Non-Extractible Rent and Compensation for Insurance Intermediaries

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Abstract:
This paper introduces the non-extractible consumer rent and compares relative efficiency among diverse broker compensation systems: fee, commission, and contingent commission. We find that neither the fee system nor the contingent commission system dominate each other, while the contingent commission system dominates the commission system. Under the fee system, the broker has incentives to render the service producing non-extractible benefit, which increases consumer welfare. Under the commission and the contingent commission systems, however, the focus is on sales and the insurer's profit, leading to the non-extractible benefit being ignored. Therefore, if the non-extractible rent is large enough, the fee system is socially desirable. We also find that adverse selection may increase consumer welfare. Under the fee system, the broker may opt not to reveal risk types to the insurer, creating adverse selection. However, consumer welfare can be increased, if the insurer, without knowing the risk types, offers low prices to attract both risk types.

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I. Introduction

Compensating brokers and independent agents in the insurance market has been a controversy since New York Attorney General Spitzer's investigation of insurance brokers in 2004. Major insurance brokers such as Marsh & McLennan, Aon, and Willis were accused of bid-rigging and of receiving kickbacks from insurers. The practice of contingent commission is considered a form of illegal kickbacks, constituting an anticompetitive practice. In 2005, as a resolution, those brokers agreed to establish over $1 billion dollars as restitution funds, and fully disclose their compensations schemes.

In the insurance brokerage market, there are three categories of compensation methods: fee, commission, and contingent commission. Under a fee system, consumers directly pay brokers for the advice provided to them. The fee system allows consumers to separate purchasing advice from purchasing products. From the legal viewpoint that brokers are agents for consumers, not for insurers, the fee system is considered a natural compensation system for brokers. Under a commission (or premium-based commission) system, brokers are paid by insurers when consumers are placed with the insurers. Payment is based on premiums. In the U.S. Property Casualty industry, the commission is 11.4% of premiums for commercial lines and 9.4% for personal lines as of 2004 (Cummins and Doherty, 2006).

In addition to commissions, brokers may also be given contingent commission. In a typical contingent commission, compensations for brokers are based on the profitability or volume of the brokers' business placed with the insurer. Contingent commission represents incentive schemes for brokers provided by insurers. In the U.S. Property Casualty industry, the contingent commission is about 1.1% of premiums as of 2004. It also accounts for over 5% of revenues for top 100 brokers (Cummins and Doherty, 2006).

Academic research is focused on the relative efficiency among different compensation methods. Gravelle (1993, 1994) compares between the fee system and the commission system given the competitive insurer's market and free entry in the broker's market. In an equilibrium, insurers make zero expected profits, and brokers earn zero expected profits. He shows that the weak information position of consumers is exploited by brokers, since brokers have incentives to provide biased advice in either compensation system. When the gross benefit of insurance is high, the fee system tends to yield greater welfare, since high benefit reduces the value of advice thus lowering the broker's ability to increase fee, while the price under a commission system tends to be high. In general, he shows that neither system guarantees higher social welfare.

Cummins and Doherty (2006) point out that contingent commission may be socially beneficial in the Rothschild and Stiglitz model. Profit-based contingent commission provides brokers with the incentives to reveal consumer's risk type, which reduces adverse selection costs. Such incentives cannot be provided by the fee or the commission systems, since compensation is made at time of purchase, not at time of loss realization.

Focht, Richter and Schiller (2009) consider the case of the monopolistic broker and the duopolistic insurers. The brokers' main function is matching. They show that the fee system and the commission system achieve the same level of social welfare. In either system, consumers are perfectly matched and consumer welfare is fully extracted. When the broker is allowed to strategically mismatch consumers for his own profit, the broker may have incentives to sign on a side-contract with insurers. This side-contracting increases the broker's profit, without changing the social welfare. Interpreting side-contracting as contingent commission, contingent commission is used for the broker to extract rents from insurers.

Schiller (2009) also considers the case of the monopolistic broker and the duopolistic insurers as in Focht, Richter and Schiller. The difference is that the brokers' main function is matching and risk classification. In the fee system, consumers are provided perfect matches, since any mismatching will lower the willingness to pay of uninformed consumers for the brokers' advice. However, when the insurers do not have effective tools to screen risk types, the adverse selection problems cause welfare losses. Although brokers potentially have incentives to mismatch under the commission system, the competition among insurers leads to perfect matching and risk classifications. This result implies that the commission system is (weakly) superior to the fee system.

The results of recent research tend to work in favor of the commission and contingent commission systems over the fee system. The ability of brokers in finding risk types plays a critical role. Finding risk types leads to efficiency improvement via two mechanisms in literature. First, it will lower adverse selection costs. Under the fee system, the information regarding risk types are not necessarily communicated with insurers. Thus, the adverse selection problem may exist under the fee system. This adverse selection problem can be resolved if risk types can be revealed to insurers. The commission and contingent commission systems are considered a mechanism to make brokers reveal the risk types to insurers. As a result, the commission and contingent commission systems are preferred to the fee system.

Second, when insurers obtain full information about consumers, the information allows insurers to fully extract rents from consumers by price discrimination. While this extraction may work against consumers, it does not reduce the social welfare that is the sum of the welfares of insurers, consumers and brokers. Social welfare can still be maximized, although consumers' welfare is reduced as a result. Therefore, full extraction is desirable, as long as social welfare is a concern.

