The Effects of Product Diversification on Firm Performance Revisit: A Non-linear Prospective

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1. Introduction & Motivation

The effect of diversification on firm performance has been examined extensively in the literature of financial service industry (Berge and Ofek, 1995; Berger, Cummins, Weiss, and Zi, 2000). The debate arises from the conflicting theoretical bases underlying between conglomerate theory and strategic focus theory. The conglomerate theory argues that firms operating in multi-segments can benefit from the scope economics by sharing costs in similar business lines, and charging a higher price for providing "one-stop-shopping" convenience to customers (Teece, 1980; Herring and Santomero, 1990; Markides, 1992; Cummins, Weiss, and Zi, 2000). On the other hand, strategic focus theory advocates that companies focusing on the core business can maximize their value, alleviate the agency costs, and be more efficient (Jensen, 1986; Meyer, Milgrom, and Roberts, 1992).

In the strand of studies examining the diversification effect, little evidence has been found to support the conglomerate theory in the insurance industry. The lack of empirical support indicates that the costs associated with diversification may outweigh the benefits. Thereby, diversifying firms' business decreases the value of the firm. However, why do we still observe the coexistence of diversified and specialized companies in insurance industry? With that being in mind, this paper first attempts to revisit the diversification-performance relationship from a non-linear perspective.

The underlying assumption of a majority of studies that examines the effect of diversification on firm performance lies in a linear relationship. Researchers postulate that the diversification-performance relation follows an Inverted-U shape (Lind and Mehlium, 2010; Santalo and Becerra, 2004). Since the costs of diversifying to unrelated businesses might offset or even outweigh the benefits, and thereby the positive effect of diversification is diminishing after increasing the number of business line to a certain level. Conceptually, the Inverted-U shape

relation might provide a better understanding of why diversified firms have taken up to 87% of total firms in Property/Liability industry, regardless a majority of literature supports the strategic focus theory. [1]

The second goal of this research is to investigate whether diversification can provide a "buffer" effect for firms when facing financial crises. As Kuppuswamy and Villalonga (2016) proposed, diversification discount can be viewed as an insurance premium that investors pay for the stable states, due to the underlying drivers of diversification may vary across different economic conditions. If this is the case, for Property/Liability insurers, who play a role of risk bearing, diversification may become an important risk management strategy for them.

Taken together, this study contributes to the literature by attempting to solve the following two research questions: (1) To test whether there is a non-linear diversification-performance relationship, specifically, an inverted U-shape relation. If it is true, an optimal level of diversification can be constructed; (2) To test the interaction between diversification and financial crisis. As many studies have tested that insurance companies are not the cause of systemic risk, but victim instead. Moreover, evidence shows that P/L insurers did not suffer great losses during the crisis, compared to life insurers and other financial institutions. Therefore, it is interesting to know whether diversification plays a role during the financial crisis.

1. Brief Literature Review and Hypotheses Development

Every strategy comes with costs and benefits, so does diversification. Diversification benefits a firm by scope economics, larger internal capital market, and risk pooling (Teece,1980; Williamson,1975; Stein,1977; Cummins and Trainar, 2009). The two main costs stem from diversification decision are agency costs and inefficient internal capital market. Diversification

[1] 87% is the average percentage of number of diversified firms during 2005 to 2014. Data is from National Association of Insurance Commissioners (NAIC) annual reports. In the sample, firms with negative direct premium written, assets, and surplus are not included.

may magnify the agency costs through insufficient monitoring mechanism to control managers' decision making for each division (Harris, Kriebel, and Raviv, 1982; Rotemberg and Saloner, 1994). On the other hand, even diversification allows firms to access larger internal capital market, firms might not fully utilize the capital in new growth opportunities. Instead, firms subsidize the poor-performing business by the new internal capital (Rajan, Servaes, and Zingales, 2000). However, the net effect of diversification is not inclusive. A significant portion of literature document a diversification discount that diversified firms, on average, have a lower return than single-segment firms (Lang and Stulz, 1994; Berger and Ofek, 1995; Liebenberg and Sommer, 2008). On the other hand, researchers also argue that diversification did not destroy firm value. Instead, firms are traded at a discount before they choose to diversify (Villalonga, 1999; Campa and Kedia, 2002).

