Providers Affiliation, Insurance and Collusion

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Abstract

This paper provides a theoretical analysis of the benefits for an insurance company to develop its own network of providers when insurance fraud is characterized by collusion between opportunistic policyholders and providers. In a static framework without collusion, exclusive affiliation of providers allows insurance companies to recover some market power and to lessen competition on the insurance market. This entails a loss of efficiency. However, with collusion, exclusive affiliation of providers may entail a positive effect on customers' surplus when insurers and providers are engaged in a repeated relationship. The threat of being deprived from exclusive affiliation acts as a deterrent for fraudulent activities. This possibility may supplement an inefficient judicial system: it is thus a second-best optimal anti-fraud policy.

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Keywords: Insurance, Affiliation/Vertical Relationships, Fraud.

1 Introduction

The relationships between insurance companies and service providers (e.g., car repairers, hospitals...) have experienced dramatic new trends during the two last decades. Concentration in the insurance market and in the markets for related services went along with the affiliation of providers by insurance companies, creating networks of affiliated or preferred service providers. Such vertical relationships may appear at odds with the usual assumption of competitive insurance markets and they may strongly affect the efficiency of resource allocations and risk sharing. As insurance companies pay for the service provided to their clients in case of an accident, they may impose restrictions on available providers. This is often the case in the health sector, particularly in the U.S. since the

[1] We thank participants at the CESifo Area Conference on Applied Microeconomics (Munich, 2006) for their useful comments and suggestions.

so-called managed care organizations (mainly HMO and PPO systems) are prevalent nowadays.[2] This is also true for other activities such as car repair by means of Direct Repair Programs (DRP).

The rise of DRP is indeed particularly striking. These programs have been around for well over twenty years in the U.S., but their actual impact did not begin to be felt, nor did the discussion regarding their legitimacy grow so heated, until the 90s. In the middle of the 90s, the estimated number of repair facilities that participated in DRP was approximately 5,000 across the U.S., with a claims volume at 8% of overall claims. Today, there are over 20,000 referral shops, thanks to the over 13,000 shops participating in State Farm's program. Allstate is next in line with approximately 5,000 facilities. In the U.S., DRP claims volume has raised regularly, reaching 20% of the total automobile claims in 1998 and 45% in 2000.

To illustrate the possible effects of DRP on market shares, Figure 1 uses data from the California Department of Insurance. It reports the market shares of the most important insurers in California over the last 7 years for the private passenger auto liability line of business.

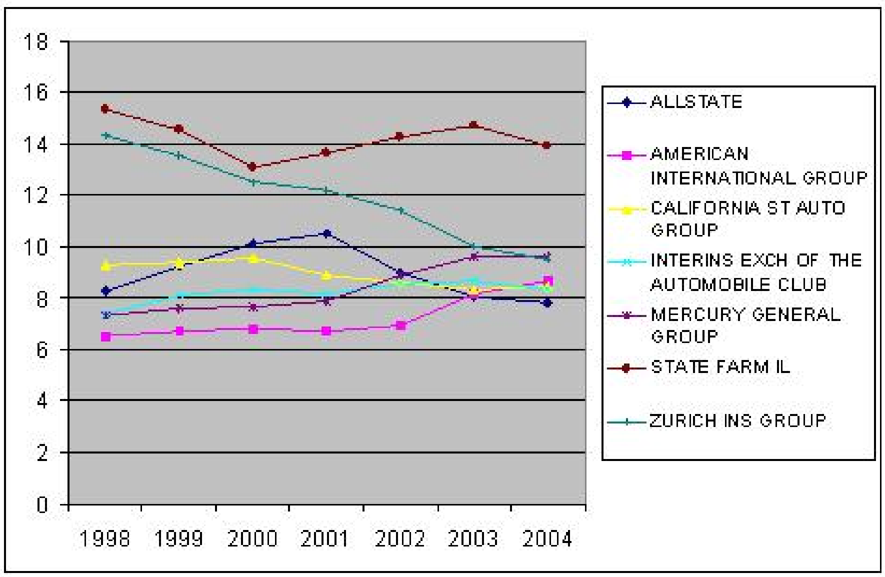

Figure 1: Market shares of the dominant insurers in California (1998-2004, passenger auto liability line of business, source: California Department of Insurance).

As it appears from the figure, up to 2000-2001, Allstate was steadily gaining market share whereas the market share of its main rival, State Farm, was declining. This might be related to the fact that Allstate was a pioneer in the implementation of Direct Repair Programs. Although the creation of DRP may have interfered with other factors, the DRP creation has provided Allstate with a strategic advantage over its competitors, until the latter finally decided to implement their own referral programs.

That trend towards more integration between insurers and service providers certainly is a world-wide phenomenon. For instance, the largest Australian automobile insurer, IAG, has recently launched a web-based quotation system known as Preferred Repairer Network System. This preference network allows claimants to benefit from services such as the timely assessment of claims,

[2] For a presentation of the questions raised by managed-care organizations, see Gaynor and Haas-Wilson (1999).

timely authorization to proceed with repairs, the opportunity to get an early release of the repaired vehicle and payment of towing expenses.

Whether such a network of preferred providers is in the interest of insureds and whether it favors economic efficiency is still a matter of discussion. In particular, smash repairers who are not on IAG's Preferred Smash Repairers List complain they are losing business because they are being surpassed by IAG's tele-claim system. Recently, the members of the New South Wales Legislative Assembly criticized the IAG Preferred Repairers Network by emphasizing that policyholders do not have the unfettered freedom of choice provided by other major car insurers, such as Allianz.[3] The creation of these providers networks and the concentration trends that have followed have been criticized as a way for insurance companies to restrict competition and to enlarge their profits at the customers' expense.[4] This has generally led regulators or competition authorities to adopt a conservative and negative stance vis-à-vis these vertical agreements.

However, more favorable explanations have also been put forward to justify the creation of DRPs, including the fact that they allow insurers (and ultimately policyholders) to benefit from economies of scale. Another reason that may stimulate the creation of referral lists lies in the alarming extent of the insurance fraud problem. Indeed, these programs may allow to better monitor the providers. Moreover, the threat of excluding deceitful providers from referral lists may act as a strong deterrence mechanism to dissuade providers from defrauding the insurance company they are affiliated with. This paper will indeed argue that the vertical organization between insurance companies and service providers affects the amount of fraudulent activities in the insurance sector. More specifically, the purpose of the following analysis is to appraise the consequences of the creation of service providers networks on the efficiency of resource allocation in insurance markets. Specific attention will be granted to the risk of collusion between insureds and providers in relation to insurance fraud.

How large a problem is insurance fraud is generally a difficult question to gauge as only the tip of the iceberg might be observed. According to insurance companies' specialized press, it is the second most popular white-collar crime in the U.S. (Claims Magazine). Best Insurance Review estimates that 6% of claims have some element of fraud.

The importance of the relationship between insurance fraud and the behavior of service providers sometimes transpires to the public through the results of police investigations. Considering the collision repair industry only, investigations recently reveal these two astonishing cases:[5]

- In San Francisco, six people, including automobile repair shop owners and employees, were involved in more than two dozen fraudulent insurance claims. This followed the closure of 10 shops and the arrests of more than 40 people few months after a six-month undercover investigation of Santa Clara County, California, collision repair shops.[6]

- In January 2005, a New York shop owner and manager were indicted on 23 counts of insurance fraud, grand larceny and falsifying business records. According to the district attorney, the defendants fraudulently inflated insurance claims, usually by either enhancing the damage to a vehicle or by simply failing to do the work for which they were paid.[7]

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[3] See New South Wales Legislative Assembly Hansard, 15 September 2005, p 49, Article 33.

[4] Likewise in 2003 the Texas Senate voted to pass a bill which banned ownership of repair shops by insurance companies.

[5] Many other spectacular examples of insurance fraud cases can be found at `http://www.insurancefraud.org/hallofshame/`.

[6] See Automotive Body Repair News, November, 2002.

[7] See Automotive Body Repair News, March, 2003.

To capture the main features of this problem while keeping the model tractable, we will limit attention to a simple setup of a double vertical duopoly with two insurance companies and two service providers.

Service providers (say, car repairers) compete on a horizontally differentiated market for the service they provide to customers. It is easily understood that service providers are not valued the same by customers. Indeed, both the convenience of their geographic locations and their word-of-mouth reputations may generate various patterns of demand by the users. Hence, providers have some market power due to the imperfect substitutability of their services.

By contrast, we assume that insurers are perceived as perfectly substitutable by their potential clients. They compete by offering insurance contracts which consists in an insurance premium and a net reimbursement in the event of an accident. These insurance contracts also depend on the provider chosen by the customers.