This paper provides a counter example to the recent strand of research. We consider the case in which consumers' welfare is not fully extractible by a monopolistic insurer. There are several reasons why the insurer may not fully discriminate consumers. First of all, regulation does not allow unfair discrimination based on non-risk characteristics. Secondly, the information provided by brokers is not necessarily perfect. Possibly, the benefit of brokers' advice may not fully materialize. The existence of non-extractible rents makes us more carefully balance between the insurer's (and brokers') profits and consumer welfare. Social welfare is not maximized simply by maximizing the insurer's and brokers' profits.

Given that the non-extractible consumer rent exists, we compare relative efficiency among diverse broker compensation systems: fee, commission, and contingent commission. We find that relative social welfare depends on parameter values such as production costs, non-extractible rent, and broker's effort costs. We find that neither the fee system nor the contingent commission system dominate each other, while the contingent commission system dominates the commission system. The existence of non-extractible rent plays an important role. Under the fee system, the broker has incentives to render the service producing non-extractible benefit, which increases consumer welfare. Under the commission and the contingent commission systems, however, the focus is on sales and the insurer’s profit, leading to the non-extractible benefit being ignored. Therefore, if the non-extractible rent is large enough, the fee system is socially desirable.

Another interesting finding is that adverse selection may increase consumer welfare. Under the fee system, the broker may opt not to reveal risk types to the insurer, creating adverse selection. However, consumer welfare can be increased, if the insurer, without knowing the risk types, offers low prices to attract both risk types. This finding challenges the argument that contingent commission is social desirable since it can resolve adverse selection.

The remainder of the paper is composed as follows. Section II describes the model. Section III provides the analysis of three compensation systems. Section IV compares the results of analysis. Section V concludes.

II. Model

We consider a monopolistic insurer, competitive brokers, and many consumers in the insurance market. Consumers in the insurance market may have different needs for insurance and also different risk types. However, they do not have information about their own needs and risk types. The insurer is also not able to directly observe the information. While consumers and the insurer cannot observe the information, they may obtain it from brokers.

Brokers can find perfect information about consumer's needs and risk types with some costs. Brokers can perform two functions: matching and finding risk types. Matching benefit is denoted by B. Good matching implies finding a right insurance product matching with the consumer's needs. Good matching provides the consumer with benefit B = G, while bad matching provides benefit of B = -G. The broker needs to incur effort cost $E_1 = e_1$ to obtain the perfect information for matching. We assume that e_1 is positive but small enough compared with other variables, such as X, G and M which will be described later. With zero effort cost ($E_1 = 0$), the consumer will be matched randomly, implying zero matching benefit.

Each consumer faces a risk of loss occurrence with the fixed loss size of D. Risk types of consumers can be high risk (H) or low risk (L) with equal probability, ex ante. The risk type of a consumer is indentified with her probability of loss: p_H and p_L, where $p_H > p_L$.

The consumer ignorant of her own risk type is denoted by type N, where $p_N = (1/2)(p_H + p_L)$. A broker can obtain the perfect information about risk type H or L by incurring effort cost $E_2 = e_2$. As with e_1, we assume that e_2 is positive but small enough compared with other variables. With zero effort cost ($E_2 = 0$), the risk type is considered N.

The insurer incurs production costs of M above the expected loss. The price above the expected loss (i.e., loading premium) charged by the insurer is denoted by P. Since the insurer is monopolistic, it will want to extract as much rents from consumers as possible. Let us denote $X = X_i$ for the extractible rent from risk type i, net of the expected loss. For simplicity, we assume that high risks have higher extractible rent than low risks: $X_H > X_L$.[1] The average of the extractible rents is denoted by $X_N = (X_H + X_L)/2$. One important feature of our model is the existence of non-extractible rents. For simplicity, we identify the non-extractible rent with matching benefit. That is, the insurer cannot extract matching benefit from consumers. For analytic convenience, we assume that $G < (X_H – X_L)/2$.[2] This assumption implies that $G + X_L < X_N$, and $G + X_N < X_H$. For analytic convenience, we assume that the insurer can discriminate consumers only with prices. That is, it cannot offer a menu of self selection contracts as in Rothschild and Stiglitz (1976) when it cannot observe risk types. The insurer's profit will be denoted by π.

Our purpose is to compare outcomes under three different compensation systems of fee, commission, and contingent commission. Under the fee (fee-for-advice) system, a broker is compensated solely by consumers. Consumers pay fees for the brokers' advice. Under the commission (premium-based commission) system, consumers do not directly pay compensation to the broker. The broker is paid by the insurer based on the premiums earned

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[1] The relationship between risk type and rent size is not crucial for our results. What we need in our model is the existence of differential extractible rents among consumers.

[2] We focus on the case of $G < (X_H – X_L)/2$, simply because this case can produce outcomes diverse enough to capture our main intuitions, not because it is realistic.

through the broker. Under the contingent commission (profit-based commission) system, the broker is paid by the insurer based on the profit earned through the broker. As notations, fee, commission and contingent commission will be denoted by F, C, and K, respectively.

A broker will determine the effort sizes for matching and finding risk types, in order to maximize his profit. Under our simple binary assumption, each effort E_j can be 0 or e_j, j = 1 for matching, or 2 for finding risk types. It is assumed that the broker's market is competitive so that a broker's profit (denoted by δ) will be zero in an equilibrium. The decision rule of the broker may be affected by compensation systems. Since the broker is directly paid by consumers under the fee system, the broker needs to maximize the consumer's benefit. Under the commission system, the broker needs to maximize the premiums. Under the contingent commission system, the broker needs to maximize the insurer's profit.

In an equilibrium, given each compensation system, $\{(E_1, E_2), P\}$ are determined to satisfy the following conditions: (i) Brokers make zero profit. (ii) Consumer's decision to purchase insurance is optimal given the broker's advice offer and insurer's insurance offer. (iii) The insurer's profit is maximized given consumer's decision and broker's advice offer. (iv) Each party has no incentives to unilaterally change his/her/its decision. Now, let us compare the outcomes under different systems.