In this paper, I argue that the diversification-performance relation is not linear, which means is neither strictly positive nor strictly negative. Since firms normally would choose to diversify to related business such that they can explore growth opportunities at a lower cost, therefore, with some degree of diversification is performance enhancing. If firms, however, chase after the benefits to an extreme, the costs may outweigh the benefits. Thus, when firms over-diversified, the diversification benefits are diminishing, to some extreme, even harmful to firms' performance. As a result, I postulate the following hypothesis:

Hypothesis 1: The diversification-performance relationship follows an Inverted-U shape relation.

Several studies have found significant decreases in firm performance during the crisis (Campello et al. 2010; Invashina and Scharfstein, 2010). Specifically, Kuppuswamy and Villalonga (2016) look at how the effect of financial crisis differ between the conglomerate and single-segment firms. They found that financial crisis intrinsically increases diversification value

through better access to the credit market and efficient utilization of internal capital market. As a result, diversification serves as insurance in bad states, and the diversification discount serves as premium in stable states. Since Property/Liability insurers always play a role of risk bearing and risk management, the risk buffering function of diversification might be more important for these insurers. Thus, the second hypothesis as follow:

Hypothesis 2: In facing the financial crisis, the diversified firms would have higher performance than their specialized counterparties.

2. Data and Methodology

2.1. Data

The data source is National Association of Insurance Commissioners (NAIC) database for Property/Liability insurers from 1995-2015. The data is from annual regulatory statement filed with NAIC at the firm level. Standard screening has been conducted, which refers to that firms with non-positive total admitted assets, non-positive surplus, and non-positive direct premium written. Firms that under regulatory scrutiny are also excluded. The final sample consists 21,223 firm-year observations. I also aggregate affiliated insurers into group level, because most of the diversification decisions are made in the group level management. The detail variable definition and descriptive statistics are presented in Table 1.

2.2. Methodology

i. Test for Inverted-U shape

a. Regression model

$$ROA_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Multiline_{it} + \beta_3 Lines_{it} + \beta_4 Lines_{it}^{\ 2} + e_{it} \qquad (1)$$

Where X_{it} is a set of exogenous observable characteristics of the firm.[2]

[2] The control variables are firm size, capitalization, ownership structure, geographic diversification, industry concentration, group status, and publicly traded status (might be more).

$Multiline_{it}$ is a dummy variable that equals to 1 if the firm operates in more than one business line.

e_{it} is the error term.

b. 2SLS model

To control for the endogeneity problem of the diversification decision, I intend to construct an instrument that uses the Probit model to estimate the firm's diversification decision, as showed in equation (2). The set of instruments for Multiline includes the predicted value from the Probit model, two year lagged values of firm characteristics, industry growth, and general economic growth.

$$Multiline_{it}^{*} = \delta Z_{it} + \mu_{it} \qquad (2)$$

$$Multiline_{it} = 1 \; if \; Multiline_{it}^{*} > 0$$

$$Multiline_{it} = 0 \; if \; Multiline_{it}^{*} < 0$$

Where $Multiline_{it}^{*}$ is an unobserved latent variable.

Z_{it} is a set of firm characteristics that affect the decision to diversify, including all exogenous control variables and instruments.

μ_{it} is the error term.

c. Heckman two-step model

To control for the self-selection problem, I would use Heckman two-step procedure to estimate the parameters. Assuming the errors in equation (1) and (2), e_{it} and μ_{it}, have a bivariate normal distribution with means zero, standard deviation σ_e and 1, moreover, with correlation ρ, then we have the following.

$$\mathrm{E}(V_{it}|Multiline_{it} = 1) = \alpha_0 + \alpha_1 X_{it} + \alpha_2 + E(e_{it}|Multiline_{it} = 1)$$

$$\mathrm{E}(e_{it}|D_{it} = 1) = \rho\sigma_e\lambda_1(\delta Z_{it}), \text{ where } \lambda_1(\delta Z_{it}) = \frac{\phi(\delta Z_{it})}{\Phi(\delta Z_{it})}.$$

