

Matching and Risk Classification in Insurance Markets with Intermediation*

Jörg Schiller[†]

March 2009

Abstract

This paper analyzes the impact of different remuneration systems (fee-for-advice versus commission system) on two important services of independent insurance intermediaries: finding adequate coverage for policyholders (matching) and providing risk information to insurance companies and policyholders as well (risk classification). The model considers a situation in which a broker has private and non-verifiable information with respect to the best matching product for and the expected claim cost of policyholders. In a fee-for-advice system the broker is exclusively remunerated by policyholders. In this system the broker does not have any positive incentives to give bad advice with respect to the best match. However, if the broker's information regarding the policyholder's risk type is non-verifiable and insurance companies are unable to perfectly screen different risk types, a fee-for-advice system may lead to well-known adverse selection problems. In a standard commission system where the broker is exclusively remunerated by policyholders, the broker may have incentives for bad advice with respect to the best match. However, due to the insurers' commission rate competition a standard commission system may in general lead to perfect matching and risk classification.

1 Introduction

Independent intermediaries (independent agents and retail brokers) are both in the United States and in the European Community the predominant distribution channel for commercial property-casualty insurance products. These specialized agents mainly act as market makers and offer transaction related services to businesses (policyholders) and insurance companies. Brokers provide

*Financial support by the Deutsche Forschungsgemeinschaft (SCH1 1004/3-1) and the hospitality of the Wharton School's Insurance and Risk Management Department (University of Pennsylvania, Philadelphia) are gratefully acknowledged.

[†]University of Hohenheim, Chair in Insurance and Social Systems, Fruwirthstr. 48, 70599 Stuttgart, Germany, phone: +49-(0)711-459-22869, fax: +49-(0)711-459-23953, j.schiller@uni-hohenheim.de.

information about market prices to policyholders, help insurance companies to design and price appropriate insurance contracts and offer a great variety of other pre- and post-sale services to both transaction parties.¹

Recently, the European Commission performed a market analysis called "Sector Inquiry" on business insurance within the European Community. The study claims to identify several – mainly supply side – factors that are perceived to prevent commercial insurance markets from working well. Apart from other aspects, like the underwriting process, horizontal cooperation among insurers and contract durations, the compensation of insurance intermediaries is asserted to be critical. The reason for the European Commission's concern is primarily caused by the fact that independent intermediaries offer services to both businesses and insurance companies, but commissions paid by insurance companies are by far the major source of income for these agents.² Most commission payments are paid at the signing of the contract and are mostly conditioned upon the insurance premiums. In addition to these "premium-based commissions" intermediaries may also receive additional "contingent commissions". These commissions are ex-post payments of insurance companies based on various performance criteria such as profitability of the business placed, the volume of new business or the renewal rate with a specific insurer.

Prior to the Sector Inquiry the debate about insurance brokers' compensation was mainly set off by an investigation of the New York Attorney General's in 2004. Major insurance brokerage firms, like Marsh & McLennan ("Marsh"), Aon, and Willis, were accused of fraudulent and anti-competitive practices by i.e. steering business to "favored" insurance companies which paid the brokerage firm in return contingent commissions. In 2005, the three brokerage firms agreed to provide USD 850 million, USD 190 million and USD 50 million "for restitution to policyholders and to adopt a new business model designed to avoid conflicts of interest to pay."³ Among the reforms adopted by Marsh, Aon and Willis under the agreements was a new policy whereby the companies only accept one payment for an insurance contract at the time of placement, and that such payments are fully disclosed to and approved by their clients.

Partly in response to the above-mentioned investigations, regulatory changes have been introduced around the world. For example, Finland and Denmark have implemented a ban of any insurance company-paid commissions.⁴ Other European countries have yet not gone that far, but

¹See, e.g., Regan and Tennyson (2000) for a thorough literature review on insurance distribution systems.

²For example, the European Commission's Sector Inquiry shows that transaction based commissions are with more than 90% of the combined revenues of insurance placements and client services, the main source of intermediaries' revenues. See, European Commission (2007b), p. 54.

³See, New York State Insurance Department press releases *Insurance Broker Agrees to Sweeping Reforms: Marsh to Pay \$850 Million in Restitution and Ban Contingent Commissions* (January 31, 2005), *Aon Settles Corruption Probe: Leading Insurance Broker Agrees to Pay \$190 Million and Adopt Sweeping Reforms* (March 4, 2005), and *New York State Settles Probe of Willis: Third-Largest Insurance Broker to Pay \$50 million and Adopt Reforms* (April 8, 2005).

⁴See, European Commission (2007a), p. 100.

introduced voluntary codes of conduct according to which brokers are not allowed to be compensated by both sides of the market, insurance companies and policyholders, at the same time.⁵

The literature with respect to the provision of information by sellers of financial services to consumers is extensive. For example, Benabou and Laroque (1992) as well as Morgan and Stocken (2003) discuss a conflict of interest in the context of stock recommendations. They take a closer look at the price competition between information providers, like research analysts, and incentives for insider trading. Although the basic problem of biased information is also relevant for insurance brokers, their incentive problem is mainly caused by means of remuneration rather than by insider trading opportunities in secondary markets. In this regard, the paper of Bolton et al. (2007) is most closely related to ours. They consider a financial market where consumers are initially uninformed about the best matching product and information provided by specialized financial intermediaries, like banks, is non-verifiable. In their model the financial intermediary is only concerned with matching consumers with one of two products. The bank can either choose to specialize and only offer one product or choose to generalize and offer both products. The authors show that when banks care about their reputation, competition among specialized intermediaries can lead to full credible information disclosure. However, banks would still gain from the presence of a third party, like an independent financial advisor, because banks have to lower their prices, as the expected advice quality of policyholders negatively correlates with product prices. As a consequence, in the presence of an independent intermediary, profits of banks could be increased.

