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Equity Investment Decisions of Operating Firms: Evidence from Property and Liability Insurers

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Abstract: During the 2007–2009 financial crisis, almost 10% of Property and Liability (P&L) insurers completely liquidated their equity portfolios, and more than half of them never resumed equity market investments. In contrast, those P&L insurers that continued investing in equities after the crisis, increased their portfolio allocation substantially. To understand these findings, we develop and estimate models that explain P&L insurers' dynamic equity investment decisions, in terms of firm, group, and market characteristics over the period 2002–2018. We study three different approaches to equity investments, a pure investment strategy, internal capital market contributions, and an outsourcing option and find that the factors driving the decision to invest in equities differ from those that explain the extent of their equity investments. Moreover, we find that while equity portfolio losses drive the decision to temporarily cease investments in equities, the decision to permanently exit equity markets is driven by both equity market losses and underwriting losses. These findings shed some light on the factors driving the demand for equity investments by operating firms.

Keywords: equity investments; property and liability insurers; financial crisis



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1. Introduction

Property and Liability (P&L) insurers tend to hold a significant amount of equities in their investment portfolios. In 2019, they held over USD 500 billion in equities, which accounted for 27% of their total investments.¹ However, during the 2007–2009 financial crisis, almost 10% of P&L insurers completely liquidated their equity portfolios and more than half of them never resumed equity market investment.² In contrast, those insurers that continued investing in equities after the crisis increased their portfolio allocation substantially. The existing literature does not provide explanations for the insurers' dynamic choice to participate in equity markets or the amount of their investment. The institutional equity investment literature focuses on mutual funds and hedge funds; however, Ge and Weisbach (2020) argue that insurers are mainly operating companies who depend on the returns from their investments on financial assets to fund their operations.

There is very little research about the determinants of financial investments by operating firms, despite their importance in financial markets.³ In this study, we shed some light on the investment decisions of operating firms by studying the determinants of P&L insurers' equity investments. In particular, we model P&L equity investments as a function of firm, group, and market characteristics and examine how their investment decisions may differ in terms of participation and volume. We study three different approaches to equity investments, a pure investment strategy, internal capital market contributions, and an outsourcing option. Moreover, we provide a dynamic analysis of P&L insurers' investment behavior and focus on examining the impact of negative operational and investment shocks (caused by the financial crisis) on equity market investments.

We study US P&L insurers since (1) they have a substantial amount of funds to invest due to the time discrepancy between premiums earned and claims paid out;⁴ (2) there is a significant number of equity investing P&L insurers and, more importantly, approximately

an equal number of non-equity investing peers;⁵ and (3) detailed portfolio data are available for the insurance industry. All licensed insurers (whether public or private) are required to report highly detailed and complete accounts of their investment activities. In particular, equity investments are separately reported for affiliated firms, unaffiliated firms, and mutual fund holdings, which enables us to investigate the effects of pure investment strategies, Internal Capital Markets (ICMs), and of having an option to outsource the insurers' equity investment decisions.⁶

The existing literature on P&L insurers' investment in risky assets, such as equity, primarily depends on three theories. The risk management theory of [Smith and Stulz \(1985\)](#) and [Froot et al. \(1993\)](#) predicts that firms with weak financial conditions should decrease their investments in risky assets, while the risk shifting theory of [Jensen and Meckling \(1976\)](#) argues that financially constrained firms should increase their exposure to risky assets. The coordinated risk management theory of [Schrand and Unal \(1998\)](#) suggests risk reallocation between operation and investments.

In the context of hedging activities, [Cummins et al. \(2001\)](#) propose that insurers' hedging decisions should differ in terms of participation and volume. More specifically, only firms that have considerable risk exposures will decide to engage in hedging due to the fixed costs of initiating hedging activities, while, given the decision to participate, firms with high risk appetites will hedge less due to the marginal costs of hedging.

Market characteristics, such as market interest rates, are important determinants of P&L insurers' decisions on equity investment holdings since government bonds (including municipal bonds) take up most of their investment portfolios. [Di Maggio and Kacperczyk \(2017\)](#) document that institutional investors move their portfolios toward risky assets when faced with low market interest rates.

Insurance groups reallocate limited resources within affiliated firms through ICMs. As documented by [Kim \(2016\)](#), P&L insurers that are larger in size are more likely to provide capital to affiliated firms. Higher capital requirement regulation on risky assets in the P&L insurance industry, however, can limit available funds as well as the risk capacity of those larger P&L insurers who participate in ICMs.

Firm size effects on equity investments may not be clear since smaller firms can as easily have access to the equity markets by outsourcing, as acknowledged by [Che and Liebenberg \(2017\)](#). To study this in particular, we look into P&L insurers that have exposure to equity investments but only through mutual funds.

Therefore, we pose five research questions. (1) Are the firm-specific factors that affect equity investment participation decisions different from those that affect volume decisions? (2) Do market interest rates affect participation and volume decisions differently? (3) Do ICM considerations affect participation and volume decisions? (4) Does firm size affect participation and volume decisions in equity investments via mutual funds? (5) Are P&L insurers' decisions to quit their equity investments affected by the performance of their equity investments or underwriting portfolio?

We apply the [Cummins et al. \(2001\)](#) approach to the equity investment context and model P&L insurers' participation and volume decisions in equity investments as a function of market, group, and firm characteristics. We adopt [Cragg's \(1971\)](#) two-part model to allow the parameters for the participation and volume decisions to differ, as suggested by [Cummins et al. \(2001\)](#). Utilizing a rich data set, we differentiate insurers' equity investments in unaffiliated firms, affiliated firms, and mutual funds to further investigate the effects of pure investment strategies, ICMs, and having an outsourcing option. Given the non-trivial amount of equity investments on affiliated firms⁷, analyzing equity investments in affiliated and unaffiliated firms separately is important since it enables this study to distinguish P&L insurers' pure motivations on equity investments from the work of ICMs.

