Division of Economics
A.J. Palumbo School of Business Administration and
McAnulty College of Liberal Arts
Duquesne University
Pittsburgh, Pennsylvania

# THE EFFECT OF INTEGRATED HEALTHCARE DELIVERY SYSTEMS ON INSURER PROFITS AND CONSUMER WELFARE

Hannah Doerr

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Faculty Advisor Signature Page

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| Kevin Shaver, Ph. D.<br>Assistant Professor of Economics | Date |

Abstract

*Since the implementation of the Patient Protection and Affordable Care Act, pressure on the healthcare industry to reduce expenditures has increased. In an effort to control costs and provide care more efficiently, some health insurers and providers have merged to form integrated healthcare delivery systems. This paper theoretically models the effect of backwards vertical integration on insurers' profits and consumer welfare when asymmetric transportation costs and administrative networking costs are introduced to the market. Multiple insurer-provider network configurations are considered in this analysis of a competitive healthcare market of two insurers and two providers. The solutions indicate that backwards vertical integration is more profitable for the insurer under certain conditions; however consumer welfare is lowered.*

JEL Classification: C7, G22, G34, I11, L14

Keywords: integrated healthcare delivery system, backwards vertical integration, insurer-provider networks.

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## I. Introduction

The healthcare industry as it exists today is complex, fragmented, and costly. The Centers for Disease Control and Prevention report that in 2011, healthcare expenditures in the United States exceeded $2.7 trillion and made up 17.9 percent of the nation's gross domestic product (GDP), higher than any other industrialized country. Healthcare spending is predicted to grow in 2014 and beyond due to improving economic conditions as the country recovers from the Great Recession, the aging baby boomer population, and the implementation of the Patient Protection and Affordable Care Act (PPACA). The Center for Medicare and Medicaid Services (CMS) projects that by 2022, healthcare expenditures will make up 19.9 percent of GDP.

According to CMS, an estimated 20 million Americans gained health insurance under PPACA through Medicaid and the health insurance marketplaces as of May 2014, As a result, healthcare expenditures are expected to grow 6.1 percent in 2014 alone, a full percentage point faster than the expected average annual growth in GDP. As more Americans gain health insurance coverage, there is pressure on the healthcare industry to reduce costs and provide affordable care.

The market oriented approach employed in the United States, which utilizes competition between health insurers and providers, should achieve efficient allocation of production and consumption of healthcare (Douven et al. 2011). This approach has encouraged new forms of institutional arrangements within the industry. Vertical restraints and vertical integration can potentially reduce healthcare expenditures while still being profitable for both the insurer and provider. This paper examines the effect of backwards vertical integration, in which an insurer purchases a healthcare provider to form an integrated delivery system, on insurers' profits and consumer welfare. The model presented here draws on the bilateral-duopoly model of a competitive healthcare market from Douven et al. (2011), in which insurers and providers bilaterally bargain over contracts. Utilizing results from their bargaining game and payoff allocations, this model examines the conditions under which backwards vertical integration occurs when two types of common asymmetries within the market are introduced.

The paper proceeds as follows: Section 2 discusses the related literature and the contribution of this model; Section 3 details the model of the insurer and provider healthcare market; Section 4 defines the subgame perfect Nash equilibrium strategies; Section 5 discusses future extensions to be made to this model; and Section 6 concludes the paper.

## II. Literature Review

During the healthcare reform debate, healthcare policy experts argued that the industry should be restructured through organizational integration based on the belief that a higher level of organization will yield a more efficient healthcare system (Hwang et al. 2013). Traditionally, health insurers have reorganized their health plans by offering broad and narrow networks of providers in an effort to reduce costs. A common example of a broad network is a preferred provider organization (PPO), in which the consumer can receive healthcare treatment from a wide variety of providers and is not heavily penalized when obtaining care from providers outside of the plan's network. Narrow networks include managed care organizations (MCO) and health maintenance organizations (HMO), in which the consumer can only receive treatment from the small set of providers who are in network or else be heavily penalized when visiting an out-of-network provider. These network configurations have a direct impact on premiums.

The McKinsey Center for U.S. Health System Reform uses hospital network data from 120 unique health plans and finds that broad networks are associated with higher premiums, charging an average 13 to 17 percent higher, and that 70 percent of the lowest-priced health plans are built around narrow networks. They also report that there is no meaningful performance advantage between these configurations since broad and narrow networks are only differentiated by the number of providers in network and cost. However, these differences result in broad networks attracting riskier consumers, who are more likely to consume healthcare, because they prefer more choice (Chernew and Frick 1999).

Examining how these network configurations affect profits, Bardney and Rochet (2010) model the competition between PPOs and HMOs in which both plans compete for providers on one side and consumers on the other. Since PPOs have a higher density of providers, they attract riskier consumers who want more choice. Analyzing the consequences of this risk segmentation on the provider side, they find that the profits of the insurers depend on a demand effect, which is influenced by the value consumers put on access to providers, as well as an adverse selection effect, which captures the characteristics of the risk distribution. When the demand effect is stronger, the PPO is more profitable but when the adverse selection effect is stronger, the HMO is more profitable.

Ho (2005) studies the determinants of demand for hospital networks offered by MCOs by modeling the negotiation process between MCOs and healthcare providers using a simple profit-maximization framework. She shows that hospitals bear most of the burden of any cost increases within the market, giving them the incentive to control costs and vertically integrate with other healthcare providers. This allows the hospital to become more attractive to the consumer and can thus demand higher prices from the insurer. As a result, the insurers' leverage declines, prompting them to move from restrictive networks to offering more choice to consumers in the form of broader networks.

Recently, healthcare providers have been merging with other hospitals and physician groups to form large healthcare systems in order to reorganize the continuum of care patients receive.  Similarly, providers and health insurers have integrated with one another to create integrated healthcare delivery systems in an attempt to reduce costs and eliminate inefficiencies that may occur when the firms operate as two separate entities.  An integrated delivery system (IDS) is a firm comprised of a health insurer and healthcare providers with the goal of reducing costs and providing a continuum of care to a regional population.  While there are only a few IDSs operating in the United States today, studies show that they have positive effects on quality of care and have lowered healthcare utilization (Hwang et al. 2005).

Vijayaraghavan (2011) performs a case study of seven IDSs.  He finds that on average, the premiums charged by the insurance side of these systems are lower than local, conventional health insurers.  For instance, Minnesota's HealthPartners charges premiums 8 percent lower than local insurers and Pennsylvania's Geisinger charges premiums 30 percent lower.  In the case of the systems that do not have lower premiums, he finds that they are subject to local wages and other inputs, and the insurers must align their prices with competition.  Not doing so would attract sicker, higher risk patients who are more likely to consume healthcare, resulting in more claims and less profit for the insurer.

One of the original IDSs in the United States is Kaiser Permanente, which is comprised of a health plan, hospitals, and medical groups.  It has become the largest nonprofit IDS since it opened in 1945, serving 8.6 million members in eight regions throughout California, Colorado, and other neighboring states.  The organization controls costs by offering the choice of a narrow network that includes only providers owned by Kaiser Permanente (McCarthy et al. 2009).  The providers can offer care at a lower cost while sharing the financial results.

Kaiser Permanente has proven to be a successful healthcare system through its vertically integrated structure. There are only a few theoretical studies in the health economics literature that analyze the effect of vertical integration between insurers and healthcare providers, with most focusing on forwards integration. Gal-Or (1997) studies a bargaining model of two insurers and two hospitals to analyze equilibria when there are exclusionary vertical restraints in healthcare markets. Insurers simultaneously choose hospital networks, which determine the premiums they can charge, and through simultaneous bilateral Nash bargaining, the insurers' profits are determined for each possible network configuration. She finds that selective contracting can arise in equilibrium and consumers are better off. When insurers are perceived to be differentiated by the consumers, it is advantageous for them to restrict their networks of providers in order to secure more favorable contracting terms.