In respect to the compensation of insurance brokers, there is a general intuition that favors a fee-for-advice system, where the broker is only compensated by policyholders. One rather naive rationale for this kind of opinion is that in a fee-for-advice system advice and insurance products are sold separately. Thus, welfare would be higher under a fee-for-advice system, because in this remuneration system the broker is not directly affected by the purchase decision of consumers. Gravelle (1993, 1994) tackles this type of argument by a theoretical comparison of commission and fee-for-advice based compensation systems for independent life-insurance agents. In his model brokers face search cost and entry in the broker market is endogenous. One of the problems he identifies is that too few consumers become informed under a fee-for-advice regime. Consequently, even though a fee-based compensation system may lead to a higher intermediation quality, it is not necessarily superior to a commission system once the number of brokers and overall purchases by consumers are taken into account. Cummins and Doherty (2006) emphasize that pure premium-related commissions do not provide an incentive for the broker to reveal his private information with respect to different risk types. In addition, they state that profit related contingent commissions are necessary to align insurance companies' and brokers' interests with respect to consumer's risk-classification. The actual impact of contingent commissions on the underwriting performance of

⁵See, Ladbury (2007), p. 29.

insurance companies is explored by Regan and Kleffner (2007). Among other things they find that higher proportions of contingent commissions are associated with lower loss ratios and lower combined ratios, and lower relative variation in both loss and combined ratios over time. However Ma et al. (2008) do not find any evidence that either the use or the level of contingent commissions is positively correlated with insurer profitability. One important shortcoming of both empirical studies is that the authors do not distinguish volume and profit related contingent commissions. Therefore, both papers can neither support nor confirm the supposed impact of profit-related contingent commissions stated by Cummins and Doherty (2006).

The main aim of this paper is to take a closer look at incentive effects of different compensation system for independent insurance agents. We compare a fee-for-advice and a commission system with respect to two major services: finding adequate coverage for consumers (matching) and providing risk information to insurance companies and consumers as well (risk classification). Without intermediation insurance companies are unable to screen different risk types and consumers are uninformed about their best matching product. We consider a situation in which an insurance market without intermediation does not exist, since a pooling premium exceeds the average willingness to pay of consumers. However, a broker possesses a costly information technology which provides perfect and non-verifiable information about the consumers' best match and risk type.

We show that a commission system is a weakly superior remuneration system for broker, when matching and risk classification is from major importance. If the broker acts completely non-strategic the latter is in a fee-for-advice system unable to credibly communicate her private information regarding consumer's risk type to insurance companies. Hence, if the fraction of high-risk consumers is sufficiently high, well-known adverse selection problem may arise. In contrast, a standard commission system will always lead to an efficient market outcome with perfect matching and risk classification. If the broker is able to strategically use her private information but side-contracting with insurance companies is infeasible, matching will be perfect under both remuneration systems. A standard commission system may lead to an efficient market outcome with a perfect risk classification. However, as brokers are exclusively compensated by policyholders, insurance companies are unable to induce any incentives for a proper risk classification in a fee-for-advice system.

The paper is organized as follows. In section 2 we introduce the model framework and characterize a second-best situation without intermediation. In section 3 we consider a completely non-strategic broker and compare the market outcomes for a fee-for-advice and a commission system. In section 4 we compare the broker's incentives for bad advice under both remuneration systems and characterize the different market outcomes. Finally, section 5 concludes.

2 Model framework and second-best

In the spirit of Meurer and Stahl (1994) and Bolton et al. (2007), we consider an economy with two insurance companies $j = A, B$. These companies offer horizontally differentiated insurance products at an insurance premium $\alpha_j \geq 0$. Consumers in the insurance market differ in their expected claim cost c_i , with $i = H, L$ and $c_H > c_L \geq 0$. The proportion of high and low cost consumers are p_H and p_L , where $p_H + p_L = 1$ and $p_i > 0 \forall i$. As products are horizontally differentiated, each consumer has a preferred provider of insurance coverage. Both risk types are evenly divided in terms of best matches: half of the types prefer A and half prefer B . A good match generates a value $v_i > c_i$ with $v_H > v_L$. The associated strictly positive rent of a good match is $\Delta_i \equiv v_i - c_i > 0 \forall i$ with $\Delta_L > \Delta_H$. The value of a mismatch is positive but smaller than the value of a good match with $r_i < v_i$. The rent of a mismatch is $\Phi_i \equiv r_i - c_i$. Each of the four different consumer types $\theta = \{H, L\} \times \{A, B\}$ only needs one insurance policy and does not re-enter the market even after experiencing a mismatch. Consumers and insurance companies are initially uninformed about the specific consumer type θ and for the sake of simplicity all parties are assumed to be risk neutral.

In the considered insurance market an independent agent (broker) possesses an information technology which can reveal the type of an individual consumer. After the performance of a risk assessment at cost $k \geq 0$, the specific type becomes private information of the broker. The broker can use her non-verifiable information to improve both matching and risk classification.

Before we start to take a closer look at the two different compensation systems, it is in the first instance helpful to assess the potential benefits of intermediation. In a worst-case situation consumers and insurance companies are uninformed about the specific consumer type and the information technology is not available. In this case, consumers are perceived as completely homogenous and insurance companies do not possess any market power. Hence, the insurance premium corresponds to average marginal cost $\bar{c} = p_H c_H + p_L c_L$ and an uninformed consumer has the expected willingness to pay $\bar{v} = \frac{1}{2} \sum_i (v_i + r_i)$.

Assumption An insurance market without intermediation does not exist ($\bar{c} > \bar{v}$).

In a situation with endogenous information and strictly positive risk analysis cost, the decision whether or not to perform the risk analysis service depends, from a social planner's point of view, on the relation between the expected rent generated by the information technology and the risk analysis cost.

Lemma 1 *The broker should only carry out her risk analysis service from a social planner's point of view, if $k \leq \sum_i p_i \Delta_i$. In a second-best situation, insurance premiums are $\alpha_j^i \in [c_i, v_i]$ and welfare corresponds to $W^{SB} = \sum_i p_i \Delta_i - k$.*

The Lemma highlights that our assumption is without loss of generality. If an insurance market without intermediation exists, consumers will have a positive reservation utility of $u = \frac{\bar{v}}{2} - \bar{c} > 0$. Thus, the general value of intermediation is lower but still positive.

3 Truthful Intermediation

In this section, we assume that the broker always truthfully reports her private information to the respective transaction partners. The impact of potential mismatching incentives under the different remuneration systems will be analyzed in section 4.

3.1 Fee-for-advice system

In a fee-for-advice system the broker exclusively offers her risk analysis service to the consumer and is only remunerated by a flat fee $f > 0$. We consider the following sequence of play:

- Stage 1: Nature determines the consumer type θ .
- Stage 2: Insurance companies make their premium offers $\alpha_j > 0$.
- Stage 3: The broker makes an offer $f > 0$ for her intermediation service to the consumer.
- Stage 4: The consumer decides whether or not to accept the broker's offer. If she accepts the offer, the consumer's type θ is revealed to the broker and the broker truthfully reports his information to the consumer.
- Stage 5: The consumer decides whether or not to accept any of the offered insurance contracts.
- Stage 6: The game ends and payoffs are paid.

As the broker's information is non-verifiable, neither the broker nor the consumer can credibly communicate the specific type to any insurance company. In the considered context the broker only informs consumers about the best matching product.

