Does Diversification Benefit Health Insurers?

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Abstract

This paper is a study of the effects of economies of *scope* and *scale* on the financial performance of U.S. health insurers from 2001-2011. In the finance literature, there has been considerable debate about the effects of scope (i.e., diversification) on firm performance in various industries, but there has been no previous study of health insurers. We proxy scope by two Herfindahl measures of diversification: by insured populations (individual comprehensive, group comprehensive, federal comprehensive, Medicare, and Medicaid) and by geography (50 States and the District of Columbia). We assess insurer performance by return on total assets and return on capital as well as by risk adjusted return on assets and capital. In the presence of appropriate controls, we find that small insurers benefit from population diversification, but not from geographic diversification. For large insurers, the opposite results obtain. In addition, reductions in volatility of return on assets and capital are associated with population diversification for large insurers. Given the expansion of scope imposed by the Patient Protection and Affordable Care Act (ACA), especially of Medicaid and individual comprehensive insurance, we expect that these results will be of interest to both insurers and regulators.

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I. Introduction

In this study we explore the effects of population mix and geographical diversification on the performance of U.S. health insurers during 2001-2011. We investigate both economies of scope, and of scale within an industry currently undergoing massive changes due to The Patient Protection and Affordable Care Act (ACA) of 2010. In recent months we have also witnessed a major shift towards large mergers and acquisitions in the U.S. health insurance industry. This study considers the potential implication of such consolidation in relation to the ACA and within the larger body of research in economies of scale and scope.

In their endless pursuit of greater value and returns corporations undergo a constant churning process, shifting from one strategy to another—leading to periodic waves of conglomeration, followed by divestitures and concentration on core business, and then, inevitably back to expansion. Business historians can trace this process back to the late 19th century and the emergence of the first "big business" firms, the large industrial concerns that gained an advantage through vertical integration and horizontal expansion. (Chandler, 1977, 1990).

By the early twentieth century, many capital-intensive industries were dominated by a few oligopolistic firms. Through the 1910s however, most large firms concentrated on a single industry. This began to change during the 1920s as firms began to diversify—primarily into related product areas where they already had some expertise—allowing them to achieve greater economies of scope. As they searched for additional growth areas, many U.S. firms also expanded internationally. After World War II, this quest for growth led corporations to further diversify—this time into unrelated industries and products. (Chandler, 1977, 1990).

Historically, corporate diversification has been a growth strategy that inevitably peaks and then reverses itself. The conglomerate wave of the 1960s was followed by a renewed focus on core business during the divestitures of the 1980s. The current trend of health insurance mergers indicates that in today's health insurance market, diversification is considered a growth strategy. Media coverage of recent health insurance mergers (and attempted mergers) draws a clear connection between the ACA and insurance industry consolidation. In the June 23, 2015 *New York Times*, Andrew Sorkin wrote:

"*All of this deal-making is largely the result of the Affordable Care Act, which in effect constrains the amount of profit hospitals and insurers can generate, leading both to seek additional scale in hopes of generating higher margins by squeezing additional savings out of a broader customer base."*[1]

A July 3, 2015 *Wall Street Journal* article, announcing the merger of Aetna and Humana, explained the consolidation trend as *"being fed by a desire to diversify and cut costs, amid a landscape changed by the Affordable Care Act. Insurers are eager to reduce expenses and*

[1] Sorkin, Andrew Ross, "Health Care Law Spurs Merger Talks for Insurers," *New York Times*, June 23, 2015

build scale that will help them face off against health-care providers that are bulking up."[2] The Aetna-Humana merger is driven by Aetna's desire to expand (and diversify) into the rapidly growing Medicare Advantage market, where Humana is currently the second-largest insurer. A combined Aetna-Humana would be the market leader.

While diversification is driving the current merger trend in the health insurance industry, no scholar has yet studied the effects this diversification might have on the performance of health insurers themselves.[3] A larger body of research does exist on diversification in other industries. It is part of a broad literature on economies of scope and scale, covering many industries and countries, and representing the perspectives of several academic fields, ranging from strategic management to financial economics. While we cannot cover all aspects of this vast scholarship, we review some of the more significant work on diversification and firm value in the literature review (section II). These studies, however, provide little consensus on whether diversification is beneficial for either performance or risk reduction.

As our focus is on the health insurance industry, the literature review also provides more comprehensive summaries of studies looking at diversification in the insurance industry. But, most of this scholarship focuses on property and liability insurance or the insurance industry more generally. No one has yet explored the effects of diversification on health insurance firms. This study not only fills this gap, but also contributes to the larger discussions of both diversification and the health insurance industry in the U.S.

While the term "diversification" can have a variety of meanings, the economic and finance literature we review here focuses primarily on two types of diversification, product diversification and geographic diversification. In studies of insurance firms, the term "product diversification" usually refers to diversification into different lines of insurance, such as auto, homeowners, etc. For product diversification, our study, however, looks at a single line—health insurance. In this case, firms diversify not by expanding into other lines, but by offering health insurance coverage to different populations—or what we call "population diversification." Our study also looks at geographical diversification across the states.

To quantify insurers' product underwriting exposure, we use the total premium written scaled by an insurer's total assets, *ProdExposure*, as an exposure-based proxy. Since we focus on insurers specialized in comprehensive coverage (Individual Comprehensive, Group Comprehensive, FEHBPs, Medicare, and Medicaid) in our study, the total premium written refers to these five products only.

In this study we hypothesize that both economy of scope (diversification both by population and geography) and scale (size) are related positively to health insurers' performance. We also

[2] Hoffman, Liz, Dana Mattioli and Anna Wilde Mathews "Aetna Agrees to Buy Humana for $34.1 Billion" By Liz Hoffman," Wall Street Journal July 3, 2015 http://www.wsj.com/articles/aetna-nears-deal-to-buy-humana-1435883861

[3] Related literature on consolidation in the health insurance industry focuses on the effects on consumers. Most of these studies find that the fewer insurers in a market the higher premiums they are able to charge. Whether this relationship persists under the ACA remains to be seen. With insurer profits capped under the ACA, better performance by insurers may even translate into lower premiums. For more details on the health insurance consolidation literature see the literature review (section II).

hypothesize that the volatility of performance is lowered for greater diversification of both types.

We use the National Association of Insurance Commissioners (NAIC) health insurers' annual filing data from 2001 to 2011. Detailed data is available for Comprehensive coverage for individuals and groups in the workforce (as one group of working population), comprehensive coverage for Federal Employee Health Benefit Plans (FEHBPs), and coverage for the Medicare, and Medicaid populations' health insurance.[4] Differences among the populations are the basis for diversification since health insurance products exhibit similarities in coverage, methods of utilization review and managed care networks and systems. These differences are along income levels (Medicaid), working status (comprehensive for all working people), age (Medicare) and working for the federal government. Because of the population differences, the reimbursement methods are different leading to the diversification and as we hypothesize to economies of scope in health insurance. Our study uses performance measures to examine the effect of economies of diversification (by population and geography). Performance is proxied by return on assets (ROA), risk adjusted return on assets (RAROA), return on capital (ROC) and risk adjusted return on capital (RAROC).

We hypothesize that the geographic diversification is probably less important since "people are people" no matter where they are. There may be pockets of more illness in the country where only large health insurers may be exposed to these greater risks. But, the risk pooling may mitigate the levels of exposure to sickness.[5] For these health insurers, geographic diversification may be an added value to the insurer in reducing the overall risk of the health insurance coverage to a larger pool of patients.

Using regression analysis with fixed effects for performance as the dependent variable with diversification and many regular control variables as the independent variables, our results show:

1. The performance of small health insurers is positively related to the population diversification. We can see that the population diversification actually benefits small insurers in terms of ROA and RAROA. It is interesting to see that the population diversification helped small insurers improve performance during the crisis years.

2. The performance of large health insurers is positively related to the geographic diversification level – as hypothesized. The geographic diversification benefits large insurers in terms of ROA and ROC. And the geographic diversification is associated with improved large insurers' performance during the crisis years.

3. The population diversification reduces large health insurers' performance volatility. And population diversification helps large insurers reduce the performance volatility, consistent with our risk-reduction hypothesis.

We see strong evidence for economies of scale. Larger insurers do perform better than small insurers after controlling for the other covariates. Controlling for the size effect, we find

[5] See map of differences in Medicare Reimbursement at:
http://www.dartmouthatlas.org/data/topic/topic.aspx?cat=21

support for economies of scope. Consistent with the basic statistics in Table 2 and figures 3-8 and with our observations in Section 5, health insurers with higher level of population diversification perform better than specialized insurers.

These results can inform managers and regulators about the current merger and acquisition activities in the health insurance industry in the aftermath of PPACA. Evidence that diversification in health insurance helps in performance, movement toward M&A that increases diversification can be helpful to the performance and thus indirectly benefit the systemic when the financial intermediaries (see Figures 1 and 2) are healthier.

The paper is organized as follows: Section 2 provides a literature review and the hypotheses to be tested. Section 3 describes the data and the proxies. Section 4 provides the methodology and simple analyses. Section 5 describes the results of the models that test the hypotheses. Section 6 concludes the paper with implications.