III. Analysis

1. The fee system

Let us assume that a consumer's expected utility, denoted by EU, can be expressed as EU = B + X – P – F, when she purchases insurance with loading premium P and broker's fee F. The equilibrium outcomes depend on the relative size of the production costs and the extractible rents. In each case, a broker's decision on efforts will be denoted by $E = (E_1, E_2)$. Our task is to find equilibrium outcomes under various circumstances.

Since brokers are competitive and are paid by consumers under the fee system, brokers are assumed to maximize the consumer's expected utility. We do not rule out the possibility that brokers may want to reveal risk types to the insurer, when brokers observe them. Brokers may do so if it increases the consumer's expected utility. However, it turns out that brokers will not reveal risk types under the fee system, since the rents will be extracted by the insurer.

Case 1: $M < X_L$

When the broker's efforts $E = (0, 0)$, no consumers are informed about matching and risk types. Fee F is determined to be zero. The extractible rent is X_N, so that the insurer sets $P = X_N$. The consumer's expected utility $EU = X_N – X_N – 0 = 0$. The insurer's profit $\pi = X_N – M$. The broker's profit $\delta = F – 0 = 0$.

When $E = (e_1, 0)$, consumers enjoy the benefit of good matching, G. The fee should be e_1. Under $E_2 = 0$, the extractible rent is X_N, so that the insurer sets $P = X_N – e_1$.[3] As a result, $EU = G + X_N – (X_N – e_1) – e_1 = G$; $\pi = X_N –M – e_1$; and $\delta = F – e_1 = 0$.

When $E = (0, e_2)$, consumers are informed about the risk types. The fee should be e_2. Under $E_1 = 0$, the matching benefit is zero. Under $E_2 = e_2$, the extractible rents are X_H or X_L. Since the insurer cannot observe the rents, it may use one of two pricing strategies. First, it may target both risk types. For this, the insurer will set $P = X_L – e_2$. A high risk consumer's expected utility becomes $X_H - X_L$ and a low risk consumer's expected utility

[3] While it is possible to assume that brokers may extract some of G, it does not provide any additional intuition to the model. For simplicity, we assume that only the extractible rent can be extracted by the insurer and brokers when the consumer purchases insurance.

becomes 0. On average, a consumer's expected utility $EU = (1/2)(X_H – X_L)$. In this case $\pi = X_L – M – e_2$. Second, it may target high risks only. In this case, low risks will not purchase insurance, while the extractible rent of high risks is fully extracted. The insurer will set $P = X_H – 2e_2$, so that the consumer's expected utility becomes zero: $EU = (1/2)0 + (1/2)(X_H – P) – e2 = 0$.[4] In this case, $\pi = (1/2)(X_H - M) – e_2$.

The insurer will select its pricing strategy to maximize the profit. By comparing two profits, we have the following result: If $M < 2X_L - X_H$, targeting both risk types is more profitable. Otherwise, targeting high risks is more profitable.

When $E = (e_1, e_2)$, consumers are informed about both matching and risk types. Similarly as in the case of $(0, e_2)$, there are two insurers' strategies. When targeting both risk types, $P = X_L – (e_1 + e_2)$, $\pi = X_L – M – (e_1+e_2)$, and $EU = G + (1/2)(X_H – X_L)$. When targeting high risks only, $P = X_H – 2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) – (e_1+e_2)$, and $EU = (1/2)G$. If $M < 2X_L - X_H$, targeting both risk types is more profitable. Otherwise, targeting high risks is more profitable.

Now, let us determine the broker's choice of efforts. Recall that the broker will select efforts to maximize the consumer welfare under the fee system. Note first that (e_1, e_2) dominates $(0, e_2)$, since the former provides a higher consumer's expected utility than the latter. Note also that $(e_1, 0)$ dominates $(0, 0)$. Now, let us compare between $(e_1, 0)$ and (e_1, e_2). When $M < 2X_L - X_H$, the consumer's expected utility under (e_1, e_2) is $G + (1/2)(X_H – X_L)$ which is greater than G, the expected utility under $(e_1, 0)$. However, when $M \geq 2X_L - X_H$, the consumer's expected utility under (e_1, e_2) is $(1/2)G$ which is less than G, the expected utility under $(e_1, 0)$. As a result, when $M < 2X_L - X_H$, the broker selects (e_1, e_2), and the consumer's expected utility is $G + (1/2)(X_H – X_L)$. When $M \geq 2X_L - X_H$, the broker selects

[4] When the consumer does not purchase insurance, the fee is assumed to be paid out of pocket.

(e_1, 0), and the consumer's expected utility is G. Finally, note that the broker has no incentives to reveal the risk types to the insurer, since it will simply lower the consumer welfare.

Case 2: $X_L \le M < G + X_L$

Note that $G + X_L < X_N$. When E = (0, 0) and (e_1, 0), we can apply Case 1. When E = (0, 0), $P = X_N$, $\pi = X_N – M$, and EU = 0. When E = (e_1, 0), $P = X_N – e_1$, $\pi = X_N – M – e_1$, and EU = G. Now consider the case of E = (0, e_2). In this case, the insurer cannot profitably target low risks, since $P < X_L$ implies a negative profit ($P \le M$). As a result, the unique strategy is targeting high risks only. Thus, $P = X_H – 2e_2$, $\pi = (1/2)(X_H –M) – e_2$, and EU = 0 (see Case 1). When E = (e_1, e_2), the unique strategy is again targeting high risks only. Now, $P = X_H – 2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) – (e_1+e_2)$, and EU = (1/2)G. It is easy to see that the broker selects (e_1, 0) since it produces the greatest consumer's expected utility, G.

