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# A Reexamination of the Relationship between Organizational Forms and Distribution Channels in the U.S. Property Liability Insurance Industry

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**Abstract**

How do property liability insurance companies choose their organizational forms and distribution channels? Prior studies have not yet provided a consistent conclusion. In this paper, we propose a reduced form approach to reexamine the relationship between organizational forms and distribution channels in the insurance industry, using cross-sectional data pertaining to U.S. property liability insurance companies in 2004. We adopt a conditional dependence test, which can overcome the sensitivity problem of the structural form setting. The results show that after we control for all explanatory variables, the relationship between organizational forms and distribution channels is conditionally uncorrelated. The result is consistent with Regan and Tzeng (1999), but contradicts the findings of Baranoff and Sager (2003) and Kim et al. (1996).

**KEYWORDS:** organizational form, distribution channel, conditional dependence test, reduced form, structural form

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## 1. Introduction

The choice of organizational forms and distribution channels remains an important issue in insurance. The choice of organizational forms faced by insurers is driven by the differential relative advantages enjoyed by the insurers themselves,[1] for example, the concern over agency costs, attitudes to risk taking, efficiency, and so on (Regan and Tzeng, 1999; Dionne, 2000). On the other hand, the choices of alternative distribution channels for insurers are also based on their comparative advantages,[2] such as minimizing agency costs, economic cost, and the efficiency of intermediary services (Kim *et al.*, 1996; Regan, 1999; Dionne, 2000; Brockett *et al.*, 2005). In a word, the choice of organizational forms and/or the choice of distribution channels are well discussed in the insurance literature.

According to the National Association of Insurance Commissioners' (NAIC) annual report in 2004, approximately 72% of stock insurers accounted for the same market share of yearly net written premiums in the U.S. property liability insurance industry. On the other hand, in 2004, approximately 64% of independent agency insurers accounted for 51% of the yearly net written premiums in the U.S. property liability insurance industry. Moreover, about 69% of stock insurers with independent agency systems accounted for approximately 52% of the yearly net written premiums in the pool of stock insurers. Furthermore, in the pool of mutual insurers, about 78% of yearly net written premiums were accounted for by approximately 49% of mutual insurers with a direct writing agency system. Overall, these ratios indicate that stock insurers tend to adopt an

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[1] In general, there are four types of organizational forms in the property liability insurance industry, namely, stock, mutual, reciprocal, and Lloyds.

[2] In this paper, we category the distribution channels into two classes: an independent (including brokers) agency system and a direct writing agency system (Dionne, 2000). In A.M. Best's Key Rating, the marketing codes of independent agency systems are as follows: A (Agency), AB (Agency, Broker), AD (Agency, Direct Response), B (Broker), BA (Broker, Agency), BD (Broker, Direct Response), BG (Broker, Managing General Agent), G (Managing General Agent), GA (Managing General Agent, Agency), GB (Managing General Agent, Broker), GD (Managing General Agent, Direct Response), and L (General Agent). If any system does not fall within these categories, we define it as a direct writing agency system. We also thank an anonymous referee who provided the reference for an evolving distribution channel from the Insurance Information Institute (http://www.iii.org/media/hottopics/insurance/distribution/). This reference is helpful when discussing the choice of distribution channels for insurers.

independent agency system, whereas the number of mutual insurers that choose a direct writing agency system is not significant. Nevertheless, these ratios indicate that mutual insurers with a direct writing agency system have a greater market share than independent agency mutual insurers. We postulate that there is a size effect on the mutual insurer pool because we learn that some mutual insurers are larger in size in the U.S. property liability insurance industry. As a result, according to these ratios, we conjecture that organizational forms and distribution channels tend to interact with each other before controlling for firm characteristics.

Most studies in the literature discuss the choice of organizational forms and distribution channels separately (see Mayres and Smith, 1988; Regan and Tennyson, 1996; Regan, 1997; Kim *et al.*, 1996). For example, Regan (1997) discusses the advantages of the choice of distribution channels and treats the organizational form as an explanatory variable (or control variable) in the logistic regression model. She concludes that exclusive brokers (a direct writing agency system) can offer greater advantages to insurers when products are complex, the underlying uncertainty is higher, or the relationship-specific investments (e.g., advertising, the information system) are less important. Kim *et al.* (1996) treat distribution channels as an explained variable and organizational forms as an explanatory variable. They find that stock insurers tend to use more independent agency systems than mutual insurers. These papers find a unilateral influence but not a joint influence with regard to the choice of organizational forms and distribution channels.