3.1.1 Pooling equilibria

In a pooling equilibrium insurance premiums α_j are type-independent and both risk-types prefer to purchase insurance coverage at that uniform premium. A pooling contract with intermediation will only exist if the broker makes non-negative profits, uninformed consumers prefer to become informed and both risk types accept one of the offered pooling contracts.

Optimal pooling contracts with truthful intermediation are the solution to the following maximization problem

$$\max_{\alpha_j} \frac{1}{2} (\alpha_j - \bar{c}) \quad (1)$$

s.t.

$$\bar{v} - \alpha_j - f \geq 0 \quad (2)$$

$$v_i - \alpha_j \geq 0 \quad \forall i \quad (3)$$

$$f \geq k \quad (4)$$

Condition (2) corresponds to the consumer's ex-ante participation constraint. A consumer will only accept one of the offered contracts at stage 4 for a given premium α_j if his net utility weakly exceeds the reservation utility. The consumer's ex-post participation constraint (3) states that both risk types must weakly prefer to accept the offered pooling contract with α_j at stage 5. Finally, the broker's participation constraint (4) guarantees that the broker offers her intermediation service and makes non-negative profits.

Lemma 2 *If $c_H > v_L$ and $p_H \in \frac{\Delta_L}{c_H - c_L}$, a pooling equilibrium in a fee-for-advice system will not exist. Otherwise, a pooling equilibrium will always exist if $k \leq \sum_i p_i \Delta_i$ holds.*

- For $k \geq p_H (v_H - v_L)$, insurance companies offer contracts at $\alpha_j = \bar{v} - k$ and yield non-negative profits. The broker offers her service at $f = k$ and only breaks even.
- For $k < p_H (v_H - v_L)$, insurance companies offer coverage at $\alpha_j = v_L$ and yield non-negative profits, while the broker makes strictly positive profits with $\hat{f} = p_H (v_H - v_L) > k$.

In any pooling equilibrium consumer's expected utility is zero and welfare corresponds to $W = \sum_i p_i \Delta_i - k$.

The results of Proposition 1 are mostly straightforward. First of all, by informing consumers about their best match, the broker increases the overall willingness to pay in the market from \bar{v} to $\tilde{v} = \sum_i p_i v_i$. As low-risk consumers are unable to signal their risk type and insurance companies are unable to screen the different risk types, only pooling contracts are feasible.

Generally, depending on whether or not the ex-post participation constraint (3) of low-risk types binds, two types of pooling equilibria may exist. In an pooling equilibrium of type P_1 , insurance companies are able to extract all available rents from low-risk consumers with $\alpha = v_L$. As the risk analysis costs k are strictly lower than the remaining rent $p_H (v_H - v_L)$ of high-risk consumers, the broker is able to make strictly positive profits with $\hat{f} = p_H (v_H - v_L) \geq k$ for which the consumer's ex-ante participation constraint binds. In the opposite pooling equilibria of type P_2 , the risk analysis cost are sufficiently high with $k \geq p_H (v_H - v_L)$. In this case the insurance companies' ability to

extract rents is only limited by the consumer's ex-ante participation constraint. Consequently, the insurance premium corresponds to $\hat{\alpha}_j = \bar{v} - k$ which implies that the broker only breaks even with $\hat{f} = k$.

In any pooling equilibrium with $c_H < v_L$ the insurance premium is sufficient to cover the marginal costs of both risk types. As the profitability of low-risk types is strictly positive with $v_L - c_H > 0$, the insurers' profitability constraint $k \leq v_L - \bar{c}$ never binds. In this case, a pooling equilibrium always exists. For all equilibria of type P_1 , the broker only breaks even and the insurance companies charge the premium $\hat{\alpha}_j = \bar{v} - k$. For pooling equilibria of type P_2 , the broker can generate strictly positive profits with $\hat{f} = p_H (v_H - v_L) \geq k$ and insurance companies always break at least even with their premium $\hat{\alpha}_j = v_L$.

If the marginal costs of high-risk consumers exceed the willingness to pay of low-risk consumers with $c_H > v_L$, a necessary condition for a pooling equilibrium is that the fraction of high-risk consumers is below the critical value of $p_H^d \equiv \frac{\Delta_L}{c_H - c_L}$. Figure 1 illustrates the different equilibria in this case. For pooling equilibria of type P_1 the broker's risk analysis costs are sufficiently-high with $k \geq p_H (v_H - v_L)$. Hence, the consumer's ex-post participation constraint binds and insurance companies can only charge the premium $\hat{\alpha}_j = \bar{v} - k$. This premium does only cover the average cost \bar{c} if the fraction of high-risk consumers is sufficiently small with $p_H \leq p_H^d$. In these equilibria the broker only breaks even with $\hat{f} = k$. In pooling equilibria of type P_2 , risk analysis costs are sufficiently low and insurance companies are able to charge $\hat{\alpha}_j = v_L$. Again, insurance companies only break even when the fraction of high-risk types is sufficiently low with $p_H \leq p_H^d$.

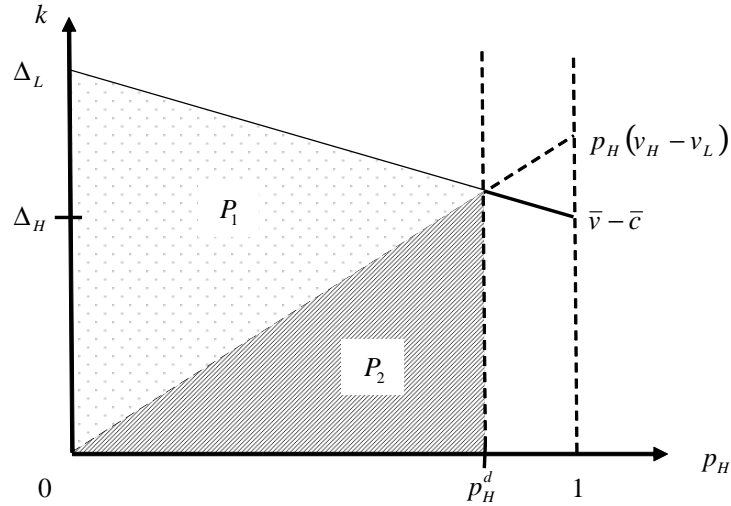


Figure 1: Pooling equilibria with $c_H > v_L$.

Finally, it seems important to note that the existence of any pooling contract and in particular the question whether or not intermediation takes place only depends on the profitability of insurance companies. Due to the broker's credibility problem, insurance companies are unable to distinguish high-risk from low-risk consumers. Therefore, if the costs of high-risk types exceed the willingness to pay of low-risk types and the fraction of high-risk types is sufficiently high, intermediation in a fee-for-advice system does not take place, although it would be preferable from a social planner's point of view.

