Do close relationships matter? Asymmetric information problems encountered when insurance companies sell contracts through brother banks

Abstract

This paper investigates whether a close relationship between insurance companies and banks can benefit the insurance companies by mitigating asymmetric information problems when the insurance companies increasingly rely on bank distribution channels to sell contracts. We analyze health insurance contracts from a large insurance company in Taiwan, revealing that a moral hazard problem instead of an adverse selection problem exists. Moreover, the moral hazard problem is less severe among the insureds from the brother bank of the insurance company than among the insureds from other banks. This result is consistent with those reported in the literature, that vertical financial integration can facilitate solving the agent cost problem. The insurance company forward integrates its distributing business with its brother bank through its financial company, thereby mitigating the moral hazard problem. Furthermore, we determine that the moral hazard problem can only be mitigated rather than eliminated through financial integration, possibly because the moral hazard problem from the bank and the reciprocity consideration under one holding company remains.

Jin-Lung Peng
Associate Professor, Department of Risk Management and Insurance
National Chengchi University, Taipei, Taiwan
Research Fellow, Risk and Insurance Research Center,
College of Commerce, National Chengchi University

Kili C. Wang*
Professor, Department of Insurance
Tamkang University, Taipei, Taiwan
Research Fellow, Risk and Insurance Research Center,
College of Commerce, National Chengchi University

* E-mail address: kili@mail.tku.edu.tw

Introduction

Increasingly more life insurance companies rely on bank distribution channels to sell insurance contracts. In Taiwan, most banks are independent agents of insurance companies. However, two types of relationships between insurance companies and their independent bank channels exist. One type occurs when an insurance company franchises the right to sell insurance contracts only through a vertical contract. The other type is a closer relationship between an insurance company and a bank: Both of them belong to the same financial holding company. This paper focuses on whether an insurance company can benefit more from a closer relationship with a bank, exploring such a benefit from the angle of asymmetric information problem mitigation.

Insurance literature often discusses distribution channels from the viewpoint of the comparative advantage provided by an exclusive or independent agent.[1] Regan (1997) applied the concept of organizational form to compare exclusive agents with independent agents, and she explained the relationship between the insurance companies and exclusive agents as a forward vertical integration. However, no research has explored the differing relationships between independent agents and insurance companies, namely, whether the agents and insurance companies belong to the same holding company.

In Taiwan, when an insurance company franchises the right to sell insurance contracts only to a bank, no organizational integration with the bank occurs. Thus, regarding the organizational structure, the bank and the insurance company are independent of one another. By contrast, when a bank not only sells insurance for an insurance company but also belongs to the same holding company with that insurance company. The mother company establishes a vertically integrating relationship when

[1] Joskow (1973), Cummins and VanDerhei (1979), Barrese and Nelson (1992), and Regan (1993) have determined that independent agents have higher expense margins and are therefore less efficient. Regan (1997) found that independent agents provide more comprehensive service even though they have relatively higher costs.

bank sells insurance contract for the insurance company. However, instead of total vertical forward integration, the insurance company and bank have only a brother relationship, which is still closer than that established through mere franchising.

Literature on the organizational form between upstream and downstream firms often pertains to comparing loose vertical contract integration (e.g., franchises) with close vertical financial integration (i.e., integration into one formal organization). Mahoney (2005) indicated that applying formal vertical financial integration can achieve superior information revealing,[2] coordination and control,[3] audit and resource allocation,[4] and communication and trust.[5] Nevertheless, the disadvantage of slack and reciprocity between divisions could be involved. Lafontaine and Slade (2007) mentioned that although vertical financial integration can reduce transaction costs, a moral hazard problem could arise.

We can apply the inferences from the aforementioned literature to thepractices between banks and insurance companies, vertical financial integration could conciliate there interest conflicts. In the issue we investigate, banks are interested in earning commission from selling contracts; they have incentive to sell as many contracts as possibly. However, although the insurance companies are interested in earning profit, selling more insurance contracts does not necessarily imply more profit. When banks focus on selling more contracts, an asymmetric information problem could emerge because the quality of underwriting is ignored, incurring serious costs

[2] For example, Anderson (1988), Maitland et al. (1985), and Provan and Skinner (1989) indicated that opportunistic agents could exploit asymmetric information for their own advantage. Vertical financial integration can reveal the asymmetric information that exists before integration and could be one solution.

[3] Dow (1987) mentioned that within a firm, the existent authority relationship could provide firmer control of the manager's opportunistic behaviors.

[4] Chandler (1977) found that railroad cartels can achieve a more favorable audit on their railroad firms. Williamson (1975) indicated that the audit power within a firm is superior to that achieved through a contract. In addition, Crocker (1983) agreed that financial integration can enable more effective resource allocation because of the superior information foundation.