Several affiliation structures are considered. In the case of non-exclusive affiliation, customers of both insurance companies are free to elect the provider of their choice. Hence, among the customers of each insurance company, some choose to visit one provider in the event of an accident whereas other visit the other provider. In that scenario, competition between insurers is fierce as each insurance company can always undercut its rival. Therefore, insurance companies are unable to elicit any surplus from customers: the premium is actuarially fair, customers are fully insured and insurers make no profit. Providers enjoy a positive markup from their imperfect substitutability.

In the situation where insurance companies are attached to their own provider through their referral lists, the case of exclusive affiliation, we show that insurance companies are able to pull out some of the providers' market power, to the detriment of their customers. In other words, exclusive affiliation allows to transfer some market power from the differentiated providers to the undifferentiated insurers.

We will also analyze the case of common affiliation in which insurers choose the same provider as their unique referral, and the case of asymmetric affiliation choices where one insurer affiliates one single provider while the other insurer affiliates both providers.

As a consequence of this analysis, we show that when insurance companies decide non-cooperatively of their affiliation structure, then each insurer always affiliates exclusively one provider only. Hence, in this setting, allowing insurers to restrict access to a specific provider reduces the welfare of insureds. If the government gives more social value to the insureds' welfare (in terms on wealth certainty equivalent) than to insurers' profit, say, for equity reasons, then it should prevent insurers to restrict access to providers. Hence, in this basic setting without insurance fraud, the maximization of the policyholders' surplus should lead the government to forbid exclusive affiliation of providers by insurers.

We then consider the insurance fraud problem. To streamline the analysis, insurance fraud is modeled in a crude way. Opportunistic policyholders may file fraudulent claims when they do not have suffered any accident. Service providers facilitate fraudulent claiming by certifying that the policyholder actually needed a car repair, allowing him to receive the insurance indemnity. This insurance indemnity is the collusive stake and it is split between the two collusive actors, the policyholder and the car repairer. We develop our analysis of insurance fraud first in a static context. Insurance fraud may be deterred through auditing. If providers are risk-neutral, collusion is deterred if the gains obtained by providers from a successful collusive deal (i.e., the fraction of the insurance indemnity obtained by providers) is lower than the expected fine providers have to pay if audit reveals collusion.

When binding, such a collusion-proofness condition affects the features of insurance contracts offered in the market. It leads insurers to offer partial coverage policies in order to decrease the collusion stake. The lower the probability of a successful audit, the lower the insurance coverage for collusion proofness to be maintained. Likewise, the lower the fine imposed by courts on providers guilty of fraud, the lower the insurance coverage. In particular, a stronger judicial system (i.e., larger expected fines imposed on dishonest providers) leads to less distortions on the insurance market.

In this static setting, non-exclusive providers affiliation still leads to larger policyholders' surplus than exclusive providers affiliation. More precisely, there are cases in which the collusion-proofness condition is not binding under exclusive affiliation whereas it binds under non-exclusive affiliation. The reason is that in the former case, insurance companies recover some market power and can thus reduce the amount of indemnities given to their customers, thereby reducing the collusive stake. Even in these cases, we show that non-exclusive affiliation is preferred to exclusive affiliation as the loss of surplus associated to imperfect risk-sharing under non-exclusive affiliation is smaller than the loss of surplus associated to the insurers' market power under exclusive affiliation.

Therefore, in this one-shot framework, the defence of the policyholders should thus lead the government to ban insurers from excluding some providers from its network.

The results are strikingly different when insurers and providers are engaged in a repeated relationship. In such a setting, we consider the additional deterrence effect of the insurer's threat to exclude a fraudulent provider from its referral list. Of course, for such a threat to be effective, it must be that insurance companies are free to settle and unsettle their affiliation as they wish –in particular when a provider is caught colluding. Differently put, a regulatory ban on exclusive affiliation implies that the unique way for insurers to fight collusion is through the audit procedures.

Under non-exclusive affiliation, the outcome of the game is the replication of the outcome of the static game at each period. The lower the efficiency of the audit procedure, the stronger the incentives of the providers to collude, and the larger the distortions on insurance contracts to prevent collusion. When the proportion of potential collusive deals is small, insurers may prefer not to deter collusion. Such a situation also entails distortions on insurance contracts offered at equilibrium. Hence, when audit procedures are relatively inefficient to discover collusion by the providers and when the amount of collusive deals in the industry is large enough, non-exclusive affiliation forces insurance companies to strongly distort their contracts.

Things are different under exclusive affiliation. Indeed, the threat of excluding a collusive provider from the network of affiliated providers may dissuade collusion, even when the audit procedures are inefficient or when the fraction of collusive deals in the industry is large. Indeed, if a provider is caught colluding and excluded from the network, a situation of common affiliation is created. As previously explained, the excluded provider then suffers from a competitive disadvantage vis-à-vis its rival. By contrast, were that provider not colluding, it would have enjoyed the profit associated to the exclusive affiliation scenario. When the provider puts sufficiently large a weigh on future profits, that is, when its discount factor is sufficiently large, the threat of being excluded from the network of affiliated providers destroys any incentives to collude, even when the efficiency of audit procedures is low or when the fraction of potential collusive deals is large.

From a methodological standpoint, our analysis shares a common interest with papers on the organization of health care markets. For instance, Gal-Or (1997) analyzes managed-care organizations in a framework involving two insurance companies and two service providers (hospitals). Insurance companies may choose to exclude or not hospitals, depending of the agreement they can negotiate with them. She determines the agreements that are reached at equilibrium assuming that insurers are differentiated, hospitals are differentiated too and negotiation occurs according to a Nash bargaining game. The questions we focus on are similar although we are more interested in the impact of fraud and in the repeated interactions between insurers and service providers on the organization of insurance markets and on their efficiency in terms of risk-sharing properties. In a different vein, the effects of collusion between providers and insureds on insurance contracts and on the physicians' effort to deliver good care is investigated in Ma and McGuire (1997). As neither the quantity of treatment (decided by the patient) nor the physician's effort are contractible, only third-best regimes are attainable. They analyze how "professional ethics" and competition among physicians allow to relax the constraints that restrict insurance contracts.[8] Finally, our analysis bears some resemblance with the analysis of vertical restraints in Industrial Organization, as extensively surveyed in Rey and Tirole (2006). Our contribution with respect to this literature is to account for two specificities of insurance markets, namely risk-sharing and fraud.

The paper is organized as follow. The next section sets up the model. Then, in Section 3, we analyze how the different affiliation structures impact the equilibrium on the insurance market in the absence of fraud. In Section 4, we analyze the relationship between providers affiliation and insurance fraud in a static setting where fraud may be deterred by the threat of being sentenced in courts. In Section 5, we investigate the role of exclusive affiliation as a mechanism to deter fraudulent activities in a dynamic setting with a repeated relationship between insurers and providers. Section 6 concludes.

2 The Model

Our model involves three main characters: insurers, service providers and potential customers. Customers are exposed to a risk and may therefore buy an insurance policy from one of the insurance firms. In case of an accident, they may also ask for the services of one of the providers to compensate for their loss.

Providers. Two providers, denoted by $j \in \{0, 1\}$, propose services to customers who have suffered from an accident. At cost c (which, for analytical convenience, is taken to be the same across providers), a provider can fully compensate a customer from its loss. Provider j posts price p_j for its services.[9]

Insurers. Two insurers, denoted by $i \in \{A, B\}$, offer insurance policies which consist of a premium k_i^j and a net indemnity s_i^j in the event of an accident (i.e., $s_i^j + k_i^j$ is the gross indemnity) when an insured has chosen provider j.

Insureds. There is a unit mass of risk-averse potential customers, with initial wealth w, who are uniformly located on interval $[0, 1]$. Each customer may suffer from an accident with probability π. In case of an accident, the monetary loss is ℓ with $\ell > c \geq 0$. Customers have preferences described by a von Neumann-Morgenstern utility function $u(.)$, with $u'(.) >$ and $u''(.) < 0$.

The two providers are located at the extremities of the segment, namely at $x_0 = 0$ for provider 0 and $x_1 = 1$ for provider 1. Hence, the expected utility of a customer located in $x \in [0, 1]$ is thus:

$$(1 - \pi)u(w - k_i^j) + \pi \left[u(w + s_i^j - p_j) - t|x - x_j| \right], \tag{1}$$

[8] The interested reader can find a rather large literature on health markets. The changes and consolidation trend in health care markets along with the problems that have followed are exposed in Newhouse (1996) and Gaynor and Haas-Wilson (1999). Several empirical studies document the consolidation trends in the health sector and investigate the benefits of managed care: see Town and Vistnes (2001), Backer and Brown (1999) and Evans Cuellar and Gertler (2005) for recent studies. Several analytical studies followed Gal-Or's (1997) investigation. See in particular Gal-Or (1999) and Lyon (1999) for a study on mergers and consolidation in health markets.

