Influences of Organizational Structure and Diversification on Medical Malpractice Insurer Performance

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Abstract: Prior literature has indicated some advantage to physician-directed insurers in the medical malpractice insurance market (Lei and Browne, 2008, and Lei and Schmit, 2008, 2010). We anticipate that these advantages lead to enhanced financial performance, and test that hypothesis. We note, however, that physician-directed insurers tend to be highly specialized both in product line and geography, generating the vast majority of their premium volume from medical malpractice liability insurance in one or just a few states. The advantages of physician-directed insurers could be due to such specialization and concentration, or perhaps be independent of those characteristics. We report our tests of the hypothesis that organizational form, product specialization, and geographic concentration of medical malpractice insurers affect their financial performance. Our results indicate that product diversification is positively related to financial performance. Furthermore, holding product diversification constant, we also find that physician directed insurers show enhanced performance over other organizational forms. [Key words: medical malpractice insurer performance, diversification, organizational structure.]

INTRODUCTION

Medical malpractice insurance provides coverage against professional liability for health-care providers. As most readers are likely aware, over the past several decades medical malpractice insurance has experienced three distinct periods of large price increases and withdrawal of

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carriers from the market. One response to these market shocks has been the formation by health-care providers of their own insuring entities. These entities are physician-owned and/or physician-operated insurers, which we refer to as "physician-directed insurers." Some are mutuals, some closely-held stock insurers, some are risk-retention groups, and some are captives. The key element is the influence of health-care providers in the management and operation of the insurer.

The emergence of physician-directed insurers runs counter to the conventional organizational theory. That theory holds that firms organized as stock companies are better suited to write lines where there is significant managerial discretion, such as complex lines of liability insurance. Mutual or mutual-like companies are expected to perform better in less complex and risky situations with little managerial discretion (Mayers and Smith, 1994; Fama and Jensen, 1983a, 1983b). In the medical malpractice insurance market, however, we observe a strong presence of physician-directed mutual or mutual-like companies. According to The Physician Insurers Association of America (PIAA), a trade association of such insurers, they collectively cover approximately 60 percent of America's health care providers. These facts suggest that physician-directed insurers have an important role in the market.

Two empirical studies provide support for the importance of physician-directed insurers. Danzon, Epstein, and Johnson (2004) find that physician-directed insurers are less likely to exit the market than are non-physician-directed insurers. These results are consistent with Lei and Browne (2008), who in their state-level analysis of entry and exit of medical malpractice insurers observe less frequent exits from the market in states with larger market share held by mutual companies, reciprocals, and risk retention groups.

Given the strong presence of physician-directed insurers and their apparent role in helping stabilize the medical malpractice insurance market, it is important to understand how they differ from their non-physician-directed counterparts and what advantages and disadvantages they may offer. Lei and Schmit (2008, 2010) find that physician-directed insurers are indeed different from their counterparts in various operational aspects, including more conservative loss reserving practices and less reliance on reinsurance.

The purpose of this article is to build on the above-mentioned prior research and investigate whether physician-directed insurers have better financial performance than non-physician-directed insurers. We believe our findings can add to the existing organizational theory because most literature focuses on the broader industry, typically the life insurance industry or property-liability insurance industry as a whole. We examine

the unique organizational structure of the medical malpractice insurance market, offering a potential variation from the broader context.

At the same time, we believe our results can contribute to the existing diversification-performance literature. The unique structure of the medical malpractice market is strongly associated with product and geographic specialization. Physician-directed insurers typically are highly specialized in the particular line of medical malpractice liability coverage, and operate in only one or a few states.[3] Such lack of diversification in product mix and geographic location may pose a disadvantage to physician-directed insurers since they do not enjoy the potential risk reduction effect associated with diversification strategy. As a matter of fact, this lack of diversification has become a concern for regulators and rating agencies, who often encourage these physician-directed insurers to diversify across state lines as well as across lines of business.[4] The value of such diversification strategies, however, remains uncertain because there are both costs and benefits associated with them. On one hand, diversification may bring economies of scope and risk reduction to a firm, enhancing its financial performance. On the other hand, a firm's value may be adversely affected (hence the notion of "diversification discount") if diversification increases operational and agency costs and leads to inefficient cross-subsidization of poorly performing businesses. Empirical studies of various industries have found mixed results on the net effect of diversification on firm performance (e.g., Liebenberg and Sommer, 2008; Elango et al., 2008).

We examine how the unique organizational structure opportunities within the medical malpractice insurance market, along with an insurer's diversification profile, affect its financial performance. Our findings offer input to the question of whether or not diversification in this particular market is a positive approach to risk management. The results of our research also add to the general understanding of the role played by physician-directed insurers in the malpractice market.

The remainder of the article is organized as follows. We review the literature in the next section, followed by a discussion of our data and methodology. We report our results, and conclude with a brief summary.

[3]Mutual versus stock medical malpractice insurers do not demonstrate differences in product or geographic diversification; physician-directed versus non-physician-directed medical malpractices insurers, however, do demonstrate such differences.

[4]A review of Best's Insurance Reports demonstrates this practice.

LITERATURE REVIEW

The relationship between a firm's organizational form (or ownership structure) and its real activities, financial behaviors, and performance has been the subject of extensive research, beginning with Mayers and Smith (1981) and Fama and Jensen (1983a, 1983b), who contend that a firm's choice of organizational structure can be used to control agency costs. Organizational form, therefore, should have a significant impact on the firm's activities, with different organizational forms demonstrating comparative advantages in differing scenarios (Smith, 1986).

In the insurance industry, two organizational forms dominate: stock and mutual. Stock insurers separate the functions of managers, owners (stockholders), and policyholders. Mutual companies merge the owner and policyholder functions. These company forms are found to excel in different lines of businesses. Mutuals are considered to be more efficient in writing lines of insurance where there is little managerial discretion, whereas stock companies do better in lines where there is significant managerial discretion (Mayers and Smith, 1994; Fama and Jensen, 1983a, 1983b).