[5] Ouchi (1980) highlighted that a successful organization can bring an "ungroundable vital sense of human solidarity" to divisions within that organization.

for the insurance companies. Thus, a conflict of interest arises between banks and insurance companies. According to the literature, vertical financial integration could aid in resolving the conflict of interest as well as the insurer's asymmetric information problem.

Banks can distinguish the quality of their customers. Thus, they can help to solve the asymmetric information problem for the insurer if they are willing. Bergendal (1995) mentioned that involvement in deposits, loans, and payments enabled banks to determine customer qualities by assessing credit records. In addition, Peng and Wang (2015) found that banks can screen out better record customers and assist insurance companies by providing a list of ideal customers. The empirical evidence provided by the researchers indicated that because of this list, telephone marketing customers involve a smaller asymmetric information problem.

However, the literature also reports that a moral hazard problem and reciprocity between divisions can occur in vertical financial integration. Accordingly, the interests of banks cannot be entirely eliminated or sacrificed after vertical financial integration. Hence, we expect to observe that an asymmetric information problem also exists in vertical financial integration.

Whether the severity of the asymmetric information problem in vertical financial integration can be mitigated because of the coordination ability by an organization remains unclear. Considering the coordinating effect of financial integration, we predict that under vertical financial integration, the insurer's asymmetric information problem should be minor. If the problems of moral hazard and reciprocity between divisions remain, we predict that under vertical financial integration, the insurer's asymmetric information problem, although mitigated, will remain.

Of course, we cannot say the brother relationship created within the same holding company is a vertical financial integration. So, our research motivation is to

confirm that whether the inference from literature pertains to vertical financial integration could be sustained when we compare the closer brother relationship between a bank and an insurance company with the looser franchise relationship. Although some literature discusses similar problems among firms within one holding company or one conglomerate,[6] no study has investigated the topic from the angle of vertical integration of a business or the benefit of asymmetric information problem mitigation. This is the essential and unique contribution of this paper.

We use individual data derived from the health insurance contracts collected from a large insurance company in Taiwan, the market share of which approaches 30%. When we focus on contracts obtained from a bank channel, we find evidence of an asymmetric information problem, including adverse selection and moral hazard, from this data set. Nevertheless, both adverse selection and moral hazard problems are less severe in contracts that were sold by the brother bank of the target insurance company than in those sold through other channels. This empirical finding supports our first prediction that the conflict of interest between an insurance company and its brother bank is smaller. The brother bank can recommend better customers to the insurance company. Furthermore, the empirical finding supports our second prediction that a close relationship between an insurance company and its brother bank can aid in only mitigating—not entirely eliminating—the problems of adverse selection and/or moral hazard. We still observe these problems in insureds from the brother bank.

The remainder of this paper is organized as follows. The second section describes the data we use. The third section details the methodology and empirical findings, and the final section offers a conclusion.

[6] Scharfstein (1998) revealed that the benefit of a weak unit under a conglomerate is often sacrificed for the benefit of the whole conglomerate; Lelyveld and Knot (2009) and Laeven and Levine (2007) indicated that cross subsidization could occur among the units within a financial holding company.

Data

The data used in this study are collected from a large insurance company in Taiwan, the market share of which approaches 30%. Hence, the research sample is representative.

This insurance company sells many health insurance contracts. Among the various distribution channels, the insurance company currently heavily relies on independent bank agents. Although the insurance company is held by one large financial holding company, the insurance distribution channel is not restricted to only the bank under the same holding company; rather, numerous banks sell the contracts for the insurance company. In the research data, approximately 40% of the health insurance contracts are sold by its brother bank. Thus, we compare the severity of the asymmetric information problem between the contracts sold by the brother bank and those sold by other banks.

In this study, we focus only on the health insurance contracts sold through bank channels over the research period of 2009–2012. We target the claim records from effective health insurance contracts during this period, obtaining 41,657 observations in the research sample, which constitutes unbalanced panel data. We collect individual information on the health insurance contracts, including the contract coverage, insured characteristics, and claim record during the research period.

This insurance contract indemnifies the expense of hospitalization. The coverage the insured chooses determines the indemnity per day as well as the upper limit on the total indemnity. Thus, we define the contract coverage according to the hospitalization expense per day. Coverage varied from NT$500 per day to NT$3,000 per day. Of the insureds, 75.62% chose the coverage of NT$1,000 per day, which is the standard coverage amount promoted by sellers. Only 23.24% of the insureds chose coverage exceeding NT$1,000 per day. Hence, in this study, we define contracts with coverage

exceeding NT$1,000 per day as high coverage contracts.[7]

The characteristics of the insureds we collect from the insurance company include age, gender, area of residence, and health checkup status. We categorize age into seven groups. The residential area of the insured is classified as urban or rural, and includes five parts of Taiwan. The health checkup status is classified as standard or nonstandard. Table 1 presents these variable definitions and mean values as well as the sample structure, which can be observed from the mean value of the variables. The table shows that many contracts, approximately 34.67% of them, cover young children and were purchased by parents. Most of the remaining contracts were purchased by young and median age insureds, aged 20–49 years. Insureds aged 50–59 years and 60–64 years comprise only 5.65% and 0.74% of the sample, respectively; only 0.22% of the insureds are older than 64 years. In Taiwan's commercial health insurance market, old people are seldom covered by voluntarily purchased commercial health insurance,[8] It is partly because that the health insurance has not developed greatly until this decade. However, old people have already missed the time to purchase inexpensive health insurance. Hence, they are not willing to purchase at this time. The other reason is that there is National Health Insurance (NHI) program in Taiwan. It makes the old people even more unwilling to purchase expensive voluntary commercial health insurance.