$\phi(.)$ and $\Phi(.)$ are the density and cumulative distribution functions, respectively, of the standard normal. Similarly, the expected value for single-segment firms as follows,

$$\mathrm{E}(e_{it}|Multiline_{it}=0)=\rho\sigma_e\lambda_2(\delta Z_{it}), where\ \lambda_2(\delta Z_{it})=\frac{-\phi(\delta Z_{it})}{1-\Phi(\delta Z_{it})}.$$

The difference in the value of single-segment and diversified firms is given by

$$\mathrm{E}(V_{it}|Multiline_{it}=1)-\mathrm{E}(V_{it}|Multiline_{it}=0)=\beta_2+\rho\sigma_e\frac{\phi(\delta Z_{it})}{\Phi(\delta Z_{it})(1-\Phi(\delta Z_{it}))} \quad (3)$$

In equation (3), the right-hand side is the coefficient of Multiline in equation (1), estimated by OLS. Therefore, it indicates that the estimator from OLS would be biased upward (downward) if ρ is positive (negative).

Thus, using Heckman's two-step procedure, I will first estimate equation (2) using a Probit model to get the consistent estimates of δ, denoted by $\hat{\delta}$. Next, estimate the λ_1 and λ_2, the correction for self-selection. In the second step, I estimate the β by estimating

$$V_{it}=\beta_0+\beta_1X_{it}+\beta_2Multiline_{it}+\beta_\lambda[\lambda_1(\hat{\delta}Z_{it})\times Multiline_{it}+\lambda_2(\hat{\delta}Z_{it})\times(1-Multiline_{it})]+\eta_{it}$$

$$=\beta_0+\beta_1X_{it}+\beta_2Multiline_{it}+\beta_\lambda\lambda+\eta_{it} \quad (4)$$

Where $\beta_\lambda=\rho\sigma_e$

ii. Interaction with financial crisis indicators

Equation (5) is the main equation to test the interaction effect between diversification and financial crisis, while the results from 2SLS and Heckman two-step procedure would also be reported.

$$ROA_{it}=\beta_0+\beta_1X_{it}+\beta_2Multiline_{it}+\beta_3Lines_{it}+\beta_4{Lines_{it}}^2+\beta_5Lines_{it}\times FC_{it}+e_{it} \quad (5)$$

Where FC_{it} is a dummy variable, equals to 1 if it is in financial crisis period

3. Empirical results

Results for the effect of diversification strategy on ROA and the test for non-linearity by using three estimation methods are presented in Table 2. Column 1 is estimated by OLS, and column 2 reports the results from 2SLS. Results from Heckman procedure are reported in column 3.

The coefficient on key explanatory variable multiline is negative and significant in OLS and Heckman model, but it is not significant under the 2SLS after addressing endogeneity issue. This finding supports the strategic focus theory that diversified firms exhibit ROA than its focused counterparts. The following explanations will focus on the results from Heckman regression. The significant positive coefficient on Lines indicates increasing the number of product line will have a positive impact on ROA. This may provide some insights that diversifying can benefit from cost or revenue scope economies. However, the significantly negative coefficient on the quadratic term of Lines shows that this relationship is non-linear. As the number of product line increases, the positive effect diminishes. This is coincided with the hypothesis that moderate product line diversification has positive impact on firm performance, but if diversifying into an extreme degree, the positive impact will vanish. Based on the coefficient from Heckman regression, we can construct the optimal line of business.[3]

The significant negative coefficient on WCONC indicates that firms operate in a high competition line of business would have lower ROA. Larger firms have higher ROA and firms with higher surplus to asset ratio also have higher ROA, supporting the hypothesis that customers are willing to pay more for insurance from low solvency risk insurers. The positive coefficient on SDROA indicates that higher return volatility results in higher return, which supports the risk-

[3] Use the coefficient from Heckman regression, we can solve the quadratic equation with one unknown. The optimal number of business line is 10. The next step is tempting to link the optimal number of business lines with the relatedness of business lines, such that to confirm the hypothesis that firms choose to diversify into related business first, and unrelated business later.

return theory. Additionally, there is no significant performance difference between mutual and stock insurers, neither as group and unaffiliated insurers.