A growing literature in economics (such as [Malmendier and Nagel 2011](#)), illustrates that personal experiences can affect individual investors' decision making process substantially. For instance, [Andersen et al. \(2019\)](#) document that great losses from investment activities can lead individual investors not only to refrain, but also to shy away from

risky investments. Institutional investors, such as P&L insurers are more likely to behave more rationally, but insurers with weak financial status and lean risk capacity from their operations may be more susceptible to those adverse experiences. We conduct Logit regression analyses for insurers' quit decisions that separately estimate the permanent and temporary quitters.

First, we document that P&L insurers are not as flexible in their participation decisions as they are in their volume decisions. Insurers appear to be volatile in deciding the amount invested in equity assets and these decisions are inversely related to market interest rates, while insurers' decision to participate in the equity market appear to be more stable and insurers seem not to take notice of market interest rates in making these decisions. Our multivariate analysis supports these observations. Our Cragg two-part model on pure equity investments⁸ documents that, in their participation decisions, insurers take into consideration firm environment variables, firm financial status factors, and operation risk capacity measures, but do not consider profitability variables and market interest rates. Therefore, their decision to participate is rather rigid and inflexible. In their volume decisions, however, insurers are more affected by risk appetite and profitability measures. Insurers significantly regard their profitability concerns and pay attention to the changes in external market conditions, increasing equity investments when the interest rates decrease. Firm environment variables are still significant determinants of their decision. In contrast, some of the firm risk-related variables, in particular operation risk capacity measures, lose their significance in their volume decisions.

With respect to the effects of ICMs, the results on total equity investments (i.e., affiliated and unaffiliated) show a positive relationship between interest rates and participation decisions, but a negative relationship in the volume decision. Further analysis on equity investments only in affiliated firms reveals that insurers' capital contributions to the affiliates in the forms of equity investments are positively related with market interest rates as higher interest rates imply higher costs of external capital. In the volume decisions, however, appetite for higher profit outweighs the effect of ICMs. P&L insurers are required to hold more capital for risky assets, such as equity, and thus capital transfers through ICMs hamper larger insurers to employ their optimal equity investments in unaffiliated firms.

As for the use of an outsourcing option, we document that firm size has no significant impact on insurers' participation decisions when insurers have an option to outsource equity investments via mutual funds. However, insurers respond to changes in market interest rates in their participation decisions. The results imply that insurers, regardless of their size, have incentives to respond to the changes in the external market conditions even in their participation decision, and they are willing to act and accomplish this desire if no major fixed costs are involved.

In the analysis of the quit decision, we document that P&L insurers with lower gains (higher losses) from both equity investments and underwriting are more likely to quit equity investments. Moreover, we find that market interest rates do not significantly influence insurers' quit decisions and that the effects of ICMs are limited on insurers' quit decisions. Furthermore, temporary quitters are less influenced by the losses in equity investments and not affected at all by fluctuations in underwriting performance.

Our study fills several gaps in the existing literature. First, prior studies do not distinguish between the participation and volume decisions for equity investments and evidence (from hedging behavior) suggests that these decisions may be driven by different factors (Cummins et al. 2001). Second, prior studies have not explicitly examined the various equity investment strategies available to P&L insurers, and it is possible that the factors affecting equity investment differ by investment strategy. Third, although some studies have explored factors affecting investment in risk assets (e.g., Che and Liebenberg 2017; Yu et al. 2008), there is an absence of research focusing on the decision to end, or quit, equity investments.

Our contribution to the existing literature is three-fold. First, we develop a model to study the equity investment behavior of institutional investors, in particular of opera-

tional institutional investors. We show that they pay close attention to profit measures as well as market interest rates when choosing the extent of their equity investments given their participation decision. This approach is novel as it allows for the determinants of the participation and volume decisions to differ and the previous literature has mainly focused on studying how firms' risk characteristics affect their risky investments. Second, unlike previous literature, we are able to identify different approaches for insurers' equity investments and study them separately. We document differences in the factors driving the participation and volume decisions of pure equity investment strategies, ICM capital contributions, and the option to outsource through mutual fund investments. Third, we develop a model to better understand the decision to quit equity markets and find evidence supporting experimental studies that suggest that institutional investors shy away from risky assets when they are exposed to unfavorable experiences (Malmendier and Nagel 2011; Chiang et al. 2011; Chernenko et al. 2016; Knüpfer et al. 2017; Andersen et al. 2019).

Our results are significant since they shed new light on the determinants of equity investments by an important class of institutional investor—P&L insurers. Moreover, our analysis of the three major equity investment strategies for P&L insurers illustrates the differences in factors that affect each strategy. Finally, our study documents the significant impact of the financial crisis on insurer equity investment and examines the factors associated with the decision to quit equity investments.

The rest of this paper is organized as follows. Section 2 presents a literature review and hypotheses development. Section 3 describes our methodology. Section 4 describes our data and summary statistics. Sections 5 and 6 report the multivariate analysis and results. Section 7 presents the summary and conclusions.