Regarding gender, female insureds account for 52.17%, a percentage that approximates the gender structure of Taiwan's population. More than 70% of the

[7] We define the high coverage contract according to the criterion of coverage exceeding NT$1,000 per day because, often, the insured decides to purchase a contract with coverage exceeding NT$1,000. Sellers often promote a standard contract with a coverage amount of NT$1,000. Thus, choosing coverage exceeding NT$1,000 per day indicates that the insured intends to purchase high coverage. Furthermore, we define high coverage by including a contract with a coverage amount of NT$1,000 per day. However, the empirical results, which are related to the evidence of asymmetric information, are nonsignificant.

[8] In contrast to NHI, the commercial health insurance means the contracts for which are sold by the insurance company and voluntarily purchased by individuals.

insureds are concentrated in urban areas, and more than 50% of them reside in Northern Taiwan, followed by Central and Southern Taiwan (23.65% and 16.61%, respectively). Comparatively few insureds reside in Eastern Taiwan or the outlying islands (2.17% and 0.12%, respectively).

The claim records reveal which insureds have filed a claim during one policy year. For contracts involving filed claims, we can observe the claim frequency, total number of hospitalization days, details related to reason for hospitalization, and hospital in each claim. These details in the claim records provide us with much valuable information. In Table 1, we can observe that, first, 4.3% of the insureds in our research sample have ever filed at least one claim each policy year. Second, among these, the claim frequency each policy year is near 1.17, indicating that most of the insureds who were hospitalized filed only one claim during one policy year; the average number of hospitalization days within one policy year is 5.26.

Because we have information on which hospitals the insureds stayed in and the reason for hospitalization, we can assess the following aspects. First, "supplier-induced demand" is of substantial concern when the moral hazard problem in medical insurance is discussed. The insurance company has compiled a list of suspicious hospitals it has encountered that have frequently made dubious diagnoses to exploit the insurance company, building up the claim or making false claims by inducing treatment demand or colluding with patients. The insurance company ranks the hospitals' degree of suspiciousness from 1 to 4.[9] Hence, we define an insured who has ever filed claim for treatment at a suspicious hospital (*claim_susp*) as an insured who has ever had claim for treatment at a hospital with a suspicious rank exceeding 1. According to Table 1, this type of insured accounts for approximately 55% of the

[9] The least suspicious hospitals have a rank of 1, and the degree of suspicion increases as the rank increases. Approximately 45%, 19%, 17%, and 19% of the hospitals are ranked as 1, 2, 3, and 4, respectively.

insureds who filed claims.

Second, the insured also has an incentive to exploit the insurance company through false or built-up claims. Invented ailments are often attributed to diseases with ambiguous causes. The insurance company has accumulated experience in detecting such diseases, including noninfectious gastroenteritis, duodenal ulcer, acute bronchitis, acute faucitis, acute tonsillitis, influenza, and pneumonia. Thus, we also regard a claim as suspicious when it is for a disease with an ambiguous cause. We define an insured who has ever filed an ambiguous claim (*clm_ambg*) as an insured who has ever had a claim filed for a disease with an ambiguous cause. In our research sample, this type of insured accounted for 23.43% of the insureds who filed claims.

According to the aforementioned information, we classify all the insureds into five categories. The first category is insureds who never filed a claim (95.7%). The second category comprises insureds who filed a legitimate claim (1.57%).[10] The third category consists of insureds who filed claims for diseases diagnosed at suspicious hospitals but that were not for diseases with ambiguous causes (1.73%). The forth category comprises insureds who filed claims for diseases with ambiguous causes that were not diagnosed at suspicious hospitals (0.42%). The claims of the insureds in final category are for diseases with ambiguous causes that were diagnosed at suspicious hospitals (approximately 0.59%). When there is asymmetric information, the information related to the above claim categories is important to help us to identify moral hazard from adverse selection.

[10] For conciseness, we use “legitimate claims” to represent the claims which are neither for diseases diagnosed at suspicious hospitals nor for diseases with ambiguous causes.

Methodology and empirical findings

The main purpose of this study is to investigate whether a close relationship between a bank and an insurance company could facilitate reducing the asymmetric information problem. We determine the answer according to the comparative severity of the asymmetric information problem related to the insureds from the brother bank of our target insurance company when we treat the insureds who are from the other bank as the counter group. Before addressing this question, we evaluate whether asymmetric information exists in the market.