Douven et al. (2011) use the ideas presented by Gal-Or (1997) to examine the market conditions in which exclusive contracts and vertical integration are harmful in a concentrated healthcare market of two insurers and two hospitals. The insurers and providers, who are differentiated along respective Hotelling lines, negotiate on the amount the insurer will pay the provider for providing healthcare. A successful negotiation results in the provider joining the insurer's network and once the networks are established, the insurers compete on premiums.

Analyzing various configurations of the healthcare market when there are exclusive contracts and vertical integration, Douven et al. (2011) find that while it is more profitable for the insurer to adopt exclusive contracts or vertically integrate, consumer welfare is lowered. This is because when there is an exclusive contract or vertical integration between a specific insurer-provider pair, the other insurer can be excluded from contracting with that provider and thus becomes less attractive to the consumer, leaving the consumer with less choice.

Drawing from Douven et al. (2011), the model presented here introduces two types of common asymmetries to analyze the conditions in which backwards vertical integration is more profitable for a health insurer and the effect it has on consumer welfare. Asymmetric transportation costs to the healthcare providers are introduced to allow one provider to gain a majority of the market. Administrative networking costs are presented to incorporate the insurer's cost of networking with a provider. These asymmetries have an effect on the insurer's decision to integrate and/or network with a particular provider. The end goal of this model is to develop a more complete understanding of why IDSs form and how consumers are affected.

## III. General Model

The setup for this bilateral-duopoly model follows the approach of Gal-Or (1997) and Douven et al. (2011). In this model, two insurers and two healthcare providers serve a population of consumers that have the same ex ante risk. It is assumed that the insurers and providers engage in bilateral negotiations about the amount transferred from the insurer to the provider for the healthcare services provided to its insurees. If the negotiation is successful, the provider will join the insurer's network. Once both insurers' networks are established, they compete for consumers by setting a uniform premium for health insurance that fully covers treatment from the respective network.

### III-A. Consumer Choice

The consumer preferences are indicated by the same consumer indirect utility function as in Douven et al. (2011). The consumer at location $y$ on the insurers' Hotelling line purchases health insurance from insurer $I_i$ for a premium, $P_i$, in which he will only have access to the healthcare providers that are in the insurer's network, $N_i$. The consumer's ex ante expected utility is:

$$U_i = \theta\big(v - T(N_i)\big) - (P_i + My). \quad (1)$$

The first term represents the consumer's expected utility from receiving healthcare services from the providers in network $N_i$. The fixed parameter $v$ reflects the utility the consumer receives from being treated and is assumed to be large enough such that the consumer's utility is always positive. $T(N_i)$ represents the expected transportation cost to the providers in network $N_i$. The consumer incurs a transportation cost $t_j$ when traveling to a healthcare provider, $H_j$, where $j$ = {A, B}. The consumer falls ill with fixed probability $\Theta$ and then learns his location, $x$, on the providers' Hotelling line, so the consumer's ex post transportation cost to providers $H_A$ and $H_B$ is $t_A x$ and $t_B(1-x)$, respectively. A straightforward calculation yields the location of the marginal consumer, $\tilde{x} = \frac{t_B}{t_A + t_B}$. If network $N_i$ includes both providers, the consumer will choose the one which is closer to his location, $x$. If network $N_i$ only includes one provider, then the consumer will have no choice but to seek treatment from that provider. Thus, the expected transportation costs $T(N_i)$ are as follows:

$$T(\{H_A, H_B\}) = t_A \int_0^{\tilde{x}} z dz + t_B \int_{\tilde{x}}^1 (1-z) dz = \frac{t_A \tilde{x}^2 + t_B(\tilde{x}-1)^2}{2}, \quad (2.1)$$

$$T(\{H_A\}) = t_A \int_0^1 x dx = \frac{t_A}{2}, \quad (2.2)$$

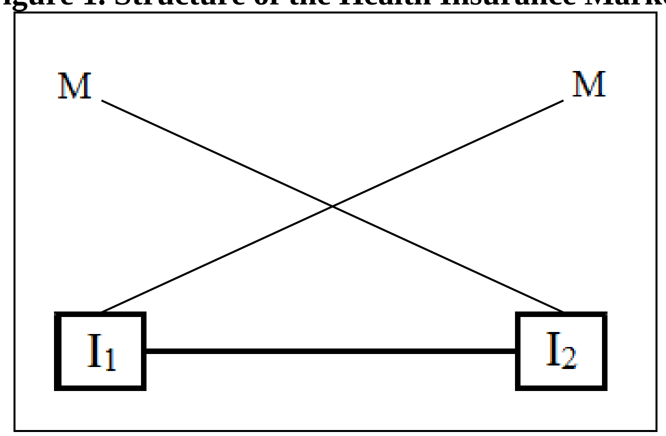
$$T(\{H_B\}) = t_B \int_0^1 x dx = \frac{t_B}{2}. \quad (2.3)$$

The second term of the consumer's expected utility function represents cost of purchasing health insurance which consists of the insurance premium, $P_i$, charged to the consumer by $I_i$ and the transportation cost incurred, $My$. The parameters $M$, $t_j$, $P_i$, $x$, $y$, and $\Theta$ and the terms $I_i$, $H_j$, and $N_i$ are discussed in greater detail below.

**III-B. Insurance Market**

Two health insurers, $I_i$ where $i = \{1, 2\}$, are assumed to be located at the endpoints of a downstream Hotelling line of unit length. The consumer population is uniformly distributed between the two insurers with a transportation cost, *M*, which represents the degree of differentiation between the insurers. The consumer views the two insurers as differentiated ex ante and has a preference for one insurer over the other based on additional services other than health insurance offered, a different list of approved physicians, or the presence of switching costs. The consumer is aware of his location, $y \in [0, 1]$, on the insurers' Hotelling line when he purchases health insurance. It is assumed that there is a fixed total demand for insurance.

**Figure 1. Structure of the Health Insurance Market**

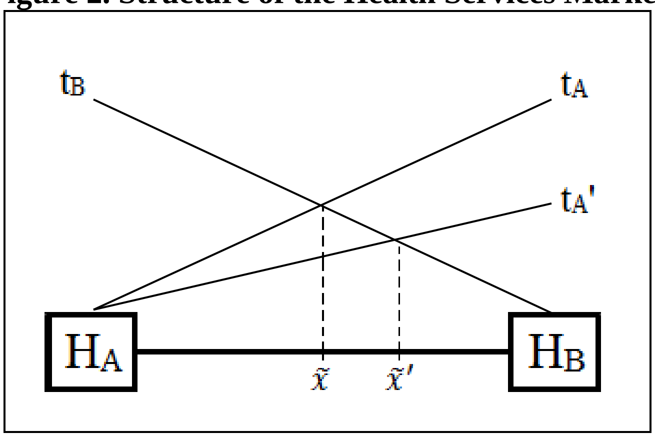



The two insurers are the strategic players in this model and the extensive form game, which is discussed in greater detail in Appendix B, proceeds as follows. The first insurer chooses whether to vertically integrate with a healthcare provider. That insurer then establishes its network of providers. The second insurer observes the first insurer's decisions and then establishes its own network of providers.

