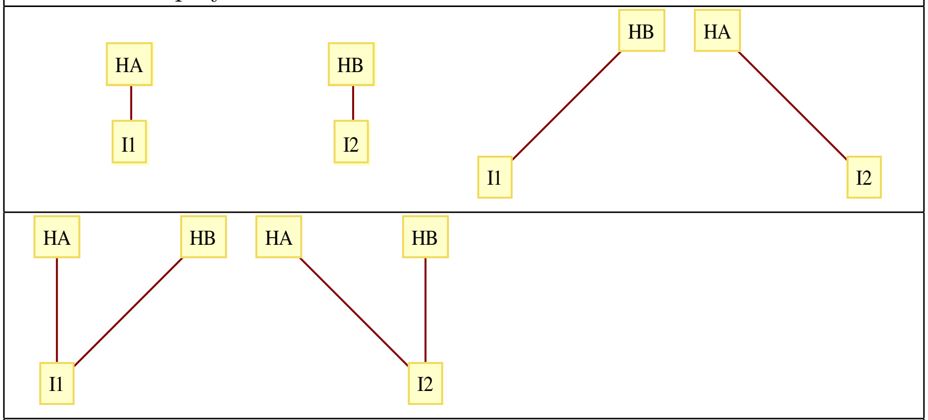
Appendix 1

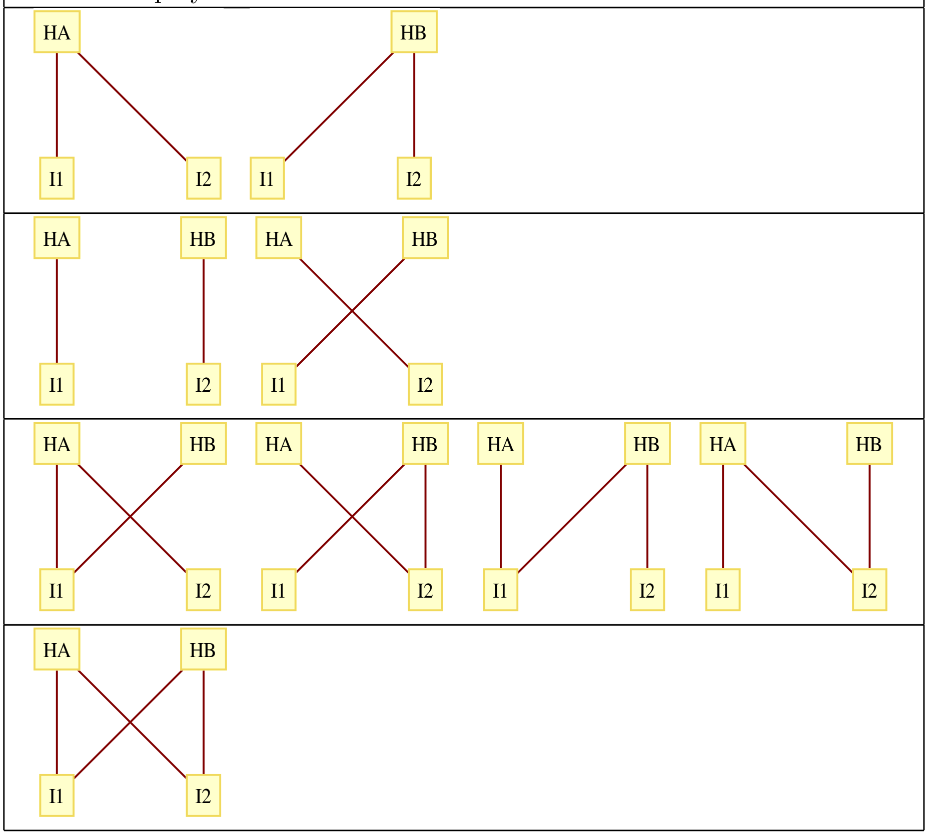
Table 5 shows fifteen possible network configurations. We distinguish six monopoly and nine duopoly configurations. In the symmetric case each row in Table 5 features the same type of network. These six different types of network configurations are also listed in Table 1.

Table 5. All network configurations

Insurer monopoly:



Insurer duopoly:



Appendix 2

Here we provide technical details justifying our requirements on the payoff allocation. The bargaining framework is proposed by de Fontenay and Gans (2007), who consider the following extended form game. Suppose there are N agents with a set of links L among them (called 'network'), in which each linked pair ij is associated with a joint action x_{ij} ($x_{ij} = 0$, if the pair is not linked; the notation $\mathbf{x}$ will be used for the vector that contains all joint actions x_{ij}). Each agent has a payoff-function $u_i(\mathbf{x}) - \sum_{j \in N} t_{ij}$, where the functions $u_i(\mathbf{x})$ are strictly concave utility functions of agents and the transfer payments t_{ij} are equal to zero if the pair ij is not linked.