According to the vast amount of empirical literature pertaining to the asymmetric information problem, the relationship between coverage and claims has been investigated using static data; distinguishing moral hazard from adverse selection is often difficult unless other information has been considered. For example, Dionne and St-Michel (1991) and Peng and Wang (2015) have considered moral hazard to be evidenced when the increment in difficultly diagnosed diseases is inconsistent with that in easily diagnosed diseases as coverage increases. In the present study, the additional information we collect, which is related to hospital of diagnosis, makes the moral hazard problem caused by the provider can be further considered.

Using the claim information related to disease reason and hospital of diagnosis, we separate the claims into the five categories mentioned in the previous section. When we investigate the relationship between coverage and claim, instead of exploring the conditional correlation between the probability of choosing high coverage and the probability of making a claim, we evaluate the conditional correlation between the probability of choosing high coverage and the probability of different claim categories. To test for this conditional correlation, we adopt the multi-nominal logistic model:

$$\log\left(\frac{p_k}{p_1}\right) = \beta_{cov} cov\_H_i + X_i\beta_X + \varepsilon_i \quad \text{for } k = 2,..,5 \qquad (1)$$

where p_1 represents the probability of not filing a claim during the policy year, p_k represents the probability of claim type, $k = 2$ represents a legitimate claim, $k = 3$ represents a claim that is diagnosed at a suspicious hospital but is not for a disease with an ambiguous cause, $k = 4$ represents a claim for a disease with an ambiguous cause that is not diagnosed at a suspicious hospital, and $k = 5$ represents a claim for a disease that is diagnosed at a suspicious hospital and has an ambiguous cause. When cov_H_i equals 1, the insured purchased a high-coverage contract. In this paper, we define high coverage as hospital expense indemnity exceeding NT$1,000 per day. The vector X_i includes the characteristics of the insureds (Table 1).

When we run regression (1), the endogeneity problem may arise because the variable cov_H_i maybe not be purely exogenous to the decision to file a claim; that is, it is maybe not purely exogenous to p_1 and p_k $(k = 2,..,5)$. To address this endogeneity problem, we use a two-stage instrumental variable method. At the first stage, we instrument the variable cov_H_i. We first attempt to find instrumental variables that are closely related to the decision to purchase high coverage (cov_H_i), but are not related to the decision of which category of claim to file. There are two candidate variables: the insured's wealth level and the insured's education level. We believe that an individual's decision to purchase insurance may relate to wealth and education level. In the literature, it is widely accepted that wealthier people tend to be less risk averse. Hence, they may be less willing to purchase high coverage. However, the insurance contract we investigate here is for a policy with cash value and is similar to savings for an individual. Consequently, wealthier people may tend to purchase high coverage for this contract. Well-educated people also tend to be more willing to purchase insurance. However, we do not know each insured's wealth and

education level; thus, we can determine indices only for each insured's wealth and education level. In the data set, we have information related to the residential area in which each insured lives. We can collect data on the corresponding average income level and density of the well-educated population in each residential area from public information reported by the government.[11] Because individuals who live in areas with high income levels tend to be wealthier, we use the average income level of each residential area in the corresponding year as the index for the insureds' wealth level. Individuals who live in areas with a higher density of well-educated people have a higher probability of being well-educated themselves; thus, we use the density of the well-educated population in each residential area in the corresponding year as the index for the insureds' education level. Hence, before running regression (1), we must run the following probit regression at the first stage:

$$Probit(cov\_H_i = 1) = \Phi(\beta_{incm} income_i + \beta_{edu} edu_i + X_i\beta_X + \varepsilon_i)$$

After running this instrumental regression and instrumenting cov_H_i as $\widehat{cov\_H_i}$, we use this instrumented high coverage choice variable to replace the cov_H_i in regression (1)[12]:

$$\log\left(\frac{p_k}{p_1}\right) = \beta_{cov}\widehat{cov\_H_i} + X_i\beta_X + \varepsilon_i \quad \text{for } k = 2,..,5 \qquad (1')$$

The estimated coefficient $\hat{\beta}_{cov}$ is the key variable to be tested. When we compare p_5 with p_1, the $\hat{\beta}_{cov}$ indicates the tendency of the insured with high coverage to file a claim for a disease with an ambiguous cause and diagnosed at a suspicious hospital. Similarly, when we compare p_4 with p_1, the $\hat{\beta}_{cov}$ represents the tendency of the insured with high coverage to file a claim for a disease with an ambiguous cause but not diagnosed at a suspicious hospital. When we compare p_3

[11] We define the well-educated population in this study as the population of people who have a master's degree or PhD. We attempt to extend the definition of well-educated by including those with a bachelor's degree, master's degree, or PhD in the well-educated population; however, the explanatory power of choosing an insurance contact in this education index becomes nonsignificant.