[9] Our analysis remains qualitatively unchanged if we assume that providers offer prices which depend on the choices of insurance companies by the customers.

if that customer subscribes an insurance policy from insurer i and buys the service offered by provider j. Implicit in this formulation is that customers are heterogeneous in their preferences toward the providers: to fix ideas, consider that customers have to bear different transportation costs to visit the various providers. Notice also that these transportation costs are expressed in utils. In addition to true transport disutility, these costs may correspond to the ability of each provider to offer specific services that more or less matter for each individual. For example, repairers may be specialized in some brands of car, hospitals may be more efficient for the treatment of some diseases, etc. Parameter t is thus an index of the substitutability across providers.

By contrast, if a customer is not insured and chooses not to use the providers' services, then its expected utility writes as:

$$u_{\emptyset} \equiv (1-\pi)u(w) + \pi u(w-\ell). \tag{2}$$

Providers affiliation by insurance companies. Insurers can decide to affiliate one particular provider or to affiliate both of them. If insurer i affiliates provider j only, then i's customers are required to visit j in the event of an accident.

The game. Let us now describe the game under consideration.

1. Affiliation decisions are first made non-cooperatively by insurance companies.
2. Insurers offer insurance policies $\{k_i^j, s_i^j\}$, $j \in \{0,1\}$ and $i \in \{A, B\}$. Simultaneously, providers post prices p_j, $j \in \{0,1\}$ for their services.
3. Given the observed insurance policies and providers prices, customers choose at most one insurance contract.
4. Finally, any customer who suffers from a loss decides to visit or not a provider among those who are affiliated by his insurer.

3 Optimal Affiliation Structures

In this section, we characterize the (subgame-perfect) Nash equilibrium of our game. We proceed in two steps: first, we analyze the equilibrium of the subgame starting at stage 2 in which the insurers' choice of affiliations is given. Then, in a second step, we look at the non-cooperative affiliation decisions made by insurance companies at stage 1.

3.1 Non-exclusive affiliation

In this first case, both insurance companies have affiliated both providers. Figure 2 represents the situation under consideration.

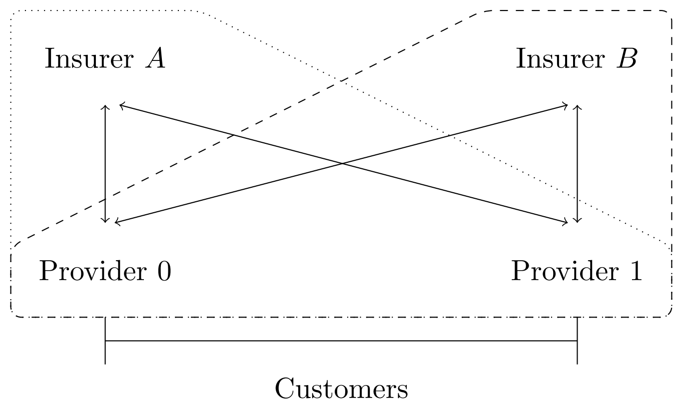

Figure 2: No affiliation.

We focus on symmetric equilibria of that subgame in which insurers offer the same insurance policy, i.e., $k_A^j = k_B^j \equiv k^*$ and $s_A^j = s_B^j \equiv s^*$ for $j \in \{0, 1\}$, and providers offer the same price, i.e., $p_0 = p_1 \equiv p^*$. Given that decisions are taken simultaneously by the providers and the insurers, we look at the conditions under which none of the players has an incentive to deviate from that symmetric outcome.

Competition in contracts between insurers. Competition between the insurance companies leads to the following contract that is offered at equilibrium:

$$\{k^*, s^*\} \in \arg\max_{\{k,s\}} (1-\pi)u(w-k) + \pi u(w - p^* + s)$$
$$\text{s.t. } (1-\pi)k - \pi s = 0.$$

Indeed, otherwise either insurer A or insurer B could deviate and propose another contract that would increase its profit by attracting more customers: any equilibrium contract must be such that insurance companies exactly break even and that customers' expected utility is maximized.

Straightforward manipulations show that the equilibrium insurance contract satisfies:

$$s^* = (1-\pi)p^* \text{ and } k^* = \pi p^*. \tag{3}$$

In words, the equilibrium insurance policies involve full insurance for the customers and actuarial premia.

The following intuition turns out to be helpful later on. When both insurers affiliate all providers, they have no possibility to discriminate between customers. Put differently, with such an affiliation structure, insurers fiercely compete to attract all potential customers, those who have a stronger preference for provider 0 as well as those who express a stronger preference for provider 1. Hence, if one insurance company, say A, enjoys a strictly positive profit, then the rival company B could destabilize such a situation by slightly undercutting A and proposing to A's customers a more attractive insurance policy together with the possibility of choosing their preferred providers freely. As a result of the competitive process, at a symmetric equilibrium, insurance companies are led to offer a contract such that, first, they earn no profit and, second, the contract maximizes the customers' expected utility (gross of the transportation costs).

Price competition between providers. A mass π of customers have suffered from a loss and are willing to buy the services offered by the providers. Let denote by $\tilde{x}$ the address on $[0, 1]$ of the customer who is exactly indifferent between provider 0 and provider 1, that is:

$$u(w - p_0 + s^*) - t\tilde{x} = u(w - p_1 + s^*) - t(1 - \tilde{x}). \tag{4}$$

Hence, the marginal customer is characterized as follows (where subscript 'p' stands for 'provider'):

$$\tilde{x}_p(p_0, p_1, s^*) = \frac{1}{2} + \frac{1}{2t}\left[u(w - p_0 + s^*) - u(w - p_1 + s^*)\right]. \tag{5}$$

Intuitively, if providers offer identical prices, then they share the demand equally since customers base their choice (of provider) on the basis on the transportation cost only. By contrast, if provider 0 offers a price lower than provider 1, it increases its market share since some customers are now willing to bear a higher transportation cost in order to benefit from a lower price.

The profit of, say, provider 0 can thus be written as:

$$\pi_0(p_0, p_1, s^*) = \pi(p_0 - c)\tilde{x}_p(p_0, p_1, s^*). \tag{6}$$

At a symmetric equilibrium, the (necessary and sufficient) first-order condition associated to the providers' profit-maximization problem yields:

$$t - (p^* - c)u'(w - p^* + s^*) = 0. \tag{7}$$

Therefore, when insurers have decided to affiliate both providers, the providers' price and insurers' contracts offered at equilibrium are characterized by (3) and (7). The next lemma summarizes this case.

Lemma 1. *At a symmetric equilibrium (p^*, s^*, k^*) with non-exclusive affiliation:*

- *insurance companies provide full coverage at actuarial price, i.e., $k^* = \pi p^*$, $s^* = (1 - \pi)p^*$*
- *providers charge a price with a margin over marginal cost such that $p^* - c = t/u'(w - p^* + s^*)$.*

3.2 Exclusive affiliation

Suppose now that each insurance company has its own referral provider, a situation that is called 'exclusive affiliation' in the following. Hence, insurer A (resp. B) requires its customers to visit provider 0 (resp. 1) in the event they incur an accident. Accordingly, denote by $\{k_A, s_A\} = \{k_A^0, s_A^0\}$ and $\{k_B, s_B\} = \{k_B^1, s_B^1\}$ the contracts offered by the insurance companies; under exclusive affiliation, $\{k_A^1, s_A^1\} = \{k_B^0, s_B^0\} = \{0, 0\}$.

This situation is represented in Figure 3.

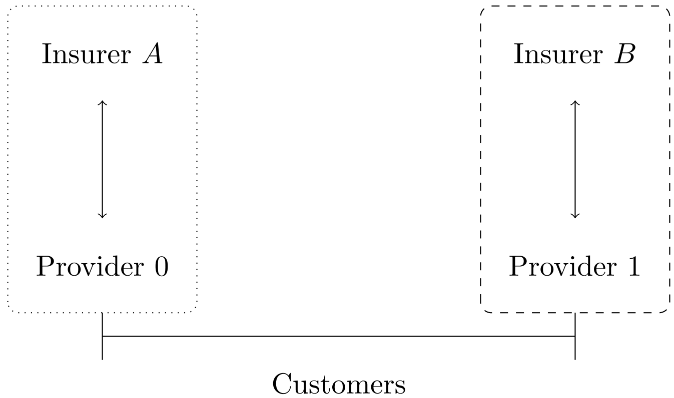

Figure 3: Exclusive affiliation.

Again we look for a symmetric equilibrium in which insurance premiums, net reimbursements and providers' prices are identical, given by $k_A = k_B \equiv \hat{k}$, $s_A = s_B \equiv \hat{s}$ and $p_0 = p_1 \equiv \hat{p}$ respectively.