2. Previous Literature and Research Questions

The existing literature on risk management for operating firms (including institutions, such as P&L insurers that hold substantial risky financial assets) relies heavily on three theories. (1) The risk management theory of Smith and Stulz (1985) and Froot et al. (1993) which suggests that firms manage risk in order to reduce their total risk and avoid costly financial distress or undesirable underinvestment. This theory implies that financially constrained firms should reduce their investments in risky assets. (2) The risk shifting theory of Jensen and Meckling (1976) which suggests that financially weak firms should increase their exposure to risky assets since raising the volatility of the firms' investments can increase shareholder value when there is a substantial probability of a default.⁹ (3) Schrand and Unal (1998) suggest a coordinated risk management theory that focuses more on risk reallocation. They argue that firms balance the levels of risk from their core business with the levels of risk from their investments, so that a decrease in the core business risk should enable them to increase their investments in risky assets.¹⁰

In the insurance industry, Cummins et al. (2001) study the risk management behavior of Life and Health (L&H) and P&L insurers, in terms of their hedging strategies, and propose that the decision to participate in the derivatives market is distinct from the choice regarding the extent, or volume, of derivatives holdings. The authors argue that, given the fixed costs for hedging, only firms with substantial risk exposures would find it worthwhile to enter the derivatives market. However, once they have chosen to participate in the derivatives market, firms with high risk appetites will hedge less due to the marginal costs of hedging in the form of risk premiums. Therefore, while the main determinants of risk management are primarily associated with firms' risk measures (e.g., financial constraints and core business risk) in the participation decisions, the volume decisions are determined by the firms' risk appetites. For P&L insurers, one of the primary risks that they face is from equity investments. *Our first research question*, motivated by Cummins et al. (2001) and the three risk management theories discussed earlier, is whether the firm-specific factors that affect equity investment participation decisions differ from those that affect volume decisions.

Theory suggests that external factors, such as interest rates, will also affect equity investment decisions. P&L insurers invest, on average, most of their available funds in government bonds and municipal bonds, which are highly affected by interest rates.¹¹ Low interest rates make those safe assets less attractive for P&L insurers and give an incentive to reach for higher yield generating assets, such as equity. For instance, a number of studies provide evidence that institutional investors, such as banks, mutual funds, and pension funds invest in riskier assets when interest rates are low, a phenomenon often referred to as “reaching for yield” (Maddaloni and Peydró 2011; Jiménez et al. 2014; Chodorow-Reich 2014; Hanson and Stein 2015; Choi and Kronlund 2018; Di Maggio and Kacperczyk 2017; Andonov et al. 2017).¹² Our second research question, based on the aforementioned studies, is whether market interest rates affect equity investment participation and volume decisions (See Jiménez et al. 2014; Di Maggio and Kacperczyk 2017; Lian et al. 2019).

P&L insurers’ equity investment decisions may be driven by commitments to provide capital to affiliates. Therefore, we also investigate the role of internal capital markets on these decisions by conditioning on insurer investments in affiliates. Powell et al. (2008) show that the ICMs are active in the P&L insurance industry and that capital contributions are the most significant channel. We argue that P&L insurers’ equity investments in affiliated firms are likely motivated by ICM-related factors as opposed to pure investment considerations. As noted in the prior studies (e.g., Kim 2016), larger insurers are expected to engage in ICMs and transfer capital to affiliated firms. Therefore, our third research question is whether ICM considerations affect equity investment participation and volume decisions.¹³

Another important consideration is the ability to outsource equity investment decisions. Pottier (2007) suggests that large insurance firms have in-house investment analysts and credit specialists, which would provide an advantage in investing risky equity assets. However, Che and Liebenberg (2017) point out that the trend of investment outsourcing provides small firms easy access to the equity market. Given that investments in mutual funds are a way to outsource equity investment, our fourth research question is whether firm size affects the participation and volume decisions in equity investments via mutual funds.

Traditional views on individual investors assume that they have stable risk preferences and are rational using all available information when forming beliefs about risky outcomes. However, psychology literature proposes that personal experiences, in particular recent and small sampled ones, can affect investors’ decisions to a great extent (See Nisbett and Ross 1980; Weber et al. 1993; Hertwig et al. 2004). Malmendier and Nagel (2011) and Malmendier et al. (2020) show that individual experiences of macroeconomic shocks affect financial risk taking and Chiang et al. (2011) report that high returns in previous IPO auctions increase the likelihood of individual investors participating in future auctions. Furthermore, two recent studies document that individual investors actively shy away from, rather than simply refraining from, risky investments: For Knüpfer et al. (2017), the experiences are about adverse labor market conditions, while for Andersen et al. (2019), the shocks come from investment activities. While operating institutional investors, such as P&L insurers are expected to behave in accordance with rational expectation views and less likely to be influenced by transitory experiences, P&L insurers that are financially constrained and have less risk capacity from their operations will be more likely to be affected by adverse experiences.¹⁴ Furthermore, a number of studies show that the effects of experiences are not only subject to individual investors, but also to institutional investors (See Chiang et al. 2011; Malmendier and Nagel 2011; Chernenko et al. 2016). Our fifth research question is whether P&L insurers’ decisions to quit their equity investments are affected by equity investment or underwriting performance.

3. Methodology

Following the approach taken by Cummins et al. (2001) for insurer hedging, we adopt Cragg’s (1971) two-part model to allow for a potential difference in the determinants of the participation and volume decisions in P&L insurers’ equity investments. To investigate the potential effects of ICMs and having an outsourcing option, we define four different equity

investment dependent variables. To investigate why P&L insurers decide to quit equity investments, we conduct a Logit regression.

3.1. The Effects of ICMs and the Outsourcing Option

First, we investigate the determinants of equity investments of P&L insurers, where the fraction of equity investments to total invested assets is regressed against firm specific variables along with macro-economic variables. The dependent variable is equal to zero if an insurer does not participate in equity investments, but equal to the volume (ratio) of equity investments if an insurer engages in equity investments. The dependent variable is truncated at zero and is continuous otherwise.

Although the Tobit model is a standard and very widely used procedure when the dependent variable is truncated or censored, the implications of the Tobit model are particularly restricted for this type of study. One of the major limitations of the Tobit model is that the participation decision and the volume decision are determined by the same vector of parameters. Specifically, the signs of the explanatory variables are forced to be the same on both, the decision to participate and the volume decision. Therefore, when the effects of firm specifics are expected to be different depending on the two decisions, the Tobit model is more likely to be misspecified.