In recent studies, only a few papers analyze the choice of organizational forms and distribution channels simultaneously. For example, Regan and Tzeng (1999) examine the relationship between organizational forms and distribution channels using simultaneous equation modeling (SEM) and find that they have an indirect association through firm-specific characteristics. However, when Baranoff and Sager (2003) also use SEM to examine the relationship between organizational forms and distribution channels, they discover that organizational forms and distribution channels are significantly associated in terms of their stock

dummy equation,[3] but insignificantly associated in regard to their agency dummy equation. Both Regan and Tzeng (1999) and Baranoff and Sager (2003) employ the structural form of simultaneous equations to examine the relationship between these two decision variables, yet they yield different results. These inconsistent findings may result from the setting of the structural form equation. To provide another angle to this problem, we propose a reduced form and/or a conditional dependence test to reexamine the relationship between organizational forms and distribution channels.[4]

Because prior studies still cannot provide a consistent conclusion on the relationship between organizational forms and distribution channels, we focus on discovering this relationship in terms of different methodologies. Specifically, we adopt a conditional dependence test to reexamine the relationship between organizational forms and distribution channels for the insurance industry, using cross-sectional data for 450 U.S. property liability insurance companies in 2004. Similar to Chiappori and Salanei (2000), we propose a conditional dependence test to control for the effects of all the explanatory variables for these two decision variables. We find that the generalized residuals of these two reduced form models are conditionally uncorrelated. Thus, when we control for the effects of all the explanatory variables, the organizational forms and distribution channels

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[3] Regan and Tzeng (1999) and Baranoff and Sager (2003) indicate that organizational forms and distribution channels have an interactive relationship and are jointly determined. These two papers confirm that organizational forms and distribution channels are likely to be observed together. However, their models do not provide direct evidence of a causal relationship between organizational forms and distribution channels. It may be that this issue requires further research. In this study, we cannot identify the causal relationship between organizational forms and distribution channels. Nevertheless, we do provide evidence of an association between organizational forms and distribution channels.

[4] We do not propose that the conditional dependence test is better than SEM. Each of these two methodologies has its merits in econometrics. In other words, we treat these two methodologies as being complementary. Chiappori and Salanie (2000) point out that the conditional dependence test has some merit in detecting asymmetric information. For example, this test is surprisingly robust in regard to correlation among the generalized residuals. Moreover, this test does not rely on specific functional forms and it does not require particular assumptions regarding preferences, technology, or the nature of the equilibrium. As a result, the conditional dependence test we use may inherit these advantages directly. Wu and Lee (2008) also indicate that the conditional correlation approach has less of a heteroskedasticity problem and allows researchers to address empirical questions more convincingly. Consequently, the conditional dependence test is adopted in this study.

appear to be uncorrelated. These results are consistent with Regan and Tzeng (1999) but contradict the findings of Baranoff and Sager (2003) and Kim *et al.* (1996).

Our paper contributes to the literature in two ways. First, we propose an alternative methodology to reexamine the relationship between organizational forms and distribution channels. The conditional dependence test benefits from the robustness of the correlation detection, less the heteroskedasticity problem, and a convincing explanation of the empirical issues (Chiappori and Salanie, 2000; Wu and Lee, 2008). As a result, we can provide a plausible and convincing explanation of the empirical results. Second, although some papers in the literature find evidence to support the view that the choices of organizational forms and distribution channels are correlated, our empirical evidence indicates that organizational forms and distribution channels are conditionally uncorrelated. In other words, firm-specific characteristics, such as risk, financial pressure, or size, affect the choice of organizational forms and distribution channels. Nevertheless, the choice of organizational forms does not appear to be directly affected by the distribution channels, nor does the choice of distribution channels appear to be directly affected by the organizational forms for insurers.

We organize the remainder of this paper as follows: In Section 2, we review the literature. In Section 3, we describe our data and develop the variables. In Section 4, we test the methodology, our hypothesis, and the empirical results. In Section 5, we conclude.

## 2. Literature Review

Regan and Tzeng (1999) synthesize theories and empirical predictions of the literature for both the choice of organizational forms and distribution channels. Likewise, in this study we also provide a literature survey for organizational form choice, distribution channel choice, and the integration of organizational form and distribution channel choice.

**Literature on Organizational Form Choice.** In the existing literature, the motivation behind the choice of organizational form for insurers is the focus on managerial discretion, risk taking, and efficiency, etc. (Dionne, 2000). The managerial discretion hypothesis argues that conflicts in terms of incentives among owners, managers, and policyholders result in different choices of organizational forms by an insurer in order to minimize agency costs (Mayers and Smith, 1981, 1988, 1994). In such instances, mutuals should have a comparative advantage since they have less requirement of managerial discretion, while stocks should have a comparative advantage in activities which need greater managerial discretion. Lamm-Tennant and Starks (1993) find that stock insurers write more business in lines with higher underwriting risk than mutual insurers. Mayers and Smith (1990) analyze U.S. reinsurance markets and find that a less diversified ownership structure will entail the purchase of more reinsurance contracts, whereas Gavern and Lamm-Tennant (2003) and Cole and McCullough (2006) find the opposite result. Moreover, Baranoff and Sager (2003) provide evidence that stock insurers tend to have higher asset risk than mutual insurers. Overall, stock insurers tend to bear more risk than mutual insurers because stock insurers in general have the advantage of risk diversification. Cummins *et al.* (1999) analyze organizational forms and efficiency for U.S. property-liability insurers and find that stock insurers have higher technology efficiency and cost efficiency than mutual insurers when producing stock outputs, whereas mutual insurers have higher technology efficiency than stock insurers when producing mutual outputs.