[12] The Appendix details this instrumental variable method further.

with p_1, the $\hat{\beta}_{cov}$ indicates the tendency of the insured with high coverage to file a claim for a disease diagnosed at a suspicious hospital but not with an ambiguous cause. When we compare p_2 with p_1, the $\hat{\beta}_{cov}$ represents the tendency of the insured with high coverage to file a legitimate claim.

When some of the $\hat{\beta}_{cov}$s are positive and significantly differ from 0, the asymmetric information problem exists. When it exists, whether we can distinguish adverse selection from moral hazard depends on the comparison between the $\hat{\beta}_{cov}$s when $k = 3..5$ and the $\hat{\beta}_{cov}$ when $k = 2$. If only the $\hat{\beta}_{cov}$s when $k = 3..5$ are positive and significantly differ from 0, moral hazard is evidenced instead of adverse selection because the significantly positive conditional correlation between coverage and claim exists only when the claim is for a disease with an ambiguous cause and/or diagnosed at a suspicious hospital. If all $\hat{\beta}_{cov}$s, regardless of whether $k = 3..5$ or $k = 2$, are positive and significantly differ from 0, we must compare the values of the $\hat{\beta}_{cov}$s between $k = 3..5$ and $k = 2$. Unless the $\hat{\beta}_{cov}$s when $k = 3..5$ are significantly higher than the $\hat{\beta}_{cov}$ when $k = 2$, we cannot ascertain whether the asymmetric information problem derives from adverse selection only, or whether there is also moral hazard. If the $\hat{\beta}_{cov}$s when $k = 3..5$ are significantly higher than the $\hat{\beta}_{cov}$ when $k = 2$, moral hazard exists, possibly with the adverse selection problem.

In exploring the comparative severity of the asymmetric information problem caused by the brother bank, we add an additional interaction term ($\widehat{cov\_H_i} * same_i$) at the second stage regression:

$$\log\left(\frac{p_k}{p_1}\right) = \beta_{cov}\widehat{cov\_H_i} + \beta_{covsame}\widehat{cov\_H_i} * same_i + X_i\beta_X + \varepsilon_i \quad \text{for } k = 2,..,5 \tag{2}$$

where $same_i = 1$ indicates that the insured i is from the distribution of the

insurance company's brother bank. Hence, when the aforementioned asymmetric information situation exists and the estimated coefficient $\hat{\beta}_{covsame}$ of corresponding k is negative and significantly differs from 0, the identified asymmetric information problem is less severe than when the insured is from the brother bank.

Table 2 presents the empirical results related to the overall asymmetric information. The estimated coefficient $\hat{\beta}_{cov}$ is positive and insignificantly different from 0 when $k = 2$. However, the other estimated coefficient $\hat{\beta}_{cov}$s are positive and significantly differ from 0 when $k = 3, 4,$ and 5. These results indicate that the conditional correlation between high coverage and claim is significant only when the claim is for a disease with an ambiguous cause, a disease diagnosed at a suspicious hospital, or both. By contrast, claims other than these are not significantly correlated with the contract coverage. Hence, we infer that the asymmetric information problem exists and is moral hazard instead of adverse selection. Furthermore, the moral hazard phenomenon is caused by insureds who claim for diseases that are difficult to identify and/or insureds who claim for medical services provided by hospitals that are ranked as being highly suspicious of inducing treatment demand or fraud.

Dionne et al. (2015) provided a modified methodology for the Dionne, Gourieroux, and Vanasse (DGV) approach proposed by Dionne et al. (2001). They also accounted for the endogeneity problem when the conditional correlation between claim and coverage was tested. According to the DGV approach, the dummy variable of cov_H_i is added in the second stage regression. In addition, the conditional correlation between claim and coverage is determined by summarizing the estimated coefficient of $\widehat{cov\_H_i}$ and the estimated coefficient of cov_H_i. We adopt this method to test the robustness of our results. The right panel in Table 2 shows the results obtained using the DGV approach. When cov_H_i is added, the empirical

outcomes of the $\hat{\beta}_{cov}$s for each k are similar to those listed in the left panel. The estimated coefficients of cov_H_i for each k are positive and insignificantly different from 0, implying that the empirical results from regression (1') and the DGV approach are consistent: All of them indicate moral hazard instead of adverse selection.

In the health insurance industry, moral hazard has long been suspected as a major cause of medical resource waste. However, few studies have identified and distinguished it from adverse selection. Most research investigating the asymmetric information problems related to health insurance has reported that insureds covered by more insurance are less healthy, referring to this circumstance only as "adverse selection" (e.g., Cutler and Zeckhauser, 1998; Cutler and Reber, 1998), possibly because distinguishing moral hazard from adverse selection requires much information. Peng and Wang (2015) used the information of whether the claim is for a disease with an ambiguous cause to distinguish moral hazard from adverse selection, determining that both moral hazard and adverse selection coexist. In the present study, we use the additional information of claim reason and the providing hospital to identify moral hazard; however, we find evidence of moral hazard only.