3.1.2 Separating equilibria

In a fee-for-advice system neither the broker nor consumers can credibly communicate the specific risk type. Apart from pooling contracts designed for both risk types, insurance companies can also offer separating contracts designed to attract only one risk type. Due to $v_H > v_L$, a separating contract can only be designed to attract high-risk types, because any contract with $\alpha_j < v_L$, which might be profitable for low-risk types would also be chosen by high-risk types.

An optimal separating contract is a solution to the following optimization problem

$$\max_{\alpha_j} \frac{p_H}{2} (\alpha_j - c_H) \quad (5)$$

s.t.

$$p_H (v_H - \alpha_j) - f \geq 0 \quad (6)$$

$$v_H - \alpha_j \geq 0 \quad (7)$$

$$v_L - \alpha_j \leq 0 \quad (8)$$

$$f \geq k \quad (9)$$

Since insurance contracts in a separating equilibrium are only designated for high-risk consumers, these consumers have to be identified by the broker. Consequently, the ex-ante participation constraint (6) should guarantee that all initially uninformed consumers prefer to accept the broker's fee-for-advice at stage 4. After all consumers became informed about their risk-type and best match, the separating contract should only be profitable for high-risk consumers. In this respect, the ex-post participation constraint for high-risk types (7) must ensure that these types accept the contract offer α_j whereas the incentive compatibility constraint (8) leads to the non-participation of low-risk types. Finally, the participation constraint (9) states that the broker must at least break even.

Lemma 3 *Separating contracts in a fee-for-advice system will only exist if $k \leq p_H \Delta_H$ and $p_H \geq \frac{v_L}{v_H}$. In this case the broker charges a fee $f = k$ and insurance companies offer insurance coverage at $\alpha_j = v_H - \frac{k}{p_H}$ which is only purchased by high-risk consumers. The overall welfare in the economy corresponds to $W = p_H \Delta_H - k < W^{SB}$.*

The results of Proposition 2 can be summarized as follows: If insurance companies offer insurance contracts that are solely designated for high-risk consumers, uninformed consumers have to become informed. In equilibrium, the ex-ante participation constraint for uninformed consumers binds, since insurance companies want to extract all available rents from high-risk types. A separating equilibrium only exists if the insurance premium is sufficiently high with $\check{\alpha}_j = v_H - \frac{k}{p_H}$ and low-risk types prefer to stay uninsured. Given $\check{\alpha}_j$ accepting the fee-for-advice offer is only profitable if the fraction of high-risk consumers is sufficiently high and $p_H \geq p_H^c = \frac{v_L}{v_H}$ holds. However, a separating contract will only be offered if insurance companies at least break even. The latter will only be true, if the return for high-risk types exceeds the overall risk analysis cost. By construction a separating contract is never second-best efficient, because low-risk types stay uninsured.

3.1.3 Optimal contracts

An important question is now whether or not there is any situation for which insurance companies may prefer to offer separating rather than pooling contracts.

Proposition 1 *If $c_H < v_L$, insurance companies prefer to offer separating contracts for $p_H \geq \frac{v_L}{v_H}$ with $k \in [0, p_H \Delta_H]$. If $c_H > v_L$ and $\frac{\Delta_L}{c_H - c_L} \geq \frac{v_L}{v_H}$, insurance companies prefer to offer separating contracts for $p_H \geq \frac{v_L}{v_H}$ with $k \in [0, p_H \Delta_H] \wedge [0, -\Delta_L + p_H (v_H - c_L)]$.*

Proof. See Appendix. ■

The implications of Proposition 3 are the following. If the willingness to pay of low-risk consumers v_L exceeds the costs for high-risk consumers c_H every pooling contract under a fee-for-advice system breaks at least even for insurance companies as long as matching is perfect. As the latter is guaranteed by truthful intermediation, a fee for-advice system is always second best efficient.

However, if $c_H > v_L$ holds, risk classification is crucial. In this case pooling contracts will not be offered if the fraction of high-risk consumers exceeds the critical level of p_H^d . Additionally, separating contracts which are exclusively purchased by high-risk consumers only exist if the fraction of high-risk consumers exceeds p_H^c . In a situation with $p_H^d < p_H^c$, for a specific range of high-risk consumers no contracts will be offered. Therefore, due to the non-existing risk classification, a fee-for-advice system may be associated with a breakdown of the insurance market. The latter situation is illustrated in Figure 2. Although separating contracts are offered for $p_H \geq p_H^c$, these contracts are only purchased by high-risk consumers and low-risk consumers stay uninsured.

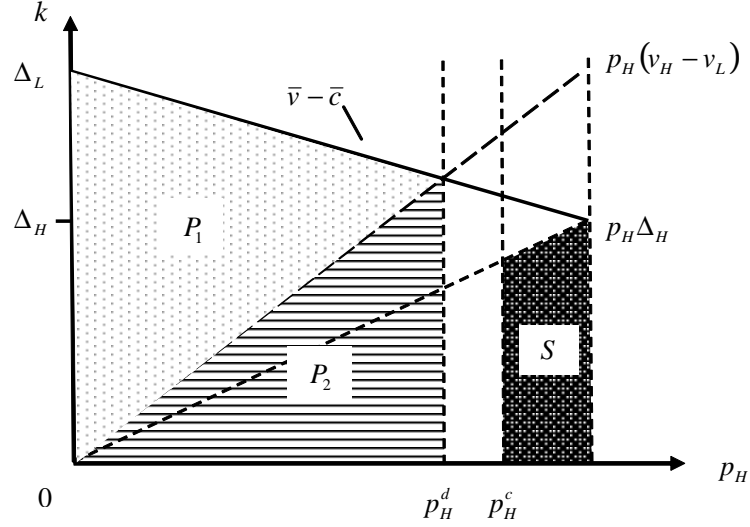


Figure 2: Optimal contracts under a fee-for advice system with $c_H > v_L$ and $p_H^d < p_H^c$

In a situation with $p_H^d > p_H^c$ pooling and separating contracts are partly both profitable. The non-existence of insurance contracts is in this case limited to the area $p_H > p_H^d$ with $k \in (p_H \Delta_H, \bar{v} - \bar{c})$. In the area $p_H \in [p_H^c, p_H^d]$ with $k \leq p_H \Delta_H$ insurance companies can either offer pooling or separating contracts. Figure 3 illustrates that separating contracts (S) only partly dominate pooling contracts of type P_2 with respect to profits. However, for a sufficiently high fraction of high-risk consumers $p_H \geq p_H^c$, the fee-for-advice system may lead to inefficient market outcomes, since under this remuneration system only pooling contracts are second-best efficient.