Medical malpractice insurance is a complex and risky line of business. The strong presence of physician-directed mutual and mutual-like insurers in the market suggests that the differences in organizational form are probably even more complex than typically examined in the literature. Mayers and Smith (1994), for example, consider a gradation of stock ownership, running from widely held stocks, to mutual-owned stocks, to closely held stocks, and association-owned stocks. We propose a gradation in the medical malpractice insurance market between physician-directed and non-physician-directed insurers. These firms might be stock insurers, or they might be mutual insurers. It is their management and general ownership by health-care providers that matters.

No single organizational form defines physician-directed insurers. Rather, we follow the Physician Insurers Association of America (PIAA) and focus on the level of health-care-provider involvement in the operations of the insurer. Such insurers may be small mutual companies or mutual-like companies[5] or reciprocals and risk retention groups, and even some stock insurers are deemed physician directed as well. Stock insurers that fall into the physician-directed category are those organized as corporations with ownership distributed through corporate stock, but formed

[5]Not every mutual company is considered physician-directed, though. Large and diversified entities (such as Liberty Mutual) are not part of the group.

by medical societies or others for the main purpose of offering their members and owners medical malpractice coverage. Regardless of their specific organizational forms, these physician-directed insurers share one common characteristic—that is, they are majority owned and run by health care providers.

Doherty (1991) and Doherty and Dionne (1993) posit that mutual insurers may possess an informational advantage over stock insurers because of the alignment of ownership and risk; therefore, mutuals may be superior in complex situations. Empirical studies have found support for this hypothesis. Both Danzon, Epstein, and Johnson (2004) and Lei and Browne (2008) find that physician-directed insurers are less likely to exit a market. Lei and Schmit (2010) argue that if physician-directed insurers indeed have informational advantage, they should be better at managing risks internally, thus purchasing less reinsurance. Their empirical results lend support to this argument.

Physician-directed insurers' informational advantage may come from their tendency to specialize in medical malpractice insurance and to operate in only a few states. Such focus on a particularly complex area of liability within specific legal jurisdiction may provide a comparative advantage in the market. We anticipate the informational advantage to help boost physician-directed insurers' financial performance.

According to the diversification-performance literature, however, the implication of physician-directed insurers' high specialization (i.e., lack of diversification) on its financial performance is not entirely clear. There are both costs and benefits associated with diversification. The conglomeration hypothesis holds that diversification can help enhance a firm's financial performance through economies of scope and risk reduction, whereas the diversification discount hypothesis contends that a firm can suffer from value destruction if diversification increases operational and agency costs, and leads to inefficient cross-subsidization of poorly performing businesses. Empirical studies of various industries have found mixed results supporting these two competing hypotheses.[6] In the insurance arena, most studies focus on the diversification effect insurers have when they choose whether or not to diversify across the life-health or property-liability industries. There is very little evidence on the intra-industry effect of insurer diversification (Liebenberg and Sommer, 2008).

Two recent studies are particularly relevant to us as they examine the diversification-performance relationship within the property-liability industry. Liebenberg and Sommer (2008) find that single-line property-liability insurers consistently outperform multi-line insurers. In a similar

[6]Martin and Sayrak (2003) offer an excellent summary of related literature.

study, Elango et al. (2008) discover that performance advantages associated with product diversification are contingent upon an insurer's degree of geographic diversification. Their results show that extreme diversification with respect to both product and geography results in significant inefficiencies. On the other hand, a highly diversified product profile with low geographic diversification is associated with the highest performance. Insurers that have relatively low product and geography diversification have medium-level performance.

Our study contributes to the existing diversification-performance literature by focusing on medical malpractice insurers and examining how their product and geography diversification associated with their unique organizational structure affects their financial performance.

We anticipate the informational advantage to help boost physician-directed insurers' financial performance, while the diversification effect on performance is not entirely clear at this point. The net effect of physician-directed insurers' organizational structure and diversification on their financial performance remains to be investigated empirically.

DATA AND MODEL

To test our hypotheses, we use the National Association of Insurance Commissioners (NAIC) database of property-liability insurers' annual statements. The NAIC does not capture all insurers, but is by far the best current resource on insurer financial data. The majority of insurers excluded are very small enterprises. Our sample is generated from data covering 1993–2006. While we use this full period for data collection, analysis actually focuses on the 1995–2006 period because one of our variables is an average of three years of data. The analysis, therefore, covers 12 years.

Our focus in this study is on the impact of organizational form and diversification on financial performance in the medical malpractice insurance market. To conduct our analyses, we first need to define a medical malpractice insurer. A natural response is to include all firms that write positive direct premiums written (DPW) in the medical malpractice line. The problem with this approach is that some insurers report to the NAIC even after they have stopped selling new policies. They continue to report positive premiums from existing relationships, but are not truly active in the market. To account for this issue, we follow Nordman, Cermak and McDaniel (2004) and define a medical malpractice insurer as one that wrote at least 2 percent of the medical malpractice premium in at least one state in that year.[7]

Using this definition, and data from the NAIC, we generate a sample of 1320 observations from 232 insurers. Of these 1320 observations, 100 are omitted because we do not have information on all of the control variables discussed in the following section. Our final sample, as a result, includes 1220 firm-year observations from 221 medical malpractice insurers, of which 71 are physician-directed and 150 are not. Physician-directed insurers wrote 54.75% of the medical malpractice market premiums. Most of the insurers in our sample diversify across lines of business, with 187 firms being multi-line and 34 mono-line.

One important item to note is that we are employing panel data analysis. Because of the unbalanced nature of our sample (not all firms have data for all 12 years of analysis), panel data analysis is particularly valuable. As discussed below, we consider panel data to be the best approach in this situation.