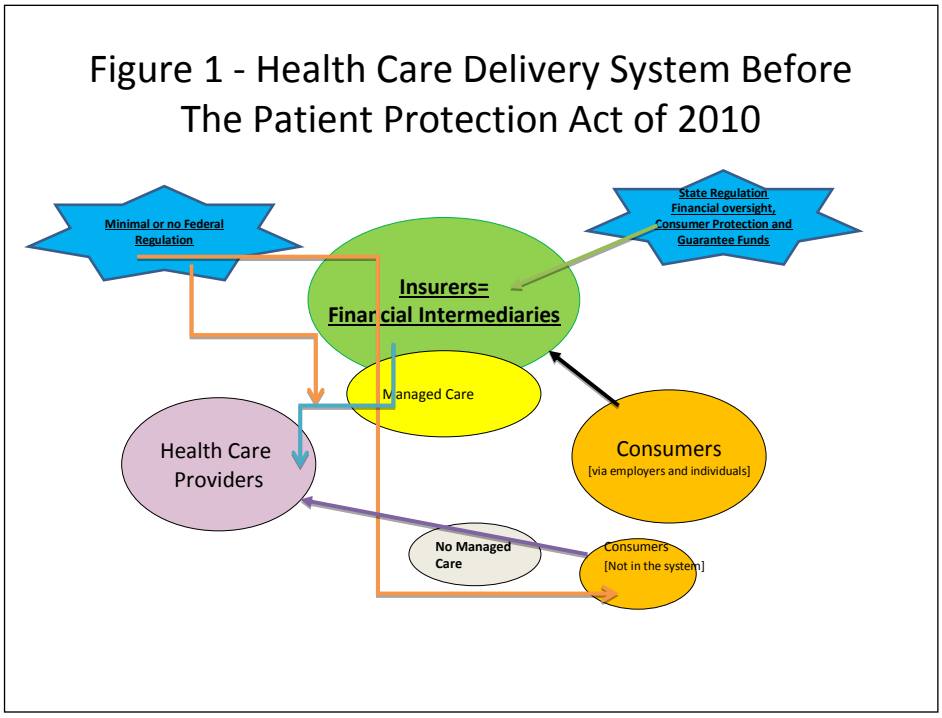
Section 2. Literature Review and Hypotheses in Relation to Health Insurers

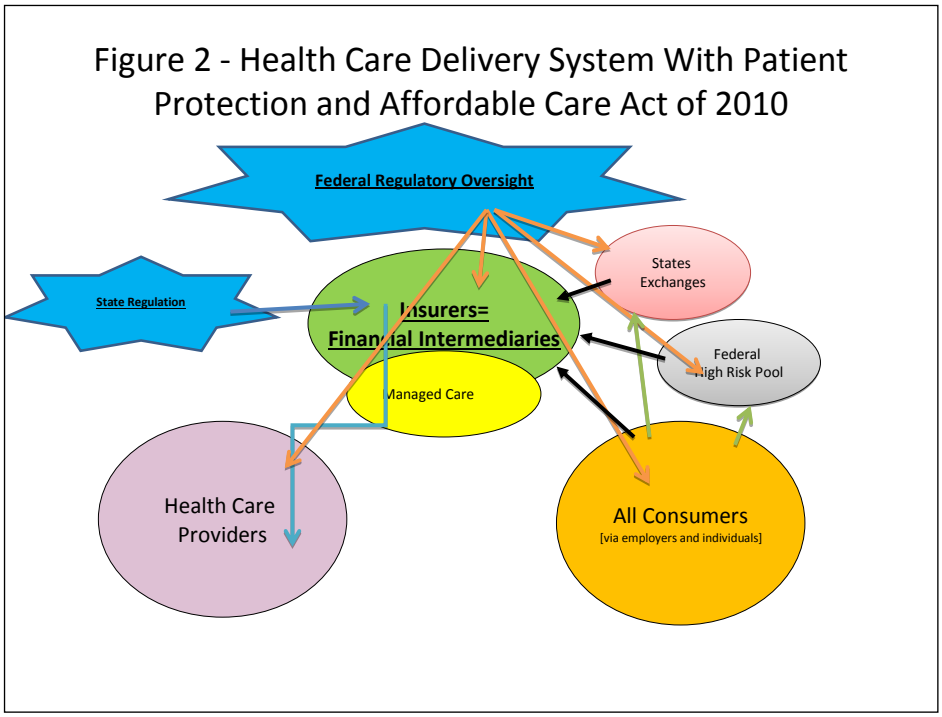
In this section, we begin by explaining the dual role of health insurers in the U.S. healthcare delivery system—where they act as both financial intermediaries and healthcare service managers. Next we review the literature regarding economies of scope and scale, focusing on the relationship between diversification and performance, and the relationship between diversification and firm risk. Finally, adapting this literature to the health insurance industry, we pose three hypotheses.

Health insurance system in the U.S. before and after the ACA

The Patient Protection and Affordable Care Act (ACA) of 2010 has led to a major restructuring of the U.S. healthcare system. As the financial intermediaries in this system, health insurers also face significant change, most notably in the makeup/demographics of the insured population. Two provisions of the ACA, Medicaid expansion and the requirement that all American's carry health insurance (the individual mandate) have altered the insurance industry's customer base.

Figures 1 and 2 (below) provide visual depictions of the main changes to the healthcare delivery system in the U.S. before and after the ACA. With the expansion of the system, the health insurance industry's role as the primary financial intermediator becomes even more pronounced.





Source: Figures 1 and 2 were developed for a presentation at a Town Hall Meeting on PPACA, held at the VCU School of Business in April 2010.

In response to the changing population mix, insurers have begun to target certain growth areas, such as Medicare and Medicaid, with insurers looking to strengthen these businesses through

mergers and acquisitions.[6] As the insured population mix continues to change, we likewise, anticipate insurers will respond in kind, resulting in greater diversification (or economies of scope) among health insurers.

Literature Review

Economies of scope: diversification and performance:

Value of Diversification: Since they began studying diversification in the 1960s, economists have addressed the value of diversified firms (Gort, 1962, Berry, 1971, Markham, 1973, Rhoades, 1973). Starting with Rumelt (1974, 1982) strategic management scholars sought to establish a relationship between diversification strategy and firm performance, finding that firms that diversified into related areas were more profitable than other diversified firms (Palepu, 1985, Ramanujam and Varadarajan, 1989). Others, however, attributed such performance differences to market structure, not diversification strategy (Christensen and Montgomery, 1981)

Mixed results of diversification: discount hypothesis vs. premium hypothesis: The value of corporate diversification has been much debated in economics and finance literature, with some seeing synergistic gains (Bradley, et al., 1988) and others finding inefficiencies (Rajan, et al., 2000). The diversification discount hypothesis posits a negative relationship between corporate diversification and profitability.

Negative relations: Wernerfelt and Montgomery (1988), Lang and Stulz (1994), and Berger and Ofek (1995) all found a diversification discount, with more diversified firms trading their stocks/equities at discounts of as much as 15%. The discounts can be explained by the agency theory of conflicts between the managers and the owners. The managers would diversify, but not necessarily create added value to the owners (see: Amihud and Lev, 1981, Jensen, 1986 and Stultz, 1990).

Positive relations: By contrast, Campa and Kedia (2002) found no diversification discount, and in some cases even a diversification premium. Other scholarship points to variability, with the relationship between diversification and performance differing across time periods, countries, and industries (Servaes, 1996, Servaes and Lins, 1999, Schmid and Walter, 2012).

Geographic diversification: Fewer studies look at the effect of geographic diversification on firm performance, although geographic diversification is often considered in conjunction with product diversification (Elango, et al., 2008, Liebenberg and Sommer, 2008, Berger, 2000). Goetz, et al. (2013) found that for U.S. bank holding companies geographic diversification intensified agency problems, and thus hurt performance. Looking at U.S. financial intermediaries, however, Schmid and Walter (2012) found no significant diversification discount overall associated with geographic diversification. Moreover, for insurance companies and credit intermediaries they identified a diversification premium.

Diversification in the insurance industry: Looking at the effect of diversification on the performance of firms in the insurance industry we see a similar variety of results. King (1975)

[6] Aetna-Coventry Merger Reflects a Changing Industry After Health Care Reform, The Huff Post, August 20th, 2012, http://www.huffingtonpost.com/2012/08/20/aetna-coventry-merger_n_1810821.html

established a relationship between market performance and diversification in property and liability insurance firms. Fiegenbaum and Thomas (1990) found greater returns for insurers that diversified across product lines, compared to firms that concentrated on either life or property lines. Tombs and Hoyt (1994) also saw a positive relationship between product diversification and profitability of insurers. Liebenberg and Sommers (2008), however, found the opposite—that property and liability insurers which diversified across lines, performed more poorly than those who did not, results which were confirmed by Cummins, et al. (2010) for both P-L and Life insurers. They concluded that strategic focus was superior to conglomeration in the insurance industry. A more complex picture, however, emerges from Elango, et al. (2008), who found that for P-L firms, "*product diversification shares a complex and nonlinear relationship with firm performance*" and that the positive effects of product diversification were related to a firm's level of geographic diversification. None of the literature, however, looks at health insurance industry exclusively, and no studies exist on diversification solely within the health insurance industry.

Economies of scope and scale for the health insurance industry in the US

The diversification proxies for economies of scope in our study are based on population and geography as will be further explained in the data section. The difference among the population is emphasized since health insurance products exhibit differences in relationship to customer base.