The results of diversification effect on return on assets during the financial crisis are reported in Table 3. The coefficients on other control variables are consistent with the prior table. The significantly negative coefficient on the interaction term of number of business line and financial crisis indicator contradicts the hypothesis, showing that there is no "buffering" effect for diversified insurers during the financial crisis. Specifically, insurers increase one additional line of business in the financial crisis period will lead to 0.095% decrease in ROA. An explanation for this contraction is that because insurers choose to diversify into related business first, therefore, if financial crisis has impact on one business line, it is highly possible that other business lines of a diversified insurers also suffer from the losses. As a result, diversification strategy does not provide a "buffering" effect in insurance industry when facing crisis or recession.

4. Conclusion

This study revisits the diversification-performance (D-P) relationship in property-liability industry, and contributes to the literature by attempting to solve the following two research questions: (1) To test whether there is a non-linear diversification-performance relationship, specifically, an inverted U-shape relation. The empirical results confirm the D-P relationship follows an inverted U-shape. ROA increases along with the increase of number of business lines, but at a decreasing rate. The results are consistent with prior studies, supporting the strategy focus theory that diversified insurers exhibit lower ROA than focused insurers. The second question is to test the interaction between product diversification and financial crisis to investigate whether product diversification provides a "buffering" effect during the crisis. The findings do not support this hypothesis, where increasing number of business lines during the financial crisis results in a lower ROA. This finding is different from that of Kuppuswamy and Villalonga (2016), the reason

may be the difference between insurance industry and other financial services. Insurers are more likely to diversify into related business first, therefore, related businesses are more likely to suffer losses from financial crisis at the same time, such that the “buffering” effect will not hold in insurance industry.

Table 1

Variable Definitions and Descriptive Statistics 1995-2015

Variable	Definition	Mean	Median	Standard Deviation
ROA	Netincome/total admitted assets	0.021	0.026	0.093
SDROA	Standard deviation of ROA over past 5 years	0.024	0.024	0.094
LINES	Number of lines in which firm has positive direct premium written(DPW)	5.19	5.00	3.84
MULTILINE	=1 if LINES>1, 0 otherwise	0.794	1.00	0.405
SIZE	Natural logarithm of total admitted assets	19.93	17.58	2.5
CAPASSET	Policyholder surplus/total admitted assets	0.471	0.42	0.242
g_HHI	Herfindahl index of DPW across 57 geographic areas	0.72	0.805	0.32
phhi	Herfindahl index of DPW across 23 product line	0.62	0.48	0.28
WCONC	Weighted sum of market share per line multiplied by line specific Herfindahl	0.05	0.05	0.02
MUTUAL	=1 if firm is a mutual, 0 otherwise	0.34	0.00	0.47
GROUP	=1 if firm is a group, 0 otherwise	0.36	0.00	0.48

Table 2
Diversification Effect on Return on Assets

VARIABLES	(1) OLS	(2) 2SLS	(3) HECKMAN
multiline	-0.00837***	0.0504	-0.0775***
	(0.00316)	(0.0326)	(0.0256)
Lines	-6.36e-05	-0.0106	0.00168**
	(0.000617)	(0.00678)	(0.000748)
Lines_s	-1.56e-05	0.000529	-8.43e-05***
	(3.86e-05)	(0.000354)	(3.17e-05)
phhi	-4.60e-06	7.65e-06	-8.96e-06
	(8.81e-06)	(1.43e-05)	(1.69e-05)
WCONC	0.000326	-0.00101	-0.00640***
	(0.00103)	(0.00149)	(0.00184)
g_HHI	1.11e-07**	2.69e-07***	-0.000312
	(5.22e-08)	(5.47e-08)	(0.000507)
group	-0.00705	0.00150	0.00783
	(0.00475)	(0.00602)	(0.00687)
mutual	-0.00385**	0.00192	0.00519
	(0.00194)	(0.00165)	(0.00357)
size	0.00424***	0.00163	0.00192*
	(0.00108)	(0.00114)	(0.00110)
capasset	0.0640***	0.0320***	0.0474***
	(0.0137)	(0.00981)	(0.0159)
SDROA	0.288*	0.700***	0.589***
	(0.173)	(0.198)	(0.188)
reinuse			-0.00201**
			(0.000953)
age			0.00508***
			(0.00110)
Constant	-0.0690***	-0.0475***	0.408***
	(0.0176)	(0.0142)	(0.0283)
Observations	17,374	15,030	16,101
R-squared	0.140	0.250	0.290