Competition in contracts between insurers. In that configuration, preferences among insurers depend on the location of individuals. Let us consider the marginal customer $\tilde{x}_i(k_A, s_A, k_B, s_B, p_0, p_1)$ (where subscript 'i' stands for 'insurer') who is exactly indifferent between buying A's insurance policy (and being required to use the service of provider 0 in the event of an accident) or B's (which involves going to provider 1 in the event of an accident):

$$(1-\pi)u(w-k_A)+\pi\left[u(w-p_0+s_A)-t\tilde{x}_i\right] = (1-\pi)u(w-k_B)+\pi\left[u(w-p_1+s_B)-t(1-\tilde{x}_i)\right]. \quad (8)$$

Insurer A determines its policy so as to maximize its profit, or:

$$\max_{\{k_A,s_A\}} \tilde{x}_i(k_A, k_B, s_A, s_B, p_0, p_1)\left[(1-\pi)k_A - \pi s_A\right]. \quad (9)$$

At a symmetric equilibrium, the premium is then characterized as follows:

$$\frac{1-\pi}{2} + \left[(1-\pi)\hat{k} - \pi\hat{s}\right]\frac{\partial \tilde{x}_i}{\partial k_A}(\hat{k}, \hat{k}, \hat{s}, \hat{s}, \hat{p}, \hat{p}) = 0. \quad (10)$$

Hence, the optimal premium is the result of the following tradeoff: on the one hand, an increase in the premium k_A allows insurer A to raise its profit on its attached customers (a proportion 1/2 at equilibrium). On the other hand, when k_A is increased then A's insurance policy becomes less attractive vis-à-vis B's policy and A's market share decreases, i.e., $\partial\tilde{x}_i/\partial k_A = -u'(w-\hat{k})(1-\pi)/(2t\pi) < 0$.

The reader can check that a similar tradeoff exists when the optimal net reimbursement s_A is increased. Hence, at a symmetric equilibrium, the following conditions characterize the contract offered by insurance companies:

$$\frac{(1-\pi)\hat{k}-\pi\hat{s}}{t\pi}u'(w-\hat{k}) = 1 = \frac{(1-\pi)\hat{k}-\pi\hat{s}}{t\pi}u'(w-\hat{p}+\hat{s}), \quad (11)$$

which gives $\hat{k}+\hat{s}=\hat{p}$. Simple manipulations thus yield:

$$\hat{k} = \pi\hat{p} + \frac{t\pi}{u'(w-\hat{k})}. \quad (12)$$

Equation (11) implies that customers enjoy the benefit of being fully insured (as in the non-exclusive affiliation case) but with a premium larger than the actuarial one (contrary to the non-exclusive affiliation case) since Equation (12) gives $\hat{k} > \pi\hat{p}$.

Competition between providers. Through its pricing decision, a provider contributes to the repartition of customers both across providers and across insurers. In the case of exclusive affiliation, the demand for services that faces provider 0 exactly coincides with the demand for insurance that addresses to company A. Hence, provider 0's optimization problem can be written as:

$$\max_{p_0} \pi(p_0 - c)\tilde{x}_i(k_A, k_B, s_A, s_B, p_0, p_1), \tag{13}$$

which gives:

$$t - (\hat{p} - c)u'(w - \hat{p} + \hat{s}) = 0 \tag{14}$$

at a symmetric equilibrium.

The next lemma summarizes these findings.

Lemma 2. *At a symmetric equilibrium $(\hat{p}, \hat{s}, \hat{k})$ where each insurer has its own referral provider:*

- *insurers provide full coverage, i.e., $\hat{s} + \hat{k} = \hat{p}$, and they charge a premium with loading $\hat{k} - \pi\hat{p} = t\pi/u'(w - \hat{k})$;*
- *providers charge a price with a margin over marginal cost such that $\hat{p} - c = t/u'(w - \hat{p} + \hat{s})$.*

Proposition 1 compares exclusive and non-exclusive affiliation systems.

Proposition 1. *As compared to non-exclusive affiliation, exclusive affiliation allows insurers to make a strictly positive profit and customers are worse-off.*

Proof. See the Appendix. □

Indeed, exclusive affiliation allows insurance companies to recover some 'market power' on the market for insurance. With exclusive affiliation of providers, the insurers' expected gain is:

$$\frac{1}{2}\left[(1-\pi)\hat{k} - \pi\hat{s}\right] = \frac{1}{2}\left[(1-\pi)\hat{p} - \hat{s}\right] > 0. \tag{15}$$

Differentiation between downstream providers generates market power which extends to upstream insurers have they chosen to affiliate exclusively their own provider. In other words, exclusive affiliation allows to transfer some market power from providers to insurers. Keeping this in mind, one clearly sees the impact of exclusive affiliation: even though they still receive full insurance at equilibrium, customers' expected utility is strictly smaller with exclusive affiliation as compared to non-exclusive affiliation. In our setting, providers turn out to be worse-off too under exclusive affiliation. A testable implication of this result is the following: insurance companies should have higher profits when we observe a trend to exclusive providers affiliation.

The reader acquainted with the Industrial Organization literature may have recognized the analogy between our setting of exclusive affiliation between insurance companies and providers with vertical integration between upstream suppliers and downstream retailers: suppliers can lessen competition on the upstream market by integrating vertically with an exclusive downstream provider. There is a difference worth noticing though: vertical integration would make the insurance company perfectly internalize the choice of an insurance policy on the provider's profit and reciprocally.

Hence, the equilibrium outcome under vertical integration is likely to be less competitive than the outcome under exclusive affiliation. Consequently, in a nutshell, judging on the sole basis of customers' welfare and absent any other considerations, non-exclusive affiliation performs better than exclusive affiliation which in turns performs better than vertical integration. We come back to that point later on.

Remark 1. Our formulation of the customers' problem under exclusive affiliation considers implicitly that a customer who does not buy insurance cannot visit an affiliated provider in the event of an accident. Regulators or competition authorities might instead require that affiliated providers serve uninsured customers on a non-discriminatory basis. As long as $u(w-\hat{k}) \geq (1-\pi)u(w)+\pi u(w-\hat{p})$, an inequality which holds when customers' risk-aversion is sufficiently large, our analysis is left unchanged with that alternative scenario, for all customers prefer to get insured at equilibrium under exclusive affiliation. Similarly, we consider that $(1-\pi)u(w)+\pi u(w-\hat{p}) \geq u_\emptyset$ or $\hat{p} \leq \ell$ to ensure that uninsured customers always choose to visit a provider.

So far, our analysis has focused on two polar cases: non exclusive affiliation or exclusive affiliation. The next step to undertake is to consider the insurance companies' incentive to create referral providers lists. This requires to study two other asymmetric situations, one in which insurers choose to affiliate the same provider (common affiliation) and another one where one insurer affiliates one provider whereas the other insurance company affiliates all providers (asymmetric choice of affiliations).

3.3 Common affiliations

We now deal with the situation in which both insurers decide to affiliate the same provider, say, provider 0. This is represented in Figure 4.

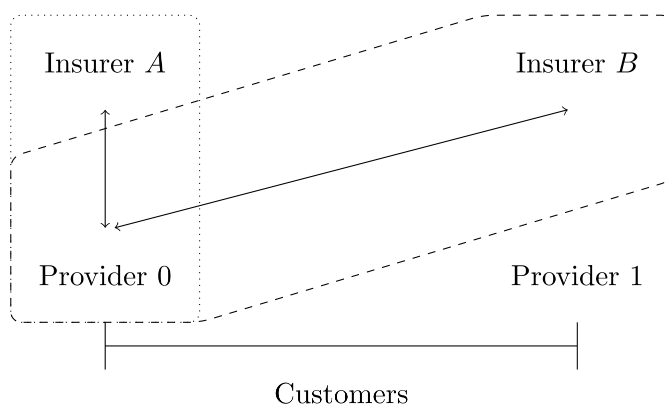

Figure 4: Common affiliation.

All insureds who suffer from a loss are required to visit provider 0; hence, from the viewpoint of the insurance companies, the provider does not help in discriminating the various customers: at equilibrium, competition in contracts leads them to offer full insurance and to set an actuarial premium, given the price p_0 set by provider 0: $k = \pi p_0$ and $s = (1-\pi)p_0$. A logic similar to that exposed in the case of non-exclusive affiliation applies.

Let us look at the customers' side. Customers must trade off, on the one hand, the possibility not to buy any insurance policy and, on the other hand, the price to pay to have access to the unique provider affiliated by the insurers. The marginal customer is now defined as follows:

$$(1-\pi)u(w-k_0)+\pi u(w-p_0+s_0)-\pi t\tilde{x}_i=(1-\pi)u(w)+\pi[u(w-p_1)-t(1-\tilde{x}_i)]. \qquad (16)$$

Equation (16) expresses the fact that customers who have decided not to buy an insurance policy can compensate for their loss by buying provider 1' service. Profits of the providers can be written as:

$$\pi_0=\pi(p_0-c)\tilde{x}_i,$$
$$\pi_1=\pi\,(p_1-c)\,(1-\tilde{x}_i).$$

With common affiliation of provider 0 by both insurance companies, the rival provider 1 in fact bears a competitive disadvantage vis-à-vis provider 0: customers being risk-averse, provider 1 must set much a lower price than provider 0 if it wants to capture part of the demand for repair services since its potential customers are not insured. Moreover, the fierce competition between insurers for customers that choose provider 0 tends also to reduce provider 1's market share.