For the health insurance industry, geographical diversification may expose the insurers to greater variation in medical cost. Using the Dartmouth Medicare map of the U.S.,[7] we can see that in some areas, the cost of medical care is much larger than in others. On the other hand, the pooling is larger, allowing reduction of the risks.

The study uses performance measures explained in the data section to examine the impact of the scope economies (by population and geography).

We test two hypotheses using population diversification and geographic diversification because economies of scale provide firms with more accesses to capital, lower cost of financing, and stronger market power, which results in better performance. Thus,

Hypothesis 1 states: Diversification (both population-wise and geography-wise) is expected to be positively related to performance.

Relations between diversification and variability in performance: The relationship between diversification and firm performance is only half the story. The connection between diversification and risk-reduction is another area of scholarly interest. Risk reduction is often cited as a motivation for a firm's diversification strategy (Amihud and Lev, 1981). Bettis (1981, 1982, 1985) sought to demonstrate a link between diversification and volatility while Bowman (1980) countered that firms could simultaneously increase profitability and reduce risk through diversification. Testing "Bowman's paradox," Fiegenbaum and Thomas (1986) found mixed results. More recently, Berger, et al., (2010) also had inconclusive results when they looked at the risk-diversification for Russian banks. Hoyt and Trieschmann (1991) found that more diversified firms had lower returns and higher risk when firms operate in only one insurance

[7] http://www.dartmouthatlas.org/data/topic/topic.aspx?cat=21

market rather than many. Tombs and Hoyt (1994) found significant negative results for P-L insurers. But Berry-Stoltz et al. (2012), who also looked at P-L insurance, found little relationship between diversification and risk.

Similarly, for health insurers, we pose

Hypothesis 2 states: Diversification (both population-wise and geography-wise) is expected to be negatively related to performance variability.

Diversification and Economies of Scale: Economy of scale can be realized when a firm becomes the dominant supplier in a geographic or product market. The impact of firm size is studied intensively in the finance and economics literature. Due to less cost of asymmetric information, large firms may have more access to capital with lower cost of financing (Slovin, et al., 1992, Berger and Udell, 1995, and Beck and Demirguc-Kunt, 2006). Moreover, large firms may possess stronger market power (Bain, 1951 and Barla, 2000).

In health insurance: Larger health insurers pool larger customer basis and can enjoy the effects of the law of large numbers (Baranoff, Brockett and Kahanee,2009). Usually, large health insurers maintain bigger healthcare provider networks, which enable health insurers to navigate patients more efficiently on their physician networks and to improve performance. Both Sorensen (2003) and Wu (2009) identified health insurers' ability to channel patients among hospitals on their network. Also, health insurers with large insureds base may possess strong bargaining power in negotiation with hospitals for a lower price per unit of healthcare services (Sorensen, 2003 and Wu, 2009). Thus,

Hypothesis 3 states: Greater positive relation between diversification and performance is expected for larger health insurers.

Section 3. Data

Our dataset was extracted from the annual statements filed with the National Association of Insurance Commissioners (NAIC) for 2001 – 2011 by U.S. insurers filing in the Health category. We focus on insurers that generate the majority of their business from underwriting health insurance in four categories: comprehensive coverage for individuals and groups in the workforce (Comprehensive), comprehensive coverage for Federal Employee Health Benefit Plans (FEHBPs), and coverage for the Medicare, and Medicaid populations. Health insurer filings for 2001 – 2011 provide 9,060 firm-years of data.

For each insurer, we calculate the ratio of the sum of premium income from Comprehensive, FEHBPs, Medicare, and Medicaid to the total premium income of the company. If the ratio is greater than 70%, we retain the insurers in our sample.[8] In addition, we apply two criteria in the sample selection. First, insurers have to file continuously. We omit insurers with one or more years' gap in filing. Second, we focus on insurers with at least four years of continuous filings in order to apply various returns and return volatilities calculation. The sample selection ensures

[8] 70% follows Baranoff, Sager and Witt (1999) and indicates a strong focus on health insurance. So by business strategy, such focused insurers may be expected to behave consistently as health insurers.

that we focus on stable survivors in the health insurance industry for the study of the relationship between population diversification and performance. We end up with 4,551 firm-years. The definitions of variables used in this study are provided in Table 1. The summary statistics of these variables are provided in Table 2.

Diversification Measures

The Herfindahl-Hirschman Index (HHI) is a commonly used measure for the level of diversification in industrial organization studies in economics. Researchers in finance and insurance industries also employ HHI or modified versions of HHI in product line mix and concentration research (Tombs and Hoyt, 1994, Sommer, 1996, Pottier and Sommer, 1997, and Elango, et al., 2008). In our study, we use the primary HHI measure for the level of product/population diversification. Following Berry (1971) and Fiegenbaum and Thomas (1990), we define the level of population diversification as:

$$Pop\ Diver = 1 - \sum_{i=1}^{n} P_i^2$$

P_i represents the premium written for insured population i in proportion to total premium written of all n insured populations. For each insurer in the sample, insured populations include Individual Comprehensive, Group Comprehensive, FEHBPs, Medicare, and Medicaid coverage.[9]

We also include the level of geographic diversification in our study. Health insurers' managed care expertise and bargaining or negotiation skills are applicable across geographic regions. In fact, coverage of broader geographic regions may strengthen insurers' bargaining power in negotiating with healthcare providers for healthcare cost. In this way, operating in diversified geographic areas can be treated as the application of economies of scope. In the meantime, higher monitoring cost and agency problems across geographic regions may dampen the benefit of geographic diversification.[10] Therefore, the impact of the geographical diversification on the firm performance is uncertain. However, economies of scale can to some extent alleviate the high monitoring cost and agency problems. Thus we expect to see a positive impact of geographic diversification on large insurers' performance. Regarding the risk-reduction effect, underwriting results in different geographic areas may reduce the overall return volatility or the firm risk. However, the variation of demographics in different geographical areas may result in more volatile underwriting results. And the risk-reduction effect of the geographical diversification is unclear from these perspectives. We calculate the level of geographic diversification as:

[9] *ProdDiver* = 1 – (Individual Comprehensive Premium Written^2 + Group Comprehensive Premium Written^2 + FEHBPs Premium Written^2 + Medicare Premium Written^2 + Medicaid Premium Written^2)/(Individual Comprehensive Premium Written + Group Comprehensive Premium Written + FEHBPs Premium Written + Medicare Premium Written + Medicaid Premium Written)^2. Therefore, the minimum of the level of population diversification is 0, which means the insurer focuses on one line of business only. The maximum of the level of population diversification is 0.8, which means that the insurer writes all five lines of business evenly in terms of premium. The higher value of *Diver* means higher level of diversification.

[10] Existing literature argues that operating in various geographic locations allows for greater managerial discretion, which incurs higher monitoring cost and thus reduces financial performance (Mayers and Smith 1988 and Pottier and Sommer 1997). In their study of the banking industry, Goetz, et al. (2013) found that geographic diversification intensified the agency problem.

$$GeoDiver = 1 - \sum_{i=1}^{n} P_i^2$$

P_i represents the premium written in state *i* in proportion to total premium written in all states. Schedule T of health insurers' annual filings to NAIC provides premium written information allocated by states and territories. If an insurer writes policies in only one state, *GeoDiver* will be 0. Thus, the more geographically diversified an insurer, the higher the level of *GeoDiver*

Performance Measure

We use two major types of performance measures:

1. Return on asset (ROA) and return on capital (ROC). These are commonly used financial performance measures, which could be either book or market value-based (Amit and Livnat, 1988, Brown, Carson, and Hoyt, 2001, Lai and Limpaphayom, 2003). We calculate ROA as the current year net income divided by the book value of total assets and ROC as the current year net income divided by the book value of capital.

2. Risk-Adjusted ROA (RAROA) or risk adjusted ROC (RAROC). This measure incorporates return volatility over a period of time (Browne, et al., 2000, Elango, et al., 2008, and Berger et al., 2010).[11] Randomly high or low returns result from the business activity risk-taking and underwriting and asset portfolio investment. RAROA and RAROC remove the risk-taking impact and focus on returns that may be related more to stable business features, such as the diversification.

Performance variability - Volatility

We also use the volatility of ROA and ROC as proxies for insurer's risks and examine whether diversification reduces the firm risk under the second set of hypotheses as explained in Section II. Following Elango, et al. (2008), we compute the standard deviation of ROA and ROC in the past three years (SD3ROA and SD3ROC) as the volatility of ROA and ROC.

Thus, RAROA or RAROC are calculated as the current year ROA or ROC divided by SD3ROA or SD3ROC.

Firm Size

We also test economies of scale for US health insurers. In previous diversification-performance literature firm size is commonly used as the proxy for economies of scale. In studying scope economies in the US insurance industry, Cummins, et al. (2010) differentiated scale versus scope economics and used logarithm of total assets to measure firm size. Liebenberg and Sommer (2008) also used natural logarithm of total assets and found a positive relationship between firm size and performance in US property-liability insurance industry. In our study, we

[11] Performance measures we do not use in this study are: Tobin's q (a ratio of firm assets in relation to its market value) is a widely used market value-based measure in the finance literature (Lang and Stultz 1994, Villalonga 2004, and Goetz and Levine 2013). Liebenberg and Sommer (2008) used Tobin's q as the performance measure when studying the U.S. property-liability insurance industry from 1995 – 2004. Other insurance industry studies utilize efficiency-based measures Chen, et al. (2005) studied efficiency performance and economies of scope in the U.S. property-liability insurance industry using Data Envelopment Analysis (DEA) and the stochastic frontier approach. Cummins, et al. (2010) used DEA to examine profit efficiency for both the U.S. life-health and property-liability insurance industries.

use the geometric mean of total assets, total liabilities, and total premium incomes as the proxy for the firm size.