Case 3: $G+ X_L \le M < X_N$

We can apply Case 2 for all efforts, since $X_L \le M < X_N$ for both cases and the insurer's offer does not depend on the non-extractible rent. When E = (0, 0), $P = X_N$, $\pi = X_N – M$, and EU = 0. When E = (e_1, 0), $P = X_N – e_1$, $\pi = X_N – M – e_1$, and EU = G. When E = (0, e_2), the insurer will target high risks only, resulting that $P = X_H – 2e_2$; $\pi = (1/2)(X_H – M) – e_2$; and EU = 0. Under ($e_1$, e_2), the insurer targets high risks only, resulting that $P = X_H – 2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) – (e_1+e_2)$, and EU = (1/2)G. As in Case 2, the broker selects (e_1, 0) since it produces the greatest consumer's expected utility, G.

Case 4: $X_N \le M < G + X_N$

When $E = (0, 0)$ and $(e_1\ 0)$, the insurer will not sell insurance, since product costs M is higher than the extractible rent X_N. Thus, the broker's profit, the insurer's profit and the expected utility are 0. When $E = (0\ e_2)$, the insurer can target high risks only. Thus, $F = e_2$, $P = X_H - 2e_2$, $\pi = (1/2)(X_H - M) - e_2$, and $EU = 0$. Finally, when $E = (e_1, e_2)$, $F = e_1 + e_2$, $P = X_H - 2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) - (e_1 + e_2)$, and $EU = (1/2)G$. The broker selects (e_1, e_2) which produces the greatest consumer's expected utility $(1/2)G$.

Case 5: $G + X_N \leq M < X_H$

When $E = (0, 0)$ and $(e_1, 0)$, the insurer will not sell insurance. When $E = (0, e_2)$, the insurer can target high risks only. As a result, we have $P = X_H - 2e_2$, $\pi = (1/2)(X_H - M) - e_2$, and $EU = 0$. When $E = (e_1, e_2)$, targeting high risks only results that $P = X_H - 2(e_1+e_2)$, $\pi = (1/2)(X_H - M) - (e_1+e_2)$, and $EU = (1/2)G$. The broker selects (e_1, e_2) which produces the greatest consumer's expected utility $(1/2)G$.

Case 6: $X_H \leq M$

There is no trade in the insurance market.

The above analysis is summarized in the following proposition. Details can be found in Table 1.

Proposition 1: [The fee system]

When $2X_L - X_H \leq M < X_N$, $E = (e_1, 0)$. That is, matching service is provided, while risk types are not known.

When $M < 2X_L - X_H$, or $M \geq X_N$, $E = (e_1, e_2)$. That is, matching service is provided, and the risk types are known to consumers. The broker does not reveal the risk types to the insurer when $M < 2X_L - X_H$. Revealing is irrelevant when $M \geq X_N$.

Table 1 near here

2. The commission system

Under the (premium-based) commission system, the broker receives commission C from the insurer. A consumer's expected utility can be expressed as $EU = B + X - P$. The insurer's margin per sale net of commission is $P - M - C$. As under the fee system, the equilibrium outcomes depend on the relative size of the production costs and the extractible rents. We will investigate the optimal effort pair in each case. One important difference from the fee system is that the broker will not select efforts to maximize the consumer's expected utility. He will select efforts to maximize the sales, which maximizes commission received, given commission rate. When the sales are the same for two different efforts, the broker is assumed to select efforts to maximize the insurer's profit. Finally, note also that the broker may have incentives to reveal risk types to the insurer in the case that it increases the sales. Reflecting this observation, we will assume that the broker reveals risk types to the insurer in such a case.[5]

Case 1: $M < X_L$

When the broker's efforts $E = (0, 0)$, no consumers are informed about matching and

[5] However, as it turns out, the assumption regarding revelation of risk types to the insurer does not change the results.

risk types. Commission C is determined to be zero. The extractible rent is X_N, so that the insurer sets $P = X_N$. The consumer's expected utility $EU = X_N – X_N = 0$. The insurer's profit $\pi = X_N – M$. The broker's profit $\delta = 0$.

When $E = (e_1, 0)$, consumers enjoy the benefit of good matching, G. W have $C = e_1$. Under $E_2 = 0$, the extractible rent is X_N, so that the insurer sets $P = X_N$. As a result, $EU = G + X_N – X_N = G$; $\pi = X_N – M – e_1$; and $\delta = 0$.

When $E = (0, e_2)$, consumers are informed about the risk types. Under $E_1 = 0$, the matching benefit is zero. Under $E_2 = e_2$, the extractible rents are X_H or X_L. Assuming that the broker does not reveal risk types to the insurer, the insurer may use one of two pricing strategies.[6] First, it may target both risk types. For this, the insurer will set $P = X_L$. We have $C = e_2$. A high risk consumer's expected utility becomes $X_H - X_L$ and a low risk consumer's expected utility becomes 0. On average, a consumer's expected utility $EU = (1/2)(X_H – X_L)$. In this case $\pi = X_L – M – e_2$. Second, it may target high risks only. In this case, low risks will not purchase insurance, while the extractible rent of high risks is fully extracted. The insurer will set $P = X_H$, so that the consumer's expected utility becomes zero: $EU = (1/2)0 + (1/2)(X_H – P) = 0$. We have $C = 2e_2$. In this case, $\pi = (1/2)(X_H - M) – e_2$.