After identifying the moral hazard problem, we further test its comparative severity for insureds from the brother bank (Table 3). The left panel of the table shows that the estimated coefficients of $\widehat{cov\_H}$ remain positive and significantly differ from 0 when $k = 3, 4,$ and 5, in contrast to the estimated coefficient of $\widehat{cov\_H}$, which is insignificantly different from 0 when $k = 2$. Furthermore, all the estimated coefficients of $\widehat{cov\_H} * same$ are negative and significantly differ from 0 when $k = 3, 4,$ and 5. These results imply that the moral hazard problem we observe is significantly less severe in insureds who come from the distribution channel of the brother bank.

The right panel in Table 3 presents the empirical results obtained using the DGV approach. The results are primarily consistent with those presented in the left panel. Within the total effect of the conditional correlation between claim and coverage, a significant effect is observed from the coefficients of $\widehat{cov\_H}$ and $\widehat{cov\_H} * same$. Thus, the moral hazard problem is significantly less severe among insureds who are from the distribution channel of the brother bank. This result supports our first prediction that when a bank and insurance company belong to the same financial holding company, their close relationship mitigates the insurer's asymmetric information problem.

However, why the brother bank mitigates the moral hazard problem for the insurance company remains unclear and may be due to several reasons. The first reason is as mentioned in the introduction, that the bank can screen out unideal customers by using credit records. If willing, the bank can recommend better customers with favorable characteristics, such as honesty and self-discipline, to the insurance company. Hence, when the objective of the insurance company and its brother bank is the same, the insurance company can substantially receive the benefit from the honest and self-disciplined customers provided by its brother bank. Accordingly, the moral hazard problem created by these customers is mitigated.

The second reason is that the insurance company may be easier to audit and reject suspicious claims by insureds from the brother bank. Bank agents generally receive complaints when customer claims are rejected. When banks and insurance companies are connected only by a contract, the banks often pass such complaints on to the insurance companies, creating pressure that may cause the insurance companies to hesitate to audit or reject claims because the insurance companies highly rely on bank distribution channels. However, when banks and insurance companies have a brother relationship under a mother company, they may have a more similar objective.

Instead of creating pressure for the insurance companies, brother banks may attempt to pacify insureds when claims are rejected. Furthermore, banks often maintain positive relationships with customers, especially when such relationships are built on trust. Consequently, the banks can more effectively explain to customers why claims were rejected. When a suspicious claim is easier to audit and reject, the moral hazard problem is expected to be largely mitigated.

Whether the moral hazard problem can be entirely eliminated when the insurance company uses the distribution channel of its brother bank remains in question. Thus, we assess the summation of the estimated coefficients $\hat{\beta}_{same}$ and $\hat{\beta}_{covsame}$ for each k. This summation value reveals the conditional correlation between the probability of choosing high coverage and the probability of claim in different categories for insureds from the brother bank. For $k = 3..5$, the summation values of $\hat{\beta}_{same}$ and $\hat{\beta}_{covsame}$ are positive and significantly differ from 0 at least at the significance level of 10%, regardless of whether the results are the right side of the DGV approach or the other approach in left hand side. The results imply that within the subgroup of insureds from the brother bank, the moral hazard problem remains, despite being mitigated. This supports our second prediction that even with a close relationship between a bank and insurance company, the asymmetric information problem cannot be eliminated entirely.

There are two reasons to explain this finding. First, a moral hazard problem exists for the brother bank when it is one division in a holding company instead of one independent company. The brother bank's incentive to compete becomes minor, decreasing its performance in finding or maintaining positive relationships with better customers and also affecting the quality of customers it provides to the insurance company. Thus, the asymmetric information problems remain.

Second, reciprocity exists between different divisions within the same mother

company. Although divisions within the same mother company should have identical interests, a division’s own interest could conflict with the mother company objective or that of other divisions. Hence, even when the goal of the entire holding company and the insurance company is profit, according to the reciprocal principle, the benefit from insurance contract commissions should sometimes be managed for the bank. This reciprocal action may violate the principle of underwriting or auditing and prevents the asymmetric information problems from being eliminated completely.

Conclusion

Asymmetric information problems are explored extensively in the literature. The effect insurance companies exert when using bank distribution channels is also discussed in the literature. This paper contributes to relevant literature and practical applications. We find that an insurance company can benefit by using its brother bank's distribution channel. The brother bank can mitigate asymmetric information problems involving insureds for the insurance company.

In this study, we find that moral hazard problems exist in the hospitalization claims of medical insurance contracts. Such problems are identified using information that reveals whether the claims are for diseases with ambiguous causes or for medical services provided by suspicious hospitals. These problems can be mitigated through assistance from its brother bank. The severity of moral hazard in insureds who are from the brother bank's channel is less than that in insureds from other bank channels.