**Literature on Distribution Channel Choice.** The distribution theories are well documented in the insurance literature. Most of these studies focus on determining which distribution method is more cost efficient. From the viewpoint of economic costs, Joskow (1973) and Cummins and Vanderhei (1979) adopt the underwriting expense ratio to analyze the cost efficiency of distribution channels and conclude that the direct writing agency system has a cost advantage. Barrese and Nelson (1992) incorporate a continuous variable, defined as the percentage of an insurance group's premium obtained from independent agents, to refine the cost differential between an exclusive agency system (a direct writing agency

system) and an independent agency system. Their conclusion is consistent with those of Joskow (1973) and Cummins and Vanderhei (1979). Regan (1999) analyzes a larger variety of property-liability insurance lines and finds that the advantage of the expense ratio in a direct writing agency system is not consistent across different lines of business. Overall, these studies simultaneously treat organizational forms and distribution channels as explanatory variables. As a result, cost efficiency is distinctly different between the direct writing agency system and the independent agency system as well as between stock insurers and mutual insurers. Nevertheless, the relationship between organizational forms and distribution channels is not explicit based on the empirical results.

From the point of view of conflicting incentives, Marvel (1982) indicates that insurers that write directly are more likely to protect their promotional effects (advertising and/or information technology) because the free-riding problem tends to emerge if insurers adopt an independent agency system. He also provides supporting empirical results that show that independent agency insurers spend relatively less on advertising than agency insurers that write directly. Grossman and Hart (1986) indicate that when agents' services (agents' efforts in building the customer list) are relatively important to insurer profitability and the payments of commission are higher, the independent agency system will be used. Regan and Tennyson (1996) offer an alternative model of differences in agents' efforts across distribution systems. They indicate that the participation of independent agents in risk assessment is valuable for insurers. Thus, when agent information is important for risk classification, an independent agency system may be preferred.

The coexistence of different distribution systems in the market is also documented. Seog (1999) tries to explain that when consumers are poorly informed about price distribution, direct writing and independent agency systems may coexist. His equilibrium theory explains that two agency systems coexist in the market under two situations, either (1) in terms of the relative efficiencies of direct writing and independent agency systems, or (2) where the less efficient agency system offering a higher average price is dominant. Seog (2005) theorizes that firms compete in a Cournot-Nash game. Under the different operating leverages, he finds that coexistence is possible when independent agent insurers

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are less efficient than direct writing agent insurers. Berger *et al.* (1997) distinguish between the *market-imperfections hypothesis* and the *product-quality hypothesis* as an explanation for the long-term coexistence of the direct writing and independent agency systems. Using frontier efficiency methods, they find that independent agent insurers produce higher-quality outputs and are compensated with higher revenues, i.e., the *product-quality hypothesis* is strongly supported. In a recent paper, Trigo-Gamarra (2008) also presents a finding that is consistent with Berger *et al.* (1997) in the German insurance market.

**Integration of Organizational Form and Distribution Channel Choices.** As described in the Introduction, most of the literature discusses the organizational forms and distribution channels separately, while only a few papers analyze the choice of organizational forms and distribution channels simultaneously. Kim *et al.* (1996) indicate that organizational forms and distribution channels are strategic complements, such that using an independent agency system could control for potential expropriated agency costs by the insurer. That is, stock insurers find that independent agency systems are more valuable when agency costs are more severe. Therefore, stock insurers tend to use independent agency systems rather than direct writing agency systems. Regan (1997) treats the organizational form as an explanatory variable and finds that stock insurers also tend to use an independent agency system, a result that is consistent with the findings of Kim *et al.* (1996). She also finds that independent agency insurers use less advertising and technology investment, which is consistent with Marvel (1982).

Brockett *et al.* (1997, 2004, 2005) analyze the efficiency of the organizational forms and distribution channels of insurance companies by using the data envelopment analysis (DEA) approach. They find, for stock insurers, that the independent agency system is more efficient than the direct writing agency system. On the contrary, for mutual insurers, contradictory results emerge. Overall, stock insurers with an independent agency system are more efficient than mutual insurers with a direct writing agency system. Moreover, stock insurers are more

efficient than mutual insurers both in terms of adopting the independent agency system and the direct writing agency system.

In the context of the choice of organizational forms and distribution channels, there are a few papers that discuss the relationship between these two decision variables simultaneously. In recent papers, Regan and Tzeng (1999) and Baranoff and Sager (2003) examine the relationship between organizational forms and distribution channels by using the SEM approach, and find that organizational forms and distribution channels have an indirect association through firm-specific characteristics. However, these two studies yield different results. Regan and Tzeng (1999) find a strong correlation between organizational forms and distribution channels in the aggregate data. Nevertheless, in their work contradictory results emerge when risk and complexity are controlled. On the other hand, Baranoff and Sager (2003) discover that organizational forms and distribution channels have a significant association when they treat the agency system as an explanatory variable in the stock dummy equation. These mixed results highlight our motivation to reexamine the relationship between organizational forms and distribution channels.