The insurer will select its pricing strategy to maximize the profit. By comparing two profits, we have the following result: If $M < 2X_L - X_H$, targeting both risk types is more profitable. Otherwise, targeting high risks is more profitable. However, recall that this result is based on the assumption the broker does not reveal risk types to the insurer. If $M < 2X_L - X_H$, the broker does not need to reveal risk types, since the insurer will target both risk types. If $M \geq 2X_L - X_H$, however, the broker has strong incentives to reveal risk types, because it will increase the sales. Therefore, when $M \geq 2X_L - X_H$, we may assume that the

[6] The possibility of informing risk types to the insurer will be discussed later.

broker reveals risk types to the insurer. In that case, the insurer will set $P = X_H$ for high risks and $P = X_L$ for low risks, so that $EU = 0$, $\pi = (1/2)(X_H + X_L) – M – e_2$.

When $E = (e_1, e_2)$, consumers are informed about both matching and risk types. Similarly as in the case of $(0, e_2)$, there are two insurer's strategies, under the assumption that the broker does not reveal risk types to the insurer. When targeting both risk types, $P = X_L$, $C = e_1 + e_2$, $\pi = X_L – M – (e_1+e_2)$, and $EU = G + (1/2)(X_H – X_L)$. When targeting high risks only, $P = X_H$, $C = 2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) – (e_1+e_2)$, and $EU = (1/2)G$. If $M < 2X_L - X_H$, targeting both risk types is more profitable. Otherwise, targeting high risks is more profitable. However, when $M \geq 2X_L - X_H$, we may assume that the broker reveals risk types to the insurer, since, the broker has strong incentives to do so as in the case of $(0, e_2)$. In that case, the insurer will set $P = X_H$ for high risks and $P = X_L$ for low risks, so that $EU = G$, $\pi = (1/2)(X_H + X_L) – M – e_2$.

Now, let us determine the broker's choice of efforts. Recall that the broker will select efforts to maximize the sales, then the insurer's profit, under the commission system. Note first that $(0, e_2)$ dominates (e_1, e_2), since the former provides a higher insurer's profit than the latter, while the sales are the same in each sub-case. Note also that $(0, 0)$ dominates $(e_1, 0)$. Now, let us compare between $(0, 0)$ and $(0, e_2)$. Regardless of the relative sizes between M and $2X_L - X_H$, the sales are the same under $(0, 0)$ and $(0, e_2)$. However, the insurer's profit is higher under $(0, 0)$ than under $(0, e_2)$.[7, 8] Therefore, in either case, the broker will select $(0, 0)$, in which case, $\pi = X_N – M$ and $EU = 0$.

[7] Recall that $X_N = (1/2)(X_H + X_L)$.

[8] When $M \geq 2X_L - X_H$, the sales under $(0, 0)$ are larger than those under $(0, e_2)$ if we assume that the broker does not reveal risk types to the insurer. If we assume that the broker reveals risk types, the sales are the same, but the insurer’s profit under $(0, 0)$ is larger than that under $(0, e_2)$. Therefore, the result is not affected by the assumption regarding the broker’s revelation of risk types to the insurer.

Case 2: $X_L \leq M < G + X_L$

When E = (0, 0) and (e_1, 0), we can apply Case 1. When E = (0, 0), P = X_N, $\pi = X_N - M$, and EU = 0. When E = (e_1, 0), P = X_N, $\pi = X_N - M - e_1$, and EU = G. Now consider the case of E = (0, e_2). In this case, the insurer targets high risks only. Thus, P = X_H, C = $2e_2$, $\pi = (1/2)(X_H - M) - e_2$, and EU = 0. When E = ($e_1$, e_2), the insurer targets high risks only. Now, P = X_H, C = $2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) - (e_1+e_2)$, and EU = (1/2)G. It is easy to see that the broker selects (0, 0) since it maximizes the sales and the insurer's profit.

Case 3: $G+ X_L \leq M < X_N$

We can apply Case 2 for all efforts. When E = (0, 0), P = X_N, $\pi = X_N - M$, and EU = 0. When E = (e_1, 0), P = X_N, C = e_1, $\pi = X_N - M - e_1$, and EU = G. When E = (0, e_2), the insurer will target high risks only, resulting that P = X_H, C = $2e_2$; $\pi = (1/2)(X_H - M) - e_2$; and EU = 0. Under ($e_1$, e_2), the insurer targets high risks only, resulting that P = X_H, C = $2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) - (e_1+e_2)$, and EU = (1/2)G. As in Case 2, the broker selects (0, 0).

Case 4: $X_N \leq M < G + X_N$

When E = (0, 0) and (e_1, 0), the insurer will not sell insurance, since product costs M is higher than the extractible rent X_N. Thus, the broker's profit, the insurer's profit and the expected utility are 0. When E = (0 e_2), the insurer can target high risks only. Thus, P = X_H, C = $2e_2$, $\pi = (1/2)(X_H - M) - e_2$, and EU = 0. Finally, when E = (e_1, e_2), P = X_H, C = $2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) - (e_1 + e_2)$, and EU = (1/2)G. The broker selects (0, e_2), which maximizes the sales and the insurer's profit.

Case 5: $G + X_N \leq M < X_H$

When $E = (0, 0)$ and $(e_1, 0)$, the insurer will not sell insurance. When $E = (0, e_2)$, the insurer can target high risks only. As a result, we have $P = X_H$, $C = 2e_2$, $\pi = (1/2)(X_H – M) – e_2$, and $EU = 0$. When $E = (e_1, e_2)$, targeting high risks only results that $P = X_H$, $C = 2(e_1+e_2)$, $\pi = (1/2)(X_H - M) – (e_1+e_2)$, and $EU = (1/2)G$. The broker selects $(0, e_2)$, which maximizes the sales and the insurer's profit.