Dependent Variables

As noted in the literature (e.g., Pottier and Sommer, 1999; Browne et al., 2001; Lai and Limpaphayom, 2003; Elango et al., 2008; and Liebenberg and Sommer, 2008), when measuring financial performance with accounting data, either return on assets (ROA) or return on equity (ROE) is appropriate. More important than selecting between the two is to incorporate a risk-adjusted form of ROA and ROE. That is, we use the ratio of ROA (ROE) to its standard deviation over a given time period, which is three years in this study.[8] In other words, to calculate RISKADJUSTED-ROA (or RISKADJUSTED-ROE) at year *t*, we take the original ROA (ROE) at year *t*, and then divide it by the standard deviation of ROA (ROE) over a three-year period covering years *t*-2, *t*-1 and *t*. As a result, the actual analysis is over the period 1995–2006. We found that risk-adjusted ROA and risk-adjusted ROE yielded almost identical results in terms of significance of variables. Risk-adjusted ROA, however, produced a better fit. We report results for ROA only, as a result, and note the one exception of results with risk-adjusted ROE below.

[7]Danzon, Epstein, and Johnson (2004) use a fixed dollar amount as the threshold. They define a medical malpractice insurer as one with at least $100,000 in DPW in medical malpractice (in 2001 dollars) in at least one state. We choose not to use this criterion due to lack of evidence on what dollar amount would be a good threshold.

[8]Elango et al. (2008) use a three-year period. Longer time periods are also used in literature. For instance, Liebenberg and Sommer (2008) use a five-year period. We tried a five-year period as well and the corresponding results are discussed below in "Robustness Test."

Physician-Directed Insurers

A primary interest of this study is the influence of organizational structure on firm performance. Here we define organizational structure with a dummy variable that takes the value of one if a firm is considered physician directed, and zero otherwise. In order to identify physician-directed insurers, we rely on three sources.

As noted above, we identified 221 insurers that meet our definition as "medical malpractice insurers" and also have data for at least one year in our 12-year sample period. To determine which of these are physician-directed, we referred to three sources: the Physician Insurers Association of America (PIAA), a trade organization of physician-directed insurers; and the Risk Retention Reporter[9] and Managed Care-INFO, both of which offer lists of medical malpractice RRGs at their web pages.[10] Using these three sources, we are able to categorize the 221 medical malpractice insurers such that 71 are deemed physician-directed, and 150 are not.

As discussed earlier, the relationship between organizational structure and firm performance is not clear. If managerial control dominates, we would anticipate that physician-directed insurers will do worse than others. If, instead, the informational advantages of physician-directed insurers dominate, we anticipate that they will be the better performers.

Firm Diversification

In addition to organizational form, we are interested in observing the effect of product and geographic specialization on firm performance. Product and geographic diversification could influence performance in both positive and negative ways. On the one hand, diversification can be expected to lower overall risk or volatility and therefore allow for more efficient operations. Alternatively, to the extent that focus offers opportunities to benefit from specialized knowledge and skills, diversification may lead to lower return on assets.

We use a firm's line-of-business Herfindahl index[11] as a basis to measure its level of *product diversification*. The complement of this index is

[9]www.rrr.com/rrgspgs/keywordsearch.cfm.

[10]www.managedcareinfo.com/mcinfo/risk_retention_healthcare_2007.htm.

[11]It is defined as the sum of squares of percentages of an insurer's direct premiums written on each line of business. This index ranges from 0 to 1, with a higher value indicating less diversification across different business lines. The lines of insurance written can be found from Exhibit of Premiums and Losses of each insurer's NAIC financial statements. Consistent with literature, some lines of insurance have been combined to control for measure bias. We follow Liebenberg and Sommer (2008) and use the same 23 lines in the calculation.

included as a final measure of *product diversification*.[12] Similarly, a firm's *geographic diversification* is defined as the complement of the geographic Herfindahl index of premiums written across the 57 geographic areas reported in NAIC.[13]

Both continuous and discrete product diversification measures are used in the literature. We utilize a Herfindahl index–based continuous measure of diversification in this study, but we also experimented with two discrete alternative measures. The first binary variable indicates whether a firm is a single-line or multi-line insurer. The second binary variable indicates whether an insurer is a "pure player" writing more than 95% of its total premiums in the line of medical malpractice insurance (we thank one anonymous reviewer for the idea). We replicated all our analyses (to be discussed later in the paper) using the two alternative measures and detected no statistical significance of these measures. At the same time, the organizational form of being physician-directed still appears to be positively significant, as will be seen from later discussions. We chose not to report the results with the two alternative diversification measures since they showed no impact on firm performance. Our results seem to indicate that the degree of diversification is more important than the decision to diversify in terms of influencing firm performance.

A priori, we do not know the expected sign of these two variables, given the possible conflicting effects.

Control Variables

In addition to organizational structure and firm diversification, we anticipate that firm financial performance is affected by a variety of other factors, as observed in the literature and supported by underlying economic theory. These factors will include the extent of capitalization and debt, firm size, and group status.

Especially given the recent economic turmoil around the globe, capital strength of financial services organizations is likely to be a major factor in determining product demand. Sommer (1996), Liebenberg and Sommer (2008), and others observe that solvency, as measured by policyholder surplus to assets, affects prices. We therefore anticipate that an insurer's *surplus to asset* ratio will be positively related to financial performance. The extent to which a firm is leveraged also is likely to affect performance. Similar to Elango et al. (2008), we measure *leverage* as a firm's total liabilities

[12]In other words, product diversification = 1 – line-of-business Herfindahl index.

[13]In other words, geographic diversification = 1 – geographic Herfindahl index.

divided by policyholder surplus. We anticipate a negative relationship between leverage and return on assets.

Furthermore, we anticipate that larger firms, measured as the natural logarithm of an insurer's *admitted assets,* will achieve economies of scale and demonstrate higher levels of relative profitability, other factors held constant. Interestingly, the literature has observed mixed results. While Cummins and Nini (2002) and Liebenberg and Sommer (2008) report a positive relationship, Lai and Limpaphayom (2003) find the opposite. The expected sign of the relationship between admitted assets and return on assets is indeterminate *a priori*.