Deriving the equilibrium prices set by the providers is straightforward. The next lemma summarizes this case.

Lemma 3. *Consider that insurers have affiliated the same and unique provider. Then, at the equilibrium:*

- *insureds receive full insurance, the insurance premium is the actuarial one and insurance companies make no profit;*
- *the unique affiliated provider charges a higher price and makes a larger profit than its unaffiliated rival.*

Finally, notice that when customers are sufficiently risk-averse and the potential loss they face is large enough, then a corner solution is likely to emerge: in that case, the non affiliated provider is put at such a strong disadvantage with respect to its affiliated competitor that the demand it faces (and therefore its profit) may become null.

3.4 Asymmetric affiliation choices

The last case to study involves one insurer, say A, affiliating one provider, say 0, while the other insurance company choosing to affiliate both providers. This situation is represented in Figure 5.

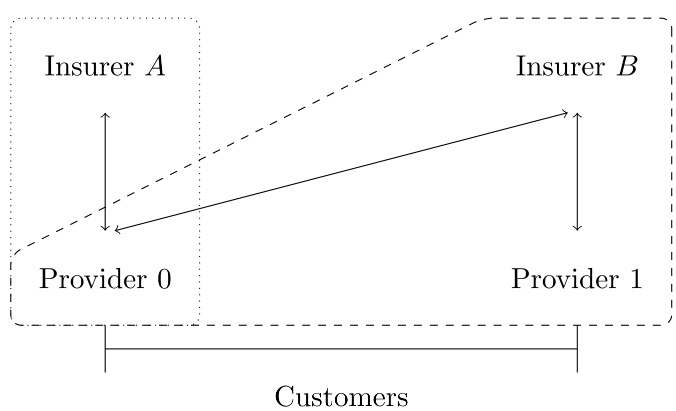

Figure 5: Asymmetric affiliations.

Insurer B / Insurer A	Provider 0	Provider 1	Provider 0 and 1
Provider 0	$(-\varepsilon, -\varepsilon)$	$(\hat{\Pi}-\varepsilon, \hat{\Pi}-\varepsilon)$	$(-\varepsilon, \hat{\Pi}-\gamma)$
Provider 1	$(\hat{\Pi}-\varepsilon, \hat{\Pi}-\varepsilon)$	$(-\varepsilon, -\varepsilon)$	$(-\varepsilon, \hat{\Pi}-\gamma)$
Provider 0 and 1	$(\hat{\Pi}-\gamma, -\varepsilon)$	$(\hat{\Pi}-\gamma, -\varepsilon)$	$(0, 0)$

Table 1: Insurers' payoffs depending on the affiliation choices.

Then, we obtain the following lemma.

Lemma 4. *Consider that one insurance company (say, A) affiliates with one provider (say, 0) whereas the other insurance firm (B) affiliates both providers (0 and 1). Then:*

- *insureds who have elected provider 0 receive full insurance and an actuarially fair premium whatever their choice of insurance company;*
- *insureds who have elected provider 1 receive full insurance but their premium is larger than the actuarial one.*

Proof. See the Appendix. □

Since insurer B doesn't impose any requirement on the customers' choice of providers, it can seize A's market share by undercutting its offer. Competition for the insureds who have elected provider 0 is fierce, leading those customers to be fully insured at an actuarial price. Insurer B can still earn some profits from customers who have elected provider 1; however, the intense competition on the segment of customers who have chosen provider 0 tends to reduce the market share of provider 1. As a consequence, the demand that faces insurance B over which it can exert some market power is constrained by this competitive pressure. In a nutshell, this situation lies in-between the non exclusive affiliation case (but customers who have chosen provider 1 are charged above the fair premium) and the exclusive affiliation situation (but customers who are close to provider 0 enjoy an actually fair insurance contract).

3.5 Non-cooperative choices of affiliation structure by insurers

Now that we have reviewed the possible affiliation structures, let us determine whether some of them are more likely than others to emerge. This amounts to solving the game starting at stage 1. Affiliation of one (or more) provider(s) comes at a cost $\varepsilon \in [0, \hat{\Pi})$ where $\hat{\Pi} = [(1-\pi)\hat{p} - \hat{s}]/2$ is the insurer's profit under exclusive affiliation. This cost may correspond, for instance, to the resources that must be devoted to make insureds informed about the affiliated provider(s). Finally, the previous subsection has shown that in the asymmetric affiliation case, the profit of the insurance company which affiliates both providers is strictly smaller than $\hat{\Pi}$: to reduce the notational burden, its profit in that case is denoted by $\hat{\Pi} - \gamma$ ($\gamma > 0$) without loss of generality.

For the sake of clarity, the payoffs for the insurers in the different configurations are summarized in Table 1. A rapid inspection of this table leads to the following conclusion.

Proposition 2. *For small affiliation costs, at a subgame-perfect equilibrium of the game, both insurers choose exclusive affiliation.*

As soon as insurance company A has decided to affiliate exclusively with provider 0 for instance, then it is an optimal decision for the rival insurance company B to affiliate exclusively with the remaining provider: indeed, choosing not to compete with the segment of customers who visit 0 in case of an accident softens the competition between providers and allows insurer B to raise its profit.

Remark 2. Notice that, as regards the choice of affiliation structures, we have given all the bargaining power to the insurance companies. This assumption is sensible since insurance companies are typically nation-wide players whereas providers are typically much smaller.

4 Affiliation and Insurance Fraud

The previous section has argued that affiliation of providers by insurance companies is an imperfect mechanism to restore some market power at the upstream level: in particular, exclusive affiliation structures allow insurance companies to enjoy a strictly positive profit at the expense of the customers (and, to some extent, of providers too). Importantly, insureds still receive full insurance from the insurers. We now look at the role of providers' affiliation choices when insureds may collude with providers.

Collusion and fraudulent claims. A simple way to introduce collusion in our setting goes as follows. We consider that insureds who did not suffer from an accident may declare a fraudulent claim to their insurance companies. Let $\theta \in [0, 1]$ be the fraction of customers that may reach a collusive deal with a provider; hence, the industry-wide number of potential collusive deals is given by $\theta(1 - \pi)$.[10]

Collusion in our context amounts to filing a fraudulent claim: the insured then obtains a monetary gain $-p_j + s_i^j + k_i^j$ (instead of $w - k_i^j$ if he does not collude), while the provider earns p_j (instead of 0 if no collusion occurs). Therefore, the net collusive stake is $s_i^j + k_i^j$, which is assumed to be equally shared between the insured and the provider.[11]

Audit and fines as collusion deterrents. The threat of fraudulent claims typically leads insurance companies to implement audit policies which allow them to detect whether a claim was justified or not. Let $q \in [0, 1]$ be the probability that the insurance company detects that the provider has engaged into fraudulent activities with a given customer.[12]

Of course, for the audit policy to be effective in deterring collusion, it must be that some kind of penalty can be implemented by the insurance companies. A simple type of penalty would consist in launching a lawsuit against the provider upon a successful audit which unveils collusion. Let us therefore denote by F the monetary fine that can be imposed by courts to the provider in case a fraudulent behavior has been unveiled.[13]

Therefore, in order to prevent collusion by provider j, insurer i has to ensure that the threat of being discovered and fined is larger than the stake of collusion between the provider and the

[10] Hence, we assume that all policyholders are potential defrauders. A different modeling choice (see Picard (1996)), would be to assume that there are two types of policyholders, some of them being inherently honest, and other ones potentially dishonest (i.e., opportunistic).

[11] One could easily think about other ways to introduce collusion. What really matters for our analysis is that the stake of collusion depends on the insurance contract.

[12] To streamline the analysis, we assume that the audit probability is the same for both insurance companies and we neglect the cost of auditing. Since q is exogenous, in the present model, nothing substantial is lost with this simplification.

[13] Assuming that the penalty is imposed on the policyholder would not qualitatively affect our results.

customer, or:

$$qF \geq \frac{s_i^j + k_i^j}{2}. \tag{17}$$

The welfare cost entailed by the risk of collusion depends on q and F. When audits are less efficient or fines imposed by courts are lower (i.e., when q or F are lower), then the collusion-proofness condition (17) is more severe and, as we will see, it entails larger adverse effects on the policyholders' welfare.