Case 6: $X_H \leq M$

There is no trade in the insurance market.

The above analysis is summarized in the following proposition. Details can be found in Table 1.

Proposition 2: [The commission system]

When $M < X_N$, $E = (0, 0)$. That is, matching service is not provided, and risk types are not known.

When $M \geq X_N$, $E = (0, e_2)$. That is, matching service is not provided, and the risk types are known to consumers. Revealing risk types to the insurer is irrelevant.

3. The contingent commission system

In the contingent commission system, the broker receives commission K from the insurer as in the (premium-based) commission system. The difference is that commission is based on the insurer's profit, not on the premium.[9] This difference also makes the broker's incentives different. Unlike under the commission system, the broker now has strong incentives to reveal risk types to the insurer, since it will increase the insurer's profit.

Case 1: $M < X_L$

When the broker's efforts E = (0, 0), commission K is determined to be zero. The extractible rent is X_N, so that the insurer sets $P = X_N$. The consumer's expected utility $EU = X_N - X_N = 0$. The insurer's profit $\pi = X_N - M$. The broker's profit $\delta = 0$.

When $E = (e_1, 0)$, consumers enjoy the benefit of good matching, G. W have $K = e_1$. Under $E_2 = 0$, the extractible rent is X_N, so that the insurer sets $P = X_N$. As a result, $EU = G + X_N - X_N = G$; $\pi = X_N - M - e_1$; and $\delta = 0$.

When E = (0, e2), consumers are informed about the risk types. Under $E_1 = 0$, the matching benefit is zero. Under $E_2 = e_2$, the extractible rents are X_H or X_L. Since the broker reveals risk types to the insurer, the insurer is able to fully discriminate risk types. Thus, it sets $P = X_L$ for low risks and $P = X_H$ for high risks. Thus, regardless of risk types, EU = 0, $K = e_2$, and $\pi = (1/2)(X_H + X_L) - M - e_2$.

When $E = (e_1, e_2)$, consumers are informed about both matching and risk types. As in (0, e2), risk types are fully discriminated, so that $P = X_L$ for low risks and $P = X_H$ for high risks. Thus, EU = G, $K = e_1 + e_2$, $\pi = (1/2)(X_H + X_L) - M - (e_1 + e_2)$.

Now, let us determine the broker's choice of efforts. Recall that the broker will select efforts to maximize the insurer's profit, under the contingent commission system. This implies that $(0, e_2)$ dominates (e_1, e_2). Note also that (0, 0) dominates $(e_1, 0)$. Similar

[9] In practice, contingent commission may be paid on the top of the (premium-based) commission. Even in such cases, total commission can be adjusted based on the insurer's profit by the contingent commission. Therefore, there is no loss of generality in our context, even if we focus on the contingent commission only.

to Case 1 of the commission system, comparison between (0, 0) and (0, e_2) results in the selection of (0, 0).

Case 2: $X_L \le M < G + X_L$

When E = (0, 0) and (e_1, 0), we can apply Case 1. When E = (0, 0), P = X_N, $\pi = X_N - M$, and EU = 0. When E = (e_1, 0), P = X_N, $\pi = X_N - M - e_1$, and EU = G. Now consider the case of E = (0, e_2). In this case, the insurer targets high risks only. Thus, P = X_H, K = $2e_2$, $\pi = (1/2)(X_H - M) - e_2$, and EU = 0. When E = ($e_1$, e_2), the insurer targets high risks only. Now, P = X_H, K = $2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) - (e_1 + e_2)$, and EU = (1/2)G. Note that (0, 0) dominates (e_1, 0) and (0, e_2) dominates (e_1, e_2) in terms of the insurer's profit. Comparison between (0, 0) and (0, e_2) results in the selection of (0, 0) if $M \le X_L + 2e_2$; and (0, e_2), otherwise.

Case 3: $G + X_L \le M < X_N$

We can apply Case 2 for all outcomes under efforts. When E = (0, 0), P = X_N, $\pi = X_N - M$, and EU = 0. When E = (e_1, 0), P = X_N, K = e_1, $\pi = X_N - M - e_1$, and EU = G. When E = (0, e_2), the insurer will target high risks only, resulting that P = X_H, K = $2e_2$; $\pi = (1/2)(X_H - M) - e_2$; and EU = 0. Under ($e_1$, e_2), the insurer targets high risks only, resulting that P = X_H, K = $2(e_1 + e_2)$, $\pi = (1/2)(X_H - M) - (e_1+e_2)$, and EU = (1/2)G. As in Case 2, (0, 0) and (0, e_2) dominate (e_1, 0) and (e_1, e_2), respectively. Comparison between (0, 0) and (0, e_2) results in the selection of (0, 0) if $M \le X_L + 2e_2$; and (0, e_2), otherwise.

Case 4: $X_N \le M < G + X_N$

When E = (0, 0) and (e_1, 0), the insurer will not sell insurance, since product costs M is higher than the extractible rent X_N. Thus, the broker's profit, the insurer's profit and the expected utility are 0. When E = (0 e_2), the insurer can target high risks only. Thus, P = X_H, K = $2e_2$, $\pi = (1/2)(X_H – M) – e_2$, and EU = 0. Finally, when E = (e_1, e_2), P = X_H, K = $2(e_1 + e_2)$, $\pi = (1/2)(X_H – M) – (e1 + e_2)$, and EU = (1/2)G. The broker selects (0, e2), which maximizes the insurer's profit.