Corollary 1 *If $c_H > v_L$ and $p_H \geq p_H^d$, a fee-for-advice system with truthful intermediation either leads to inefficient market outcomes or to the non-existence of an insurance market.*

3.2 Commission system

In a commission system the broker offers her intermediation services both to consumers and to insurance companies. Consumers are mainly interested in finding adequate coverage, while insurance companies are mainly concerned about the appropriate risk classification. In a commission system approaching a broker is free of charge for consumers. As long as consumers are not forced to buy any coverage, they will always contact a broker. The broker is exclusively remunerated by insurance companies through a commission schedule g_j which assigns a non-negative commission payment g_j for any successful contract completion at the premium α_j^i .

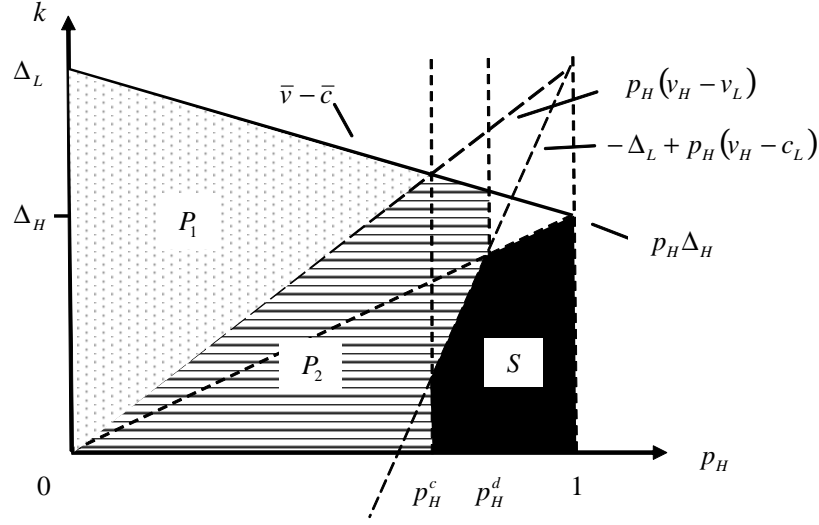


Figure 3: Optimal contracts under a fee-for advice system with $c_H > v_L$ and $p_H^c < p_H^d$

In a commission system the sequence of play is as follows:

- Stage 1: Nature determines the consumer type θ .
- Stage 2: Insurance companies make their premium offers α_j^i and their commission schedule offer g_j .
- Stage 3: The broker decides whether or not to accept the commission offers g_j . If she accepts an offer, the consumer can contact the broker. In this case the consumer's type θ is revealed to the broker and the broker makes a truthful premium offer α_j^i to the consumer.
- Stage 4: The consumer decides whether or not to accept the premium offer α_j^i .
- Stage 5: The game ends and payoffs are paid.

Proposition 2 *If $k \leq \sum_i p_i \Delta_i$, insurance coverage in a commission system with truthful intermediation is offered at $\alpha^i = v^i \forall i$. The broker is remunerated by a flat commission $g = k$ and welfare corresponds to $W = \sum_i p_i \Delta_i - k$.*

In a commission system with truthful intermediation the results are straightforward. As the broker perfectly matches all types and the intermediation service is free of charge, the consumer will always contact the broker. Since both risk types purchase insurance coverage, the broker breaks even by accepting the commission offers. Since all transaction parties are perfectly informed,

insurance companies are able to completely extract the rents from all types. Thus, the consumers expected utility is zero. As the commission rate corresponds to the risk analysis cost, the broker only breaks even.

4 Strategic intermediation

Let us now turn toward the issue of strategic intermediation. In the previous analysis the broker always truthfully revealed her private information. Now, we drop the assumption of truthful intermediation and explore whether or not the broker might be interested to match some consumer types with the inefficient product or misrepresent the specific risk type. For the sake of simplicity, we assume $c_H > v_L$. This implies that it is never profitable to mismatch and misclassify high-risk types at the same time. In respect to matching we only consider that the broker is able to match a fraction $\lambda \in [0, 1]$ of consumers of one company with the inefficient product of the opponent. Furthermore, the broker may decide to classify a fraction $\phi \in [0, 1]$ of low-risk consumer's as high risks. As strategic intermediation negatively affects consumers' utility, it is intuitive to assume that it negatively affects the broker's future credibility as well. In this respect we assume that any misrepresentation is costly for the broker. The discounted reputation costs are $q\lambda^2$ and $q\phi^2$ with $q > 0$.

4.1 Fee-For-Advice

As consumers are assumed to be rational, any mismatching activities negatively affect consumer's ex-ante profitability of intermediation and consequently their ex-ante willingness to pay for insurance coverage. Our subsequent analysis has to account for both pooling and separating equilibria.

The participation constraint of consumers in a pooling equilibrium for any mismatching intensity λ is

$$\frac{\bar{v} - \alpha_A}{2} + \frac{(1 - \lambda)[\bar{v} - \alpha_B] + \lambda[\bar{r} - \alpha_A]}{2} - f \geq 0 \quad (10)$$

In the considered situation type A consumers are always matched with the appropriate company and realize their full willingness to pay net of the insurance premium charged by insurer A . Type B consumers will only derive their full willingness to pay net of the insurance premium of company B if they are matched with insurer B . This only happens with the probability $1 - \lambda$. Hence, if consumers of type B are matched with company A , they will yield a net utility that corresponds to the average utility of a bad match $\bar{r} = \sum_i p_i r_i$ net the insurance premium of company A .

Proposition 3 *Strategic intermediation regarding the best match will not take place under a fee-for-advice system.*

In order to maximize profits the broker chooses in both types of pooling equilibria a fee f for which the consumer's ex-ante participation constraint (10) binds. As the average value of a mismatch \bar{r} is smaller than the average value of a good match \bar{v} , any mismatching of consumers reduces the consumer's expected utility and consequently the extractable rent for the broker. As long as side-contracting with insurance companies is infeasible, the broker is in a fee based remuneration system not able to collect any compensation payments from insurance companies. Thus, misrepresenting her private information with respect to the best match is neither profitable in a pooling nor in a separating equilibrium.⁶

In respect to the price of insurance coverage, the broker together with the insurance companies might have incentives to sell insurance contracts to low-risk consumers at an unfavorable premium. Again, as long as side-contracting is infeasible the broker does not receive any compensation in return for misrepresenting the consumers risk type. Therefore, the broker does not have any positive incentives for misrepresenting her private information.