Cragg (1971) proposed a two-part model, which combines a Probit model for the discrete decision and a truncated regression model for the continuous decision. This model includes two separate vector parameters of γ (for the Probit) and β (for the truncated regression) and jointly estimates the participation decision and volume decision allowing for the coefficients to differ.¹⁵

Cragg’s two-part model is applied to the following pooled regression equation that is clustered at firm level to address potential autocorrelation issues in the given panel data set. The analysis contains unobservable year and state effects, and the analysis is conducted at the insurers’ level.

$$\begin{aligned}
 E_Investments_{i,t} = & \alpha_t + \beta_1 Firm_size_{i,t} + \beta_2 Ownership_{i,t} + \beta_3 Group_{i,t} + \beta_4 Long_ratio_{i,t} \\
 & + \beta_5 Riskybond_ratio_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Lines_hfd_{i,t} + \beta_8 Geo_hfd_{i,t} \\
 & + \beta_9 Leverage_{i,t} + \beta_{10} Reinsurance_{i,t} + \beta_{11} Combined_ratio_{i,t} \\
 & + \beta_{12} RBC_adjusted_{i,t} + \beta_{13} Financial_slack_{i,t} + \beta_{14} Treasury_3m_{i,t} \\
 & + \beta_{15-31} Year_t + \beta_{32-87} State_{i,t}
 \end{aligned} \tag{1}$$

where $E_Investments_{i,t} = [E_Total_{i,t}, E_Unaffiliated_{i,t}, E_Affiliated_{i,t}, E_Mutual_Only_{i,t}]$.

To investigate the effects of ICMs and having an option to outsourcing, four different ratios of equity investments are defined as dependent variables. P&L insurers are required to report their holdings on equity investments in a very detailed manner.¹⁶ For the purpose of this paper, however, we categorize their equity holdings broadly into two categories: Equity investments on affiliated firms and unaffiliated firms. The dependent variable “E_Unaffiliated” represents equity investments only on unaffiliated firms (including mutual fund holdings), which indicates insurers’ pure investment motivation on equity. The dependent variable “E_Total” includes all equity investments, including investments both on affiliated and unaffiliated firms, which adds the effects of ICMs to their equity investment motivation. Prior studies have not distinguished between these two equity investment motivations and given the non-trivial amount of equity funds invested in affiliated firms, their findings often mislead the underlying incentives of operating firms’ investments on equity. To further illustrate the effects of ICMs, we use the dependent variable “E_Affiliated”, which includes equity investment only on affiliated firms. Finally, the dependent variable “E_Mutual_Only” denotes the cases where insurers use only the mutual fund channel if they have any exposure to the equity market. Our analysis of the “E_Mutual_Only” dependent variable would reveal the ramifications of having an “option to outsourcing” equity investments, rather than incurring substantial fixed costs.

3.2. Quit Decisions

To empirically investigate insurers’ decisions to cease equity investments, we estimate the following Logit model with random effects and firm level clustering.¹⁷

$$\text{Quit_Decisions}_{i,t} = \alpha_t + \beta_1 \text{Net_Gains_Equity}_{i,t} + \beta_2 \text{Net_Gains_Underwriting}_{i,t} + \text{Controls}_{i,t} (\text{Firm, External Market}) + \text{Fixed_Year}_t + \text{Fixed_State}_{i,t} \quad (2)$$

where $\text{Quit_Decisions}_{i,t} = [\text{Quit_All}_{i,t}, \text{Quit_Permanent}_{i,t}, \text{Quit_Temporary}_{i,t}]$.

In determining the Quit_All dependent variable, which includes insurers that cease to invest in equity in a given year, we distinguish equity-investment-quitting insurers from those insurers that go out of business. We differentiate between insurers that quit equity investment and never return during the sample period, Quit_Permanent, from insurers that once quit but then revert in later years, Quit_Temporary. Net gains from equity investments are separated into net gains from unaffiliated firms and total firms to examine the potential effects of ICMs on insurers’ quit decisions. The analysis also differentiates between net gains from equity investments that are adjusted for capital gains and those that are not adjusted for capital gains. Our control variables are the same firm specifics used in the previous section. All the independent variables in Equations (1) and (2) are defined in Table 1.

Table 1. Variables and descriptions.

Variables	Description
E_Total	The fraction of insurers’ equity investment on affiliated and unaffiliated firms over total investments.
E_Unaffiliated	The fraction of insurers’ equity investment on unaffiliated firms over total investments.
E_Affiliated	The fraction of insurers’ equity investment on affiliated firms over total investments.
E_Mutual	The fraction of insurers’ equity investment on mutual funds over total investments.
Firm_size	Insurers’ total net admitted assets in the scale of natural logarithm.
Ownership Group	Dummy variable equal to 1 for mutual insurers and 0 for stock insurers.
Long_tail_ratio	Dummy variable equal to 1 for affiliated insurers and 0 for unaffiliated.
Riskybond_ratio	The fraction of net premiums written on long-tail business lines.
ROA	The fraction of risky bond (NAIC class 3 and above) over total investments.
Lines_Div	Return on assets: The ratio of net income to total net admitted assets.
Geo_Div	The complement of the Herfindahl Index of net premiums written across business lines.
Leverage	The complement of the Herfindahl Index of net premiums written across states.
Reinsurance	The ratio of policyholder surplus to total net admitted assets.
Combined_ratio	The ratio of premiums ceded to the sum of direct premiums written and reinsurance assumed.
RBC_adjusted	The sum of incurred losses and underwriting expenses that are proportional to premiums earned; the sum of loss ratio and expense ratio.
Financial_slack	Insurers’ surplus that is adjusted to the risk based capital measurement.
Treasury_3m	The ratio of cash and short-term investments to total net admitted assets.
Quit_All	The average of the 3-month Treasury bill yields for the given year.
Quit_Permanent	Dummy variable equal to 1 for all insurers who quit equity investments in a given year.
Quit_Temporary	Dummy variable equal to 1 for insurers who quit equity investments permanently (do not re-enter).
Net_G_Naff_IC	Dummy variable equal to 1 for insurers who quit equity investments temporarily (re-enter).
Net_G_Total_IC	Equity investment income on the unaffiliated, adjusted for realized capital gains.
Net_G_Naff_ICu	Equity investment income on the unaffiliated and the affiliated, adjusted for realized capital gains.
Net_G_Total_ICu	Equity investment income on the unaffiliated, adjusted for realized and unrealized capital gains.
Net_G_Udw	Equity investment income on the unaffiliated and the affiliated, adjusted for realized and unrealized capital gains.
	Net gains from underwriting: Premiums earned minus loss incurred and expenses.