A different form of diversification occurs from being a member of a *group*. Cummins and Sommer (1996) and Sommer (1996) suggest that customers should be willing to pay more for insurance from unaffiliated insurers than those belonging to insurance groups because groups have the option to let one of their members fail and policyholders have difficulty in piercing the corporate veil. Thus policyholders might view consolidated groups as being more risky than identical single unaffiliated insurers. Liebenberg and Sommer (2008) find that group status is associated with lower financial performance. We thus anticipate a negative relationship between group status and performance.

In addition to the above-mentioned control variables, we also include year dummies to account for time-induced variation in performance. Table 1 summarizes variable definitions and expected signs discussed above.

Table 2 reports summary statistics of our sample, including minimum, 25th percentile (P25), median, 75th percentile (P75), maximum, mean, standard deviation, and the Pearson correlation coefficient each variable has with the dependent variable RISKADJUSTED-ROA.

As can be seen from Table 2, the mean and median ROA are 0.023 and 0.020, respectively. Liebenberg and Sommer (2008) report similar numbers. Recall that our sample covers medical malpractice insurers from 1995 to 2006 and Liebenberg and Sommer (2008) covers property-liability insurers from 1995 to 2004. Data in Table 2 show that the medical malpractice insurers' financial performance is consistent with that of the overall property-liability industry. When we look at risk-adjusted performances, RISKADJUSTED-ROA has an average value of 3.709. The mean value of firm size is 19.161, which is not too much different from its median value of 19.153.[14]

Table 2 also shows that 47.6% of the observations involve physician-directed insurers and 63% of the observations concern firms that belong to a group. On average, the geographic-diversification and product-diversification are 0.456 and 0.267, respectively, indicating a relatively diverse portfolio of our sample. The Pearson correlation coefficients indicate that

Table 1. Variable Definitions and Expected Signs

Variable	Definition	Expected signs
ROA	After-tax net income/total admitted assets	
STDDEV-ROA	Standard deviation of ROA over past 3 years	
RISKADJUSTED-ROA	ROA/ (STDDEV-ROA)	
ADMITTED-ASSETS	Natural logarithm of total admitted assets	+
CAPITALIZATION	Policyholder surplus/total admitted assets	+
GEOGRAPHIC-DIVERSIFICATION	1-Herfindahl index of DPW across 57 geographic areas	+/-
PRODUCT-DIVERSIFICATION	1-Herfindahl index of DPW across 23 business lines	+/-
GROUP	= 1 if firm is a group, 0 otherwise	-
PHYSICIAN-DIRECTED	= 1 if firm is physician-directed, 0 otherwise	+/-
LEVERAGE	Liability/policyholder surplus	-

all variables are correlated with RISKADJUSTED-ROA with statistical significance. We note that, without controlling for other variables, firms with larger size and higher leverage, or that are physician-directed, tend to have lower performance as measured by RISKADJUSTED-ROA. On the other hand, insurers that have higher capitalization, are more diversified (in terms of both geographic and line-of-business diversification), or belong to a group are associated with stronger performance.

Given that the two major independent variables of interest are product diversification and physician-directed organizational form, we also conducted a univariate comparison to gain a preliminary understanding of the two independent variables' potential influence on firm performance. Out of the 1220 observations in our sample, 201 are associated with single-line insurers (writing only one line of insurance) and 1019 with multi-line insurers (writing more than one line of insurance). On the other hand,

[14]Note firm size is defined as the logarithm of actual admitted assets. The minimum, P25, median, P75, maximum, and mean (standard deviation) of actual assets are [in millions]: 1.554, 62.849, 207.951, 695.648, 38198.35, and 1208.737 (3861.690), respectively. It is apparent that the actual assets have a lot of skewness (with a value of 5.7633). After we do the log transformation, we significantly reduce the skewness of this variable (which has a skewness of 0.2242).

Table 2. Summary Statistics

Variable	Min	P25	Median	P75	Max	Mean	StdDev	Corr
ROA	–0.378	0.003	0.020	0.041	3.350	0.023	0.116	0.094***
RISKADJUSTED-ROA	–13.468	0.190	1.375	3.079	122.830	3.709	11.101	1.000***
ADMITTED-ASSETS	14.257	17.956	19.153	20.360	24.366	19.161	1.797	–0.103***
CAPITALIZATION	0.011	0.231	0.304	0.413	1.000	0.353	0.199	0.395***
LEVERAGE	0.000	1.419	2.293	3.321	87.913	2.958	4.636	–0.128***
PHYSICIAN-DIRECTED	0	0	0	1	1	0.476	0.500	–0.096***
GEOGRAPHIC-DIVERSIFICATION	0	0.009	0.481	0.883	0.968	0.456	0.386	0.061**
GROUP	0	0	1	1	1	0.630	0.483	0.106***
PRODUCT-DIVERSIFICATION	0	0.005	0.086	0.556	0.904	0.267	0.306	0.179***

Note: Corr reports the Pearson correlation coefficient each variable has with the dependent variable RISKADJUSTED-ROA; *** and ** indicate the significance of the coefficient are at the 1% and 5% levels, respectively.

581 of the observations concern physician-directed insurers and 639 non-physician-directed insurers. Table 3 provides a snapshot of single-line insurers versus their counterparts, as well as of physician-directed insurers versus their counterparts. We compare the mean and median values of various variables for different types of insurers. We use the standard t-test to examine difference of means and a Wilcoxon rank sum test[15] to study difference of medians.

As can be seen from the table, single-line insurers have different profiles from multi-line insurers, with lower capitalization, higher leverage, lower geographic diversification, and less group affiliation, but greater participation of physician-directed companies. These differences are statistically significant, measured by both mean and median values of relevant variables. In terms of firm size, however, only the mean value appears to be significantly different for the two types of insurers, with single-line companies smaller than their counterparts. A similar pattern is observed when we compare physician-directed insurers and their counterparts. Physician-directed insurers seem to have lower capitalization, higher leverage, lower geographic and product diversification, and less group affiliation.

When we use ROA to measure firm performance, we see no statistically significant difference of the mean values of ROA between single-line and multi-line insurers, which also holds for physician-directed insurers and their counterparts.[16] Physician-directed insurers have statistically significant different median values of both ROA and ROE than non-physician-directed insurers.