4.2 Commission system

In a commission system the broker is able to receive compensation payments from insurance companies. The offered compensation schemes offered by the insurance companies might induce certain misrepresentation incentives. Generally, the broker can engage in two different misrepresentation activities. First of all, she can mismatch a consumer with an inefficient product and in addition, she is able to lie about the specific risk type.

In order to simplify our analysis, we will at first check whether or not and under which circumstances the broker might have incentives to engage in pure mismatching activities. Subsequently, we only consider one of the two risk types and drop the index i . Let us assume that both insurance companies simultaneously offer their premium α_j and commission rate g_j . In this context the broker will maximize

$$\max_{\lambda} \quad \kappa = \frac{(1 + \lambda)g_A + (1 - \lambda)g_B}{2} - k - q\lambda^2 \quad (11)$$

The first order condition for the optimal mismatching intensity leads to

$$\lambda^*(g_A, g_B) = \frac{g_A - g_B}{4q} \quad (12)$$

Condition (12) confirms the straightforward intuition that mismatching will only take place if $g_A > g_B$. The extent of mismatching increases in the commission disparity ($g_A - g_B$) and decreases in the broker's reputation cost parameter q .

⁶See, Focht et al. (2008) for a more detailed analysis of side-contracting.

If the commission offers differ, mismatching negatively affects the consumer's expected utility. As mismatching activities are anticipated, the consumer's willingness to pay for the product that entails mismatching decreases. Consequently, the consumer's ex-ante participation constraint is

$$\frac{v - \alpha_A}{2} + \frac{(1 - \lambda)[v - \alpha_B] + \lambda[r - \alpha_A]}{2} \geq 0 \quad (13)$$

Company B maximizes its profit by $\alpha_B = v$, because the broker's profit (11) and therefore her mismatching activities are not affected by the premium offer α_B . The offer $\alpha_B = v$ together with the fact that condition (13) must bind in an optimum, leads to the following simplified participation constraint

$$\alpha_A^* = \frac{v + \lambda r}{1 + \lambda} \quad (14)$$

Condition (14) illustrates the basic trade-off for insurance company A . Due to $v > r$, mismatching reduces the benefits of insurance coverage for the consumer that purchases the product of company A . As a consequence, the premium offer α_A must be decreased according to (14) in order to guarantee the consumer's participation.

Let us first analyze symmetric equilibria where mismatching is feasible, but does not take place. Our main task is to find a steady state in which both insurance companies do not have any incentives to deviate from their symmetric commission and premium offer given that the broker and the consumer prefer to participate.

In the considered situation the profit of insurance company A is

$$\Pi_A(\alpha_A, g_A, \lambda) = \frac{(1 + \lambda)}{2} [\alpha_A - c - g_A] \quad (15)$$

Using the broker's reaction function (12) and the participation constraint (14) give the simplified maximization problem

$$\max_{g_A} \Pi_A(g_A, g_B) = \frac{v - c - g_A}{2} + \frac{(g_A - g_B)r - c - g_A}{8q} \quad (16)$$

and the respective rearranged first order condition

$$g_A^*(g_B) = \frac{\Phi - g_B}{2} - 2q \quad (17)$$

Company's A reaction function (17) has several interesting implications. First of all, the commission rate g_B has a negative impact on insurer A 's optimal commission rate. Increasing the commission rate g_A becomes ceteris paribus more unattractive the higher the commission offer g_B . More importantly, insurer A will only consider increasing its commission offer if $\Phi > 0$ holds.

Consequently, general incentives for mismatching will only exist if the value of a mismatch is considerably high. However, in order to acquire new consumers for which A 's insurance contract is not the best match, company A has to decrease the premium offer α_A for all its policyholders to guarantee the consumer's participation. This profitability loss caused by the premium reduction must be compensated by the profit generated by new mismatched consumers. The willingness to pay of mismatched consumers r must not only exceed the marginal cost c , company A must also outbid B 's commission offer g_B and as well compensate the broker for his reputation loss in order to induce any mismatching.

In the considered asymmetric case company B can charge the premium $\alpha_B^* = v$. Due to $v > r$ and $q > 0$, company B does always have greater incentives to keep its marginal consumer than company A has incentives to steal it. Therefore, company B will always match the commission offer g_A with $g_B^*(g_A) = g_A$ in order to keep its marginal consumer. A steady state will be reached when insurance company A does not have any incentives to overbid the commission offer g_B if $g_A^*(g_B) = g_B^*(g_A)$, and therefore,

$$g_A^* = g_B^* = \frac{\Phi - 4q}{3} \quad (18)$$

However, the broker will only offer her intermediation service if the equilibrium commission rates g^* weakly exceed her risk analysis costs k . Consequently, as long as the risk analysis costs are sufficiently high and $k \geq \frac{\Phi - 4q}{3}$, there is a symmetric equilibrium with $\alpha^* = v$, $g^* = k$ and $\lambda^* = 0$. In this equilibrium insurers' profits are $\Pi^* = \frac{1}{2}(\Delta - k)$. The broker only breaks even and the consumer's expected utility is zero. Otherwise, if the risk analysis costs are low with $k < \frac{\Phi - 4q}{3}$, a symmetric equilibrium with $\alpha^* = v$, $g^* = \frac{\Phi - 4q}{3}$ and $\lambda^* = 0$ will exist. In this equilibrium insurers' profits are $\Pi^* = \frac{1}{2}\left(\Delta - \frac{\Phi - 4q}{3}\right)$. The broker makes strictly positive profits $\kappa^* = \frac{\Phi - 4q}{3} - k$ whereas the consumer's expected utility is zero.

Given our reasoning with respect to asymmetric mismatching, it is straightforward to extend our results to the general case with symmetric mismatching possibilities.

Lemma 4 *If $(g^i)^* = \max\left(k, \frac{\Phi_i - 4q}{3}\right)$, in a pure commission system mismatching with respect to the same risk type will never take place in equilibrium.*

As long as $g_{-j}^i < \frac{\Phi_i - 4q}{3}$, company j has an incentive to marginally increase its commission offer to $g_j^i > g_{-j}^i$ in order to increase its market share and profits. Therefore, both companies will at least offer $g_j^i = \frac{\Phi_i - 4q}{3}$ in order to make mismatching unattractive. However, in equilibrium the broker will only offer her service if $g_j^i \geq k$. Thus, the equilibrium commission rates are $(g^i)^* = \max\left(k, \frac{\Phi_i - 4q}{3}\right)$, but an equilibrium will only exist if $k < \Delta$ holds.

In a second step we have to check whether or not it might be attractive to mismatch and misclassify consumers at the same time.