4. Data

This paper collects P&L insurers’ data from the regulatory annual statements with the National Association of Insurance Commissioners (NAIC) for the years of 2002 through 2018. We obtain 3-month Treasury yields data and equity market return data (Standard & Poor’s 500 Index) from the FRED database and CRSP, respectively.

To construct our sample of insurers in a given year, we use the following criteria: (1) Insurers with negative total net admitted assets and negative net premiums written are excluded; (2) insurers without sufficient firm specific information necessary to calculate key variables are excluded. Therefore, insurers without adequate group affiliation and business type identifiers are excluded; (3) insurers that are neither mutual ownership nor stock ownership are excluded. After the above exclusion process, the final sample consists of an average of 1831 different firms per year (in total 2691 different firms) and 31,130 total firm-year observations over a 17-year sample period.¹⁸

Some of our key variables are substantially negatively skewed. Therefore, we use the logarithmic transformations of firm specific variables, such as total assets and adjusted risk based capital, a procedure that also helps address the scale difference among the variables. All the variables are also winsorized at the 0.99 and 0.01 percentiles. To measure P&L insurers' line of business diversification, we follow [Berry-Stölzle et al. \(2012\)](#). We first group similar business lines to arrive at 24 distinct lines, and then the measure is calculated as the complement of the Herfindahl Index of net premiums written across the business lines.¹⁹ We follow [Che and Liebenberg \(2017\)](#) to measure geographical diversification.²⁰ To measure the weight of long-tail business, we use the proportion of net premiums written in long-tail business lines.²¹

Table 2 summarizes key descriptive statistics of the sample. Our four dependent variables are positively skewed representing the censored nature of equity investments. The substantial difference between mean and median values indicates that when P&L insurers decide to participate in equity markets, they invest substantial portions of their available funds. Moreover, it is important to note the non-trivial amount of equity investments on affiliated firms; especially the fact that it takes up approximately 27.69% of total equity investments²². Therefore, analyses that fail to separately examine pure investment and total investments that include the effects of ICMs may be misleading in the insurers' motivations for equity investments. Our indicator variables are the ideal setting for our sample of P&L insurers as the industry has a good number of equity investing insurers as well as non-equity investing insurers; it also has a similar number of insurers who are affiliates and those who are not. A combined ratio that is over 100% shows that, on average, insurers are losing money from their operations, which highlights the importance of investment activities for them. Although the mean value of Long_tail_ratio is rather low due to observations in the lower tail of its distribution, the highly negative skewness indicates there are large numbers of insurers that employ long-tail lines of business. After the logarithmic transformation, the Firm_size variable appears to be free of any skewness issue, but the RBC_adjusted variable still remains highly negatively skewed. Net gains from equity investment that is adjusted to both realized and unrealized capital gains appear to be larger in size and have more variation, but less skewed than the Net gains adjusted to realized capital gains. Net gains from underwriting business are on average negative over the entire sample period and vary more severely than the gains from equity investments. This again highlights the importance of equity investment activities for these firms. Overall, the descriptive statistics in Table 2 are in line with those reported in prior studies.

Table 2. Summary Statistics. This table reports the pooled descriptive statistics of the variables used in Cragg’s two-part model analysis. The sample is collected from the NAIC database (2002–2018) and consists of an average of 1831 different firms in a given year and 31,130 firm-year observations. The statistics are at the insurer level.

Variables	Obs	Mean	Median	Min	Max	Std. Dev.	Skewness
E_Total	31,130	11.868	5.765	0.000	49.332	14.672	1.235
E_Unaffiliated	31,130	7.705	1.992	0.000	36.876	10.756	1.478
E_Affiliated	31,130	3.286	0.000	0.000	25.137	7.019	2.188
E_Mutual	31,130	1.255	0.000	0.000	11.392	3.030	2.507
Firm_size	31,130	18.330	18.290	15.130	21.759	1.849	0.089
Ownership	31,130	0.214	0.000	0.000	1.000	0.410	1.393
Group	31,130	0.685	1.000	0.000	1.000	0.464	−0.799
Long_tail_ratio	31,130	0.787	0.948	0.000	1.000	0.332	−1.650
Riskybond_ratio	31,130	0.008	0.000	0.000	0.072	0.019	2.634
ROA	31,130	0.021	0.024	−0.074	0.096	0.041	−0.447
Lines_Div	31,130	0.367	0.394	0.000	0.839	0.324	0.067
Geo_Div	31,130	0.389	0.310	0.000	0.944	0.386	0.244
Leverage	31,130	0.463	0.421	0.197	0.888	0.193	0.705
Reinsurance	31,130	0.365	0.303	0.000	0.907	0.301	0.415
Combined_ratio	31,130	1.049	0.992	0.530	2.155	0.338	1.798
RBC_adjusted	31,130	16.440	17.289	0.000	20.697	4.497	−2.837
Financial_slack	31,130	0.133	0.070	0.003	0.589	0.158	1.723
Treasury_3m	31,130	1.284	0.931	0.033	4.727	1.484	1.206
Net_G_Naff_IC	31,130	0.361	0.013	−2.325	4.931	0.935	2.126
Net_G_Total_IC	31,130	0.461	0.031	−2.581	6.389	1.150	2.451
Net_G_Naff_ICu	31,130	0.423	0.000	−6.704	7.890	1.752	0.642
Net_G_Total_ICu	31,130	0.579	0.009	−7.808	9.658	2.152	0.675
Net_G_Udw	31,130	−0.304	0.180	−28.270	18.226	6.653	−1.008