**III-C. Health Services Market**

Once consumers purchase health insurance, they fall ill with fixed probability $\theta$, such that $0 < \theta < 1$. Two healthcare providers, $H_j$ where $j = \{A, B\}$, are located at the endpoints of an upstream Hotelling line of unit length. The patient population is uniformly distributed along the interval and travel to provider $H_j$ with transportation cost $t_j$. While both providers are able to treat all types of diseases, they are differentiated in their effectiveness in treating specific diseases. A provider may have a lower transportation cost $t_j < t_{-j}$ if it is more effective in treating a disease and therefore more attractive to the consumer, which results in that provider gaining a majority of the market. It is assumed that the two providers have constant marginal costs and zero fixed costs, and so they have the same average treatment cost per patient, *c*. The consumer is not aware of his location, $x \in [0, 1]$, on the upstream Hotelling line until he becomes ill. Therefore, the insurance policy the consumer purchases is a bundle of options for access to the healthcare services of the providers covered by the insurer.

**Figure 2. Structure of the Health Services Market**




Prior to the purchase of insurance, the insurers and the providers engage in bilateral negotiations over their contracts.[1] When a negotiation is successful, $H_j$ will join $I_i$'s network, $N_i \subseteq \{H_A, H_B\}$. In this model, the two networks may overlap that such $N_1 = N_2 = \{H_A, H_B\}$. However, a monopoly cannot arise, so each insurer and each hospital must be included in some

[1] The bargaining process is modeled by Douven et al. (2011). Their sequential game consists of the following three stages: In stage one, the ownership of assets and set of potential network configurations is determined; In stage two, bargaining occurs and the equilibrium network and payoffs are established; In stage three, insurers set premiums and consumers purchase health insurance, fall ill with fixed probability ϴ, and seek treatment from the closest provider from their insurer's network.

network. The insurers experience a fixed administrative networking cost, $AC_j$, such that $AC_{A,B} = AC_A + AC_B$. In the case of backwards integration, synergies may arise that would cause the networking cost to be higher or lower, and so $AC_j$ is multiplied by $\delta > 0$ to reflect this. The insurers engage in price competition by setting insurance premiums, $P_i$, for the consumer to gain access to the $N_i$.

**III-D. Demand and Profits**

The total industry profits are derived from all potential configurations of the insurer-provider networks that may arise in the industry. Each insurer must network with one or two providers, resulting in seven different duopoly configurations, shown in Appendix A. Due to symmetry, some of these networks result in the same total profits. Thus, there are only four different network configurations to consider in the case of non-integration.

Starting with the simple insurer duopoly case in which $I_1$ contracts with $H_A$ and $I_2$ contracts with $H_B$, the insurers' demand is derived. In the Hotelling model, the marginal consumer, who is indifferent between the two insurers, determines $I_i$'s demand. A direct calculation shows that the insurer's demand, $q_i$, is the following:

$$q_i(P_i, P_{-i}|N_i, N_{-i}) = \frac{1}{2} + \frac{(P_{-i} - P_i)}{2M} + \frac{\theta[T(N_{-i}) - T(N_i)]}{2M}. \tag{3}$$

Since efficient bargaining is assumed, the profit maximizing insurers set their premiums to maximize their revenue minus production cost. The optimal premium is expressed as:

$$P_i^* = \arg\max q_i(P_i, P_{-i}|N_i, N_{-i})(P_i - \theta c) = M + \theta c + \theta[T(N_{-i}) - T(N_i)]. \tag{4}$$

Direct calculations yield the various premiums and total industry profits for the possible network configurations, shown in Appendix A.

Cooperative game theory concepts are applied to determine the payoff allocation among players in the context of bilateral bargaining. Douven et al. (2011) use an axiomatic approach to derive the equilibrium payoffs. They impose the requirement that the individual payoffs that result from bargaining are efficient and fair, meaning the intermediate tariffs are set efficiently to maximize the joint surplus of the two players and the net surplus derived from each networking relationship is split equally. It is assumed that the insurers pay the providers two-part tariffs, with the variable equal to the marginal cost of treatment, $c$. Applying the efficiency and fairness axioms leads to the system of bargaining equations, which they solve iteratively. This leads to the individual payoffs in each possible configuration, which are equivalent to the generalized Myerson-Shapley value. The Myerson-Shapley value extends upon the Shapley value, which represents the average marginal contribution of a player to various coalitions, to games where the coalition value depends on the partition of players into coalitions.

The individual payoff allocations found by Douven et al. (2011) are utilized in this model and modified to incorporate the asymmetric transportation costs and the administrative networking costs. Although this model does not consider an insurer monopoly, the monopoly profit, $\alpha$, plays a role in these payoffs. If a monopoly were to occur, a regulator would cap the monopoly's premium, $\bar{P}$, such that it cannot be less than the equilibrium premium in the insurer duopoly case. The corresponding profits would then be $\alpha = \bar{P} - \theta c$. The individual payoff allocations as they apply to this model when there is non-integration and backwards vertical integration are summarized in Tables 1 and 2, respectively.

**Table 1. Total Industry Profits and Individual Payoff Allocations: No Integration**

| Networks | Total Industry Profits | Individual Payoffs |
|---|---|---|
| $\boldsymbol{N_i = \{H_A\}}$<br>$\boldsymbol{N_{-i} = \{H_B\}}$ | $M + \Delta M - AC_A - AC_B$ | $\varphi_i = \frac{1}{4}(M + \Delta M - 2AC_A)$<br>$\varphi_{-i} = \frac{1}{4}(M + \Delta M - 2AC_B)$<br>$\varphi_A = \frac{1}{4}(M + \Delta M - 2AC_A)$<br>$\varphi_B = \frac{1}{4}(M + \Delta M - 2AC_B)$ |
| $\boldsymbol{N_i = \{H_A\}}$<br>$\boldsymbol{N_{-i} = \{H_A, H_B\}}$ | $M + \Delta M_{A,B}{}^{A} - AC_A - AC_{A,B}$ | $\varphi_i = \frac{1}{12}\left(4M + 3\Delta M_{A,B}{}^{A} - 6AC_A - 2\alpha\right)$<br>$\varphi_{-i} = \frac{1}{12}\left(4M + 3\Delta M_{A,B}{}^{A} - 4AC_{A,B}\right)$<br>$\varphi_A = \frac{1}{12}\left(4M + 3\Delta M_{A,B}{}^{A} - 6AC_A - 4AC_{A,B}\right)$<br>$\varphi_B = \frac{1}{12}\left(3\Delta M_{A,B}{}^{A} - 4AC_{A,B} + 2\alpha\right)$ |
| $\boldsymbol{N_i = \{H_B\}}$<br>$\boldsymbol{N_{-i} = \{H_A, H_B\}}$ | $M + \Delta M_{A,B}{}^{B} - AC_B - AC_{A,B}$ | $\varphi_i = \frac{1}{12}\left(4M + 3\Delta M_{A,B}{}^{B} - 6AC_B - 2\alpha\right)$<br>$\varphi_{-i} = \frac{1}{12}\left(4M + 3\Delta M_{A,B}{}^{B} - 4AC_{A,B}\right)$<br>$\varphi_A = \frac{1}{12}\left(3\Delta M_{A,B}{}^{B} - 4AC_{A,B} + 2\alpha\right)$<br>$\varphi_B = \frac{1}{12}\left(4M + 3\Delta M_{A,B}{}^{B} - 6AC_B - 4AC_{A,B}\right)$ |
| $\boldsymbol{N_i = \{H_A, H_B\}}$<br>$\boldsymbol{N_{-i} = \{H_A, H_B\}}$ | $M - 2AC_{A,B}$ | $\varphi_i = \varphi_{-i} = \frac{1}{12}\left(5M - 6AC_{A,B} - 2\alpha\right)$<br>$\varphi_A = \varphi_B = \frac{1}{12}\left(M - 6AC_{A,B} + 2\alpha\right)$ |