Even though ROA does not show us a consistent picture of different types of insurers' performance, risk-adjusted ROA does provide a consistent picture. Table 3 shows that without controlling for other variables, physician-directed insurers demonstrate lower financial performance than non-physician-directed insurers, and single-line insurers have lower financial performance than multi-line insurers. Such differences are significant in terms of mean values. Our observation that multi-line insurers outperform single-line insurers is consistent with the positive correlation coefficient product diversification has with RISKADJUSTED-ROA reported in Table 2, but is contrary to what Liebenberg and Sommer (2008) find in their research. One potential reason, besides lacking control for a variety of other

[15]We use SAS procedure "proc npar1way" to implement this test. For details see online SAS support documents: http://support.sas.com/documentation/cdl/en/statug/63033/HTML/default/statug_npar1way_a0000000200.htm.

[16]When ROE is utilized, single-line insurers have higher mean and median values of ROE at the 5% significance level.

Table 3. Univariate Comparison: Single-Line vs. Multi-Line Insurers; Physician-Directed vs. Non-Physician-Directed Insurers

	Mean		Median		Mean		Median	
Variables	SL (N = 201)	ML (n = 1019)	SL (N = 201)	ML (n = 1019)	PD (N = 581)	NPD (N = 639)	PD (N = 581)	NPD (N = 639)
ROA	0.023	0.023	0.018	0.021	0.019	0.026	0.018**	0.023
RISKADJUSTED-ROA	1.930***	4.060	1.331	1.396	2.588***	4.728	1.377	1.374
ADMITTED-ASSETS	18.077***	19.375	18.104	19.358	19.061*	19.252	19.259	19.064
CAPITALIZATION	0.296***	0.364	0.287***	0.305	0.290***	0.410	0.267***	0.341
LEVERAGE	3.799**	2.792	2.485***	2.278	3.317***	2.632	2.742***	1.930
GEOGRAPHIC-DIVERSIFICATION	0.203***	0.505	0.033***	0.594	0.310***	0.587	0.174***	0.818
PRODUCT-DIVERSIFICATION	0***	0.251	0***	0.197	0.065***	0.333	0.016***	0.401
GROUP	0.313***	0.692	0***	1.000	0.437***	0.804	0***	1
PHYSICIAN-DIRECTED	0.617***	0.448	1***	0.000	1***	1	0***	0

Note: SL = single-line insurers; ML = multi-line insurers; PD = physician-directed insurers; NPD = non-physician-directed insurers. T-test and Wilcoxon rank sum test are used to test for difference of means and differences of medians, respectively. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

variables, which will be done through regression analysis, is that they examine the entire property/liability industry while we focus on the medical malpractice insurance market only.

EMPIRICAL RESULTS

Recognizing the strong ties between organizational form and firm diversification, we test the following three regression equations[17]:

Equation 1: Performance = f (organizational structure; other firm characteristics),

Equation 2: Performance = f (product diversification; other firm characteristics),

Equation 3: Performance = f (organizational structure, product diversification; other firm characteristics).

Because a firm's decision to choose a specific organizational structure or diversification strategy may be affected by its performance, there exists the possibility for potential endogeneity, namely, either organizational structure or product diversification may be correlated with the error term in each of the three equations. Therefore, we test for endogeneity[18] of organizational structure and product diversification before we run regression analyses.

To examine the endogeneity issue, we rely on the widely used Durbin-Wu-Hausman test, which has the null hypothesis that all suspect regressors (potentially endogenous independent variables) are exogenous.[19] In order

[17]We also tested similar equations with geographic diversification but found it does not have a statistically significant impact. Therefore, we focus on product diversification here.

[18]Discussions of endogeneity tests and valid instrumental variables in this section follow standard econometric textbook teachings. One such example is Wooldridge (2002).

[19]To conduct this test, we follow three steps. First, we regress each of the suspect regressors on all instrumental variables and all exogenous control variables included in each of our three equations. Second, we include the residuals obtained from the first-stage regressions as additional independent variables in the main regression equations along with the endogenous variables and all other control variables. Lastly, we test the joint significance of the coefficients of the residuals and examine the resulting F-statistic. A large F-statistic and a small p-value would lead to rejection of the null hypothesis and indicate that one or more suspect regressors are indeed endogenous.

to perform the Durbin-Wu-Hausman test, we need to select valid instrumental variables in the first place. Valid instrumental variables must be associated with the suspect regressors ("relevance requirement") and at the same time be uncorrelated with the error term ("exogeneity requirement"). The instrument relevance requirement can be checked by regressing each of the suspect regressors on all instrumental variables and all other control variables. An F-test is then used to test the joint significance of all the instrumental variables. We then examine the instrument exogeneity requirement using Hansen's J-test of over-identifying conditions (meaning there should be more instrumental variables than endogenous regressors).[20] The Hansen J-test statistic follows a Chi-square distribution with a degree of freedom equal to the difference between the number of instrumental variables and the number of endogenous variables. The null hypothesis of this test is that all instrumental variables are exogenous.

Our initial set of instrumental variables[21] include lagged values of the independent variables, three-year historical averages of the independent variables, one-year growth in direct premiums written for the property/liability industry, one-year growth in U.S. gross domestic product, firm age, total premiums ceded to reinsurers and two indices[22] that reflect potential incentives for firms to choose a specific organizational structure and/or

[20]Hansen's J-test involves estimating the main regression model with an instrumental variable (IV) method in the first place. Save the residual from the IV model and then regress it on all exogenous variables, including instrumental variables and all other control variables. Next, test the joint significance of the instrumental variables using an F-test. Hansen's J-test statistic is the resulting F-test statistic, multiplied by the number of instrumental variables.

[21]There is lack of supporting literature on what would be good instrumental variables to test for endogeneity of organizational structure (especially the physician-directed variable we identified in our paper). So we simply follow Campa and Kedia (2002) and Liebenberg and Sommer (2008), and start from an instrument set consisting current, lagged, and historically averaged measures of firm characteristics, industry growth, and general economic growth.