5. Empirical Analysis: Participation and Volume Decisions

In this section, we examine the determinants of P&L insurers’ decisions with respect to their investments in equity assets. In the framework of Cragg’s two-part model, we jointly estimate insurers’ participation and volume decisions on equity investments. Furthermore, Cragg’s alternative model is applied to our different dependent variables that are designed to represent insurers’ pure incentives to invest in equity, motivations that incorporate the effects of ICMs, and ramifications of using mutual fund vehicles for equity investments.

5.1. Univariate Analysis

In this section, we provide initial evidence regarding our first research question and conduct a univariate analysis to investigate whether the firm specific variables are statistically different between insurers who invest in equities and insurers who do not. The mean difference is first tested by a parametric *t*-test, and then the results are further ascertained with a non-parametric Mann-Whitney-Wilcoxon test.

Table 3 reports the mean difference test results for our four dependent variables, where most of the firm specific variables are found to be significantly different between equity investing insurers and non-equity investing insurers. The results indicate that P&L insurers depend on all the tested firm specific variables in their decision making process with respect to equity investments. Overall, firms with larger size, mutual ownership, affiliation to a group, higher long tail ratio, higher fraction of risky bonds, higher profitability, more business and geographic diversification, lower leverage, lower reinsurance ratio, lower combined ratio, higher risk adjusted capital, and higher financial slack, invest more in equity assets. Therefore, the results are basically consistent with what previous studies have documented.

Table 3. Mean Difference Tests: Participation Decision. This table reports the mean difference test results for all the firm specific dependent variables. The “Yes” column reports the mean for insurers that participate in equity investments, and the “No” column reports the mean for insurers that do not participate in equity investments. The mean difference is first tested by a *t*-test, and then the results are further ascertained with a Mann-Whitney-Wilcoxon test: *** *p* < 0.01, ** *p* < 0.05, * *p* < 0.1.

Variables	E_Total			E_Unaffiliated			E_Affiliated			E_Mutual_Only		
	Yes	No	Diff.	Yes	No	Diff.	Yes	No	Diff.	Yes	No	Diff.
Firm_size	18.673	17.605	1.068 (***)	18.636	17.829	0.807 (***)	19.546	17.788	1.758 (***)	17.442	18.364	−0.922 (***)
Ownership	0.281	0.073	0.209 (***)	0.301	0.072	0.229 (***)	0.320	0.167	0.153 (***)	0.171	0.216	−0.045 (***)
Group	0.677	0.703	−0.026 (***)	0.659	0.728	−0.069 (***)	0.856	0.610	0.246 (***)	0.543	0.691	−0.148 (***)
Long_tail_ratio	0.798	0.766	0.032 (***)	0.805	0.759	0.045 (***)	0.808	0.778	0.030 (***)	0.793	0.787	0.006 ()
Riskybond_ratio	0.010	0.003	0.008 (***)	0.011	0.003	0.007 (***)	0.013	0.006	0.007 (***)	0.003	0.008	−0.005 (***)
ROA	0.023	0.017	0.006 (***)	0.023	0.017	0.006 (***)	0.023	0.020	0.002 (***)	0.019	0.021	−0.003 (**)
Lines_Div	0.407	0.281	0.126 (***)	0.412	0.292	0.120 (***)	0.463	0.324	0.139 (***)	0.235	0.372	−0.136 (***)
Geo_Div	0.421	0.320	0.101 (***)	0.412	0.350	0.062 (***)	0.512	0.334	0.178 (***)	0.302	0.392	−0.090 (***)
Leverage	0.452	0.487	−0.035 (***)	0.452	0.481	−0.029 (***)	0.431	0.478	−0.047 (***)	0.478	0.463	0.015 (**)
Reinsurance	0.333	0.433	−0.101 (***)	0.325	0.431	−0.106 (***)	0.341	0.376	−0.035 (***)	0.310	0.367	−0.058 (***)
Combined_ratio	1.026	1.098	−0.072 (***)	1.020	1.096	−0.076 (***)	1.032	1.056	−0.025 ()	1.030	1.050	−0.020 ()
RBC_adjusted	16.924	15.420	1.504 (***)	16.972	15.570	1.402 (***)	17.883	15.797	2.086 (***)	15.256	16.486	−1.230 (***)
Financial_slack	0.108	0.186	−0.078 (***)	0.108	0.175	−0.067 (***)	0.082	0.156	−0.074 (***)	0.152	0.133	0.019 (***)

Interestingly, when we separate the sample in the different types of equity investments, we see that these results are driven by insurers with unaffiliated and affiliated equity investments. However, the results for insurers with investments in mutual funds only are significant but with the opposite sign. This suggests that insurers that choose to invest only in mutual funds have different characteristics and a different motive for equity investments. For example, smaller firms invest more in mutual funds as they need the option to outsource their equity investments.

In our multivariate analysis, we will control for the effect of all these variables on our dependent variables and we will differentiate between the decision to participate in equity markets and the volume decision.

5.2. Time-Series Analysis

In this section, we present the time-series changes in P&L insurers’ equity investments.