Other variables

To quantify insurers' product underwriting exposure, we use the total premium written scaled by an insurer's total assets, *ProdExposure*, as an exposure-based proxy. Since we focus on insurers specialized in comprehensive coverage (Individual Comprehensive, Group Comprehensive, FEHBPs, Medicare, and Medicaid) in our study, the total premium written refers to these five products only.

Besides underwriting health insurance policies, health insurers manage the investment portfolio to maintain timely claims reimbursement to providers and to generate investment income. Following Baranoff, et al. (2007) we use the *Opportunity Asset Risk* (OAR), a volatility-based measure, to quantify insurers' asset risk.

In our study, we define the leverage as the ratio of insurers' capital over total assets (*CAP*). We expect a positive relationship between *CAP* and the firm performance. The literature finds that higher capitalization lowers an insurer's probability of financial distress (Colquitt and Hyot, 1997). Insurers with lower financial risk are able to charge higher prices for insurance policies with similar coverage than insurers with higher financial risk (Sommer, 1996 and Liebenberg and Sommer, 2008).Higher policy premiums lead to better underwriting results and better firm performance.

Stock and mutual are two major organizational forms for health insurers. In theory, stock insurers are faced with the agency cost resulting from the separation of ownership and management (Fama and Jensen, 1983 and Mayers and Smith, 1988), which relates negatively to firm performance. However, on the contrary, the cost reduction ability of stock insurers dominates the agency cost and helps to improve the firm performance as identified in Liebenberg and Sommer (2008) found better performance for stock insurers in the property-liability insurance industry. In our study, we include a dummy variable *Stock* as a control for organizational form, where a stock insurer has the value of 1 and a mutual insurer has the value of 0.

Two thirds of health insurers in our sample have group affiliations. Companies in groups can be described as more diversified conglomerates and as such, following our hypotheses, should perform better. But both Liebenberg and Sommer (2008) and Elango, et al. (2008) found negative relationship between firm performance and group affiliation for US property-liability insurers – which negates our hypothesis.

For health insurers, the impact of group affiliation on firm performance may be positive because of their special roles as healthcare managers. First, as part of a group, a health insurer may have access to a broader physician network enabling more efficient patient channeling. Second, insurers with group affiliation might also possess greater bargaining power in negotiating managed care contracts, resulting in lower medical reimbursement costs (Sorensen, 2003 and Wu, 2009). In this paper, insurers with group affiliation have 1 in the control variable *Group* and 0 otherwise.

The loss ratio is defined as the underwriting loss divided by the premium income.[12] Even though we focus on insurers generating a majority of premium income from Comprehensive, FEHBPs, Medicare, and Medicaid, we control for the performance of the other products sold by health insurers by *OthHealthLR*, where we calculate the total underwriting losses of all the other health insurance products except Comprehensive, FEHBPs, Medicare, and Medicaid divided by the corresponding premium incomes.

Table 1 Variable Definitions

Variables		Definition
Dependent	ROA	Net income / total assets
	SD3ROA	Three-year standard deviation of ROA including the current year
	RAROA	ROA / SD3ROA
	ROC	Net income / Book capital
	SD3ROC	Three-year standard deviation of ROC including the current year
	RAROC	ROC / SD3ROC
Independent	Size	log(Total assets*Total premiums*Total liabilities)/3
	AssetRisk	log(Opportunity asset risk / Total invested assets)
	ProdExposure	Total premium written in Comprehensive, FEHBPs, Medicare, and Medicaid / Total Assets
	PopDiver	Herfindahl index of Comprehensive, FEHBPs, Medicare, and Medicaid Premium Written
	GeoDiver	Herfindahl index of total premium written in Comprehensive, FEHBPs, Medicare, and Medicaid in each state
	CAP	Book capital / Total Assets
	Stock	Organizational type (1 = Stock)
	Group	Group affiliation (1 = Yes)
	OthHealthLR	Dental, Vision, and Other health insurance weighted loss ratio

[12] Total underwriting deduct information can be found on 'Analysis of Operation by Lines of Business' on NAIC health insurers' annual filing. It includes total hospital and medical related expenses, claim adjustment expenses, administrative expenses, and increase in reserve.

Table 2 Summary Statistics in Odd-Number Years 2001 – 2011

	2001 N=350			2003 N=389			2005 N=434		
Variables	Sum	Mean	Stdev	Sum	Mean	Stdev	Sum	Mean	Stdev
ROA		0.0211	0.1402		0.0757	0.1444		0.0828	0.1511
RAROA		0.3474	0.8947		1.5084	2.6960		1.7591	2.9533
SD3ROA		0.1469	0.1349		0.1232	0.1338		0.1114	0.1177
ROC		0.0367	0.4895		0.1683	0.3462		0.1439	0.3327
RAROC		0.4213	0.9865		1.5460	2.7072		1.7205	2.6280
SD3ROC		0.3317	0.3303		0.3314	0.4094		0.2400	0.2591
Size		17.8314	1.7432		17.8764	1.7733		17.86995	1.88346
OppARisk		1219611	4627832		904987	3454131		900893	2990283
ProdExposure		3.1624	2.4446		3.0683	2.0690		2.96338	2.03216
PopDiver		0.2557	0.2457		0.2305	0.2437		0.22698	0.23906
GeoDiver		0.0430	0.1258		0.0397	0.1255		0.04280	0.13642
CAP		0.3774	0.1756		0.4519	0.1766		0.51990	0.17005
Stock	251	0.7171	0.4510	279	0.7172	0.4509	308	0.70968	0.45444
Group	245	0.7000	0.4589	288	0.7404	0.4390	326	0.75115	0.43284
OthHealthLR		0.9687	0.3291		0.8927	0.4828		0.90282	0.26394

	2007 N = 459			2009 N = 446			2011 N = 376		
Variables	Sum	Mean	Stdev	Sum	Mean	Stdev	Sum	Mean	Stdev
ROA		0.0709	0.1657		0.0248	0.1896		0.0666	0.1298
RAROA		2.0595	5.2042		1.0230	3.4930		1.4184	2.2797
SD3ROA		0.1169	0.1311		0.1274	0.1378		0.1121	0.1379
ROC		0.1452	0.3253		0.0495	0.3484		0.1282	0.3510
RAROC		1.7718	2.7948		0.9685	2.1722		1.6056	2.6187
SD3ROC		0.2475	0.3147		0.2559	0.2833		0.2222	0.2814
Size		18.0819	1.7587		18.2251	1.7377		18.5286	1.6734
OppARisk		1535142	5677043		2410277	9261183		3019997	10200308
ProdExposure		2.8635	1.5868		3.1168	1.5401		3.0709	1.6076
PopDiver		0.2452	0.2441		0.2508	0.2425		0.2705	0.2449
GeoDiver		0.0586	0.1656		0.0580	0.1670		0.0579	0.1633
CAP		0.5072	0.1686		0.5024	0.1738		0.5056	0.1781
Stock	330	0.7190	0.4500	329	0.7377	0.4404	269	0.7154	0.4518
Group	338	0.7364	0.4411	336	0.7534	0.4315	289	0.7686	0.4223
OthHealthLR		0.8934	0.4435		0.9178	0.5302		0.9569	0.4929

Section 4. Methodology and Preliminary Analysis

In the first part of this section, we discuss the model used to test major hypotheses and statistical methods in the analysis. In the second part, the preliminary analysis, we present intuitive observations by examining various summary statistics of health insurers in the sample.

Methodology

The following is the main statistical model to test the hypotheses

$$Performance_{i,t} = \alpha + \beta_1 \times Size_{i,t} + \beta_2 \times AssetRisk_{i,t} + \beta_3 \times ProdExposure_{i,t}$$
$$+ \beta_4 \times PopDiver_{i,t} + \beta_5 \times GeoDiver_{i,t}$$
$$+ \delta \times ControlVarsVector_{i,t} + \gamma \times YearDummies + \varepsilon_{i,t}$$

The key research question of this paper is whether the level of diversification is statistically significantly related to the performance of health insurers, controlling for the other covariates. In the statistical model, we examine whether β_4 in the above model is statistically significant and the sign of β_4 determines whether diversification produced a premium or discount. If the economy of scope hypothesis prevails, we expect to see significant positive β_4. We test the existence of economies of scale by examining the statistical significance of β_1. We also test whether the diversification and the size reduce the return volatility. Negative and significant coefficients β_4 and β_1 in the model, using the return volatilities as the dependent variable, confirm the risk-reduction effect of the population diversification and the economies of scale effect. A vector of control variables include predictors that are commonly used in the empirical literature in the insurance industry such as the leverage, the ownership type, the group affiliation, and loss ratios.