Because $p^* > \hat{p}$ and $s^* + k^* = p^*$, $\hat{s} + \hat{k} = \hat{p}$, (17) shows that collusion is less likely to occur under non-exclusive affiliation than under exclusive affiliation. More precisely, when $p^* > 2qF \geq \hat{p}$, (17) is binding in the non-exclusive affiliation case whereas it is not under exclusive affiliation; by contrast, when $\hat{p} > 2qF$, the insurance fraud is a problem in both structures. The following proposition characterizes the optimal insurance contracts and providers' prices in each case (where subscript '*cp*' stands for 'collusion-proof').

Lemma 5. *The optimal collusion-proof insurance contracts and providers prices at a symmetric equilibrium are as follows when constraint (17) is binding:*

- *Under non-exclusive affiliation ($p^* > 2qF$): $s_{cp}^* = 2(1-\pi)qF$, $k_{cp}^* = 2\pi qF$ and $p_{cp}^* - c = t/u'(w - p_{cp}^* + s_{cp}^*)$, such that $p_{cp}^* > s_{cp}^* + k_{cp}^*$.*
- *Under exclusive affiliation ($\hat{p} > 2qF$): $\hat{s}_{cp} < 2(1-\pi)qF - \pi(\hat{p} - c) < s_{cp}^*$, $\hat{k}_{cp} > 2\pi qF + \pi(\hat{p} - c) > k_{cp}^*$ and $\hat{p}_{cp} - c = t/u'(w - \hat{p}_{cp} + \hat{s}_{cp})$ such that $\hat{p}_{cp} > \hat{s}_{cp} + \hat{k}_{cp}$.*
- *Moreover, when $\hat{p} > 2qF$, we have $\hat{p}_{cp} < p_{cp}^*$.*

Lemma 5 shows that, because of the threat of collusion, insurance policies offered at equilibrium may no longer provide customers with full insurance whatever the affiliation structure. Insurance premia are higher under exclusive affiliation than under non exclusive affiliation whereas it is the opposite for the insurance indemnities. We also observe that the providers' equilibrium price is lower under exclusive affiliation than under non-exclusive affiliation (the market power effect). We are now in position to compare the customers' expected utility under both affiliation structures.

Proposition 3. *When insurers offer collusion-proof contracts, exclusive affiliation leads to a lower customers' expected surplus than non-exclusive affiliation.*

Proof. See the Appendix. □

When $2qF > p^*$, the judicial system is efficient enough to deter fraud without incurring any efficiency loss whatever the affiliation structure. Hence, according to the analysis undertaken in the previous section, from the standpoint of customers' expected surplus non-exclusive affiliation always performs better than any other affiliation structure.

In the intermediate zone, that is, when $p^* > 2qF > \hat{p}$, the fraud deterrence constraint distorts insurance contracts in the non-exclusive affiliation regime only; in particular, insurance contracts under non-exclusive affiliation do no longer provide customers with full insurance. However, in the exclusive affiliation regime, contracts involve full insurance but with a strictly positive loading. Hence, there is a potential tradeoff between, on the one hand, the distortion associated to the market power of insurers under exclusive affiliation and, on the other hand, the imperfect risk sharing under non-exclusive affiliation due to the binding collusion-proofness constraint; the latter distortion depends on the expected penalty whereas the latter does not, as long as we stay in the intermediate zone. If that distortion would become strong enough (which arises for instance when qF decreases), then exclusive affiliation would be preferred as the efficiency loss associated to imperfect risk sharing outweighs the loss associated to the market power effect. Proposition 3 reveals that, as long as $p^* > 2qF > \hat{p}$, the balance always tips in favor of the non-exclusive affiliation regime.

Proposition 3 also shows that the dominance of non exclusive affiliation over exclusive affiliation remains valid when $\hat{p} \geq 2qF$, i.e., when the collusion-proofness requires to distort insurance contracts in both regimes.

Roughly speaking, in a static framework, whatever the level of expected penalty, non-exclusive affiliation is strictly preferred to exclusive affiliation from the viewpoint of customers' expected welfare. A reduction of the expected fine (weakly) increases the risk faced by customers under both affiliation regimes; however, this loss of efficiency is never strong enough under non-exclusive affiliation to offset the distortion associated to the insurers' market power under exclusive affiliation. This will no longer be always true once the repeated relationship between insurers and providers is accounted for.

5 The Threat of Collusion: Dynamic Analysis

When the threat of the judicial system is weak (that is, for a given audit technology, when the fine F is small), the structure of affiliation may allow insurance companies to retaliate against a fraudulent provider by excluding it from its referral list. Of course, for such a punishment to have some deterrent effect, insurance companies and providers must enter a repeated relationship. We now consider such an extension of our initial setting.

We consider an infinitely repeated game starting at date 0 with discount factor $\delta \in (0, 1)$. At each date $z \geq 1$, insurers choose their affiliation structures; then insurance companies offer insurance policies and providers set prices for their services simultaneously. As before, any collusive deal is detected with probability q. If a provider is convicted of fraudulent activities, then it is banned from the networks of providers that are affiliated with the insurers and both insurers affiliate the other provider in the following periods.

Let π_j^e be provider j's profit when it is exclusively affiliated with one insurance company. Similarly, let $\pi_j^c(j')$ be provider j's profit when insurance companies have affiliated j' as a common provider. The discounted profit for provider j, affiliated exclusively with insurance company i, if it decides not to collude at any period is given by $\sum_{z=0}^{+\infty} \delta^z \pi_j^e$. By contrast, if provider j decides to collude during the first period and then to never collude again, it expects a discounted profit given by:[14]

$$V = \left[\pi_j^e + \tilde{x}_i(1-\pi)\theta\left(\frac{s_i + k_i}{2} - qF\right)\right] + \left[(1-\tilde{q})\sum_{z=1}^{+\infty}\delta^z \pi_j^e\right] + \left[\tilde{q}\sum_{z=1}^{+\infty}\delta^z \pi_j^c(j')\right].$$

where $\tilde{q} \equiv q\tilde{x}_i(1-\pi)\theta$ is the probability that at least one collusive agreement will be unveiled. The first bracketed term is the discounted profit of engaging into fraudulent activities during the first period. On top of the per-period profit associated to insureds who suffer from a loss, the collusive provider j earns its share of the collusive stake (which depends on the fraction of customers insured by company i,i.e., $\tilde{x}_i$, and of the number of fraudulent customers,i.e., θ) but runs the risk of being caught and fined. The second (resp. third) term represents provider j's discounted profit starting from period 2 on if it has not been (resp. has been) caught colluding at the end of the first period. If

[14] Similar conclusion obtain when the provider decides to collude during $T > 1$ consecutive periods and then to stick to a non fraudulent behavior.

collusion is left undetected then it earns the profit of an exclusive provider; by contrast, if collusion is detected, provider j is excluded from the networks of affiliates and provider j' becomes the common provider of both insurance companies.[15]

Provider j is deterred from colluding if $\sum_{z=0}^{+\infty} \delta^z \pi_j^e \geq V$, a condition which reduces to:

$$\pi_j^e \geq \pi_j^c(j') + \frac{1-\delta}{\delta q}\left[\frac{s_i+k_i}{2} - qF\right]. \tag{18}$$

This condition defines a lower bound on the per-period revenue under exclusive affiliation. Intuitively, a higher audit probability q or a larger preference for the present δ both reduce the gain to collude. In the same vein, if provider j's gain under common affiliation of provider j' by the insurance companies is not too small, then its incentives to collude remain high since the punishment if it is caught remains low. Interestingly, condition (18) is reminiscent of the collusion-proofness constraint (17). Indeed, rearranging terms, we obtain

$$2qF + \frac{\delta q}{1-\delta}[\pi_j^e - \pi_j^c(j')] \geq s_i + k_i.$$

Hence, with respect to the static case, we observe that in a dynamic context collusion can be more easily fought by insurance companies. Not only can insurers use the legal system to impose a fine F when collusion is detected but they can also use the choice of affiliation structures to implicitly threaten providers. Indeed, as the analysis undertaken in Section 3 has shown, the profit of the non-affiliated provider under common affiliation puts that provider at a strong competitive disadvantage vis-à-vis its rival and we have $\pi_j^e > \pi_j^c(j')$; this is particularly true when customers are strongly risk-averse and their potential loss is large. Hence, even when the legal system is quite imperfect and does not put a real threat on providers, i.e., when F is close to 0, the collusion-proofness constraint (18) can still be satisfied provided that the discount factor is sufficiently large, i.e., provided that providers put sufficiently large a weight on the loss of future profits if they are caught colluding and insurance companies change their affiliation structures.

So far, we have considered a situation in which insurance companies are left free to choose their affiliation structures. We now focus on the polar case in which non-exclusive affiliation is imposed as a mandatory requirement by regulators.