Table 4 shows relative stability in insurers’ participation decisions. Given the gradual decrease in the total numbers of insurers in the industry over time, we report the participation numbers as a percentage of total insurers. We observe a very stable proportion of insurers that invest in equity. However, during the financial crisis, there is approximately a 5% reduction in the number of insurers investing in unaffiliated firms. We further investigate the decision to quit equity investments in this group of insurers in Section 6. The proportion of insurers investing in affiliated firms remains very stable (around 30%) throughout the sample period, which indicates that insurers keep their ICM strategies pretty stable even in the midst of a financial crisis. Moreover, we observe a 2% decline in

the number of insurers investing only on mutual funds during the financial crisis. The reduction in the percentage of mutual funds and unaffiliated firms during the financial crisis is consistent with the notion that pure equity investments are more likely to cease in periods of higher uncertainty and financial distress.

Table 4. Insurers’ Participation in Equity Investments Over Time. This table reports time-series changes in the numbers of insurers who hold equity investments from 2002 to 2018. Column 2 presents the total numbers of insurers; column 3 presents the numbers of insurers who hold equity investments on both affiliated and unaffiliated firms; column 4 presents the numbers of insurers who hold equity investments on unaffiliated firms; column 5 presents the numbers of insurers who hold equity investments on affiliated firms; column 6 presents the numbers of insurers who hold equity investments only in mutual funds for a given year. Proportions to the total numbers of insurers are reported in parentheses.

Year	Total	E_Total	E_Unaffiliated	E_Affiliated	E_Mutual_Only
2002	1973	1365 (69.18%)	1238 (62.74%)	677 (34.31%)	43 (2.17%)
2003	1923	1315 (68.38%)	1194 (62.09%)	633 (32.92%)	42 (2.18%)
2004	1892	1299 (68.65%)	1189 (62.84%)	598 (31.61%)	64 (3.38%)
2005	1866	1291 (69.18%)	1182 (63.34%)	590 (31.62%)	77 (4.12%)
2006	1919	1316 (68.57%)	1218 (63.47%)	596 (31.06%)	103 (5.36%)
2007	1926	1318 (68.43%)	1224 (63.55%)	578 (30.01%)	104 (5.39%)
2008	1939	1309 (67.5%)	1209 (62.35%)	586 (30.22%)	74 (3.81%)
2009	1902	1239 (65.14%)	1117 (58.72%)	582 (30.60%)	62 (3.25%)
2010	1877	1212 (64.57%)	1093 (58.23%)	565 (30.10%)	61 (3.24%)
2011	1842	1202 (65.25%)	1090 (59.17%)	557 (30.24%)	59 (3.20%)
2012	1820	1202 (66.04%)	1088 (59.78%)	555 (30.49%)	60 (3.29%)
2013	1771	1199 (67.70%)	1094 (61.77%)	539 (30.43%)	69 (3.89%)
2014	1741	1195 (68.63%)	1090 (62.60%)	520 (29.87%)	74 (4.25%)
2015	1738	1199 (68.98%)	1108 (63.75%)	525 (30.21%)	69 (3.97%)
2016	1697	1176 (69.29%)	1079 (63.58%)	514 (30.29%)	76 (4.47%)
2017	1672	1153 (68.95%)	1069 (63.93%)	493 (29.49%)	67 (4.00%)
2018	1632	1117 (68.44%)	1028 (62.99%)	482 (29.53%)	61 (3.73%)

5.3. Multivariate Analysis

In this section, we conduct a multivariate analysis in the framework of Cragg’s two-part model.

5.3.1. Pure Equity Investment Incentives: Equity Investments on Unaffiliated Firms

Columns 2 and 3 of Table 5 report the estimation results for P&L insurers’ equity investment decisions in unaffiliated firms, which includes mutual funds holdings, but excludes holdings in affiliated firms.

Table 5. Participation and Volume Decisions: E_Unaffiliated, E_Mutual_Only. This table reports the estimates of Cragg’s two-part model. Columns 2 and 3, “E_Unaffiliated,” report the estimates for insurers’ equity investment decisions on unaffiliated firms, which includes holdings on mutual funds. Columns 4 and 5, “E_Mutual_Only,” report the estimates for insurers’ decisions on equity investments only on mutual funds. Robust standard errors are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	E_Unaffiliated		E_Mutual_Only	
	Participation	Volume	Participation	Volume
Firm_size	0.1258 *** (0.0156)	−1.8415 *** (0.5092)	0.0231 (0.0155)	−1.3784 *** (0.2062)
Ownership	1.1312 *** (0.0606)	8.7137 *** (1.5295)	0.7508 *** (0.0500)	1.0517 ** (0.5086)
Group	−0.4038 *** (0.0481)	−9.2380 *** (1.5289)	−0.2781 *** (0.0484)	−1.5601 *** (0.5467)
Long_tail_ratio	0.1104 * (0.0623)	6.7956 *** (2.2799)	0.0735 (0.0660)	1.2558 (0.7761)
Riskybond_ratio	13.2930 *** (0.9283)	114.509 *** (22.7756)	2.6248 *** (0.7791)	−19.3528 * (10.3826)
ROA	−0.1487 (0.4105)	−28.4323 ** (13.8505)	−0.6554 (0.4103)	−2.3390 (4.9586)
Lines_Div	0.4511 *** (0.0652)	1.5944 (2.2259)	0.1498 ** (0.0667)	0.6775 (0.8342)
Geo_Div	0.2304 *** (0.0602)	3.8428 * (2.0583)	−0.0317 (0.1111)	3.6037 ** (1.4030)
Leverage	0.0011 (0.1072)	42.7821 *** (4.1096)	0.0399 (0.0622)	−0.6821 (0.8560)
Reinsurance	−0.7866 *** (0.0617)	−15.1529 *** (2.6614)	−0.5608 *** (0.0655)	−0.3189 (0.9136)
Combined_ratio	−0.2200 *** (0.0508)	−1.9175 (2.2487)	−0.2485 *** (0.0565)	0.4817 (0.6828)
RBC_adjusted	0.0310 *** (0.0049)	−0.1119 (0.1561)	0.0120 ** (0.0052)	−0.0647 (0.0554)
Financial_slack	−1.0040 *** (0.1115)	−10.4305 ** (5.2115)	−1.0695 *** (0.1315)	−1.6694 (1.6015)
Treasury_3m	0.0165 (0.0102)	−1.0907 *** (0.2908)	−0.0195 * (0.0103)	−0.2972 ** (0.1194)
Constant	−1.9563 *** (0.4361)	10.5739 (12.0516)	−0.9491 * (0.4988)	17.1548 *** (4.8230)
Sigma	17.9033 *** (0.5694)		17.1548 *** (4.8230)	
Fixed_State	Yes		Yes	
Fixed_Year	Yes		Yes	
Observations	31,129		31,129	