For the longitudinal data of health insurers 2001 – 2011, we ran a fixed effect model for the unbalanced panel data. Year dummies are included in all models. As reported in the finance literature, a firm's diversification decision is possibly self-selected (Campa and Kedia, 2002 and Villalonga, 2004). To control for this potential endogeneity issue, we added the lag of the diversification measure as a predictor following previous literature (Berger et al., 2010 and Elango, et al., 2008). We also ran the Durbin-Wu-Hausman test of endogeneity to make sure that the endogeneity issue does not affect our model results.[13]

Besides the major analysis using the above statistical model for all observations in the sample, we examine the impact of the population diversification and the geographic diversification on firm performance and risk in subsamples. First, we partition the sample into a large insurer group and a small insurer group on the basis of policyholder member months. Second, we split the time period of the study into a before-crisis segment and a during-crisis segment. Subsample analyses provide robustness checks for main models and hypotheses tests. More importantly, the possible impact of firm size on some key predictors in the model is isolated, and we do observe differences on coefficients for large versus small insurers.

[13] Wooldridge, J. M., 2002, Econometric Analysis of Cross Section and Panel Data, The MIT Press, Page 118

It is necessary to examine the impact of diversification for small versus large insurers because economies of scale and scope might interact for large insurers.

Table 3 Correlation Matrix of Population diversification, Geographic Diversification and Size

All Insurers			
	PopDiver	GeoDiver	Size
PopDiver	1	0.0633	0.5332
GeoDiver	0.0633	1	0.1177
Size	0.5332	0.1177	1

Large Insurers in Member Month				**Small Insurers in Member Month**			
	PopDiver	GeoDiver	Size		PopDiver	GeoDiver	Size
PopDiver	1	0.0168	0.4499	PopDiver	1	0.0344	0.3037
GeoDiver	0.0168	1	0.0420	GeoDiver	0.0344	1	0.10351
Size	0.4499	0.0420	1	Size	0.3037	0.10351	1

All correlation coefficients are significant at 5% level

The correlation matrix in Table 3 sheds light on the positive correlation between firm size and population diversification. Various theories also explain this positive correlation. On the one hand, economies of scale are more likely to be realized for large insurers within individual lines of business because large insurers underwrite more insurance policies and maintain larger physician networks. On the other hand, large insurers possess marketing, physician network, administration cost, and managed care technique advantages, which are sharable across their lines of business. Therefore, in theory, large insurers are more likely to benefit from economies of scope. In other words, the positive impact on the firm performance contributed by economies of scope is hard to differentiate from economies of scale. But for small insurers, the diversification impact should be identified with much less interaction with size.

We further separate the sample in time-series and examine the impact of the diversification on performance before versus during the financial crisis. The risk-reduction effect predicts that more diversified insurers experience less income volatility. To interpret 'less income volatility' in another way, we are expecting to see relatively better performance of diversified insurers when the industry performed poorly on average in crisis years. During crisis years, insurers with historically more stable financial status are even more appealing to policyholders, which possibly enables diversified insurers to expand the product exposure or charge higher premiums. In this way, risk-reduction may contribute to the profit or the performance.

Preliminary Analysis

In this part, we examine some summary statistics. The major research question in this study are relationships between the diversification and the performance and the firm risk. The performance and variability in performance is explained above. We use ROA and ROC to measure returns. We use SD3ROA and SD3ROC to measure the firm risk. We find that insurers that are more diversified in product and geography experienced better returns and

lower firm risks in 2001 – 2011. From the perspective of economies of scale, large insurers also experienced better returns and lower firm risks in 2001 – 2011. Table 4 presents a snapshot of the health insurance industry (by size and performance) for insurers included in our study. Size is represented by mean total assets, mean comprehensive products total premium, and mean comprehensive products total member months. Performance is measured by the mean return on asset and the mean return on capital.

Table 4 Summary mean data for insurers with more than 70% of premium written in Comprehensive (Individual and Group), FEHBPs, Medicare, and Medicaid

Year	N	Total Assets	Comprehensive Products Total Premium Underwritten	Comprehensive Products Total Member Months	Return On Asset	Return On Capital
2001	350	$ 52,577,836,735	$126,937,203,729	719,528,169	2.11%	3.67%
2002	363	$ 56,877,947,352	$144,395,973,936	746,003,444	4.49%	9.10%
2003	389	$ 67,289,454,425	$157,531,659,461	745,953,992	7.57%	16.83%
2004	401	$ 75,690,650,496	$179,397,683,157	774,647,914	8.68%	17.84%
2005	434	$ 90,753,798,543	$202,556,928,564	808,963,951	8.28%	14.39%
2006	449	$ 101,740,843,417	$221,948,777,824	810,978,555	5.82%	12.75%
2007	459	$ 110,514,981,110	$241,763,087,173	830,711,121	7.09%	14.52%
2008	464	$ 108,054,315,304	$256,594,550,014	832,142,860	4.56%	7.86%
2009	446	$ 116,650,790,970	$276,041,457,506	845,891,373	2.48%	4.95%
2010	420	$ 124,686,892,403	$276,518,616,532	821,450,174	5.85%	10.11%
2011	376	$ 127,232,296,478	$276,781,070,629	787,546,985	6.66%	12.82%

Theoretical foundations support that both economies of scope and scale can possibly improve a firm's return and reduce the firm risk. In the following, we separate insurers in our sample in three dimensions: the population diversification level (*PopDiver*), the geographic diversification level (*GeoDiver*), and the size measured by total member months. For each dimension, we compare the historical mean returns and return volatilities.

Product-Diversified vs. Product-Specialized

To qualify as a product-diversified insurer, an insurer has a population diversification measure (*PopDiver*) of at least 0.5. Product-specialized insurers are defined as insurers with more than 70% of the premium written focusing on one of Comprehensive (individual and group), FEHBPs, Medicare, or Medicaid. Figure 3a shows mean ROA and ROC comparison of product-diversified vs. product specialized insurers. And Figure 3b shows the return volatilities (SD3ROA and SD3ROC) comparison. Product-diversified insurers experienced higher returns and lower return volatilities on average.

Figure 3a Mean ROA and Mean ROC Comparison between Product-Diversified vs. Product-Specialized Insurers

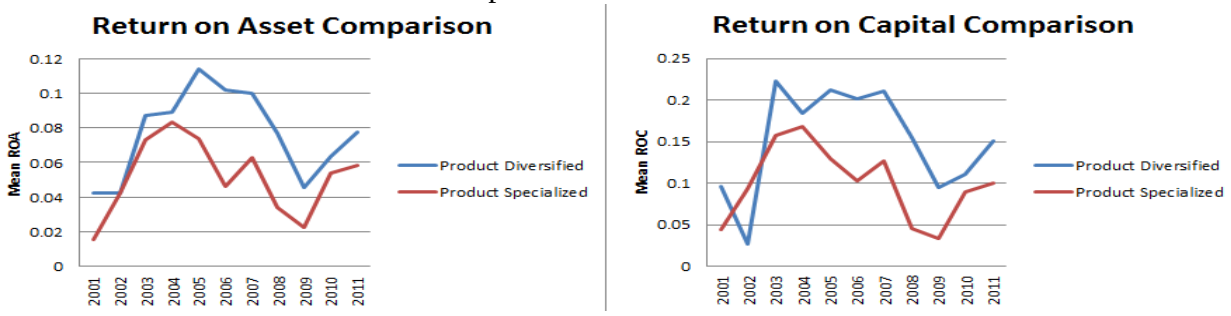
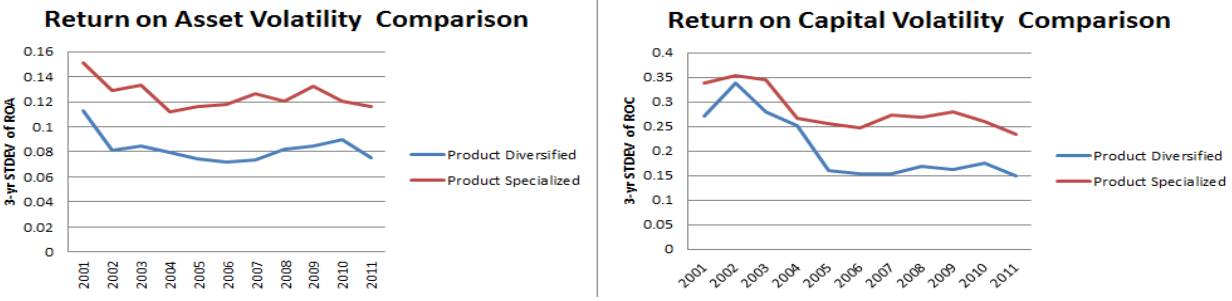


Figure 3b Mean SD3ROA and Mean SD3ROC Comparison between Product-Diversified vs. Product-Specialized Insurers



Geographic-Diversified vs. Geographic-Focused

Per Schedule T of the NAIC annual filing, where insurers record the geographic allocation of the premium written separated by product, most health insurers operate in one state. Therefore, we treat insurers operating in only one state as Geographic-Focused and the rest of insurers as Geographic-Diversified. Figure 4a shows the mean ROA and ROC comparison and Figure 4b compares the return volatilities. Geographic-diversified insurers experienced better returns and lower return volatilities. However, the difference between the two groups is not as significant as that found for population diversification.