[22]The two indices are constructed in a similar manner, following the formula, $Index_{i,t} = \sum_{s=1}^{51} p_{i,s,t} n_{s,t}$. For the first index, $p_{i,s,t}$ is the percentage of medical malpractice insurance premiums insurer i writes in state s in year t. In other words, it measures how much each insurer writes in each state in its medical malpractice line of business. $n_{s,t}$ on the other hand, is the number of medical malpractice insurers in state s, year t. For the second index, $p_{i,s,t}$ is the percentage of total premiums insurer i writes in state s in year t. In other words, it measures how much each insurer writes in each state in its property/liability business. $n_{s,t}$ on the other hand is the number of property/liability insurers in state s, year t. The rationale behind the two indices is that the supply of medical malpractice insurers and property/liability insurers may affect a firm's decision to choose a certain organizational structure or diversification strategy.

Table 4. Endogeneity Tests Results

Potentially endogenous variables (suspect regressors)	Equation 1: Organizational structure	Equation 2: Product diversification	Equation 3: Organizational structure; Product diversification
Instrument relevance test F-statistic (p-value)	13.67 (<0.0001)	22.14 (<0.0001)	Organizational structure: 13.67 (<0.0001) Product diversification: 22.14 (<0.0001)
Instrument exogeneity test Hansen J-statistic (Degree of freedom; p-value)	3.44 (3; 0.3286)	3.48 (3; 0.3234)	3.44 (2; 0.1791)
Durbin-Wu-Hausman test F-statistic (p-value)	–0.15 (0.8818)	1.04 (0.2969)	0.33 (0.7193)

diversification strategy. Multiple variables pass the instrument relevance tests but only four also pass the instrument exogeneity test. These four instrumental variables are firm age, total premiums ceded to reinsurers and the two indices. Table 4 shows that neither organizational structure nor product diversification is endogenous, as evidenced by the Durbin-Wu-Hausman tests that use the four instrumental variables.

In equation 1, we treat organizational structure as the potentially endogenous variable. The F-statistic in the instrument relevance test is 13.67 with a p-value less than 0.0001. According to Staiger and Stock (1997), an F-statistic greater than 10 is usually needed for strong instrumental variables that have strong associations with the suspect regressor. Therefore, the four instrumental variables we use pass the relevance test. The Hansen J-statistic is 3.44 with a p-value of 0.3286 at a degree of freedom equal to 3,[23] so we cannot reject the null hypothesis that our instrumental variables are exogenous. Lastly, the F-statistic for Durbin-Wu-Hausman test is –0.15 with a p-value of 0.8818. In other words, we cannot reject the null hypothesis that the organizational structure is exogenous.

When we turn to equations 2 and 3, again all the test statistics show that our instrumental variables are strong/relevant and exogenous, and

[23]Recall the J-statistic follows a Chi-square distribution with a degree of freedom equal to the difference between the number of instrumental variables (4) and the number of endogenous variables (1).

that organizational structure and product diversification are exogenous. In equation 2, where we treat product diversification as a potentially endogenous variable, the Durbin-Wu-Hausman test F-statistic is 1.04 with a p-value of 0.2969. In equation 3, where we treat both organizational structure and product diversification as potentially endogenous variables, we have a Durbin-Wu-Hausman test F-statistic equal to 0.33 with a p-value of 0.7193. In both cases, we detect no endogeneity of organizational structure and product diversification.

One limitation of the Durbin-Wu-Hausman test is that it depends on the selection of instrumental variables. There could be more than one set of instruments that meet relevance and exogeneity tests and then result in different Durbin-Wu-Hausman test statistics. To account for any potential endogeneity not detected by the Durbin-Wu-Hausman test, for all the equations we test, we use a lag structure by regressing performance in year $t + 1$ on firm characteristics in year t.[24] We do, however, also replicate all analyses using current years' values and we have found essentially the same results.[25]

We experimented with different regression techniques: pooled cross-sectional ordinary least squares (OLS), fixed time effect model[26] and random time effect model. F-test results show that the fixed effect model is better than the pooled OLS model.[27] We also ran Hausman's tests and the m-statistics indicate the fixed effect model is not superior to the random effect model. Therefore, we report empirical results from both the fixed and random effect model.

Our data are time-series and cross-sectional panel data. As Petersen (2009)[28] points out, the residuals may be correlated across observations in panel data sets. Because OLS standard errors are unbiased only when the residuals are independent and identically distributed, correlation of residuals across observations may bias and mis-estimate the true variability of the coefficient estimates. Therefore, we do cluster adjustment for both fixed and random effects models. In other words, we adjust standard errors at

[24]Prior research uses the same method to account for endogeneity; see, for instance, Elango et al. (2008).

[25]When we use the current years' value for all variables, we observe similar results. The only difference is that leverage is no longer significant in the fixed-effects model and only significant in some random-effects models.

[26]We cannot do a fixed group effect model because our main independent variable PHYSICIAN DIRECTED is time-invariant. Its effect will be swept away by firm-specific intercepts.

[27]Results from pooled OLS are very similar to those reported in this section. Tests also show there is no collinearity (VIFs are less than 3 for all variables) or heteroskedasticity issues.

[28]We thank one anonymous reviewer for letting us know about this reference so we can learn how to do cluster adjustment.

the firm level for both fixed and random effects models. Following Petersen (2009), we use SAS procedure "proc surveyreg" to do cluster adjustment for fixed effects models and rely on Generalized Least Squares (GLS) method in random effects models to adjust standard errors.[29]

Results with RISKADJUSTED-ROA[30] as the dependent variable are reported in Table 5. The p-values shown are based on cluster-adjusted standard errors. Year dummy variables are included in all the regression equations discussed in the paper, but not shown in the reports.[31]

Capitalization and leverage are shown to be statistically significant in all the regression equations and models. We find that capitalization has a positive impact on firm performance, a result consistent with Liebenberg and Sommer (2008). In other words, a well-capitalized insurer displays stronger financial performance. At the same time, we observe that highly leveraged firms also perform better financially, which is contrary to our expectation. The reason could be that our use of risk-adjusted performance measures has removed potential negative impact of high leverage.