Note: The dependent variable is ROA. OLS is an ordinary least squares regression model with year dummies. 2SLS is a two-stage least squares regression. The first stage regression is a logistic regression of Multiline on a set of excluded instruments (ages, reinsurance use) and all other explanatory variables from equation (1). Heckman is a two-step treatment effects regression that includes a parameter that controls for selectivity bias. The same instruments are used as in 2SLS. Multiline is equal to one for diversified insurers, and zero otherwise. Size is equal to the natural logarithm of total admitted assets. Capasset is the ratio of policyholder surplus to total admitted assets. G_HHI is the Herfindahl index of premiums written across 57 geographic areas. WCONC is the weighted sum of firm market share per line multiplied by each line's Herfindahl index. Group equals to one for aggregated groups, zero otherwise. Mutual equals to 1 if the ultimate ownership form is mutual, zero otherwise. SDROA is the standard deviation of ROA over the past five years.

Table 3
Diversification Effect on Return on Assets during Financial Crisis

	(1)	(2)	(3)
VARIABLES	OLS	2SLS	HECKMAN
multiline	-0.00749**	0.0381	-0.0797***
	(0.00314)	(0.0240)	(0.0255)
Lines	0.000105	-0.00761	0.00220***
	(0.000556)	(0.00518)	(0.000783)
Lines_s	-1.17e-05	0.000378	-0.000107***
	(3.25e-05)	(0.000272)	(3.28e-05)
Line*FC	-0.000647***	-0.000895***	-0.000954***
	(0.000232)	(0.000310)	(0.000243)
phhi	3.73e-06	1.51e-05	-8.47e-06
	(9.34e-06)	(1.50e-05)	(1.72e-05)
WCONC	-0.000940	-0.00207	-0.00576***
	(0.00108)	(0.00156)	(0.00177)
g_HHI	8.60e-08	2.39e-07***	-0.000298
	(5.25e-08)	(5.46e-08)	(0.000495)
group	-0.00619	0.00165	0.00664
	(0.00475)	(0.00589)	(0.00676)
mutual	-0.00430**	0.00126	0.00516
	(0.00189)	(0.00158)	(0.00360)
size	0.00409***	0.00162	0.00199*
	(0.00108)	(0.00117)	(0.00109)
capasset	0.0631***	0.0315***	0.0477***
	(0.0132)	(0.00951)	(0.0159)
SDROA	0.288*	0.701***	0.590***
	(0.174)	(0.198)	(0.189)
reinuse			-0.00201**
			(0.000953)
age			0.00509***
			(0.00110)
Constant	-0.0770***	-0.0441***	0.408***
	(0.0165)	(0.0151)	(0.0283)
Observations	17,374	15,030	16,101
R-squared	0.130	0.248	

Note: The dependent variable is ROA. OLS is an ordinary least squares regression model with year dummies. 2SLS is a two-stage least squares regression. The first stage regression is a logistic regression of Multiline on a set of excluded instruments (ages, reinsurance use) and all other explanatory variables from equation (1). Heckman is a two-step treatment effects regression that includes a parameter that controls for selectivity bias. The same instruments are used as in 2SLS. Multiline is equal to one for diversified insurers, and zero otherwise. FC equals to 1 if it is in year 2007 to 2009. Line*FC is the interaction term between number of lines and financial crisis indicator. Size is equal to the natural logarithm of total admitted assets. Capasset is the ratio of policyholder surplus to total admitted assets. G_HHI is the Herfindahl index of premiums written across 57 geographic areas. WCONC is the weighted sum of firm market share per line multiplied by each line's Herfindahl index. Group equals to one for aggregated groups, zero otherwise. Mutual equals to 1 if the ultimate ownership form is mutual, zero otherwise. SDROA is the standard deviation of ROA over the past five years.

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