Under non-exclusive affiliation, insurance companies can decide to fight collusion by offering contracts which satisfy the collusion-proofness constraint (17). In that case, the analysis is identical to the one undertaken in Section 4.

When θ is low, or when F is low, insurers may find that distorting insurance contracts to fulfill (17) is too costly and decide to let collusion happen at equilibrium.[16] In such cases where the collusion-proofness constraint is not satisfied, the presence of collusion at equilibrium leads to the following zero-profit condition:[17]

$$(1-\theta)[(1-\pi)k - \pi s] + \theta[-s] = 0 \tag{19}$$

and competition between insurers leads to insurance contract that are no longer actuarially fair. Insurers then offer partial coverage policies which also entail a welfare loss by comparison with the no-fraud situation.

[15]We consider here that as soon as an insurer discovers that its provider has colluded at least once, it changes its affiliation structure.

[16]Notice that allowing collusion at equilibrium might prevent a market breakdown: for instance, when $F = 0$ the only collusion-proof insurance contract which satisfies the zero-profit condition is such that $s = k = 0$, i.e., customers receive no insurance at all.

[17]Remind that the fine imposed to the provider if it is caught colluding is perceived by the government.

As a consequence, under non-exclusive affiliation, whatever the insurers' strategy vis-à-vis collusion between policyholders and providers, risk-sharing will be suboptimal leading to a efficiency loss from an ex ante point of view. Importantly, the less efficient the judicial system is (that is, the smaller the fine F), the larger the efficiency loss associated to imperfect risk-sharing under non-exclusive affiliation and collusion-proof insurance contracting. Similarly, the larger the proportion of collusive customers is (that is, the larger θ is), the larger is the loss of efficiency associated to imperfect risk-sharing under non-exclusive affiliation and non collusion-proof insurance contracts since insurance companies face a larger proportion of customers from which they will never recover any premium. By contrast, when exclusive affiliation is allowed in a dynamic setting, insurance companies have at their disposal an additional possibility of retaliation when they discover collusion between their provider and the insureds, namely the possibility to change the affiliation structure. This puts an additional threat on the providers which reduces their incentives to engage into fraudulent activities. Moreover, that threat neither depends on the efficiency of the judicial system embodied in F nor on the proportion of collusive customers θ.

Hence, allowing exclusive affiliation may enhance the efficiency of risk-sharing through insurance markets mechanisms. This could even lead to an higher customers welfare for large and low F. More formally, we obtain the following proposition.

Proposition 4. *For q low enough, there exist $\bar{\delta} < 1$, $\bar{\theta} < 1$ and $\bar{F} > 0$ such that exclusive affiliation is preferred by customers over non exclusive affiliation for all $\theta > \bar{\theta}, F < \bar{F}$ and $\delta > \bar{\delta}$.*

Proof. See the Appendix. □

The intuition that underlies this proposition is the following. When F goes to 0 and insurers offer collusion-proof contracts under non-exclusive affiliation, risk-sharing is extremely inefficient as insurers are almost lead to shut-down their activities. If insurers let collusion occur at equilibrium and the proportion of collusive customers is close to 1, the insurance market is also close to break down. In these two extreme cases, a ban on affiliation leads to a large inefficiency of the insurance markets.

On the other hand a quick glance at the collusion-proofness constraint (18) shows that the providers' incentives to collude can be annihilated if the discount factor δ is large enough when F close to 0 and θ close to 1. Indeed, the possibility for insurance companies to change their affiliation structures acts as a threat of retaliation towards providers; that threat is all the more effective that providers weigh strongly their future profits.

In that case, under exclusive affiliation risk-sharing is efficient although customers suffer from the insurance companies' market power. However, this situation is socially preferable to the non-exclusive affiliation one which is extremely inefficient when the judicial system is rather ineffective in deterring collusion and when the extent of fraud is rather large.

6 Conclusions

This paper provides a theoretical approach to the benefits for an insurance company to develop its own network of providers when insurance fraud is characterized by collusion between opportunistic policyholders and providers. In a static framework, the exclusive affiliation of providers allows insurance companies to recover some market power and to lessen competition on the insurance market. We have demonstrated that this entails a loss of efficiency and that customers are made worse-off by this possibility. Moreover, it turns out that in a setting in which insurers choose non-cooperatively their affiliation structures, exclusive affiliation always arises at the equilibrium. We have provided anecdotal evidences for the fact that insurance companies have taken advantage in developing their own networks of providers.

However, we have also established that exclusive affiliation may entail a positive effect on customers' surplus when insurers and providers have repeated relationship. Our argument is that the threat of being deprived from exclusive affiliation acts as an additional deterrent for fraudulent activities. In a dynamic setting, upon detection of fraudulent activities, an insurance company can retaliate by changing its affiliation structure. This possibility may supplement an inefficient judicial system: it is thus a second-best optimal anti-fraud policy.

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Appendix

A Proof of Proposition 1

As $\hat{k} > \pi\hat{p}$, let us denote $\hat{k} = \hat{\gamma}\pi\hat{p}$ where $\hat{\gamma} > 1$ and observe that we have $k^* = \pi p^*$. Conditions (7) and (14) can be written as $\psi(\hat{p}, \gamma) = t = \psi(p^*, 1)$ where:

$$\psi(p, \gamma) = (p - c)u'(w - \gamma\pi p).$$

We have $\partial\psi(p, \gamma)/\partial p = u'(w - \gamma\pi p) - (p - c)\gamma\pi u''(w - \gamma\pi p) > 0$ and $\partial\psi(p, \gamma)/\partial\gamma = -(p - c)u''(w - \gamma\pi p) > 0$. $p^* > \hat{p}$ is derived from the fact that $\psi(\hat{p}, 1) < \psi(\hat{p}, \hat{\gamma}) = \psi(p^*, 1)$.

Since customers are fully insured, using $p^* > \hat{p}$ we have:

$$u'(w - \hat{k}) = \frac{t}{\hat{p} - c} > \frac{t}{p^* - c} = u'(w - k^*).$$

As $u(\cdot)$ is concave, we must have $w - \hat{k} < w - k^*$, hence $k^* < \hat{k}$, which proves that policyholders reach a higher expected utility under non-exclusive affiliation than under exclusive affiliation.

B Proof of Lemma 4

First, notice that the contracts for customers who visit provider 0 offer full insurance and actuarially fair premiums: $k_A^0 = k_B^0 = \pi p_0$ and $s_A^0 = s_B^0 = p_0(1-\pi)$. Indeed, if it were not the case, then either insurer A or insurer B would have an incentive to undercut her rival to attract all those customers.

Second, it remains to determine the contract offered by insurance company B to customers who elected provider 1. The marginal customer $\tilde{x}$ is now defined as follows:

$$(1 - \pi)u(w - k_0) + \pi u(w - p_0 + s_0) - \pi t\tilde{x} = (1 - \pi)u(w - k_B^1) + \pi u(w - p_1 + s_B^1) - \pi t(1 - \tilde{x}).$$

The optimal insurance contract and providers' price solve:

$$\max_{\{k_B^1, s_B^1\}} (1 - \tilde{x})[(1 - \pi)k_B^1 - \pi s_B^1],$$
$$\max_{p_0} \pi\tilde{x}(p_0 - c),$$
$$\max_{p_1} \pi(1 - \tilde{x})(p_1 - c).$$

The comparisons with situations of exclusive affiliation and no exclusive affiliation is immediate.

C Proof of Lemma 5

In the non- exclusive affiliation case, s_{cp}^* and k_{cp}^* are deduced from (17) which is binding and the budget constraint. Whatever the affiliation structure, the providers' programs are not directly affected by (17). Maximizing provider 0's profit leads to $\phi(p, s) = t$ at a symmetric equilibrium, where $\phi(p, s) \equiv u'(w - p + s)(p - c)$. As $\phi'_p = u'(w - p + s) - (p - c)u''(w - p + s) > 0$ and $\phi'_s = (p - c)u''(w - p + s) < 0$, we have $\phi(p_{cp}^*, s_{cp}^*) = \phi(p^*, s^*) = \phi(p^*, (1 - \pi)p^*) < \phi(p^*, s_{cp}^*)$ and thus $p_{cp}^* < p^*$. Using the implicit function theorem, solutions (p, s) of the provider's program satisfy:

$$\frac{dp}{ds} = -\frac{\phi'_s}{\phi'_p} = \frac{-tu''/u'}{u' - tu''/u'} < 1. \tag{20}$$