A firm's size as measured by the logarithm of admitted assets, its geographic diversification, and its group status do not show any impact in either fixed or random effects models.

With regard to the two main variables of interest—organizational structure and product diversification—we find that physician-directed insurers have stronger financial performance, regardless of whether product diversification is included in the regression analysis. When we consider

[29]GLS is a technique for estimating the unknown parameters in a linear regression model. It can be used when the variances of the data values are unequal, or when there is correlation among the data values. We use SAS procedure "proc panel" to implement such technique. The PANEL procedure utilizes a two-stage GLS approach to adjust standard errors in random effects models. In the first stage, variance components are calculated by using various methods. In the second stage, variance components are used to standardize the data, and OLS regression is performed. For details, see SAS online support documents: http://support.sas.com/documentation/cdl/en/etsug/60372/HTML/default/etsug_panel_sect031.htm.

[30]The literature uses two approaches to measure an insurer's financial performance, relying on either return on assets (ROA) or return on equity (ROE). One method is illustrated by Liebenberg and Sommer (2008), who use an unadjusted ROA (or ROE) as the dependent variable and then include the standard deviation of ROA (or ROE) as an independent variable to represent risk. On the other hand, Elango et al. (2008) adjust ROA (or ROE) for risk, omitting any need for an additional independent variable. We tested our data using both methods and discovered that the standard deviation of ROA (ROE) is highly correlated with both organizational form and product diversification. We believe that this multi-collinearity prevents us from observing significance of these two variables with standard deviation also included in the equation. Furthermore, the goodness-of-fit is better for Elango et al. than for Liebenberg and Sommer. Therefore, we follow Elango et al. in using a risk-adjusting ROA (ROE) as the dependent variable.

product diversification but not organizational structure as in Equation 2, we see that diversification shows a significant and positive effect on firm performance in the random effects but not the fixed effects model.[32] When considering organizational form and product diversification together (Equation 3), both are significantly positive. This result is consistent with our observations that multi-line insurers outperform single-line insurers as reported in Table 3.

An interesting observation is that product diversification continues to exhibit a positive impact, but if we compare the coefficients and p-values between Equation 2 and Equation 3, we see that diversification has a bigger impact in Equation 3, with even lower p-values. In other words, when we include organizational structure and product diversification at the same time, the effect of diversification on performance is strengthened by the presence of organizational structure. As a matter of fact, we also observe the same pattern with the coefficients and p-values of organizational structure.

To make sense of the results regarding organizational structure and product diversification, we also partitioned our sample into two sub-samples: one containing only physician-directed insurers and the other only non-physician-directed insurers. We then ran a regression of Equation 2 in these sub-samples, and found that diversification has no impact on performance for physician-directed insurers. The same variable, however, is shown to enhance non-physician-directed insurers' performance, no matter what performance measures were used. In other words, the diversification impact mainly manifests in non-physician-directed insurers. Therefore, after including organization structure, we see stronger diversification effects in Equation 3.

We conclude from our analyses that within the medical malpractice industry, product diversification enhances financial performance. Physician-directed insurers tend to be highly specialized, with a very low diversification level; therefore, we would expect them to be associated with

[31]As indicated earlier, we use SAS "proc panel" procedure to conduct our random effects analysis. Proc panel procedure reports a generalized R-square for random effects models using GLS method. This measures the proportion of the transformed sum of squares of the dependent variable that is attributable to the influence of the independent variables. The conventional R-square measure is inappropriate because a number outside the [0,1] range might be produced. Hence, a generalization of the R-square measure is reported. For details, see http://support.sas.com/documentation/cdl/en/etsug/60372/HTML/default/etsug_panel_sect040.htm

[32]Recall that we also performed the analysis using risk-adjusted ROE, with results virtually the same. The one difference is that product diversification is positively significant using fixed effects in equation 2.

Table 5. Parameter Estimates of Lagged Models: Dependent Variable = RISKADJUSTED-ROA (N = 1220)

	Fixed effects					
	Equation 1		Equation 2		Equation 3	
Variables	Estimate	p-value	Estimate	p-value	Estimate	p-value
ADMITTED-ASSETS	0.1264	0.5247	0.1007	0.6396	0.0019	0.9933
CAPITALIZATION	24.1228	0.0016	22.5593	0.0014	23.1517	0.0011
LEVERAGE	0.4403	0.0412	0.4307	0.0440	0.4488	0.0373
GEOGRAPHIC-DIVERSIFICATION	0.2972	0.8032	–1.3182	0.4177	–1.1951	0.4575
PRODUCT-DIVERSIFICATION			3.0942	0.1667	5.2144	0.0683
PHYSICIAN-DIRECTED	1.3059	0.0887			2.5321	0.0243
GROUP	1.3138	0.1799	0.6434	0.4977	1.0567	0.2771
R-square		0.1807		0.1831		0.1910
	Random effects					
	Equation 1		Equation 2		Equation 3	
Variables	Estimate	p–value	Estimate	p–value	Estimate	p–value
ADMITTED-ASSETS	0.1338	0.5186	0.1015	0.6318	0.0067	0.9749
CAPITALIZATION	23.9911	<.0001	22.4259	<.0001	22.9958	<.0001
LEVERAGE	0.4323	0.0007	0.4234	0.0011	0.4413	0.0006
GEOGRAPHIC-DIVERSIFICATION	0.1484	0.8742	–1.4860	0.1454	–1.3622	0.1804
PRODUCT-DIVERSIFICATION			3.2635	0.0123	5.2892	0.0002
PHYSICIAN-DIRECTED	1.1826	0.0776			2.4261	0.0011
GROUP	1.2302	0.0914	0.5727	0.428	0.9703	0.1834
Generalized R-square	0.1480		0.1511		0.1586	

lower performance. In Equation 3, however, we observe that physician-directed insurers show stronger financial performance, which seems to suggest that they have their own comparative advantage that can help boost performance. This is consistent with the informational advantage hypothesized by Danzon, Epstein, and Johnson (2004) and Lei and Browne (2008).