## 3. Data and Variables

**Data.** The financial data come from the NAIC Property and Casualty Database and A.M. Best's Key Rating Guide for 2004.[5] We find a total of 2,736 Property and Casualty insurers in NAIC's data tapes. To be included in our sample, each insurer had to meet the following requirements. First, missing raw data were deleted. After deleting the missing raw data, 1,842 companies remained. Second, observations lacking complete data on several items for the year were deleted. The coefficient of variation for the annual loss ratio can be calculated only if annual loss ratios exist from the year 1995 to the year 2004.[6] As a result, 602

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[5] Due to the constraints imposed by the limited database, we adopt the database from NAIC for the year 2004.

[6] Regan and Tzeng (1999) calculate the coefficient of variation for the annual loss ratio over the period 1980 through 1994 (about 15 years). In this paper, we use roughly 10-year annual loss ratios to calculate the coefficient of variation for the annual loss ratio. This is because we perform

insurers remained in this stage. On the other hand, some unreasonable variables and missing variables were deleted. Finally, 450 available observations remained. We investigated 450 property liability insurers to reexamine the relationship between organizational forms and distribution channels in the insurance industry.

**Description of Variables.** In the regression model setting, we treat the *stock dummy* and *agency dummy* variables as explained variables. The *stock dummy* variable equals 1 if the insurer is a stock company and 0 if the insurer is a mutual company. We include the *agency dummy* variable to indicate the choice of distribution channel by insurers, such that it equals 1 if the insurer adopts an independent agency system and 0 if the insurer adopts a direct writing agency system. Following Regan and Tzeng (1999) and Baranoff and Sager (2003), we use most of the explanatory variables in their regression models to reexamine the relationship between organizational forms and distribution channels.

We proxy the risk to which insurers are exposed in several ways. Following Lamm-Tennant and Starks (1993), we use the coefficient of variation of the annual loss ratio (*cvloss*) from the year 1995 to the year 2004 as a proxy for the risk exposure of the insurers.[7] To control the mix of business in commercial lines, we use the *leverage ratio* (liabilities to surplus) to measure business risk. This ratio captures the estimation errors for the exposure of an insurer in the loss reserve. Insurers with a larger portion of business in long-tailed lines are more likely to have high leverage ratios, because loss reserves correspond to liability lines (Regan and Tzeng, 1999). Therefore, a higher leverage ratio indicates that the insurer suffers more business risk and encounters a higher probability of insolvency. By contrast, an insurer with a lower measure faces less risk.

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a robustness check on the *W* test and a correlation coefficient test of the bivariate probit models for the years 2000, 2001, 2002, and 2003, and the limited database we use extends from the year 1990 to the year 2004. As a result, each insurer needs to meet the requirement that annual loss ratios from the year 1990 to the year 2004 should exist. Consequently, most of the insurers are deleted in this stage.

[7]The coefficient of variation for the loss ratio (Lamm-Tennant and Starks, 1993) does not take into account the discounted rate. We use the coefficient of variation of the loss ratio to capture the loss volatility for insurers, as well as the economic premium ratio. The economic premium ratio also appears in prior studies that take the discounted rate and loss payout tails into consideration.

In addition, we use the sum of the insurer's business written for the general liability, workers' compensation, inland marine, allied lines, and commercial multiperil areas to reflect the specialization effect of complex lines of business (*complexity*). Regan and Tzeng (1999) find that the complexity ratio is higher when an insurer is a stock insurer or adopts an independent agency system. From a distribution channel viewpoint, Regan (1997) notes that direct writing agency insurers tend to have higher business concentrations than do independent agency insurers. Nevertheless, with the organizational form viewpoint, mutual insurers tend to exhibit greater business concentrations than do stock insurers (Mayers and Smith, 1988, 1994). As a result, to control for the business concentration effect, we follow Regan and Tzeng (1999) and use the concentration ratio (*concentration*).[8] The higher the value of the *concentration* ratio, the more specialized the insurer is.

We define size as the natural logarithm of total admitted assets (*lnasset*) and use it to control for differences across firm sizes. In general, smaller insurers tend to use the independent agency system to reduce their management and agency costs. Sass and Gisser (1989) indicate that insurers with a direct writing agency system are usually larger than those with an independent agency system, because they can provide a sufficient volume of business. Mayers and Smith (1981) also suggest that firm size has a positive impact on the choice of a stock insurer, because policyholders face a greater threat of expropriation of wealth by small stockholder-owned insurers. Consequently, firm size appears to affect the choice of both organizational forms and distribution channels. To reflect this effect, we use *lnasset* to control for size differences across firms.

In addition, to control for the effects of business specialization and underwriting risk on the choice of organizational forms and distribution channels, we include the retention ratio (*retention*)[9], which is defined as net-to-direct

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[8]Concentration is defined as the sum of the squares of the written premium for each of ten business lines, namely, private passenger auto damage, private passenger auto liability, homeowners' multiperil, commercial multiperil, fire, allied lines, workers' compensation, ocean marine, inland marine, and general liability.