**Table 2. Total Industry Profits and Individual Payoff Allocations: Backwards Vertical Integration ($I_1$ integrates with $H_A$)**

| Networks | Total Industry Profits | Individual Payoffs |
|---|---|---|
| $\boldsymbol{N_1 = \{H_A\}}$<br>$\boldsymbol{N_2 = \{H_B\}}$ | $M + \Delta M - \delta AC_A - AC_B$ | $\varphi_1 = \frac{1}{4}(M + \Delta M - 2\delta AC_A)$<br>$\varphi_2 = \frac{1}{4}(M + \Delta M - 2AC_B)$<br>$\varphi_A = \frac{1}{4}(M + \Delta M - 2\delta AC_A)$<br>$\varphi_B = \frac{1}{4}(M + \Delta M - 2AC_B)$ |
| $\boldsymbol{N_1 = \{H_A\}}$<br>$\boldsymbol{N_2 = \{H_A, H_B\}}$ | $M + \Delta M_{A,B}{}^A - \delta AC_A - AC_{A,B}$ | $\varphi_1 = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^A - 6\delta AC_A - 2\alpha)$<br>$\varphi_2 = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^A - 4AC_{A,B})$<br>$\varphi_A = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^A - 6\delta AC_A - 4AC_{A,B})$<br>$\varphi_B = \frac{1}{12}(3\Delta M_{A,B}{}^A - 4AC_{A,B} + 2\alpha)$ |
| $\boldsymbol{N_1 = \{H_A, H_B\}}$<br>$\boldsymbol{N_2 = \{H_A\}}$ | $M + \Delta M_{A,B}{}^A - \delta AC_A - AC_A - AC_B$ | $\varphi_1 = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^A - 6\delta AC_A - 6AC_B)$<br>$\varphi_2 = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^A - 6AC_A - 2\alpha)$<br>$\varphi_A = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^A - 6\delta AC_A - 6AC_A)$<br>$\varphi_B = \frac{1}{12}(3\Delta M_{A,B}{}^A - 6AC_B + 2\alpha)$ |
| $\boldsymbol{N_1 = \{H_A, H_B\}}$<br>$\boldsymbol{N_2 = \{H_B\}}$ | $M + \Delta M_{A,B}{}^B - \delta AC_A - 2AC_B$ | $\varphi_1 = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^B - 6\delta AC_A - 6AC_B)$<br>$\varphi_2 = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^B - 6AC_B - 2\alpha)$<br>$\varphi_A = \frac{1}{12}(3\Delta M_{A,B}{}^B - 6\delta AC_A + 2\alpha)$<br>$\varphi_B = \frac{1}{12}(4M + 3\Delta M_{A,B}{}^B - 12AC_B)$ |
| $\boldsymbol{N_1 = \{H_A, H_B\}}$<br>$\boldsymbol{N_2 = \{H_A, H_B\}}$ | $M - \delta AC_A - AC_B - AC_{A,B}$ | $\varphi_1 = \frac{1}{12}(5M - 6\delta AC_A - 6AC_B - \alpha)$<br>$\varphi_2 = \frac{1}{12}(5M - 4AC_{A,B} - 3\alpha)$<br>$\varphi_A = \frac{1}{12}(M - 6\delta AC_A - 4AC_{A,B} + \alpha)$<br>$\varphi_B = \frac{1}{12}(M - 6AC_B - 4AC_{A,B} + 3\alpha)$ |

## IV. Subgame Perfect Nash Equilibrium

Backward induction is used to determine the best response functions of the insurers and thus the subgame perfect Nash equilibria. The asymmetric transportation costs and the administrative networking costs within this model result in eighteen scenarios which must be analyzed to determine the conditions in which backwards vertical integration occurs. For analytical simplicity, a series of simplifying assumptions have been made to develop an intuition of the insurers' decisions within the general model.[2] While it is possible to find the best response functions of this model, the simplified form presented here presents a basic intuition of the general model.

Using the simplifying assumptions, the individual bargaining payoffs are determined for the insurers and providers in each of the eighteen possible scenarios. These eighteen scenarios result in three sets of subgame perfect Nash equilibrium strategies of the insurers, shown in Table 3.

Backwards vertical integration between $I_1$ and $H_A$ occurs in a majority of the considered scenarios. The first set of strategies that could occur is $I_1$ integrates with $H_A$, $I_1$ networks with both hospitals such that $N_1 = \{H_A, H_B\}$, and $I_2$ only networks with $H_A$ such that $N_2 = \{H_A\}$. This outcome occurs when the transportation costs are symmetric such that $t_A = t_B$ and when $AC_A < AC_B$, regardless of the value of $\delta$. In these scenarios, the two providers equally share the market; however $H_B$ is more expensive to network with. This results in higher profits for $I_1$ but less profit for $I_2$ had $I_1$ decided not to integrate. Consumers experience more utility when purchasing insurance from $I_2$ as it offers a lower premium because there is only one provider in its network.

[2] The simplifying assumptions are set to the following parameter values: M=1, c=1, ϴ=0.5, v=5, y=0.5, $t_A$=1 and 1.25, $t_B$=1 and 1.25, $AC_A$=0.05 and 0.075, $AC_B$=0.05 and 0.075, δ=0.75 and 1.25

**Table 3. Subgame Perfect Nash Equilibria**

| Subgame Perfect Nash Equilibrium Strategies | Asymmetric Conditions | | |
|---|---|---|---|
| $I_1$ integrates with $H_A$, $N_1 = \{H_A, H_B\}$, $N_2 = \{H_A\}$ | $AC_A < AC_B$ | $t_A = t_B$ | $\delta > 1$ |
| | $AC_A < AC_B$ | $t_A = t_B$ | $\delta < 1$ |
| $I_1$ integrates with $H_A$, $N_1 = \{H_A\}$ exclusively, $N_2 = \{H_B)$ | $AC_A = AC_B$ | $t_A = t_B$ | $\delta < 1$ |
| | $AC_A = AC_B$ | $t_A > t_B$ | $\delta < 1$ |
| | $AC_A = AC_B$ | $t_A < t_B$ | $\delta < 1$ |
| | $AC_A > AC_B$ | $t_A = t_B$ | $\delta < 1$ |
| | $AC_A > AC_B$ | $t_A > t_B$ | $\delta < 1$ |
| | $AC_A > AC_B$ | $t_A < t_B$ | $\delta < 1$ |
| | $AC_A < AC_B$ | $t_A > t_B$ | $\delta < 1$ |
| | $AC_A < AC_B$ | $t_A < t_B$ | $\delta < 1$ |
| | $AC_A < AC_B$ | $t_A > t_B$ | $\delta > 1$ |
| | $AC_A < AC_B$ | $t_A < t_B$ | $\delta > 1$ |
| No integration, $N_1 = N_2 = \{H_A, H_B\}$ | $AC_A = AC_B$ | $t_A = t_B$ | $\delta > 1$ |
| | $AC_A = AC_B$ | $t_A > t_B$ | $\delta > 1$ |
| | $AC_A = AC_B$ | $t_A < t_B$ | $\delta > 1$ |
| | $AC_A > AC_B$ | $t_A = t_B$ | $\delta > 1$ |
| | $AC_A > AC_B$ | $t_A > t_B$ | $\delta > 1$ |
| | $AC_A > AC_B$ | $t_A < t_B$ | $\delta > 1$ |

The second set of strategies that could occur is $I_1$ integrates with $H_A$ and then exclusively networks with $H_A$ such that $N_1 = \{H_A\}$, leaving $I_2$ with the only option to network with $H_B$ such that $N_2 = \{H_B\}$. This strategy occurs in situations where the administrative networking cost $AC_A$ is reduced when $\delta < 1$, creating the incentive for $I_1$ to integrate with $H_A$. While the insurers' profits depend on the asymmetries that result in this outcome, their profits are relatively similar to one another. The consumer receives more utility from the insurer with the lowest premium, which varies depending on these asymmetries. However, the highest utility received is equal to the lowest utility that results from the first set of equilibrium strategies.