ROBUSTNESS TEST

To test the robustness of our results, we replace the three-year-period with a five-year-period in our calculation of risk adjusted ROA. Accordingly, we have a smaller sample containing 945 observations, 455 of which are associated with physician-directed insurers. We then repeat our regression analysis[33] using this smaller sample, and the corresponding results are reported in Tables 6.

As can be seen from Table 6, results using the smaller sample are fairly consistent with those using the original larger sample. Well-capitalized and highly leveraged firms show better financial performance regardless of the equations and regression models tested and performance measures used. Again, we do not see any significant impact on firm performance by firm size or group status.

We note the significant influence of geographic diversification when random effects models are used in equations 2 and 3, which differs from the analysis on the entire sample. More geographically diversified insurers are shown to exhibit lower financial performance.

Organizational structure and product diversification are again shown to be important determinants of a firm's financial performance. The difference between results using the larger sample and those using the smaller sample is that in Equation 1 in the smaller sample, organizational structure no longer displays significant impact on financial performance when product diversification is excluded. One possible reason is that physician-directed insurers have two opposite effects at work: on the one hand, their informational advantage can help enhance performance; on the other hand, their low diversification suppresses performance. The net effect is not clear and may not be picked up with statistical significance when the smaller sample is used. After accounting for the effect of diversification,

[33]Again, we detect no collinearity, heteroscedasticity, or endogeneity of organizational structure or product diversification with the smaller sample. All p-values reported are based on cluster-adjusted standard errors.

Table 6. Parameter Estimates of Lagged Models Using Smaller Sample: Dependent Variable = RISKADJUSTED-ROA (N = 945)

	Fixed effects					
	Equation 1		Equation 2		Equation 3	
Variables	Estimate	p-value	Estimate	p-value	Estimate	p-value
ADMITTED-ASSETS	0.0722	0.5995	–0.0367	0.8261	–0.1156	0.5348
CAPITALIZATION	17.9096	0.0033	15.9105	0.0031	16.2643	0.0025
LEVERAGE	0.4843	0.0699	0.4577	0.0685	0.4437	0.0691
GEOGRAPHIC-DIVERSIFICATION	0.0165	0.9856	–1.5512	0.2367	–1.4689	0.2571
PRODUCT-DIVERSIFICATION			3.5953	0.0413	5.2055	0.0283
PHYSICIAN-DIRECTED	0.6413	0.1787			1.9144	0.0321
GROUP	0.6166	0.2793	0.1190	0.8281	0.5285	0.3626
R-square	0.2135		0.2244		0.2338	
	Random effects					
	Equation 1		Equation 2		Equation 3	
Variables	Estimate	p-value	Estimate	p-value	Estimate	p-value
ADMITTED-ASSETS	0.0772	0.6136	–0.0360	0.8159	–0.1123	0.4707
CAPITALIZATION	17.8880	<.0001	15.8782	<.0001	16.2208	<.0001
LEVERAGE	0.4730	<.0001	0.4451	0.0002	0.4323	0.0003
GEOGRAPHIC-DIVERSIFICATION	–0.0920	0.8927	–1.6844	0.0231	–1.5978	0.0304
PRODUCT-DIVERSIFICATION			3.7240	<.0001	5.2729	<.0001
PHYSICIAN-DIRECTED	0.5597	0.2728			1.8499	0.0011
GROUP	0.5763	0.2858	0.0878	0.8666	0.4848	0.3634
Generalized R-square	0.1825		0.1950		0.2040	

however, we see in Equation 3 the impact of physician-directed insurers on performance.

Product diversification is shown to positively influence financial performance in Equation 2 with all models. Consistent with what we see in Table 5, the impact of product diversification is strengthened (with greater coefficient and smaller p-value) when we also include organizational structure in the model, as can be seen from results of Equation 3. When product diversification is considered, we once again see that physician-directed insurers exhibit stronger financial performance.

In this study, we focus on the unique organizational structure in the medical malpractice industry, that is, physician-directed insurers and their counterparts. In order to compare to prior literature that generally examine stock and mutual companies, we have also further refined our categorization of organizational structures. We divide insurers into four categories: physician-directed stock companies (PD-stock), physician-directed mutual and mutual-like companies (such as risk retention groups) (PD-other), non-physician-directed stock companies (non-PD-stock) and non-physician-directed non-stock companies (non-PD-other). We experimented using different organizational forms as the holdout group in our regression models of Equations 1 and 3[34] and we found consistent results regarding all other independent variables. In terms of the organizational structure itself, we observed that PD-other companies differ from other categories of insurers with statistic significance. Our results show that PD-other companies have significantly higher performance than other types of insurers, regardless of whether product diversification is included in the model. This observation is consistent with Elango et al. (2008), who find that stock companies under-perform mutual companies when risk-adjusted performance measures are used.

CONCLUSION

In response to a volatile medical malpractice insurance market characterized by increasing insurance premiums and shrinking supply of carriers, health care providers formed their own insuring entities. Such physician-directed insurers account for a significant portion of the medical malpractice market. They also tend to be concentrated in certain geographic areas and/or specialized in medical malpractice insurance. Rating agencies and regulators often encourage these physician-directed

[34]The finer categorization only affects equations 1 and 3 since equation 2 does not include organizational structure.

insurers to diversify across state lines as well as across lines of business. This paper examines the value of the recommended diversification strategy by investigating the relationship between organization structure and diversification with firm performance.

Our results indicate that product diversification and organizational form significantly affect firm performance, measured by risk-adjusted return on assets and return on equity. More diversified insurers demonstrate better financial performance. Holding that product diversification constant, we also find that physician-directed insurers show enhanced performance. Therefore the regulators' recommendation of being more diversified may be counterproductive.

Our study contributes to the organization theory literature by examining the unique company form in the medical malpractice market. It also adds to the diversification-performance research by focusing on the effect of diversification on firm performance within the U.S. medical malpractice insurance market.

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