[9] Regan and Tzeng (1999) use "net retention" to measure reinsurance volume and to control the differences in reinsurance across insurers. Likewise, we follow their usage and use the *retention*

premiums written. Mayers and Smith (1994) suggest that stocks are more likely to be members of groups than are mutuals because of the lower costs of regulatory compliance across states. Thus, the *single dummy* variable, defined as being equal to 1 if the insurer is not organized as a member of a group, and 0 otherwise, appears in our model.

Regan (1997) indicates that specific investment factors, such as advertising costs, help determine distribution channel choice. Regan and Tzeng (1999), Baranoff *et al.* (2000), and Baranoff and Sager (2003) confirm that total commissions and advertising expenses are relevant to the choice of distribution channels. Thus, we include the ratio of advertising expenses to net premiums written (*ad*) and the log of commissions to total premium (*lncom*) in our regression model. Baranoff and Sager (2003) examine the relationships among organizational forms and distribution channels, capital structure, and asset risk in the life insurance industry and reveal that capital structure and asset risk influence the choice of organizational forms and distribution channels. To proxy the regulatory requirement of risk control[10], we use the log of the RBC ratio (*lnRBC*) and define the RBC ratio as (total adjusted capital × 100) / (2 × authorized control level RBC)[11] (Baranoff and Sager, 2003; Baranoff *et al.*, 2000). Baranoff and Sager (2003) find that stock insurers tend to have higher RBC ratios than

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ratio to control for the effects of business specialization and underwriting risk on the choice of organizational forms and distribution channels.

[10] The NAIC system details specific actions to be taken if an insurer's actual capital falls below certain thresholds. For example, if the ratio exceeds 200% (a 100% ratio using the Company Action Level RBC), no action is suggested. If the ratio is less than 200%, a capital plan is required. If the ratio is between 70% and 100%, the regulator has the option of taking control of the insurer, and if the ratio is below 70%, the regulator is required to place the insurer under control.

[11] According to Cummins *et al.* (1999), the RBC formula for property liability companies comprises five major components related to different categories of risk: (1) R1: asset risk (default and market value declines); (2) R2: credit risk (uncollectible reinsurance and other receivables); (3) R3: underwriting risk (pricing and reserve inadequacy); (4) R4: growth risk; and (5) R5: other forms of off-balance sheet risk (e.g., guarantees of parent obligations). Another major change was the creation of R0 risk for the investments of affiliated companies. The risk-based capital formula combines these six components into a single composite measure, referred to as RBC authorized capital, which are presented as follows. RBC Authorized Capital = 0.4*(R0 + R5 + Square Root of $((R1 + R4)^2 + R2^2 + R3^2)$. Cummins *et al.* (1999) point out that the RBC system is important not only to avoid the costs to the guaranty fund system arising from insolvencies, but also to avoid imposing unnecessary regulatory costs on financially sound insurers.

non-stock insurers. In general, the higher the RBC ratio, the lower the regulatory pressure. As a result, they conclude that non-stock insurers are more likely to have higher regulatory pressure. On the other hand, they find that regulatory pressure does not influence the choice of distribution channels.

Moreover, the retained earnings not only affect the capital structure and asset risk but also organizational forms and distribution channels (Baranoff and Sager, 2003). Thus, we consider the return on capital, defined as income/adjusted book capital (*roc*). Following Baranoff and Sager (2003), we control for other explanatory variables of capital structure and asset risk models, such as the total premium written and A.M. Best's ratings, because their results indicate that these variables may affect the choice of organizational forms and distribution channels. As a result, we also include the log of total premiums (*logWtot*) and A.M. Best's ratings (*ratingA*, *ratingB*, and *ratingC*) in our analysis.

In Table 1, we report the summary statistics for all explained and explanatory variables. Stock insurers represent approximately 67.56% of the total sample, and mutual insurers constitute the remaining 32.44%. Independent agencies make up 76.67%, whereas direct writing agencies account for 23.33% of the sample. From Table 1, we also recognize 319 affiliated and 131 non-affiliated insurers in our effective sample. Furthermore, 349 insurers receive the rating A based on A.M. Best's ratings. Overall, the means of these variables are consistent with Regan and Tzeng (1999) and Baranoff and Sager (2003).