The final set of subgame perfect Nash equilibrium strategies does not involve vertical integration. Both insurers network with both providers such that $N_1 = N_2 = \{H_A, H_B\}$ when $\delta > 1$ and when $AC_A = AC_B$ or $AC_A > AC_B$, regardless of the asymmetries that may occur in the transportation costs to the providers. This happens because when $\delta > 1$, the administrative networking costs increase if an insurer chooses to integrate. Thus, in the settings where

$AC_A = AC_B$ and $AC_A > AC_B$, $I_1$ always experiences higher networking costs if it integrates with $H_A$, resulting in a lower individual payoff. Therefore, $I_1$ chooses not to integrate. Regardless of the asymmetries that result in this set of strategies, the insurers' premiums and profits are equal. Consumers receive the same utility from both insurers and the highest utility of the three sets of subgame perfect Nash equilibrium strategies.

These results show that in twelve out of the eighteen scenarios that result from the different combinations of the asymmetries in this model, backwards vertical integration is more profitable for the integrating insurer; however, overall consumer welfare is lowered. In the six scenarios that lead to no integration, the insurers make equal profits and consumer welfare is maximized. This is because the consumer's utility function, expressed in equation (1), depends on the expected transportation costs to the providers in the insurer's network, $T(N_i)$, and the premium, $P_i$. The consumer receives more utility when $T(N_i)$ is low, which occurs when both providers are in the insurer's network and the consumers are offered more choice, as shown in equations (2.1), (2.2), and (2.3). Conversely, when there is only one provider in an insurer's network, the consumer receives more utility because $P_i$ is lower, as shown in equation (4) and detailed in Appendix A. However, because $P_i$ depends on $T(N_i)$, $P_i$ is averaged when the two networks are equal, such as in the last set of subgame perfect Nash equilibrium strategies where $N_1 = N_2 = \{H_A, H_B\}$. This strategy results in both a low $P_i$ and a low $T(N_i)$, therefore maximizing consumer welfare. Consumer welfare is lowered when $P_i$ is high and there is only one provider in network, thereby restricting consumer choice.

## V. Future Research and Extensions to the Model

While the model presented in this paper provides a basic framework for examining the conditions in which backwards vertical integration is more profitable for insurers and its impact on consumer welfare, there are several extensions that would improve the model. The first extension to be made to this model is to expand the extensive form game such that both insurers have the option to integrate with a provider. Other extensions include incorporating the administrative networking costs, $AC_j$, as a per unit of demand cost rather than a fixed cost and explicitly modeling the negotiation about the amount transferred from the insurer to the provider.

When both insurers have the option to vertically integrate with a provider, the model has the potential to provide a theoretical understanding of the impact of IDSs when they are the sole healthcare system available. The healthcare system as it exists today is costly and inefficient, possibly due to insurers and providers operating as separate entities. The formation of IDSs can lead to reduced costs and higher profits for the insurers and providers. However, as this model shows, the presence of one IDS lowers consumer welfare. Therefore, extending this model to incorporate the presence of multiple IDSs would provide insight as to which types of institutional arrangements within the healthcare industry consumers prefer most.

Another improvement to this model is to incorporate the administrative networking costs as a per unit demand cost rather than a fixed cost. While this further complicates the model, a per unit demand cost may have a greater impact on an insurer's decision to integrate and/or network with a provider than the fixed cost, altering the outcome of the game. This allows for a further understanding of the potential synergies that may arise when an insurer and provider integrate.

Finally, the bargaining game utilized in this model has important implications on the networks and payoff allocations of the insurers and extending it would improve the results. This model implicitly assumes the negotiation over the amount transferred from the insurer to the provider whereas extending upon this and explicitly modeling the negotiation process would allow for a more complete understanding of the healthcare industry. Although this requires additional work, performing and analyzing the bargaining game developed by Douven et al. (2011) with the inclusion of the asymmetries introduced in this model may alter the payoff allocations of the insurers and the providers. Thus, this extension would provide a more accurate and in depth analysis of why IDSs form.

**VI. Conclusion**

The purpose of the theoretical model developed in this paper is to improve our understanding of the conditions in which IDSs form and how they affect consumer welfare. The results of the general model suggest that while it is more profitable for an insurer to integrate with a healthcare provider in a majority of scenarios, overall consumer welfare is lowered. When synergies arise and the cost of networking is reduced, backwards vertical integration occurs. Consumer welfare is lowered because the narrow network configurations that result from integration restrict the consumers' choice of providers. When these synergies do not exist, integration does not occur, both insurers network with both providers, and consumer welfare is maximized because consumers are offered more choice. These results are theoretically consistent with the findings of Douven et al. (2011).

Restructuring the healthcare industry is vital to improving the efficiency of healthcare provision in the United States. An IDS is one example of how insurers and healthcare providers can reorganize in order to provide more affordable care while increasing profits. As these systems continue to form throughout the United States and insurers make higher profits at the expense of consumer welfare, it raises the question of what kind of policy response might be needed to raise the social efficiency in the healthcare market.

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**Appendix A: Network Configurations and Profits**

Table 4 shows seven possible network configurations when there is no integration. Due to symmetry, some of these networks result in the same total profits and thus there are only four different network configurations to consider. In the case of backwards vertical integration, there are five possible network configurations, shown in Table 5. The premiums, demand, and profits for these various configurations are shown in Tables 6 and 7, respectively.