Lemma 5 *In a pure commission system mismatching and misclassification at the same time will only be profitable for low-risk types if $\Phi_L > 0$ holds. The mismatching and misclassification incentives for low-risk types increase in p_L but stealing can always be prevented by a commission $g_j^L \in [k, \Phi_L]$.*

Proof. See Appendix. ■

First of all, due to $c_H > v_L$, it might only be profitable for insurance companies to sell contracts designated for high-risk consumers to low-risk types that are mismatched. Thus, in respect to high-risk types there is just mismatching but not any misclassification competition. In regard to low-risk types both companies might have an incentive to sell high-risk contracts to low-risk consumers of the other company. However, in equilibrium each insurance company will increase its commission g_j^L until stealing is no longer attractive for the other company. The actual extent of the stealing incentives increases in the probability of low-risk types p_L , because the costs of a marginal premium decrease for all high-risk types which would be necessary is very high too. If, for example, the fraction of low-risk types is negligent with $p_L \rightarrow 0$, insurance companies will not have any incentives to attract low-risk types of the other company. If the fraction of low-risk types is very high, stealing incentives are very high. In this case, stealing can only be prevented by increasing the symmetric commission rate $(g^L)^*$. In the extreme case with $p_L \rightarrow 1$ each company can only protect its low-risk types by setting a commission rate $(g^L)^* = \Phi_L$.

In our preceding analysis we designed incentive compatible commission system that prevents any mismatching behavior of the broker. Finally, a pure commission system does not only have to guarantee proper matching it also has to ensure a proper risk classification of own consumers.

Lemma 6 *If $g_j^H \geq g_j^L$, a pure commission system leads to a proper risk classification with respect to own consumers.*

First of all, as long as insurance companies offer contracts at premiums $(\alpha^L)^* = v_L$ and $(\alpha^H)^* = v_H$ the broker is committed to offer low-risk types the designated contract. Any misclassification of low-risk types would be anticipated and therefore these types would refuse to buy any insurance. On the other hand, high-risk types would definitely accept contracts at the premium $(\alpha^L)^* = v_L$, but if some high-risk types are misclassified, the profitability of low-risk contracts declines. Consequently, as long as the commission rate for low-risk contracts does not exceed the commission rate for high-risk contracts, the broker does not have any positive incentives for misclassification of own consumers.

Finally, the following Proposition summarizes our results.

Proposition 4 *If $k \leq \Delta_i$ and $\Phi_H > \Phi_L$, an equilibrium in a pure commission system with $(\alpha_i)^* = v_i$ which leads to perfect matching and risk classification will always exist. In equilibrium $\Pi^* = \sum_i \frac{p_i}{2} (\Delta_i - (g^i)^*)$, $\kappa = \sum_i p_i (g^i)^* - k$, $u_i = 0$, and $W = \sum_i p_i \Delta_i - k$ hold.*

- *If $\Phi_i < 0 \forall i$ holds, mismatching is not profitable. In equilibrium companies choose commission rates $(g^i)^* = k \forall i$.*
- *If $\Phi_L \in [0, k]$ holds, only mismatching with respect to the same risk type is potentially profitable. In equilibrium companies choose commission rates $(g^i)^* = \max\left(k, \frac{\Phi_i - 4q}{3}\right) \forall i$.*
- *If $\Phi_L > k$ holds, pure mismatching and simultaneous mismatching and misclassification of low-risk types are potentially profitable. In equilibrium companies choose commission rates $(g^L)^* = (k, \Phi_L)$ and $(g^H)^* = \max\left(\frac{\Phi_H - 4q}{3}, (g^L)^*\right)$.*

Interestingly, the broker does not receive any incentive pay for a proper risk classification. However, in equilibrium both matching and risk classification are perfect. The reason for this at first glance surprising result is simple. The premium offer $\alpha^L = v_L$ is a perfect commitment device with respect to proper risk classification of low-risk types. Given the offers $\alpha_j^i = v_i$, low-risk consumers will only participate if they are perfectly matched and classified by the broker. However, any potential mismatching and misclassification incentives give the broker bargaining power related to the commission rate competition between the insurance companies. If companies fear any stealing of certain consumer types, they will increase their respective commission offers to prevent such behavior. As a positive result for the broker, she will earn strictly positive profits if there is an actual danger of stealing. However, a proper risk classification of high-risk types is especially only guaranteed if $(g^H)^* \geq (g^L)^*$. In equilibrium insurance companies' profits are $\Pi^* = \sum_i \frac{p_i}{2} (\Delta_i - (g^i)^*)$. The broker's profit corresponds to $\kappa = \sum_i p_i (g^i)^* - k$ and the consumer's expected utility is zero. Consequently, welfare corresponds to $W = \sum_i p_i \Delta_i - k$.

5 Conclusions

Our results can be summarized as follows: In a situation in which the broker reports her private information absolutely truthfully, a fee-for-advice system is weakly inferior to a commission system. The basic intuition for this result is pretty straightforward. In a fee-for-advice system the insurer is unable to distinguish the respective risk-types, because neither the broker nor the policyholder is able to credibly communicate the specific risk type. Consequently, if the fraction of high-risk types is sufficiently high, an adverse selection problem will arise, since consumers are informed about

their own risk type. In this case, the insurance market leads to inefficient outcomes, because either there are only separating equilibria or the market completely collapses. Under the assumption of truthful reporting a commission system will always lead to perfect matching and risk classification.

When we allow strategic intermediation, our earlier results for a fee-for-advice system do not change. In the absence of side-contracting the broker cannot collect any monetary rewards for mismatching. Even worse, any mismatching activities lower the willingness to pay of uninformed consumers for the broker's service. Hence, the broker will always perfectly match consumers although the adverse selection problems remain. In a commission system mismatching can only occur if the value of a mismatch net the marginal costs is positive. In this case insurance companies can potentially induce the broker to mismatch certain consumer types. However, in order to create such incentives without violating the consumer's participation constraint, insurance companies have to lower their premiums and pay higher commissions than the opponent. In fact, mismatching is not an equilibrium phenomenon, because the value of a good match exceeds the value of a bad match. Hence, an insurance company can always prevent any stealing activities by increasing the commission rate for the affected consumer types. In respect to risk classification the broker does not need any specific incentive pay in our model, because the premium levels set by insurance companies do not leave any space for inefficient matching and risk classification.

This paper provides a very simple framework for analyzing compensation issues in insurance market. We had to leave many important aspects aside. First of all, we consider a symmetric situation, where both insurance companies have the same market share with respect to the best match. Additionally, we do not consider any competition in the broker market. Future research should definitely further explore the latter points as well as incentives for side-contracting between the broker and the insurance companies. In this respect these extensions may lead to additional insights into the role of contingent commission, which seem to play an important role in certain intermediated insurance markets.