Hence, we provide a crucial policy suggestion for insurance companies, especially for insurance companies that belong to the same holding company as a bank: They should utilize the distribution channels provided by their brother banks.

However, insurance companies should also notice that even with assistance from a brother bank, asymmetric information problems cannot be completely eliminated. Problems related to the brother bank's moral hazard and considerations of reciprocity exist as well. Hence, when insurance companies use brother bank distribution channels, controlling these coexisting problems remains a concern that requires attention.

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Table 1 The variable definition and the sample structure

Variables	**Definition**	**Mean**
cov_high	A dummy variable, it equals 1 when the coverage of hospitalization expense is higher than NT$1000 per day; otherwise it equals 0.	0.2324
Clm	A dummy variable, it equals 1 when the insured have ever filed the claim in one policy year; otherwise it equals 0.	0.0430
clmnumber	The claim frequencies within one policy year when the insured have filed the claim.	1.1724
claim_susp	A dummy variable, among the insured have filed the claim, it equals 1 when the insured stay in highly suspicious hospital each time of hospitalization claim within one policy year; otherwise it equals 0.	0.5491
clm_ambg	A dummy variable, among the insured have filed the claim, it equals 1 when the insured hospitalized because of the ambiguous reason disease in each claim; otherwise it equals 0.	0.2343
Same	A dummy variable, it equals 1 when the insured come from the brother bank of this insurance company; otherwise it equals 0.	0.4117
The characteristics of the insured:		
Standard	A dummy variable, it equals 1 when the insured's health status is qualified and does not need further health checkup for underwriting; otherwise it equals 0.	0.9522
Female	A dummy variable, it equals 1 when the insured is female, otherwise it equals 0.	0.5217
Child	A dummy variable, it equals 1 when the insured is younger than 20 years old; otherwise it equals 0.	0.3467
age2029	A dummy variable, it equals 1 when the insured is from 20 to 29 years old; otherwise it equals 0.	0.2105
age3039	A dummy variable, it equals 1 when the insured is from 30 to 39 years old; otherwise it equals 0.	0.2115
age4049	A dummy variable, it equals 1 when the insured is from 40 to 49 years old; otherwise it equals 0.	0.1652
age5059	A dummy variable, it equals 1 when the insured is from 50 to 59 years old; otherwise it equals 0.	0.0565
age6064	A dummy variable, it equals 1 when the insured is from 60	0.0074

	to 64 years old; otherwise it equals 0.[13]	
North	A dummy variable, it equals 1 when the insured lives in the northern part of Taiwan; otherwise it equals 0.	0.5745
Central	A dummy variable, it equals 1 when the insured lives in the central part of Taiwan; otherwise it equals 0.	0.2365
South	A dummy variable, it equals 1 when the insured lives in the southern part of Taiwan; otherwise it equals 0.	0.1661
East	A dummy variable, it equals 1 when the insured lives in the eastern part of Taiwan; otherwise it equals 0.[14]	0.0217
City	A dummy variable, it equals 1 when the insured lives in the city areaof Taiwan; otherwise it equals 0.	0.7112

Note: The mean values of "*clmnumber,*" "*risk_h,*" "*hspdays,*" and "*clm_ambg*" are calculated according to the subgroup of insureds who have filed a claim.

[13] The counter group of these age categories comprises insureds aged 65 years or older. We categorize the age of the insureds in a manner consistent with the categories in underwriting and pricing.

[14] The counter group of these area categories comprises insureds who live on the outlying islands of Taiwan.

Table 2 The empirical results of the asymmetric information problems

	Instrumental Method				**DGV approach**			
	***k* =2**	***k* =3**	***k* =4**	***k* =5**	***k* =2**	***k* =3**	***k* =4**	***k* =5**
constant	-13.9539	-15.8107	-19.4753	-18.6084	-14.0178	-15.8539	-19.3669	-18.7481
$\widehat{cov\_H}$	0.0422	0.1029***	0.3476***	0.3608***	0.0412	0.1016***	0.3500***	0.3578***
cov_H					0.1012	0.0874	0.1114	0.1609
standard	-0.3162	-0.3742**	-0.1237	-1.3122**	-0.3126	-0.3721**	-0.1401	-1.2854**
female	0.1472*	0.3610***	0.6701***	0.5834***	0.1464	0.3604***	0.6734***	0.5782***
child	0.1372	14.7645	16.8495	18.1379	0.1236	14.7546	16.8776	18.0942
age2029	0.2593	15.4429	14.7097	16.2673	0.2455	15.4338	14.7393	16.2230
age3039	0.7278	15.5426	15.1656	16.3137	0.7125	15.5320	15.1970	16.2659
age4049	0.6663	15.3492	13.6167	16.4540	0.6527	15.3401	13.6457	16.4093
age5059	0.6258	15.4811	13.3979	14.6423	0.6131	15.4732	13.4224	14.6153
age6064	0.5015	15.5896	14.9243	0.7488	0.5017	15.5904	14.9251	0.7498
north	13.8130***	-1.3710**	12.1524	12.1110	13.8127***	-1.3735**	12.1465	12.1153
central	14.0806***	-1.0006*	13.1216	13.9648	14.0782***	-1.0045*	13.1171	13.9686
south	13.4946***	-1.1165*	11.4851	11.7774	13.5018***	-1.1136*	11.4697	11.7958
east	13.3564***	-1.2557*	11.2843	12.1229	13.3586***	-1.2564*	11.2733	12.1343
city	0.2540**	-0.4228***	-0.0727	-0.5975***	0.2543**	-0.4226***	-0.0760	-0.5941***