Figure 4a Mean ROA and Mean ROC Comparison between Geographic-Diversified vs. Geographic-Focused Insurers

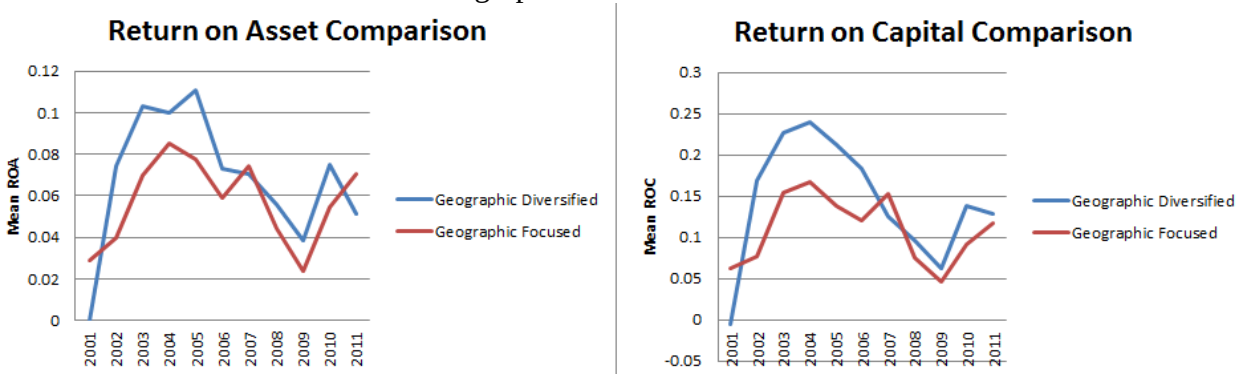
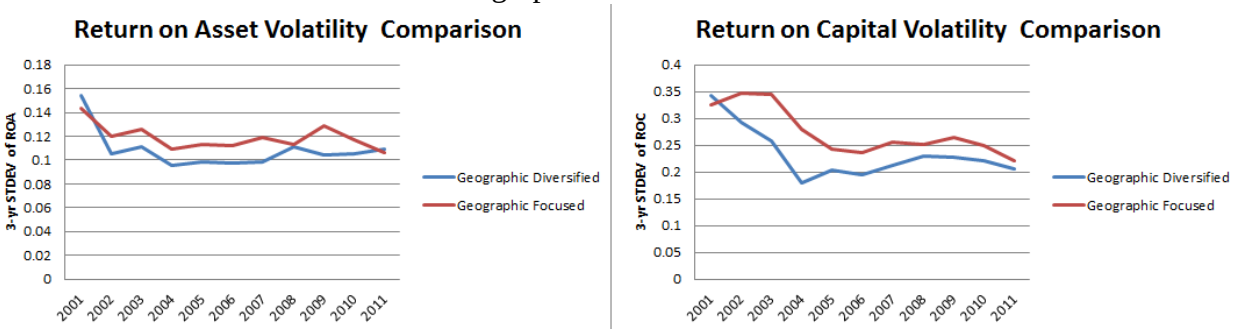


Figure 4b Mean SD3ROA and Mean SD3ROC Comparison between Geographic-Diversified vs. Geographic-Focused Insurers



Large vs. Small

We examine the total member months to separate insurers into large versus small, designating an insurer as large if its total member months underwritten is above the third quartile of the entire industry. Figure 5a shows mean ROA and ROC comparison of large vs. small insurers. And Figure 5b shows the return volatilities (SD3ROA and SD3ROC) comparison. Large insurers experienced higher returns and lower return volatilities significantly.

Figure 5a Mean ROA and Mean ROC Comparison between Large vs. Small Insurers

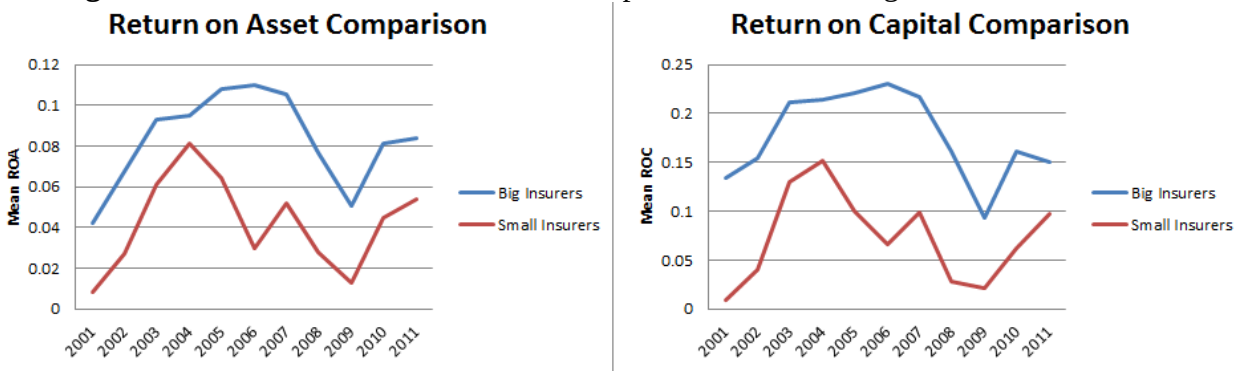
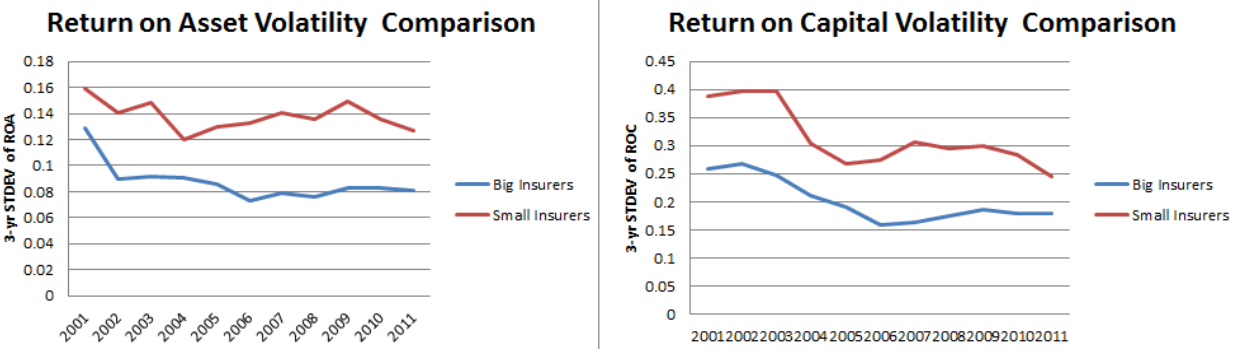


Figure 5b Mean SD3ROA and Mean SD3ROC Comparison between Large vs. Small Insurers



Section 5. Results

Performance – Diversification Relationship for All Insurers in the Sample

Table 5 shows empirical results of the fixed effect model for all 4,551 firm-years in our study. We run four models: the main model with lagged population diversification proxy *PopDiver* as one of the predictors; the model with an additional quadratic term – $PopDiver^2$; the model with the geographic diversification proxy *GeoDiver*; and the model with all three diversification proxies. Table 5a uses the return on assets (*ROA*) and the risk-adjusted return on assets (*RAROA*) as dependent variables. And Table 5b uses the return on capital (*ROC*) and the risk-adjusted return on assets (*RAROC*) as dependent variables. In the model using RAROA or RAROC as the dependent variable, asset risk-taking (*AssetRisk*) and the product risk-taking (*ProdExposure*) are left out because the left-hand-side return measure has been adjusted for risk.

Estimation results show strong evidence for economies of scale since the coefficients of *Size* are always positive and statistically significant at 1% level. Larger insurers do perform better than small insurers controlling for the other covariates. Controlling for the size effect, we find support for economies of scope. The coefficient of *PopDiver* is significant at 5% level using *ROA*. Consistent with the basic statistics observations in Section 4, health insurers with higher levels of population diversification perform better than specialized insurers. Results in Table 5a show just marginal support for the non-linear relationship between population diversification and firm performance as Elango, et al. (2008) found for US property-liability insurers. But results in Table 5b show significant coefficient for the quadratic terms. Therefore, there is not conclusive support for the non-linear relationship between the level of diversification and the firm performance for health insurers, either. Besides, we find that geographic diversification (*GeoDiver*) does not have statistically significant relationship with health insurers' performance in terms of ROA and RAROA. Health insurers that took more investment risks (*AssetRisk*) achieved poorer performance. Well capitalized insurers (*logCAP*) performed better on average. Consistent with the finding of Liebenberg and Sommer (2008) for property-liability insurance industry, stock insurers performed better than mutual insurers for the health insurance industry. But the group affiliation did not help performance.