**Table 4. All Network Configurations: No Integration**

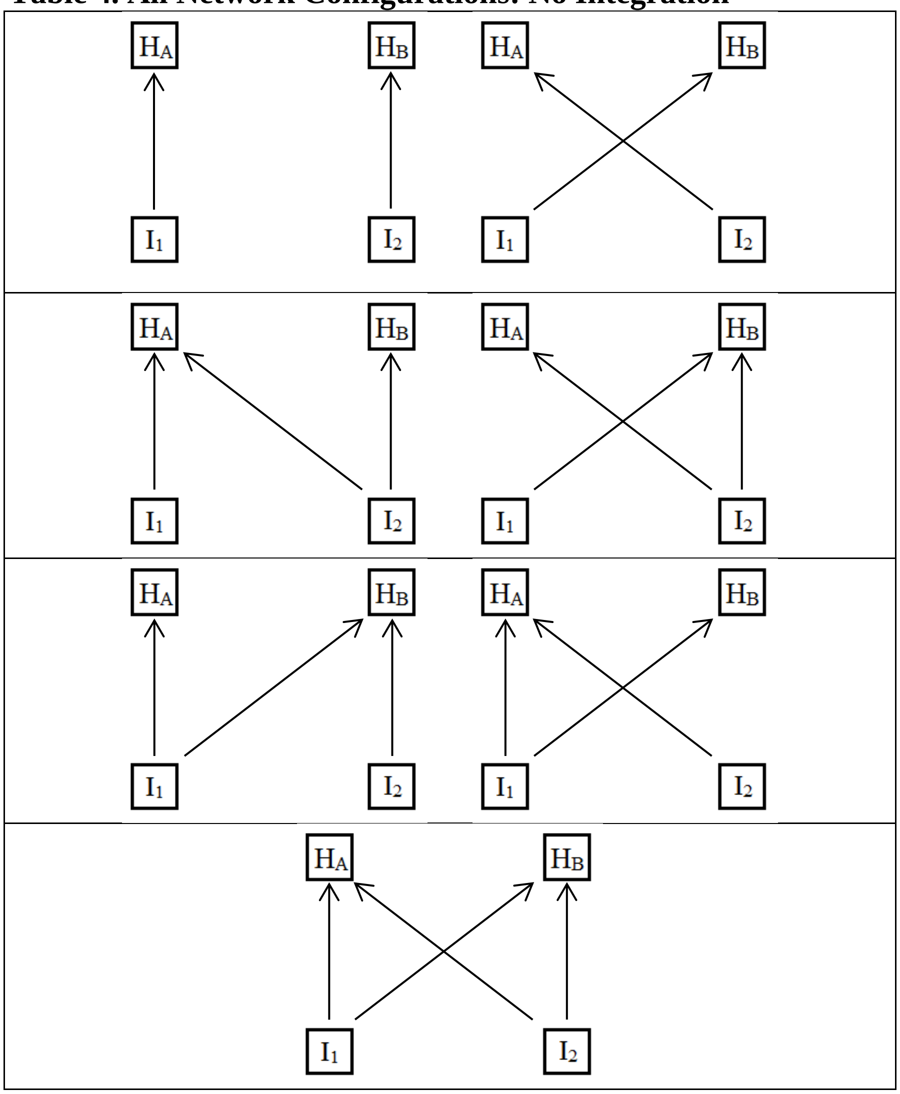


**Table 5. All Network Configurations: Backwards Vertical Integration ($I_1$ integrates with $H_A$)**

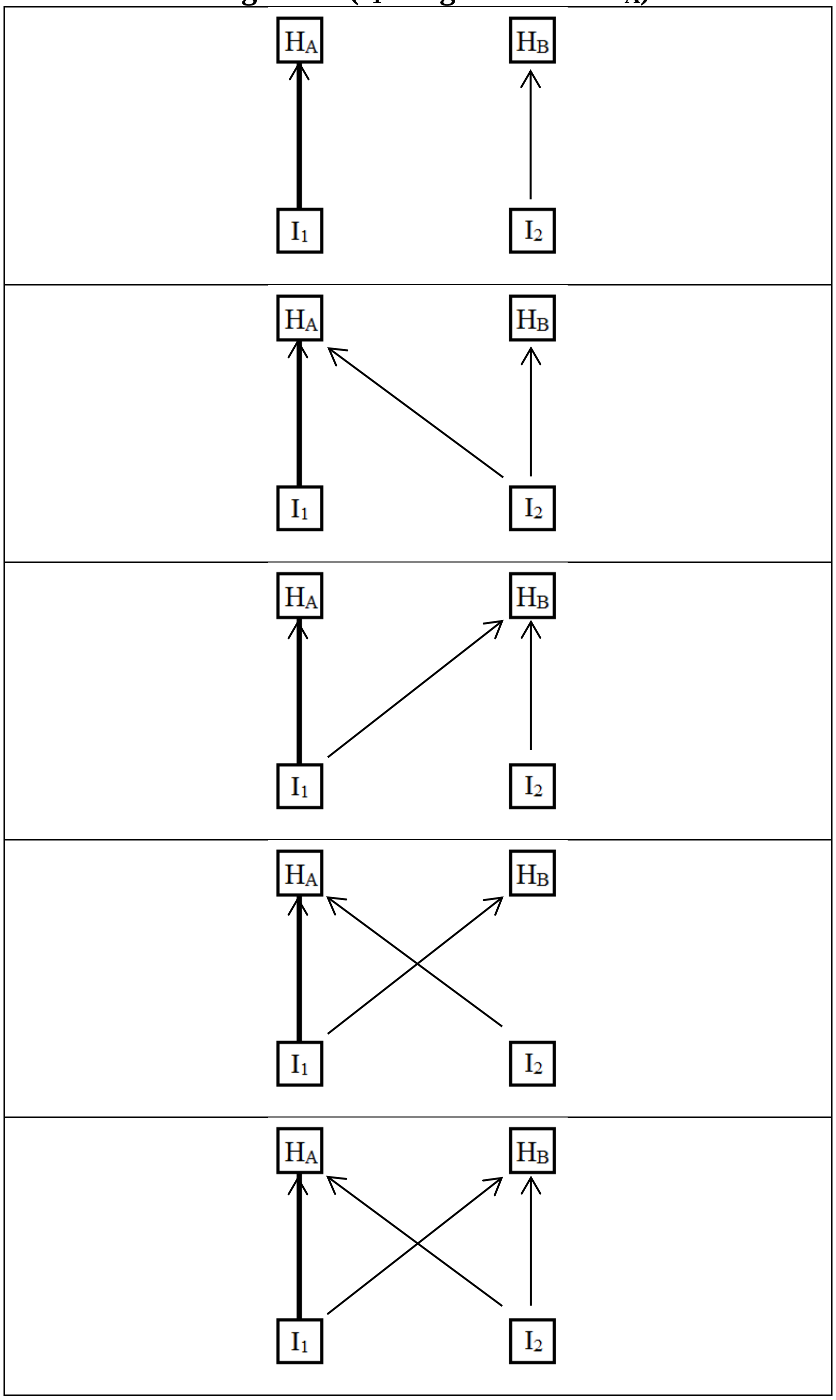


**Table 6. Premiums, Demand, and Profits: No Integration**

| | | |
|---|---|---|
| $N_i = \{H_A\}$ $N_{-i} = \{H_B\}$ | Premium | $P_i = M + \theta c + \frac{\theta(t_B - t_A)}{2}$ $P_{-i} = M + \theta c + \frac{\theta(t_A - t_B)}{2}$ |
| | Demand | $q_i = \frac{1}{2} + \frac{\theta(t_A - t_B)}{4M}$ $q_{-i} = \frac{1}{2} + \frac{\theta(t_B - t_A)}{4M}$ |
| | Insurer Profit | $\pi_i = \frac{M}{2} + \frac{\theta^2[t_A t_B - t_A{}^2 - t_B{}^2]}{8M} - AC_A$ $\pi_{-i} = \frac{M}{2} + \frac{\theta^2[t_A t_B - t_A{}^2 - t_B{}^2]}{8M} - AC_B$ |
| | Total Industry Profit | $M + \frac{\theta^2[t_A t_B - t_A{}^2 - t_B{}^2]}{4M} - AC_A - AC_B = M + \Delta M - AC_A - AC_B$ |
| $N_i = \{H_A\}$ $N_{-i} = \{H_A, H_B\}$ | Premium | $P_i = M + \theta c + \frac{\theta[t_A\tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_A]}{2}$ $P_{-i} = M + \theta c + \frac{\theta[t_A - t_A\tilde{x}^2 - t_B(\tilde{x}-1)^2]}{2}$ |
| | Demand | $q_i = \frac{1}{2} + \frac{\theta[t_A - t_A\tilde{x}^2 - t_B(\tilde{x}-1)^2]}{4M}$ $q_{-i} = \frac{1}{2} + \frac{\theta[t_A\tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_A]}{4M}$ |
| | Insurer Profit | $\pi_i = \frac{M}{2} + \frac{\theta^2[(t_A\tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B\tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_A{}^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_A$ $\pi_{-i} = \frac{M}{2} + \frac{\theta^2[(t_A\tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B\tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_A{}^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_{A,B}$ |
| | Total Industry Profit | $M + \frac{\theta^2[(t_A\tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B\tilde{x}^2(\tilde{x}-1)^2]}{2M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_A{}^2 + (t_B(\tilde{x}-1)^2)^2]}{4M} - AC_A - AC_{A,B} = M + \Delta M_{A,B}{}^{A} - AC_A - AC_{A,B}$ |
| $N_i = \{H_B\}$ $N_{-i} = \{H_A, H_B\}$ | Premium | $P_i = M + \theta c + \frac{\theta[t_A\tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_B]}{2}$ $P_{-i} = M + \theta c + \frac{\theta[t_B - t_A\tilde{x}^2 - t_B(\tilde{x}-1)^2]}{2}$ |
| | Demand | $q_i = \frac{1}{2} + \frac{\theta[t_B - t_A\tilde{x}^2 - t_B(\tilde{x}-1)^2]}{4M}$ $q_{-i} = \frac{1}{2} + \frac{\theta[t_A\tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_B]}{4M}$ |
| | Insurer Profit | $\pi_i = \frac{M}{2} + \frac{\theta^2[t_A t_B\tilde{x}^2 + t_B{}^2(\tilde{x}-1)^2 + t_A t_B\tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_B{}^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_B$ $\pi_{-i} = \frac{M}{2} + \frac{\theta^2[t_A t_B\tilde{x}^2 + t_B{}^2(\tilde{x}-1)^2 + t_A t_B\tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_B{}^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_{A,B}$ |
| | Total Industry Profit | $M + \frac{\theta^2[t_A t_B\tilde{x}^2 + t_B{}^2(\tilde{x}-1)^2 + t_A t_B\tilde{x}^2(\tilde{x}-1)^2]}{2M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_B{}^2 + (t_B(\tilde{x}-1)^2)^2]}{4M} - AC_B - AC_{A,B} = M + \Delta M_{A,B}{}^{B} - AC_B - AC_{A,B}$ |
| $N_i = \{H_A, H_B\}$ $N_{-i} = \{H_A, H_B\}$ | Premium | $P_i = P_{-i} = M + \theta c$ |