Table 1 Summary Statistics of Numerical Variables

| Variables | Min | Mean | Median | Max | Std Dev |
|---|---|---|---|---|---|
| *The explanatory variables of the stock and agency models of Regan and Tzeng (1999) and Baranoff and Sager (2003)* | | | | | |
| *cvloss* | 3.7073 | 19.3845 | 12.8929 | 281.033 | 23.3435 |
| *leverage* | 0.0192 | 1.9452 | 1.7275 | 16.7142 | 1.3536 |
| *complexity* | 0.0000 | 0.4344 | 0.4011 | 1.0000 | 0.3377 |
| *concentration* | 0.0000 | 0.4096 | 0.3427 | 1.0000 | 0.2614 |
| *lnasset* | 13.9986 | 18.8607 | 18.8607 | 25.1589 | 1.8402 |
| *retention* | 0.0041 | 0.9749 | 0.8596 | 4.6438 | 0.6871 |
| *ad* | 0.0000 | 0.0082 | 0.0009 | 2.2502 | 0.1062 |
| *lncom* | -7.1650 | -2.1937 | -1.8775 | -0.4523 | 0.8823 |
| *roc* | -0.0421 | 0.0376 | 0.0367 | 0.1293 | 0.0156 |
| *lnRBC* | 3.9081 | 5.9011 | 5.8302 | 9.7201 | 0.6582 |
| *single* | 0.0000 | 0.2911 | 0.0000 | 1.0000 | 0.4548 |
| *The explanatory variables of the CAP and Risk Models of Baranoff and Sager (2003)* | | | | | |
| *lnWtot* | 10.3260 | 17.8374 | 17.8361 | 24.1979 | 1.9400 |
| *ratingA* | 0.0000 | 0.7756 | 1.0000 | 1.0000 | 0.4177 |
| *ratingB* | 0.0000 | 0.1556 | 0.0000 | 1.0000 | 0.3628 |
| *ratingC* | 0.0000 | 0.0133 | 0.0000 | 1.0000 | 0.1148 |
| *The explained variables* | | | | | |
| *stock dummy* | 0.0000 | 0.6756 | 1.0000 | 1.0000 | 0.4687 |
| *agency dummy* | 0.0000 | 0.7667 | 1.0000 | 1.0000 | 0.4234 |
| *Sample size* | 450 | | | | |

## 4. Methodology and Empirical Results

In this section, we propose a robustness test, referred to as the conditional dependence test, to examine the relationship between organizational forms and distribution channels. We then report the results of this test and of the robustness checking.

**Methodology.** As we mentioned previously, prior studies yield mixed results regarding the correlation of the choice of organizational forms and distribution channels. Therefore, we implement a conditional dependence test, as proposed by Chiappori and Salanie (2000), to reexamine this issue. First, we run a reduced form of two probit regressions by using all explanatory variables and retaining the generalized residuals. Second, we use Chiappori and Salanie's (2000) $W$ test to detect whether these two generalized residuals correlate conditionally.[12] We now describe the probit models and testing methodology.

In the first stage, we set up the two binary response models as follows:

$$Prob\{stock = 1\} = F(X\beta_1), \text{ and} \tag{1}$$

$$Prob\{agency = 1\} = F(X\beta_2), \tag{2}$$

where $F(.)$ is a standard normal CDF with $ND(0, 1)$, and $X$ is an N× K matrix, with K explanatory variables indexed by k = 1, …, K and N samples indexed by i=1, …, N. In addition, $X$ represents the explanatory variables mentioned in the previous section, and $\beta_1$ and $\beta_2$ are K × 1 vectors that represent the coefficients of the K explanatory variables. Finally, $\varepsilon_i$ and $\eta_i$ are two independent centered normal errors with unit variance.

In the second stage, to test the conditional dependence of $\hat{\varepsilon}_i$ and $\hat{\eta}_i$, we follow Chiappori and Salanie (2000) and use the $W$ statistic:[13]

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[12] Recent studies that use the rationale of the conditional dependence test focused on asymmetric information. Examples include Hyytinen and Pajarinen (2005)—firm financing strategy and information disclosure, Wu and Lee (2008) and Lee and Wu (2009)—the analysis of information content of equity-selling, Edelberg (2004)—the analysis of adverse selection and moral hazards in consumer loan markets, and Makki and Somwaru (2001)—the analysis of adverse selection in crop insurance markets.

[13] In Chiappori and Salanie's (2000) empirical data set, the difference in the length of policies stems from the mismatch between the policy and calendar year, so their $W$ statistic needs a weight.

$$W = \frac{(\sum\limits_{i=1}^{N} \hat{\varepsilon}_i \hat{\eta}_i)^2}{\sum\limits_{i=1}^{N} \hat{\varepsilon}_i^2 \hat{\eta}_i^2}, \tag{3}$$

where $W$ is distributed asymptotically as $X^2(1)$. We test its significance according to the null hypothesis of $cov(\varepsilon_i, \eta_i) = 0$. The $W$ statistic provides a test of the conditional dependence between organizational forms and distribution channels.

As a robustness check, we also run a bivariate probit regression[14], as suggested by Chiappori and Salanie (2000), to reexamine the correlation between the choices of organizational forms and distribution channels. We assume that the two independent centered normal errors $\varepsilon_i$ and $\eta_i$ follow a joint normal distribution with zero mean and unit variance but have a correlation coefficient $\rho$. We then test whether $\rho = 0$.

**Empirical Results.** The probit regression results for the reduced form of the first stage in our analysis are described in Table 2. Table 2 indicates that higher complexity ratio insurers tend to be stock insurers and to choose an independent agency system. This result is consistent with Regan and Tzeng (1999). Moreover, stock insurers tend to have a higher leverage ratio, a finding that indicates that stock insurers suffer more business risk and encounter a higher probability of insolvency. On the other hand, we find that insurers who adopt an independent agency system also tend to have a higher leverage ratio. Stock insurers are less likely to be single firms. Furthermore, Model 2 and Model 4 of Table 2 indicate that the payment of commission to insurers that adopt an independent agency system is larger than that for those who adopt a direct writing agency system. This finding is consistent with Baranoff and Sager (2003). Overall, most of the results are consistent with previous studies.