Table 5a Fixed-Effect Models Using ROA and RAROA as Dependent Variables

Variable	ROA	RAROA	ROA	RAROA	ROA	RAROA	ROA	RAROA
Intercept	-0.3799	-5.5351	-0.3745	-5.5366	-0.3932	-5.5433	-0.3748	-5.5638
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Size	0.0237	0.4028	0.0234	0.4029	0.0257	0.4015	0.0234	0.4045
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
AssetRisk	-0.0186		-0.0183		-0.0157		-0.0183	
	(<.0001)		(<.0001)		(<.0001)		(<.0001)	
ProdExposure	0.0089		0.0083		0.0060		0.0083	
	(0.0057)		(0.0109)		(0.0442)		(0.0110)	
ProdDiver	0.0215	0.2286	0.0677	0.2370			0.0676	0.2376
	(0.0386)	(0.1836)	(0.0212)	(0.2054)			(0.0214)	(0.2042)
ProdDiver^2			-0.0751	-0.0212			-0.0750	-0.0204
			(0.0928)	(0.9096)			(0.0932)	(0.9129)
GeoDiver					0.0023	-0.2107	-0.0009	-0.1781
					(0.8644)	(0.3275)	(0.9469)	(0.4588)
logCAP	0.1317	1.2197	0.1305	1.2198	0.1259	1.1345	0.1305	1.2211
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Stock	0.0269	0.2506	0.0261	0.2501	0.0244	0.2124	0.0261	0.2556
	(<.0001)	(0.0048)	(<.0001)	(0.0049)	(<.0001)	(0.0068)	(<.0001)	(0.0042)
Group	0.0025	-0.1637	0.0028	-0.1639	-0.0051	-0.1657	0.0028	-0.1600
	(0.6348)	(0.0644)	(0.5993)	(0.0642)	(0.3095)	(0.0334)	(0.5974)	(0.0713)
OtherHealthLR	-0.0261	-0.1910	-0.0262	-0.1905	-0.0260	-0.1552	-0.0261	-0.1855
	(<.0001)	(0.0312)	(<.0001)	(0.0319)	(<.0001)	(0.0503)	(<.0001)	(0.0372)
Number of Obs.	3873	3868	3873	3868	4381	4423	3873	3868
Adj. R^2	0.1656	0.1141	0.166	0.1139	0.1655	0.1281	0.1658	0.1138

Numbers in parenthesis are p-values.

Results for year fixed effect are not reported for space limitation.

Table 5b Fixed-Effect Models Using ROC and RAROC as Dependent Variables

Variable	ROC	RAROC	ROC	RAROC	ROC	RAROC	ROC	RAROC
Intercept	-0.7899	-5.8333	-0.7685	-5.8307	-0.8631	-5.9535	-0.7613	-5.8531
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Size	0.0427	0.3511	0.0414	0.3509	0.0477	0.3630	0.0411	0.3521
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
AssetRisk	-0.0182		-0.0173		-0.0161		-0.0170	
	(0.0089)		(0.0130)		(0.0183)		(0.0149)	
ProdExposure	-0.0023		-0.0052		-0.0104		-0.0049	
	(0.7718)		(0.5114)		(0.1723)		(0.5320)	
ProdDiver	0.0203	0.4293	0.2673	0.4150			0.2685	0.4154
	(0.4352)	(0.0223)	(0.0003)	(0.0423)			(0.0003)	(0.0421)
$ProdDiver^2$			-0.4034	0.0365			-0.4055	0.0372
			(0.0004)	(0.8581)			(0.0004)	(0.8556)
GeoDiver					0.0264	-0.1446	0.0270	-0.1444
					(0.4537)	(0.5390)	(0.4412)	(0.5828)
Stock	0.0345	0.1124	0.0302	0.1133	0.0293	0.0477	0.0293	0.1178
	(0.0087)	(0.2432)	(0.0221)	(0.2401)	(0.0260)	(0.5749)	(0.0266)	(0.2238)
Group	0.0040	-0.07541	0.0052	-0.07522	-0.0180	-0.07282	0.0047	-0.0720
	(0.7611)	(0.4325)	(0.6913)	(0.4338)	(0.1717)	(0.3888)	(0.7226)	(0.4547)
OtherHealthLR	-0.0557	-0.21878	-0.0561	-0.2196	-0.0595	-0.16934	-0.0569	-0.2155
	(<.0001)	(0.0236)	(<.0001)	(0.0232)	(<.0001)	(0.0507)	(<.0001)	(0.0264)
Number of Obs.	3860	3859	3860	3859	4366	4412	3860	3859
Adj. R^2	0.0569	0.0816	0.0598	0.0814	0.0541	0.0918	0.0597	0.0812

Numbers in parenthesis are p-values.

Results for year fixed effect are not reported for space limitation.

Large versus Small Insurers

As we discussed in the methodology, size of insurers may interact with the diversification and the other control variables. We ran the models separately for small versus large insurers in terms of the member month. Table 6a shows results using ROA and ROC as dependent variables. And Table 6b shows results using RAROA and RAROC as dependent variables. The separation of insurers by size reveals a clearer picture. We can see that the population diversification actually relates positively to performance for small insurers in terms of ROA and RAROA. Geographic diversification relates positively to ROA and ROC for large insurers. Large insurers' sharable managed care skills and/or bargaining power dominated the monitoring and agency costs. The organizational form as a stock insurer only improves large insurers' performance, not the small ones.

Table 6a Fixed-Effect Models Using ROA and ROC for Small versus Large Insurers

Variable	Small Insurers				Large Insurers			
	ROA		ROC		ROA		ROC	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Intercept	-0.5347	<.0001	-0.8600	<.0001	-0.2084	0.0022	-0.5989	0.0008
Size	0.0347	<.0001	0.0485	<.0001	0.0137	<.0001	0.0332	<.0001
AssetRisk	-0.0210	<.0001	-0.0181	0.0841	-0.0164	<.0001	-0.0164	0.0567
ProdExposure	0.0004	0.9209	-0.0131	0.2167	0.0066	0.3113	0.0025	0.8828
PopDiver	0.0434	0.0074	0.0494	0.2230	0.0076	0.5150	-0.0061	0.8394
GeoDiver	-0.0375	0.1196	-0.0446	0.4573	0.0300	0.0309	0.0815	0.0241
logCAP	0.1474	<.0001			0.1098	<.0001		
Stock	0.0067	0.4099	-0.0019	0.9270	0.0362	<.0001	0.0645	0.0001
Group	-0.0003	0.9693	0.0047	0.7950	0.0053	0.4556	-0.0094	0.6093
OthHealthLR	-0.0281	0.0029	-0.0636	0.0067	-0.0177	0.0006	-0.0412	0.0022
Number of Obs.	2232		2225		1641		1635	
Adj. R^2	0.1627		0.0356		0.1647		0.0523	

Table 6b Fixed-Effect Models Using RAROA and RAROC for Small versus Large Insurers

Variable	Small Insurers				Large Insurers			
	RAROA		RAROC		RAROA		RAROC	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Intercept	-4.7144	<.0001	-3.8282	<.0001	-6.5109	<.0001	-8.0635	<.0001
Size	0.3772	<.0001	0.2482	<.0001	0.4354	<.0001	0.4602	<.0001
PopDiver	0.6160	0.0027	0.6528	0.0027	-0.3252	0.2852	-0.0983	0.7708
GeoDiver	-0.4973	0.1243	-0.6335	0.0642	0.0861	0.8137	0.2691	0.5096
logCAP	1.2606	<.0001			1.1631	<.0001		
Stock	0.1182	0.2741	0.0821	0.4713	0.3473	0.0330	0.2502	0.1664
Group	-0.2678	0.0057	-0.1050	0.2989	0.0121	0.9479	-0.1712	0.4072
OthHealthLR	-0.2695	0.0322	-0.3273	0.0139	-0.0865	0.5146	-0.1303	0.3777
Number of Obs.	2241		2231		1627		1628	
Adj. R^2	0.0997		0.0422		0.0762		0.0567	

Performance Volatility

If the risk-reduction effect exists, we are expecting to see lower return volatility for more diversified insurers. Using the 3-year standard deviation of ROA and ROC of insurers (SD3ROA and SD3ROC) as dependent variables, we run the fixed effect model for all insurers and small versus large insurers. Table 7 reports the estimation results. The level of population diversification (*PopDiver*) is negatively related to SD3ROA and SD3ROC for all insurers, which means that insurers with more population diversification experience lower performance

volatility. It is consistent with what the risk-reduction effect predicts. However, in the sub-sample analysis, we can see that the performance volatility reduction actually did not happen for small insurers, which is similar finding to Berry-Stoltz, et al. (2012) for U.S. property-liability insurance industry. Population diversification is significantly related to reduced performance volatility, consistent with our risk-reduction hypothesis. Opposite to the population diversification, the geographic diversification adds onto insurers' performance volatility for large insurers, but the results are only significant using SD3ROA, not SD3ROC. Meanwhile, the size effect in reducing return volatility prevails for both small and large insurers. Interestingly, health insurers with higher capital ratios experience lower performance volatility since the coefficient of logCAP is negative and always highly significant. Consistent with Table 5, higher capitalization is positively related to health insurers' performance and negatively related to the return volatility.