Since $p^* > p^*_{cp}$, we thus have:

$$p^* < p^*_{cp} + s^* - s^*_{cp},$$

which implies:

$$p^*_{cp} > (1-\pi)2qF + \pi p^* > 2qF.$$

Under exclusive affiliation, insurer A's program can be written as:

$$\max_{\{k_A, s_A\}} \left\{ \tilde{x}_i \left[(1-\pi)k_A - \pi s_A \right] : k_A + s_A \leq 2qF \right\},$$

where:

$$\tilde{x}_i = \frac{1}{2} + \frac{1}{2t\pi} \{(1-\pi)[u(w-k_A) - u(w-k_A)] + \pi[u(w-p_0+s_A) - u(w-p_1+s_B)\}.$$

The corresponding Lagrangian is given by:

$$L = \tilde{x}_i \left[(1-\pi)k_A - \pi s_A \right] + \lambda \left[2qF - (k_A + s_A) \right],$$

where $\lambda \geq 0$. First-order conditions are:

$$\begin{aligned} (1-\pi)\tilde{x}_i - \frac{(1-\pi)u'(w-k_A)}{2t\pi} \left[(1-\pi)k_A - \pi s_A \right] - \lambda &= 0, \\ -\pi \tilde{x}_i + \frac{u'(w-p_0+s_A)}{2t} \left[(1-\pi)k_A - \pi s_A \right] - \lambda &= 0, \end{aligned}$$

and simplify to:

$$\begin{aligned} t\pi - 2t\pi\lambda/(1-\pi) &= u'(w-\hat{k}_{cp}) \left[(1-\pi)\hat{k}_{cp} - \pi \hat{s}_{cp} \right], \\ t\pi + \lambda &= u'(w-\hat{p}_{cp}+\hat{s}_{cp}) \left[(1-\pi)\hat{k}_{cp} - \pi \hat{s}_{cp} \right], \end{aligned} \tag{21}$$

at a symmetric equilibrium. This leads to:

$$\frac{u'(w-\hat{k}_{cp})}{u'(w-\hat{p}_{cp}+\hat{s}_{cp})} = \frac{t\pi - 2t\pi\lambda/(1-\pi)}{t\pi + \lambda}.$$

Consequently, we have $u'(w-\hat{k}_{cp}) < u'(w-\hat{p}_{cp}+\hat{s}_{cp})$ when $\lambda > 0$, i.e., $\hat{p}_{cp} > \hat{s}_{cp} + \hat{k}_{cp} = 2qF$. The maximization of the provider 0's program leads to condition $\phi(\hat{p}_{cp}, \hat{s}_{cp}) = t$ at a symmetric equilibrium, and thus:

$$u'(w-p+s)\pi(p-c) = \pi t.$$

Use of (21) gives:

$$\frac{(1-\pi)\hat{k}_{cp} - \pi \hat{s}_{cp}}{\pi(\hat{p}_{cp} - c)} = \frac{t\pi + \lambda}{t\pi};$$

hence $(1-\pi)\hat{k}_{cp} - \pi \hat{s}_{cp} > \pi(\hat{p}_{cp} - c)$ when $\lambda > 0$. Consequently, $\hat{s}_{cp}$ and $\hat{k}_{cp}$ verify:

$$\begin{aligned} \hat{s}_{cp} + \hat{k}_{cp} &= 2qF, \\ (1-\pi)\hat{k}_{cp} - \pi \hat{s}_{cp} &> \pi(\hat{p}_{cp} - c), \end{aligned}$$

which gives $\hat{s}_{cp} < (1-\pi)2qF - \pi(\hat{p} - c)$ and $\hat{k}_{cp} > \pi 2qF + \pi(\hat{p} - c)$. Finally, as $\hat{s}_{cp} < s^*_{cp}$ and $\phi(p^*_{cp}, s^*_{cp}) = \phi(\hat{p}_{cp}, \hat{s}_{cp}) > \phi(\hat{p}_{cp}, s^*_{cp})$, we have $p^*_{cp} > \hat{p}_{cp}$.

D Proof of Proposition 3

We know that customers are better-off without affiliation than with exclusive affiliation when $p^* < 2qF$. Let us show first that this is still the case when $\hat{p} \leq 2qF < p^*$. Assume the reverse, i.e., that:

$$u(w - \hat{k}) \geq (1-\pi)u(w - k^*_{cp}) + \pi u(w - p^*_{cp} + s^*_{cp}). \tag{22}$$

As $p^*_{cp} > k^*_{cp} + s^*_{cp}$, we have:

$$(1-\pi)u(w - k^*_{cp}) + \pi u(w - p^*_{cp} + s^*_{cp}) > u(w - p^*_{cp} + s^*_{cp}),$$

and thus (22) implies $\hat{k} < p^*_{cp} - s^*_{cp}$. Solving the provider's program we obtain that $\phi(\hat{p}, \hat{s}) = \phi(p^*_{cp}, s^*_{cp}) = t$ and, from (20), we know that the solutions (p, s) of the provider's program satisfy $dp/ds < 1$. Consequently, as $p^*_{cp} > 2qF \geq \hat{p}$, we have:

$$p^*_{cp} < \hat{p} + s^*_{cp} - \hat{s} = \hat{k} + s^*_{cp}.$$

Using $\hat{p} = \hat{s} + \hat{k}$, we obtain a contradiction.

Consider now the case $qF < \hat{p}/2$. From Lemma 5, we know that $p^*_{cp} > \hat{p}_{cp}$ whatever $qF < \hat{p}/2$. Again, assume that customers are better-off under exclusive affiliation than without affiliation. We have:

$$(1-\pi)u(w - \hat{k}_{cp}) + \pi u(w - \hat{p}_{cp} + \hat{s}_{cp}) \geq (1-\pi)u(w - k^*_{cp}) + \pi u(w - p^*_{cp} + s^*_{cp}). \tag{23}$$

Observe first that we cannot have $\hat{s}_{cp} - \hat{p}_{cp} \leq s^*_{cp} - p^*_{cp}$. Indeed, in that case (23) implies $\hat{k}_{cp} \leq k^*_{cp}$ and thus:

$$\hat{k}_{cp} + \hat{s}_{cp} - \hat{p}_{cp} \leq k^*_{cp} + s^*_{cp} - p^*_{cp},$$

which implies $p^*_{cp} \leq \hat{p}_{cp}$ using $\hat{s}_{cp} + \hat{k}_{cp} = k^*_{cp} + s^*_{cp} = 2qF$. Hence, (23) implies $p^*_{cp} > \hat{p}_{cp} + s^*_{cp} - \hat{s}_{cp}$. But since $p^*_{cp} > \hat{p}_{cp}$, we have $p^*_{cp} < \hat{p}_{cp} + s^*_{cp} - \hat{s}_{cp}$ using (20), a contradiction.

E Proof of proposition 4

Define $U_1(F)$ and $U_2(\theta)$ as:

$$U_1(F) \equiv \left\{ \max_{\{k,p,s\}} (1-\pi)u(w-k) + \pi u(w-p+s) : k + s = 2qF; (1-\pi)k - \pi s = 0; \phi(p,s) = t \right\}$$

and:

$$U_2(\theta) \equiv \left\{ \max_{\{k,p,s\}} (1-\pi)[(1-\theta)u(w-k) + \theta u(w + (s-k)/2)] + \pi u(w-p+s) : (19), \phi(p,s) = t \right\}.$$

Hence, $U_1(F)$ (resp. $U_2(\theta)$) is an upper bound of customers' expected utility under non-exclusive affiliation when insurance companies offer collusion-proof (resp. non collusion-proof) contracts. Let $\bar{\theta}$ and $\bar{F}$ denote the threshold values of θ and F such that $U_2(\bar{\theta}) = U_1(\bar{F}) = u(w - \hat{k})$. We have $U_2'(\theta) < 0$, $U_1'(F) > 0$ and $u(w - \hat{k}) > U_1(0)$ (where $U_1(0)$ corresponds to the expected utility of customers without insurance) and $u(w - \hat{k}) > U_2(1)$ (where $U_2(1)$ also corresponds to the expected utility of customers without insurance).

Consequently, $\bar{F} > 0$, $\bar{\theta} < 1$ and we have $U_2(\theta) < u(w - \hat{k})$ for all $\theta > \bar{\theta}$ and $U_1(F) < u(w - \hat{k})$ for all $F < \bar{F}$.

Denote by $\bar{\delta}$ the threshold value of defined by:

$$2qF + q\frac{\bar{\delta}}{1-\bar{\delta}}[\pi_j^e - \pi_j^c(j')] = \hat{s} + \hat{k} = \hat{p}$$

We have $0 < \bar{\delta} < 1$ and the collusion proofness constraint (18) is satisfied under exclusive affiliation for all $\delta \geq \bar{\delta}$. The proposition comes from the fact that when $qF < p^*/2$, the customer's expected utility (gross of his transportation cost) is smaller or equal to $U^*(F,\theta) = \max\{U_1(F), U_2(\theta)\}$ and that we have $u(w - \hat{k}) > U^*(F,\theta)$ for all $F < \bar{F}$ and $\theta > \bar{\theta}$.