Table 3 The empirical results of the asymmetric information problems in the insureds from brother bank versus the insureds from other banks

	Instrumental Method				**DGV approach**			
	***k* =2**	***k* =3**	***k* =4**	***k* =5**	***k* =2**	***k* =3**	***k* =4**	***k* =5**
constant	-13.9566	-16.0918	-20.0924	-19.4836	-14.0199	-16.1464	-20.0515	-19.6583
$\widehat{cov\_H}$	0.0392	0.1030***	0.3408***	0.3502***	0.0374	0.1014***	0.3433***	0.3476***
$\widehat{cov\_H}$****same***	-1.6E-05	-0.0054***	-0.0087**	-0.0115***	0.0002	-0.0043**	-0.0117***	-0.0133***
cov_H					-0.0966	0.0796	0.2949	0.3935
cov_H*same					0.3458	0.0796	-0.7779*	-0.4195
standard	-0.3161	-0.3542*	-0.1539	-1.3358**	-0.3123	-0.3507*	-0.1515	-1.3005**
female	0.1471	0.3494***	0.6404***	0.5414***	0.1462	0.3471***	0.6319***	0.5322***
child	0.1369	14.7275	16.8467	18.1111	0.1226	14.7110	16.8507	18.0626
age2029	0.2589	15.3919	14.6856	16.2079	0.2450	15.3796	14.6825	16.1535
age3039	0.7274	15.5010	15.1535	16.2704	0.7118	15.4867	15.1529	16.2133
age4049	0.6661	15.3370	13.6526	16.4803	0.6515	15.3209	13.6662	16.4340
age5059	0.6256	15.4318	13.3587	14.5501	0.6126	15.4188	13.3638	14.5269
age6064	0.5015	15.5558	14.8616	0.6860	0.5016	15.5555	14.8606	0.6902
north	13.8137***	-1.2805**	12.3633***	12.3966	13.8125***	-1.2815**	12.3808	12.4132
central	14.0812***	-0.9307	13.2731	14.1695	14.0783***	-0.9304	13.2779	14.1785
south	13.4954***	-1.0117	11.7181	12.0965	13.5011***	-1.0094	11.7453	12.1357
east	13.3571***	-1.1540*	11.5457	12.4709	13.3596***	-1.1446*	11.5314	12.4798
city	0.2539***	-0.4377***	-0.0664	-0.5969***	0.2544**	-0.4378***	-0.0747	-0.5954***

Appendix

When we adopt the two stage instrumental variable method, the empirical results of the first stage regression are as follows:

Variable	Est.	P value
constant	-45.1050	<0.0001
income	0.0035	<0.0001
edu	19.2659	0.0030
standard	2.3302	<0.0001
female	-1.8985	<0.0001
child	-4.5699	<0.0001
age	-0.5509	<0.0001
age_sq	0.0083	<0.0001
north	4.9972	0.0860
central	2.5549	0.3800
south	7.2475	0.0130
east	8.4408	0.0040
city	0.6849	0.0010

To confirm that the instrumental variable method is appropriate, we perform the J test, Anderson Rubin test, and Durbin–Wu–Hausman test by using a linear model. In the Durbin–Wu–Hausman test, we reject the null hypothesis of no endogeneity problem at the 0.0212 significance level. An endogeneity problem is caused by the endogenous variable "cov_H." The null hypothesis of the J test cannot be rejected at the 0.6111 significance level, indicating that the model is not over-identified. The null hypothesis of the Anderson Rubin test also cannot be rejected at the 0.5075 significance level, which confirms the exogeneity of the instruments in the aforementioned instrumental regression. In summary, we confirm that our instrumental variable method is relevant.

The empirical results from the previously mentioned regression are consistent with our prediction. The estimated coefficients of $income$ and edu significantly differ from 0 at the 1% significance level, and the estimated coefficient of $income$ and the estimated coefficient of edu are positive. This result implies that people with a higher wealth level tend to purchase more insurance. This supports the assumption that wealthier people tend to purchase more coverage because the cash value of the policy is treated as savings. In addition, people with a higher education level are also more likely to purchase more insurance.