Table 7a Fixed-Effect Models Using SD3ROA

Variable	All Insurers		Small Insurers		Large Insurers	
	SD3ROA	P-Value	SD3ROA	P-Value	SD3ROA	P-Value
Intercept	0.3628	<.0001	0.3329	<.0001	0.3491	<.0001
Size	-0.0183	<.0001	-0.0188	<.0001	-0.0150	<.0001
AssetRisk	-0.0090	<.0001	-0.0142	<.0001	-0.0027	0.2804
ProdExposure	0.0089	0.0009	0.0110	0.0031	-0.0012	0.8114
PopDiver	-0.0207	0.0149	-0.0163	0.2274	-0.0252	0.0043
GeoDiver	0.0294	0.0111	0.0291	0.1511	0.0300	0.0046
logCAP	-0.0252	<.0001	-0.0284	0.0001	-0.0201	0.0003
Stock	-0.0058	0.1771	-0.0080	0.2411	0.0051	0.2915
Group	0.0010	0.8211	0.0033	0.6033	-0.0013	0.8086
Number of Observations	3875		2234		1641	
Adj. R^2	0.0947		0.0484		0.0810	

Table 7b Fixed-Effect Models Using SD3ROC

Variable	All Insurers		Small Insurers		Large Insurers	
	SD3ROC	P-Value	SD3ROC	P-Value	SD3ROC	P-Value
Intercept	0.6960	<.0001	0.3672	0.0033	0.8639	<.0001
Size	-0.0390	<.0001	-0.0241	0.0002	-0.0430	<.0001
AssetRisk	-0.0101	0.0952	-0.0224	0.0164	-0.0003	0.9589
ProdExposure	0.0213	0.0020	0.0147	0.1255	0.0092	0.4754
PopDiver	-0.0513	0.0204	-0.0224	0.5190	-0.0571	0.0135
GeoDiver	0.0293	0.3297	0.0208	0.6921	0.0458	0.0987
logCAP	-0.2479	<.0001	-0.2625	<.0001	-0.2147	<.0001
Stock	0.0089	0.4264	0.0130	0.4633	0.0030	0.8126
Group	0.0220	0.0528	0.0370	0.0226	0.0139	0.3239
Number of Observations	3874		2234		1640	
Adj. R^2	0.1527		0.1141		0.2039	

Diversification Impact Over Time

To examine the impact of product and geographic diversification and size in normal versus crisis years, we separate the sample into before-crisis (2001 – 2006) and during- crisis (2007 – 2011) segments. Table 8a and 8b report the fixed-effect estimation results using ROA and ROC as dependent variables. It is interesting to see that the population diversification helped small insurers improve the performance during the crisis years since the coefficient of *PopDiver* is only significant after 2006 for small insurers. Geographic diversification improved large insurers' performance during the crisis years, where the *GeoDiver* is significant for large insurers. These observations confirm that diversified insurers perform better in crisis years. Also, only large insurers organized as stock insurers experienced higher ROA across two time periods, which is consistent with the finding in Table 6a.

Table 8a Fixed-Effect Models Using ROA as Dependent Variable

ROA as Dependant Variable	Small Insurers				Large Insurers			
	2001 – 2006		2007 – 2011		2001 – 2006		2007 – 2011	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Intercept	-0.5992	<.0001	-0.5611	<.0001	-0.1580	0.0631	-0.2599	0.0180
Size	0.0326	<.0001	0.0369	<.0001	0.0131	0.0016	0.0151	0.0031
AssetRisk	-0.0370	<.0001	-0.0160	0.0031	-0.0133	0.0031	-0.0193	0.0002
ProdExposure	0.0006	0.9226	0.0001	0.9912	0.0137	0.0929	0.0001	0.9888
PopDiver	0.0278	0.2026	0.0543	0.0215	-0.0038	0.8021	0.0182	0.3068
GeoDiver	-0.0422	0.3450	-0.0388	0.1933	0.0147	0.4424	0.0415	0.0383
logCAP	0.1272	<.0001	0.1738	<.0001	0.1334	<.0001	0.0906	<.0001
Stock	-0.0066	0.5402	0.0206	0.0848	0.0353	<.0001	0.0388	<.0001
Group	0.0009	0.9225	-0.0006	0.9557	0.0043	0.6448	0.0048	0.6483
OthHealthLR	-0.0316	0.0276	-0.0250	0.0492	-0.0080	0.2867	-0.0251	0.0005
Number of Obs.	1033		1199		814		827	
Adj. R^2	0.1688		0.1600		0.2126		0.1436	

Table 8b Fixed-Effect Models Using ROC as Dependent Variable

ROC as Dependant Variable	Small Insurers				Large Insurers			
	2001 – 2006		2007 – 2011		2001 – 2006		2007 – 2011	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Intercept	-1.0429	<.0001	-0.7767	<.0001	-0.5380	0.0179	-0.6642	0.0181
Size	0.0490	<.0001	0.0489	<.0001	0.0330	0.0027	0.0360	0.0057
AssetRisk	-0.0566	0.0035	-0.0027	0.8291	-0.0041	0.7312	-0.0287	0.0244
ProdExposure	-0.0183	0.2238	-0.0116	0.4383	0.0216	0.3142	-0.0170	0.5208
ProdDiver	-0.0289	0.6254	0.1129	0.0432	-0.0387	0.3358	0.0245	0.5899
GeoDiver	0.0633	0.5988	-0.0787	0.2634	0.0598	0.2396	0.1008	0.0498
Stock	-0.0357	0.2228	0.0265	0.3443	0.0631	0.0043	0.0714	0.0048
Group	-0.0087	0.7394	0.0178	0.4864	-0.0120	0.6321	-0.0095	0.7259
OthHealthLR	-0.0395	0.3081	-0.0803	0.0069	-0.0138	0.4903	-0.0608	0.0010
Number of Obs.	1030		1195		810		825	
Adj. R^2	0.0324		0.0351		0.0221		0.0580	

Section 6. Conclusions and implications for PPACA

See the whole section 2. The Patient Protection and Affordable Care Act (ACA) of 2010 has restructured the healthcare industry since its implementation. As the financial intermediaries in the US healthcare system, health insurance companies have faced many changes. One important change to the industry's mix of covered populations results from the

expansion of Medicaid and the requirement that all Americans have health insurance. A new mechanism to obtain coverage also has been introduced in the form of health insurance exchanges featuring more "government-regulated standardized health insurance plans." Health insurance companies can opt to be listed as providers. Since the initial open enrollment on October 1st 2013, there have been 311 health insurers listed in the health insurance exchanges in all states as of Jan. 2015.[14] To be listed as a provider in the health insurance exchanges gives health insurers the opportunity to expand into the individual comprehensive health insurance market. The existence of the exchanges also has influenced the group comprehensive health insurance markets. As published in the media, some large employers have already planned to give their employees the money to buy their own coverage through the health insurance exchange.[15] It is foreseeable that the group comprehensive insurance business will go through more changes when the health insurance marketplace is open to large employers by 2017.[16] Simultaneously, there are changes in Medicaid since 27 states adopted Medicaid expansion by March 2014 (see Kaiser Family Foundation report in March 215).[17] Insurers have begun to strengthen their Medicaid and Medicare businesses by merger and acquisition.[18] At this juncture, health insurers' product portfolio composition as shown by the health insurance population mix is expected to change. Since the diversification or economies of scope is known to impact firms' performance, we have examined the economies of scope of health insurers in relationship to their performance.

Our study ends up with a number of interesting findings:

First, economies of scale prevail strongly. Large insurers measured by size always experience better performance and lower performance volatility.

Second, measured by return on assets (ROA) and return on capital (ROC), the performance of small health insurers is positively related to the population diversification and the performance of large health insurers is positively related to the geographic diversification. The population diversification relates positively to small health insurers' performance. And the geographic diversification relates positively to large insurers' performance. The relationships are stronger in crisis years (after 2007) than in normal years, as shown in Table 8a. Thus, economies of scope are supported in the health insurance industry even for limited insurers.

Third, measured by the three-year standard deviation of the return on assets (SD3ROA) and the return on capital (SD3ROC), the performance volatility of large health insurers is negatively

[14] Data source: http://kff.org/other/state-indicator/number-of-issuers-participating-in-the-individual-health-insurance-marketplace/#note-1 as of January 2015

[15] International Business Machines Corp. plans to move 11,000 retirees off the company-sponsored health plans and give them a payment to buy coverage on the health insurance exchange. IBM to Move Retirees Off Health Plan, Wall Street Journal, September 7th 2013.
Time Warner has the same plan as IBM regarding the retiree health plan. Time Warner Joins IBM in Health Shift for Retirees, Wall Street Journal, September 8th 2013

[16] Health Insurance Markets, also known as Health Insurance Exchange Fact Sheet, Cigna how do we get this information?

[17] Source: http://kff.org/health-reform/state-indicator/state-decisions-for-creating-health-insurance-exchanges-and-expanding-medicaid/

[18] Aetna-Coventry Merger Reflects a Changing Industry After Health Care Reform, The Huff Post, August 20th, 2012, http://www.huffingtonpost.com/2012/08/20/aetna-coventry-merger_n_1810821.html

related to population diversification and positively related to geographic diversification. Population diversification is negatively related to large insurers' performance volatility, which supports the risk-reduction effect. However, geographic diversification is positively related to the performance volatility.

Finally, we also find that capitalization is positively related to health insurers' performance and negatively related to the performance volatility. More investment risk-taking lowers health insurers' performance. Consistent with Liebenberg and Sommer (2008), stock insurers perform better than mutual insurers in the health insurance industry, particularly for large insurers.

In financial service industries, the performance-diversification relationship has been studied in the life/health insurance, the property-liability insurance, and the banking industries. Our work enriches the insurance literature by examining the health insurance industry. We find evidence of both economies of scale and economies of scope for the US health insurance industry. Besides the industry-wide study, we examine large versus small insurers in terms of member months. The finding shows the different impact of population diversification and geographic diversification on small versus large insurers' performance. Moreover, we examine the impact of population and geographic diversification on large versus small insurers in different time periods, which also supports our results. More importantly, we examine how performance volatility is related to product and geographic diversification. We find support for the risk-reduction effect of diversification in US health insurance industry.

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