| | Demand | $q_i = q_{-i} = \frac{1}{2}$ |
| | Insurer Profit | $\pi_i = \pi_{-i} = \frac{M}{2} - AC_{A,B}$ |
| | Total Industry Profit | $M - 2AC_{A,B}$ |

**Table 7.1 Premiums, Demand, and Profits: Backwards Vertical Integration ($I_1$ integrates with $H_A$)**

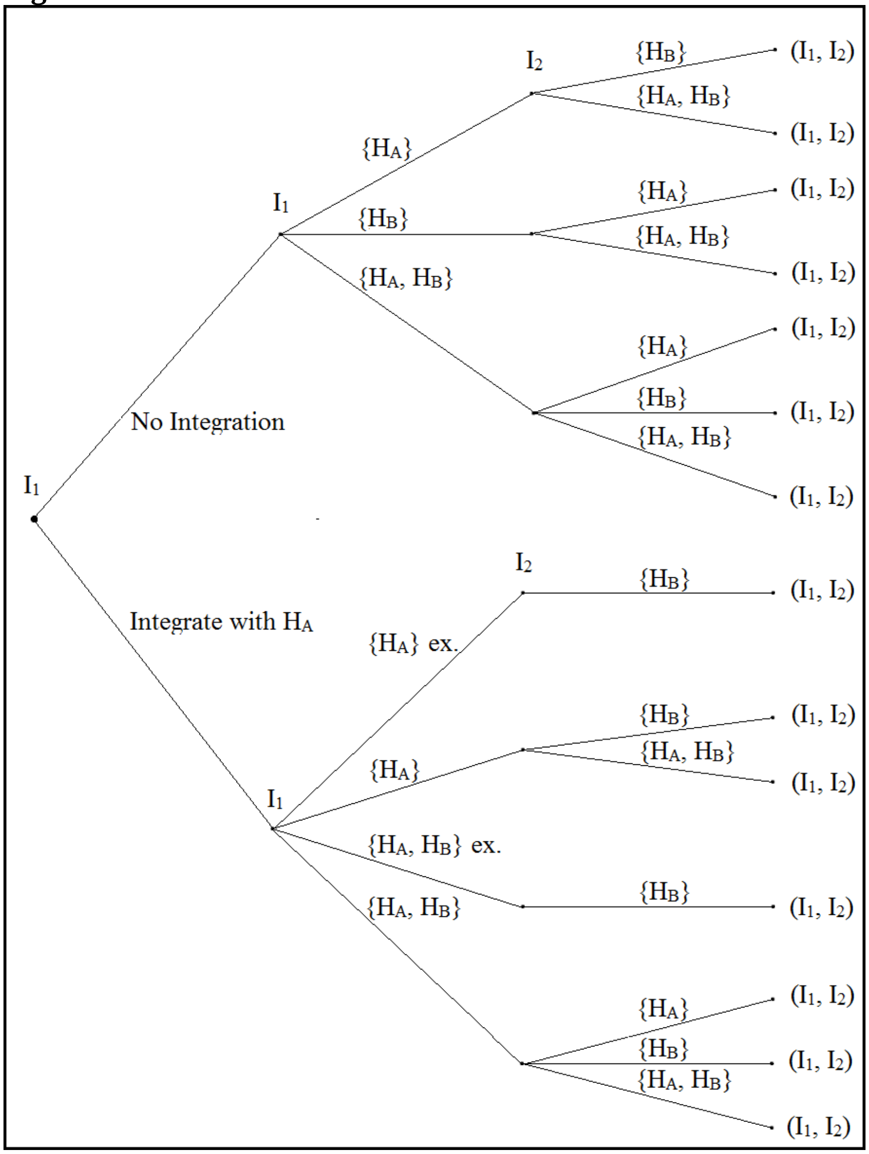
| | | |
|---|---|---|
| $N_1 = \{H_A\}$<br>$N_2 = \{H_B\}$ | Premium | $P_1 = M + \theta c + \frac{\theta(t_B - t_A)}{2}$<br>$P_2 = M + \theta c + \frac{\theta(t_A - t_B)}{2}$ |
| | Demand | $q_1 = \frac{1}{2} + \frac{\theta(t_A - t_B)}{4M}$<br>$q_2 = \frac{1}{2} + \frac{\theta(t_B - t_A)}{4M}$ |
| | Insurer Profit | $\pi_1 = \frac{M}{2} + \frac{\theta^2[t_A t_B - t_A^2 - t_B^2]}{8M} - \delta AC_A$<br>$\pi_2 = \frac{M}{2} + \frac{\theta^2[t_A t_B - t_A^2 - t_B^2]}{8M} - AC_B$ |
| | Total Industry Profit | $M + \frac{\theta^2[t_A t_B - t_A^2 - t_B^2]}{4M} - AC_A - AC_B = M + \Delta M - \delta AC_A - AC_B$ |
| $N_1 = \{H_A\}$<br>$N_2 = \{H_A, H_B\}$ | Premium | $P_1 = M + \theta c + \frac{\theta[t_A \tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_A]}{2}$<br>$P_2 = M + \theta c + \frac{\theta[t_A - t_A \tilde{x}^2 - t_B(\tilde{x}-1)^2]}{2}$ |
| | Demand | $q_1 = \frac{1}{2} + \frac{\theta[t_A - t_A \tilde{x}^2 - t_B(\tilde{x}-1)^2]}{4M}$<br>$q_2 = \frac{1}{2} + \frac{\theta[t_A \tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_A]}{4M}$ |
| | Insurer Profit | $\pi_1 = \frac{M}{2} + \frac{\theta^2[(t_A \tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B \tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A \tilde{x}^2)^2 + t_A^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - \delta AC_A$<br>$\pi_2 = \frac{M}{2} + \frac{\theta^2[(t_A \tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B \tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A \tilde{x}^2)^2 + t_A^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_{A,B}$ |
| | Total Industry Profit | $M + \frac{\theta^2[(t_A \tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B \tilde{x}^2(\tilde{x}-1)^2]}{2M} - \frac{\theta^2[(t_A \tilde{x}^2)^2 + t_A^2 + (t_B(\tilde{x}-1)^2)^2]}{4M} - AC_A - AC_{A,B}$<br>$= M + \Delta M_{A,B}{}^A - \delta AC_A - AC_{A,B}$ |
| $N_1 = \{H_A, H_B\}$<br>$N_2 = \{H_A\}$ | Premium | $P_1 = M + \theta c + \frac{\theta[t_A - t_A \tilde{x}^2 - t_B(\tilde{x}-1)^2]}{2}$<br>$P_2 = M + \theta c + \frac{\theta[t_A \tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_A]}{2}$ |
| | Demand | $q_1 = \frac{1}{2} + \frac{\theta[t_A \tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_A]}{4M}$<br>$q_2 = \frac{1}{2} + \frac{\theta[t_A - t_A \tilde{x}^2 - t_B(\tilde{x}-1)^2]}{4M}$ |
| | Insurer Profit | $\pi_1 = \frac{M}{2} + \frac{\theta^2[(t_A \tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B \tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A \tilde{x}^2)^2 + t_A^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - \delta AC_A - AC_B$<br>$\pi_2 = \frac{M}{2} + \frac{\theta^2[(t_A \tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B \tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A \tilde{x}^2)^2 + t_A^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_A$ |
| | Total Industry Profit | $M + \frac{\theta^2[(t_A \tilde{x})^2 + t_A t_B(\tilde{x}-1)^2 - t_A t_B \tilde{x}^2(\tilde{x}-1)^2]}{2M} - \frac{\theta^2[(t_A \tilde{x}^2)^2 + t_A^2 + (t_B(\tilde{x}-1)^2)^2]}{4M} - AC_A - AC_{A,B}$<br>$= M + \Delta M_{A,B}{}^A - \delta AC_A - AC_A - AC_B$ |