Case 5: $G + X_N \leq M < X_H$

When E = (0, 0) and (e_1, 0), the insurer will not sell insurance. When E = (0, e_2), the insurer can target high risks only. As a result, we have P = X_H, K = $2e_2$, $\pi = (1/2)(X_H – M) – e_2$, and EU = 0. When E = ($e_1$, e_2), targeting high risks only results that P = X_H, C = $2(e_1+e_2)$, $\pi = (1/2)(X_H - M) – (e_1+e_2)$, and EU = (1/2)G. The broker selects (0, e_2), which maximizes the insurer's profit.

Case 6: $X_H \leq M$

There is no trade in the insurance market.

The above analysis is summarized in the following proposition. Details can be found in Table 1.

Proposition 3: [The contingent commission system]

When $M \leq X_L+2e_2$, E = (0, 0). That is, matching service is not provided, and risk types are not known.

When $M > X_L+2e_2$, E = (0, e_2). That is, matching service is not provided, and the risk types are known to consumers.

IV. Comparison among compensation systems

Depending on the size of M, we have various outcomes under each compensation system. The following results can be found from the above analysis.

First, the broker's incentives to render the matching service are affected by the compensation systems. The broker makes effort for matching only under the fee system. This is a result of the non-extractible rent along with the fact that fee is paid by consumers. Since a fee is paid by consumers, competition among brokers leads to the selection of efforts to maximize consumer welfare. Since the matching benefit is not extracted by the insurer, the broker can contribute to consumer welfare by rendering matching service. As a result, the fee system produces higher consumer welfare. Under other compensation systems, however, sales and the insurer's profit are the main concerns, leading to the matching benefit being ignored.

Second, the compensation system also affects the broker's decision to reveal the risk types to the insurer. Revealing risk types does not occur except under the contingent commission systems. Since revealing risk types leads to extraction of rents, the broker does not do so under the fee system. Under the commission system, the broker may do so when it increases sales. However, it is not an equilibrium outcome, since the broker can always find a cheaper way of increasing sales by not obtaining information regarding risk types. Under the contingent commission system, the broker is assumed to reveal risk types, since it helps to increase the insurer's profit. Note, however, that revelation of risk types itself is not necessary even under the contingent commission system. What is important is the concern about the insurer's profit, which affects the decision to obtain information regarding risk types. The broker has stronger incentives to obtain information under the contingent commission than under other systems, since it increases the insurer's profit (see Cases 2 and 3).

Third, regarding social welfare, no compensation system strictly dominates others. However, we find that the contingent commission system (weakly) dominates the commission system, since the latter makes the broker focus on sales that may not necessarily be profitable. What is more interesting is that neither the fee system nor the contingent commission system is dominant. Due to the non-extractible rent, the fee system is superior to the contingent commission if the non-extractible rent is high. However, even if the non-extractible rent is not high enough, the broker may still have incentives to provide consumers with the service, since it can attract consumers and the cost will be eventually charged to the insurer. In such a case, the contingent commission results in higher social welfare than the fee system. Social welfare comparison is reported in the following proposition.

Proposition 4: [Social welfare]

(A) Case 1: $M < X_L$

Suppose that $M \geq 2X_L - X_H$.

If $G \geq e_1$, then the social welfare is maximized under the fee system: SW (social welfare) = $G + X_N - M - e_1$.

If G < e1, then the social welfare is maximized under the commission and the contingent commission systems: SW = $X_N - M$.

Suppose that $M < 2X_L - X_H$.

If $G \geq e_1 + e_2$, then the social welfare is maximized under the fee system: SW = $G + X_N - M - e_1 - e_2$.

If $G < e_1 + e_2$, then the social welfare is maximized under the commission and the contingent commission systems: SW = $X_N - M$.

(B) Case 2: $X_L \leq M < G + X_L$

Suppose that $M \leq X_L+2e_2$.

If $G \geq e_1$, then the social welfare is maximized under the fee system: $SW = G + X_N-M-e_1$.

If $G < e_1$, then the social welfare is maximized under the commission and the contingent commission systems: $SW = X_N-M$.

Suppose that $M > X_L+2e_2$.

If $G \geq (1/2)[M – X_L] + e_1 – e_2$, then the social welfare is maximized under the fee system: $SW = G + X_N-M-e_1$.

If $G < (1/2)[M – X_L] + e_1 – e_2$, then the social welfare is maximized under the contingent commission system: $SW =(1/2)(X_H-M)-e_2$.

(C) Case 3: $G + X_L \leq M < X_N$

Suppose that $M \leq X_L+2e_2$.

If $G \geq e_1$, then the social welfare is maximized under the fee system: $SW = G + X_N-M-e_1$.

If $G < e_1$, then the social welfare is maximized under the commission and the contingent commission systems: $SW = X_N-M$.

Suppose that $M > X_L+2e_2$.

If $G \geq (1/2)[M – X_L] + e_1 – e_2$, then the social welfare is maximized under the fee system: $SW = G + X_N-M-e_1$.

If $G < (1/2)[M – X_L] + e_1 – e_2$, then the social welfare is maximized under the contingent commission system: $SW =(1/2)(X_H-M)-e_2$.

(D) Case 4: $X_N \leq M < G + X_N$

If $G \geq (1/2)[M – X_L] + e_1$, then the social welfare is maximized under the fee system: SW = G

+ X_N-M-e_1-e_2.

If G < (1/2)[M – X_L] +e_1, then the social welfare is maximized under the commission and the contingent commission system: (1/2)(X_H-M)-e_2

(E) Case 5: G + X_N ≤ M < X_H

If G ≥ (1/2)[M – X_L] + e_1, then the social welfare is maximized under the fee system: SW = G + X_N-M-e_1-e_2.