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However, this problem does not emerge in our database. As a result, the $W$ statistic does not need to take into consideration a weight factor in our analysis.

[14] Since our focus is on the coefficient $\rho$ test, we do not tabulate the results of the bivariate probit regression here.

## Table 2 Probit Regression Results

| Variables | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | *Stock dummy* | | *Agency dummy* | | *Stock dummy* | | *Agency dummy* | |
| | Coeff | P-Value | Coeff | P-Value | Coeff | P-Value | Coeff | P-Value |
| *intercept* | 2.5251 | 0.0543 | 2.8195 | 0.0422 | 2.8464 | 0.0553 | 3.9854 | 0.0122 |
| *cvloss* | 0.0078 | 0.0757 | -0.0036 | 0.2693 | 0.0048 | 0.3157 | -0.0070 | 0.0528 |
| *leverage* | 0.1506 | 0.0729 | 0.2576 | 0.0029 | 0.1441 | 0.1080 | 0.2316 | 0.0126 |
| *complexity* | 0.4857 | 0.0339 | 1.0061 | <.0001 | 0.4809 | 0.0437 | 0.8838 | 0.0011 |
| *concentration* | 0.1436 | 0.6121 | -0.6051 | 0.0612 | 0.1539 | 0.5907 | -0.6005 | 0.0676 |
| *lnasset* | -0.1136 | 0.0121 | -0.1222 | 0.0177 | 0.0404 | 0.7953 | 0.1379 | 0.3489 |
| *retention* | 0.0048 | 0.9631 | 0.1848 | 0.1288 | 0.0175 | 0.8688 | 0.2222 | 0.0830 |
| *ad* | 13.9570 | 0.2416 | 1.1495 | 0.3700 | 17.3312 | 0.1683 | 0.6913 | 0.6095 |
| *lncom* | 0.0031 | 0.9695 | 0.6997 | <.0001 | 0.0320 | 0.6987 | 0.7388 | <.0001 |
| *roc* | 2.8823 | 0.4899 | 1.1445 | 0.8075 | 1.6812 | 0.6955 | 0.2692 | 0.9558 |
| *lnRBC* | -0.0741 | 0.5998 | 0.1840 | 0.2015 | -0.1175 | 0.4697 | 0.0068 | 0.9679 |
| *single* | -1.0293 | <.0001 | -0.2028 | 0.2662 | -1.0310 | <.0001 | -0.1549 | 0.4202 |
| *lnWtot* | | | | | -0.1671 | 0.2799 | -0.2807 | 0.0552 |
| *ratingA* | | | | | 0.1765 | 0.5898 | 0.2416 | 0.4977 |
| *ratingB* | | | | | 0.1416 | 0.6672 | 0.3759 | 0.3089 |
| *ratingC* | | | | | 1.1384 | 0.1554 | -1.0367 | 0.1128 |
| *Log Likelihood* | -251.7764 | | -191.0584 | | -249.9132 | | -186.4694 | |
| *Sample size* | 450 | | | | | | | |

This table provides the probit regression results for Stage 1. The explained variable for Model 1 and Model 3 is the *stock dummy variable*. The explained variable for Model 2 and Model 4 is the *agency dummy variable*. The explanatory variables of Model 1 and Model 2 are *cvloss, leverage, complexity, concentration, lnasset, retention, ad, lncom, single, roc,* and *lnRBC*. On the other hand, the

explanatory variables of Model 3 and Model 4 are *cvloss, leverage, complexity, concentration, lnasset, retention, ad, lncom, single, roc, lnRBC, logWtot, ratingA, ratingB,* and *ratingC*. We report the coefficients and the P values of these four probit models. The log likelihood value is also presented. The observations we use consist of 450 Property-Liability insurance companies.

According to the empirical results for Models 1 and 2 in Table 3, after controlling for all explanatory variables,[15] the conditional correlation coefficient is 0.0741, and the *W* statistic is 2.0750, which is less than the critical value $X^2(1)$ = 3.84. This result shows that we cannot reject the null hypothesis $H_0$. Furthermore, it implies that organizational forms and distribution channels are conditionally uncorrelated. From Models 3 and 4 of Table 2, after we add the explanatory variables for the capital structure and asset risk models, as suggested by Baranoff and Sager (2003)[16], we realize that the *W* statistic is 2.1530, and the conditional correlation coefficient is 0.0759. Again, we cannot reject the null hypothesis $H_0$.

<div align="center">Table 3 <em>W</em> Statistic Test</div>

| | Model 1 vs. Model 2 | Model 3 vs. Model 4 |
|---|---|---|
| **Conditional correlation coefficient** | 0.0741 | 0.0759 |
| *W* **statistic** | 2.0750 | 2.1530 |

This table provides the conditional correlation coefficient and *W* statistic. The explained variables of Models 1 and 2 are the *stock dummy* and *agency dummy*, respectively, for the two probit models. The explanatory variables are *cvloss, leverage, complexity, concentration, lnasset, retention, ad, lncom, single,*

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[15]All explanatory variables are adopted from the organizational form and distribution channel regressions of Regan and Tzeng (1999) and Baranoff and Sager (2003). See Table 1.