**Table 7.2 Premiums, Demand, and Profits: Backwards Vertical Integration ($I_1$ integrates with $H_A$)**

| | | |
|---|---|---|
| $N_1 = \{H_A, H_B\}$<br>$N_2 = \{H_B\}$ | Premium | $P_1 = M + \theta c + \frac{\theta[t_B - t_A\tilde{x}^2 - t_B(\tilde{x}-1)^2]}{2}$<br>$P_2 = M + \theta c + \frac{\theta[t_A\tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_B]}{2}$ |
| | Demand | $q_1 = \frac{1}{2} + \frac{\theta[t_A\tilde{x}^2 + t_B(\tilde{x}-1)^2 - t_B]}{4M}$<br>$q_2 = \frac{1}{2} + \frac{\theta[t_B - t_A\tilde{x}^2 - t_B(\tilde{x}-1)^2]}{4M}$ |
| | Insurer Profit | $\pi_1 = \frac{M}{2} + \frac{\theta^2[t_At_B\tilde{x}^2 + t_B{}^2(\tilde{x}-1)^2 + t_At_B\tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_B{}^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - \delta AC_A - AC_B$<br>$\pi_2 = \frac{M}{2} + \frac{\theta^2[t_At_B\tilde{x}^2 + t_B{}^2(\tilde{x}-1)^2 + t_At_B\tilde{x}^2(\tilde{x}-1)^2]}{4M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_B{}^2 + (t_B(\tilde{x}-1)^2)^2]}{8M} - AC_B$ |
| | Total Industry Profit | $M + \frac{\theta^2[t_At_B\tilde{x}^2 + t_B{}^2(\tilde{x}-1)^2 + t_At_B\tilde{x}^2(\tilde{x}-1)^2]}{2M} - \frac{\theta^2[(t_A\tilde{x}^2)^2 + t_B{}^2 + (t_B(\tilde{x}-1)^2)^2]}{4M} - AC_B - AC_{A,B}$<br>$= M + \Delta M_{A,B}{}^B - \delta AC_A - 2AC_B$ |
| $N_1 = \{H_A, H_B\}$<br>$N_2 = \{H_A, H_B\}$ | Premium | $P_1 = P_2 = M + \theta c$ |
| | Demand | $q_1 = q_2 = \frac{1}{2}$ |
| | Insurer Profit | $\pi_1 = \frac{M}{2} - \delta AC_A - AC_B$<br>$\pi_2 = \frac{M}{2} - AC_{A,B}$ |
| | Total Industry Profit | $M - \delta AC_A - AC_B - AC_{A,B}$ |

**Appendix B: Extensive Form Game and Subgame Perfect Nash Equilibrium**

**Figure 3. Extensive Form Game**




The extensive form game, shown in Figure 3, proceeds as follows: Insurer $I_1$ decides whether to integrate with provider $H_A$. $I_1$ then establishes its network of healthcare providers. In the case where $I_1$ chooses no integration, $I_1$ can network with $H_A$, $H_B$, or both $H_A$ and $H_B$. In the case where $I_1$ chooses to integrate with $H_A$, $I_1$ must always network with $H_A$, therefore $I_1$ can network with $H_A$ and both $H_A$ and $H_B$. $I_1$ can also choose to exclusively network with $H_A$, preventing insurer $I_2$ from networking $H_A$.

Once $I_1$ makes its decisions, $I_2$ observes these decisions and then establishes its own network of providers, with some restrictions. If $I_1$ networks with $H_j$, then $I_2$ must network with $H_{-j}$ or both providers. Solely networking with $H_j$ would exclude $H_{-j}$ from the market, which this model does not allow. When $I_1$ integrates with $H_A$ and decides to exclusively contract with $H_A$, $I_2$ has no choice but to network with $H_B$.

Once all decisions have been made and the networks are established, the two insurers set their premiums accordingly and offer mandatory health insurance to consumers. After consumers purchase insurance, fall ill with fixed probability $\Theta$, and seek treatment from the providers in their insurer's network, the insurers transfer the cost of treatment, $c$, to the providers. The profits are realized, shown in Tables 6 and 7. The total industry profits are then divided into the respective individual payoff allocations, shown in Tables 1 and 2.

Backward induction is used to determine the best response functions of the insurers and thus the subgame perfect Nash equilibria. Since $I_2$ makes the final decision, that insurer will choose the networking strategy that results in its highest individual payoff in each subgame. Taking this into consideration, $I_1$ then chooses the networking strategy that results in its highest individual payoff when it decides not to integrate and the highest combined individual payoff of itself and $H_A$ when it integrates with $H_A$. This is because when $I_1$ and $H_A$ integrate, they become one firm and thus the joint payoff must be considered. Finally, $I_1$ must decide whether to integrate and chooses the strategy that results its highest individual payoff, since $I_1$ wants to maximize its own payoff.