If G < (1/2)[M – X_L] +e_1, then the social welfare is maximized under the commission and the contingent commission systems: (1/2)(X_H-M)-e_2.

Finally, let us compare our results with the existing literature. The results of this paper are distinguished from existing papers in several aspects. The existence of non-extractible rent plays an important role for our results. When all rents are extractible, matching and risk classification will be performed well under the commission and contingent commission systems, since they allow insurers thus the broker to extract rents (Focht, Richter and Schiller, 2009; Schiller, 2009). This will also increase social welfare. However, when some rents are not extractible, the broker may focus only on extractible rents under the commission and the contingent commission systems. As a result, their social welfare levels may be lower than under the fee system as shown in this paper.

In Cummins and Doherty (2006), contingent commission resolves adverse selection, since it allows the broker to reveal risk types to insurers. This will increase consumer welfare under the competitive insurance market. In our model, however, revealing risk types to the insurer does not necessarily lead to consumer or social welfare improvement. For example, the broker may opt to not reveal risk types under the fee system (see Case 1).

For this, note that the insurer, without knowing the risk types, offers low prices to attract both risk types, which increases consumer welfare. If the insurer knows the risk types, then it will discriminate fully among consumers to extract all extractible rent. In this case, under the fee system, the broker may opt to not observe risk types in the first place, since it incurs costs without increasing consumer welfare. As a result, not revealing risk types maximizes consumer welfare, which is also followed by social welfare maximization. Resolving adverse selection does not necessarily imply either consumer or social welfare improvement.

V. Conclusion

This paper introduces non-extractible consumer rent and compares relative efficiency among diverse broker compensation systems: fee, commission, and contingent commission. We find that relative social welfare depends on parameter values such as production costs, non-extractible rent, and broker's effort costs. Unlike in the recent research regarding broker compensation systems, we find that neither the fee system nor the contingent commission system dominate each other, while the contingent commission system dominates the commission system. The existence of non-extractible rent plays an important role. Under the fee system, the broker has incentives to render the service producing non-extractible benefit, which increases consumer welfare. Under the commission and the contingent commission systems, however, the focus is on sales and the insurer’s profit, leading to the non-extractible benefit being ignored. Therefore, if the non-extractible rent is large enough, the fee system is socially desirable.

Another interesting finding is that adverse selection may increase consumer welfare. Under the fee system, the broker may opt not to reveal risk types to the insurer, creating adverse selection. However, consumer welfare can be increased, if the insurer, without knowing the risk types, offers low prices to attract both risk types. This finding challenges the argument that contingent commission is social desirable since it can resolve adverse selection.

Our analysis identifies the conditions when one system is more socially desirable than others. Our results are in favor of the fee system, compared with other recent papers. However, our model is not able to fully capture important aspects such as brokers' opportunistic behavior, collusion between brokers and insurers, and advice quality of brokers. We leave these topics for future research.

Table 1: Results under each compensation system

	Fee	Commission	Contingent Commission
$M < X_L$	$^*(e1, 0)$ if $M \geq 2X_L - X_H$ $EU = G$ $\pi = X_N - M - e1$ $SW = G + X_N - M - e1$ $^*(e1, e2)$ if $M < 2X_L - X_H$ $EU = G + .5(X_H - X_L)$ $\pi = X_L - M - (e1+e2)$ $SW = G + X_N - M - e1 - e2$	$(0, 0)$ $EU = 0$ $\pi = X_N - M$ $SW = X_N - M$	$(0, 0)$ $EU = 0$ $\pi = X_N - M$ $SW = X_N - M$
$X_L \leq M < G + X_L$	$(e1, 0)$ $EU = G$ $\pi = X_N - M - e1$ $SW = G + X_N - M - e1$	$(0, 0)$ $EU = 0$ $\pi = X_N - M$ $SW = X_N - M$	$^*(0, 0)$ if $M \leq X_L + 2e2$ $EU = 0$ $\pi = X_N - M$ $SW = X_N - M$ $^*(0, e2)$ if $M > X_L + 2e2$ $EU = 0$ $\pi = .5(X_H - M) - e2$ $SW = .5(X_H - M) - e2$
$G + X_L \leq M < X_N$	$(e1, 0)$ $EU = G$ $\pi = X_N - M - e1$ $SW = G + X_N - M - e1$	$(0, 0)$ $EU = 0$ $\pi = X_N - M$ $SW = X_N - M$	$^*(0, 0)$ if $M \leq X_L + 2e2$ $EU = 0$ $\pi = X_N - M$ $SW = X_N - M$ $^*(0, e2)$ if $M > X_L + 2e2$ $EU = 0$ $\pi = .5(X_H - M) - e2$ $SW = .5(X_H - M) - e2$
$X_N \leq M < G + X_N$	$(e1, e2)$ $EU = .5G$ $\pi = .5(X_H - M) - (e1+e2)$ $SW = G + X_N - M - e1 - e2$	$(0, e2)$ $EU = 0$ $\pi = .5(X_H - M) - e2$ $SW = .5(X_H - M) - e2$	$(0, e2)$ $EU = 0$ $\pi = .5(X_H - M) - e2$ $SW = .5(X_H - M) - e2$
$G + X_N \leq M < X_H$	$(e1, e2)$ $EU = .5G$ $\pi = .5(X_H - M) - (e1+e2)$ $SW = G + X_N - M - e1 - e2$	$(0, e2)$ $EU = 0$ $\pi = .5(X_H - M) - e2$ $SW = .5(X_H - M) - e2$	$(0, e2)$ $EU = 0$ $\pi = .5(X_H - M) - e2$ $SW = .5(X_H - M) - e2$
$X_H \leq M$	No trade	No trade	No trade

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