[16] Baranoff and Sager (2003) run a two-stage simultaneous equation model of four explained variables that indicates that the explanatory variables of capital structure and asset risk models may affect the choice of organizational forms and distribution channels. We add those other explanatory variables of capital structure and asset risk models to our two probit models. See Table 1.

*roc,* and *lnRBC*. The explained variables of Models 3 and 4 are *stock dummy* and *agency dummy*, respectively, for the two probit models. The explanatory variables are *cvloss, leverage, complexity, concentration, lnasset, retention, ad, lncom, single, roc, lnRBC, logWtot, ratingA, ratingB,* and *ratingC*. $X^2(1) = 3.84$.

Furthermore, the results of the bivariate probit regression also confirm this finding. From Models 1 and 2 of Table 4, we find that the correlation coefficient is 0.1520 and the P value is 0.1158, which implies that the choice of organizational forms and distribution channels is uncorrelated. Models 3 and 4 of Table 4 reveal a correlation coefficient of 0.1533 and a P value of 0.1180. In addition, we cannot reject the null hypothesis $H_0 = 0$. These results again provide evidence that the choice of organizational forms and distribution channels is uncorrelated.

Table 4 Correlation coefficient test of bivariate probit regression models

|  | Model 1 vs. Model 2 | Model 3 vs. Model 4 |
|---|---|---|
| **Correlation coefficient** | 0.1520 | 0.1533 |
| **P value** | 0.1158 | 0.1180 |

This table provides the correlation coefficients and P values of the bivariate probit regression models. The explained variables of Models 1 and 2 are *stock dummy* and *agency dummy*, respectively, for the two probit models. The explanatory variables are *cvloss, leverage, complexity, concentration, lnasset, retention, ad, lncom, single, roc,* and *lnRBC*. The explained variables of Models 3 and 4 are *stock dummy* and *agency dummy*, respectively, for the two probit models. The explanatory variables are *cvloss, leverage, complexity, concentration, lnasset, retention, ad, lncom, single, roc, lnRBC, logWtot, ratingA, ratingB,* and *ratingC*.

The results in Table 3 and 4 show that organizational forms and distribution channels are conditionally uncorrelated, even though prior studies are indicative of an association between them. A plausible explanation suggests that the correlation between organizational forms and distribution channels may result from those explanatory variables or the different settings of the structural form

models. We use a reduced form model to reexamine the relationship between organizational forms and distribution channels and find that they are conditionally uncorrelated.

For consistent checking of the relationship between organizational forms and distribution channels, we also implement the $W$ test and correlation coefficient test for the years 2000, 2001, 2002, and 2003. In addition, we cannot reject the null hypothesis $H_0 = 0$ for these years. These results again indicate that the choices of organizational forms and distribution channels are uncorrelated. Also, they are consistent to our main result. We do not tabulate these results here[17].

To sum up, the choices of organizational forms and distribution channels are apparently correlated, but this correlation is driven indirectly by firm-specific characteristics. After filtering the influence of these firm-specific characteristics, our evidence shows that, consistent with Regan and Tzeng (1999), the choice actually is conditionally uncorrelated.

## 5. Conclusion

In this paper, we proposed a reduced form approach to reexamine the relationship between organizational forms and distribution channels in the insurance industry, using cross-sectional data pertaining to U.S. property liability insurance companies in 2004. We adopted a conditional dependence test, which overcome the sensitivity problem of the structural form setting. We found that the generalized residuals of these two reduced form models were conditionally uncorrelated, which implies that when we control for the effects of all the explanatory variables, the organizational forms and distribution channels are uncorrelated. Furthermore, the results of the bivariate probit model also confirm that the organizational forms and distribution channels are uncorrelated. These

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[17] We do not implement the panel data analysis (from the year 2000 to the year 2004) because the organizational form and distribution system do not change within a short horizon. In general, the change in organizational form does take the insurer about 3~5 years because it must receive both regulatory and policyholder approval (Viswanathan and Cummins, 2003). For instance, panel data analysis tends to be biased and misleading.

results are consistent with Regan and Tzeng (1999), but contradict the findings provided by Baranoff and Sager (2003) and Kim *et al.* (1996).

Our empirical results show that the choices of organizational forms and distribution channels are more likely to be correlated, but this correlation is driven indirectly by the firm-specific characteristics, such as risk, financial pressure, and size. In other words, firm-specific characteristics affect the choice of organizational forms and distribution channels. The relationship between organizational forms and distribution channels occurs indirectly through those firm-specific characteristics. However, an insurer's choice of organizational forms is not directly affected by distribution channels, and the choice of distribution channels by an insurer is not directly affected by organizational forms, either. Our findings indicate that the critical factors regarding the choice of organizational forms and distribution channels are the firm-specific characteristics. Therefore, what type of organizational form may be complementary to what type of distribution channel should mainly depend on the business circumstances and characteristics of the insurer.

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