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6 Appendix

Proof of Proposition 1 In order to determine which type of contract insurance companies prefer to offer, we have to compare the associated profits of both contract types. However, we only have to evaluate situations for which pooling and separating contracts coexist. Separating contracts only yield non-negative profits, if $k \leq p_H \Delta_H$. As P_1 -pooling contracts will only be offered, if $k \geq p_H (v_H - v_L)$ holds, those contract types never coexist.

P_1 -pooling and separating contracts only coexist if $c_H > v_L$ and $p_H^c < p_H^d$. A separating weakly dominates a type P_2 -pooling contract in terms of profit, if

$$\frac{p_H}{2} \left(\Delta_H - \frac{k}{p_H} \right) \geq \frac{1}{2} (v_L - \bar{c}) \quad (19)$$

holds.

Rearranging (19) leads to

$$k \leq -\Delta_L + p_H (v_H - c_L) \quad (20)$$

In this case, separating contracts weakly dominate existing type- P_2 pooling contracts if $p_H \geq p_H^c$ and $k \leq -\Delta_L + p_H (v_H - c_L)$. \blacksquare

Proof of Lemma 5 Due to $v_i > r_i$ equilibria in pure strategies can only be symmetric with $\alpha_A^H = \alpha_B^H$ and $\alpha_A^L = \alpha_B^L$. In the remainder we check whether or not one company might have incentives to attract consumers which are both mismatched and misclassified. Let us now check the latter case and assume that company A prefers to acquire a fraction ϕ of low-risk types from company B which are misclassified and mismatched as high-risk types of company A . In this respect, we will now determine under which circumstances insurer A is not interested in stealing low-risk consumers from company B . In the considered context the broker will maximize

$$\max_{\lambda} \kappa = \frac{p_H}{2} (g_A^H + g_B^H) + \frac{p_L}{2} [g_A^L + (1 - \phi) g_B^L + \phi g_A^H] - k - q\phi^2 \quad (21)$$

The first order condition for the optimal mismatching intensity leads to

$$\phi^* = \frac{p_L (g_A^H - g_B^L)}{4q} \quad (22)$$

The impact of the commission disparity increases in p_L . Hence, stealing incentives also increase in the fraction of low-risk consumers. The consumer's ex-ante participation constraint for a given misrepresentation fraction ϕ is

$$\frac{p_H}{2} [(v_H - \alpha_A^H) + (v_H - \alpha_B^H)] + \frac{p_L}{2} [(v_L - \alpha_A^L) + (1 - \phi)(v_L - \alpha_A^L) + \phi(r_L - \alpha_A^H)] = 0 \quad (23)$$

Considering $\alpha_A^L = \alpha_B^L = v_L$ and $\alpha_B^H = v_H$ simplifies the participation constraint (23) to

$$\alpha_A^H = \frac{p_H v_H + p_L \phi r_L}{p_H + p_L \phi} \quad (24)$$

By using (22), (24) changes to

$$\alpha_A^H = \frac{4qp_H v_H + p_L^2 (g_A^H - g_B^L) r_L}{4qp_H + p_L^2 (g_A^H - g_B^L)} \quad (25)$$

The assumption $p_L \in (0, 1)$ directly leads to $\alpha_A^H \in (r_L, v_H)$. Starting from $\lim_{p_L \rightarrow 0} \alpha_A^H = v_H$ the premium decreases in p_L until $\lim_{p_L \rightarrow 1} \alpha_A^H = r_L$. Hence, the higher the fraction p_L , the higher must

α_A^H be decreased in order to guarantee the participation of consumers which get the premium offer α_A^H .

In the considered situation the profit function of insurance company A is

$$\Pi_A = \frac{p_L}{2} [v_L - c_L - g_A^L] + \frac{p_H}{2} [\alpha_A^H - c_H - g_A^H] + \frac{\phi p_L}{2} [\alpha_A^H - c_L - g_A^H] \quad (26)$$

In order to keep our proof tractable, we will only regard three different cases which indicate the general impact of p_L on the stealing incentives for company A .

Case 1: $p_L \rightarrow 0$. Combining (26), (22) and (25) we get

$$\lim_{p_L \rightarrow 0} \Pi_A = \frac{1}{2} [\Delta_H - g_A^H] \quad (27)$$

If p_L converges to zero, insurance company A will not have any incentives to reduce its premium offer $\alpha_A^H = v_H$ and to increase its commission offer g_A^H in order to acquire low-risk consumers from company B .

Case 2: $p_H = p_L = \frac{1}{2}$. Again from (26) and (22) together with (25) we get

$$\max_{g_A^H} \Pi_A \left(p_H = p_L = \frac{1}{2} \right) = \frac{\Delta_L - g_L^A + \Delta_H - g_A^H}{4} + \frac{(g_A^H - g_B^L) (\Phi_L - g_A^H)}{32q} \quad (28)$$

Rearranging the first order condition of the latter maximization problem yields

$$(g_A^H)^* = \frac{\Phi_L + g_B^L}{2} - 4q \quad (29)$$

Insurance company A will not have any incentives to attract low-risk consumers of company B if $(g_A^H (g_B^L))^* \leq g_B^L$, and therefore,

$$\Phi_L \leq g_B^L + 8q \quad (30)$$

holds. If $k + 8q \geq r_L - c_L$ holds, stealing is not profitable.

Case 3: $p_L \rightarrow 1$. In this case, the simplified maximization problem of insurer A is

$$\lim_{p_L \rightarrow 1} \Pi_A = \frac{1}{2} [\Delta_L - g_A^L] + \frac{(g_A^H - g_B^L) (\Phi_L - g_A^H)}{8q} \quad (31)$$

Rearranging the first order condition gives

$$(g_A^H)^* = \frac{\Phi_L + g_B^L}{2} \quad (32)$$

Insurance company A will not have any incentives to attract low-risk consumers of company B ,

if $(g_A^H (g_B^L))^* \leq g_B^L$, and therefore,

$$\Phi_L \leq g_B^L \tag{33}$$

holds.

Obviously, stealing incentives in this case are rather strong, since acquiring new consumers is virtually free of cost. However, insurer A is only interested in acquiring mismatched and misclassified consumers if the commission offer g_B^L does not exceed the unit profit Φ_L of a redirected consumer.

Our three cases illustrate that the stealing incentives increase in p_L . However, stealing will only be profitable if the value of a mismatch is positive and $\Phi_L > 0$. If this is true both insurance may have to increase their commission offers g^L depending on the specific value of p_L in order to prevent any stealing of low-risk consumers. Therefore, are able to prevent any stealing by offering a commission $(g^L)^* \in [k, \Phi_L]$. ■