The agents play a bilateral sequential bargaining game. Only one pair is involved in bargaining at each time. The extensive form of the game is as follows. First, the order of negotiating pairs is fixed and becomes a common knowledge. This order is only needed for technical convenience and does not matter for the equilibrium outcome. Second, each pair plays a Binmore-Rubinstein-Wolinsky (1986) bilateral game, in which one firm makes an offer and the other firm either accepts or rejects. When the offer is rejected, the bargaining continues with probability σ (and now the other firm makes an offer). Otherwise, with probability $(1-\sigma)$, all negotiations end, and the bargaining process recommences for a network that excludes the link between the two parties who failed to reach an agreement. The state of the network is common knowledge throughout the game. However, each player has incomplete information about the actions of the other players, which are also not revealed ex-post (so it is impossible to write a contract contingent on the actions of others). The negotiating players hold passive beliefs about the actions of other players, that is, they do not revise their beliefs about any other's action when receive an offer different from what they expected in equilibrium. Furthermore, it is assumed that actions satisfy feasibility, which means that the following conditions hold for all subgraphs $K \subseteq L$ and for any link $(ij) \in K$:

$$u_i(\widehat{\mathbf{x}}(K)) - \sum_{j \in N} t_{ij}(K) \geq u_i(\widehat{\mathbf{x}}(K \backslash ij)) - \sum_{j \in N} t_{ij}(K \backslash ij). \tag{5}$$

Under these conditions, as $\sigma \to 1$, the game has a unique perfect Bayesian equilibrium, in which the players's actions satisfy conditions of bilateral efficiency:

$$\begin{aligned} \widehat{x}_{ij} &= \arg\max_{x_{ij}} \left(u_i(x_{ij}, \widehat{\mathbf{x}} \backslash \widehat{x}_{ij}) + u_j(x_{ij}, \widehat{\mathbf{x}} \backslash \widehat{x}_{ij}) \right), \quad \text{if } ij \in L, \\ \widehat{x}_{ij} &= 0, \quad \text{if } ij \notin L, \end{aligned}$$

and their payoffs $\Phi_i = u_i(\widehat{\mathbf{x}}(L)) - \widehat{t}_{ij}$ are expressed as a generalized Myerson-Shapley value:

$$\Phi_i = \sum_{P \in P^N} \sum_{S \in P} (-1)^{|P|-1} (|P|-1)! \left[\frac{1}{N} - \sum_{\substack{i \notin S' \in P \\ S' \neq S}} \frac{1}{(|P|-1)(N-|S'|)} \right] \widehat{v}(S, L_P). \tag{6}$$

Here P denotes a partition of N players into coalitions, P^N is a set of all partitions, S and S' are coalitions in P, $|.|$ is the notation for the number of elements in the respective set of elements, L_P is the partitioned graph (the graph what contains all links of L connecting the members of the same coalition within P, but excludes those connecting the members of different coalitions), and $\widehat{v}(S, L_P) = \sum_{i \in S} u_i(\widehat{\mathbf{x}})$ are the total industry profits on a partitioned graph L_P.

It can be shown that these payoffs satisfy the attractive properties of fairness and efficiency (Myerson, 1977a):

$$\begin{aligned} \Phi_i(K) - \Phi_i(K \backslash ij) &= \Phi_j(K) - \Phi_j(K \backslash ij), \\ \sum_i \Phi_i(K) &= \widehat{v}(K). \end{aligned} \tag{7}$$

The first equation expresses the fairness of each bilateral bargaining relation: both parties have an equal amount to gain from closing the contract. The second equation expresses the fact that all the payments sum up to the industry profits, taking into account the various competitive externalities that the firms impose on each other. Recursive substitution of these equations gives the payoffs expressed by the generalized Myerson-Shapley value (6).

Note, that De Fontenay and Gans (2005) apply this model in the context of Cournot competition, in which the secret joint actions x (quantities supplied) fully determine the industry production, and hence also the outcome of the quantity competition downstream. In our application, the contracts are simpler: they only specify a transfer payment, for which the hospital has to deliver its services at its marginal cost, and do not specify secret joint actions. This means that the quantities supplied are not restricted in contracts. Therefore, after signing such contracts in Stage 1 of the game, the insurers will still have to compete for consumers in the downstream market in Stage 2. Therefore, in our game, the industry profits are determined as the outcome of the Hotelling game between the insurers in Stage 2.

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