First, the participation decision estimates indicate that the decision to invest in the equity market depends on firm financial status factors, operation risk capacity measures, and firm environment variables, although the decision does not seem to be a function of profitability or leverage. Evidence regarding our second research question is provided by the coefficient estimates for the variable “Treasury_3m”. Our analysis suggests that the market interest rate (3-month Treasury bill yield) had no significant impact on the insurer’s decisions to initiate unaffiliated equity investments.

In the volume decision regressions, the firm financial constraints and operational risk variables (e.g., Combined_ratio and RBC_adjusted capital) are not significant—unlike what is seen in the participation decision regressions. Another important difference with respect to the participation decision is that the insurers' volume decision is inversely and significantly (at the 1% level) related to market interest rates. This implies that when interest rates are low (high), insurers reduce (increase) their investments in bonds and increase (decrease) their equity investments.

Several results on the firm specific variables shed light on our first research question. First, firm size is a significant determinant of both the participation and volume decisions. Firms entering the equity market require expertise that will incur substantial fixed costs. Pottier (2007) suggests that large insurance firms have in-house investment analysts and credit specialists, which would provide an advantage in investing in risky equity assets. Consistently, the results show that the firm size coefficient is positive in the participation decision. However, the negative firm size coefficient in the volume decision is not only puzzling, but also counter-intuitive: Larger insurers that should have more available funds and risk capacity invest less in equity assets. This negative coefficient is driven by insurers that invest in mutual funds, which are included in this group of insurers investing in unaffiliated firms. We will study insurers investing only in mutual funds in Section 5.3.3.

Second, prior studies, such as Yu et al. (2008) and Che and Liebenberg (2017) suggest that given that long-tail insurers have higher operational risk, they should take less asset risk to achieve a balanced portfolio. However, an alternative explanation is that long-tail insurers are more willing to invest in equity since the greater length of time before claims are paid provides more flexibility with respect to their investment activities. The positive and significant sign on the Long_tail variable supports this explanation and suggests that there exists a profitability incentive that is derived from this kind of business along with its risk-related consequences.

Third, prior studies report mixed evidence on the effects of insurers' ownership structure (whether mutual or stock) on their investments in risky assets, such as equity. Yu et al. (2008) find that stock insurers are more averse to risky investments since they are subject to shareholders' monitoring, while Che and Liebenberg (2017) document the exact opposite, stock insurers are more capable of assuming risk due to easier access to capital markets. Our results provide support for the former argument.

Finally, the negative coefficient on the Financial_Slack variable implies that insurers with lower liquidity (less cash and short-term investments) hold more equity investments, which is consistent with the findings of Colquitt et al. (1999). They argue that cash holdings and common stock holdings are substitutes, and consequently find that insurers with high stock holdings hold less cash and short investments.

5.3.2. The Effects of ICMs: Equity Investments in both Affiliated and Unaffiliated Firms

Columns 2 and 3 of Table 6 document Cragg's two-tier model outcomes for insurers' equity investment decisions in both affiliated and unaffiliated firms (E_Total), while columns 4 and 5 present the results for investments in affiliated firms only (E_Affiliated). Given the non-trivial amounts of equity investment in affiliated firms, this section addresses our third research question by investigating the effects of ICMs on insurers' equity investment decisions.

Table 6. Participation and Volume Decisions: E_Total, E_Affiliated. This table reports the estimates of Cragg’s two-part model. Columns 2 and 3, “E_Total,” report the estimates for insurers’ equity investment decisions in all firms: Both unaffiliated firms and unaffiliated. Columns 4 and 5, “E_Affiliated,” report the estimates for insurers’ equity investment decisions in affiliated firms only. Robust standard errors are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	E_Total		E_Affiliated	
	Participation	Volume	Participation	Volume
Firm_size	0.2073 *** (0.0167)	2.0777 *** (0.5222)	0.3289 *** (0.0179)	0.1780 (0.4775)
Ownership	1.1643 *** (0.0650)	12.4260 *** (1.5949)	1.0703 *** (0.0626)	−3.8262 ** (1.4864)
Group	−0.3353 *** (0.0502)	0.6390 (1.7012)	0.6011 *** (0.0605)	30.2774 *** (3.8819)
Long_tail_ratio	0.0552 (0.0643)	5.1640 ** (2.5521)	−0.0491 (0.0739)	2.3725 (2.3191)
Riskybond_ratio	13.3146 *** (1.0145)	131.191 *** (22.5869)	4.5369 *** (0.8233)	19.1463 (18.6491)
ROA	−0.8737 ** (0.4208)	−93.2503 *** (15.3412)	−1.8493 *** (0.4496)	−76.5657 *** (12.7091)
Lines_Div	0.3893 *** (0.0683)	6.7485 *** (2.3686)	0.2206 *** (0.0748)	2.0751 (2.0731)
Geo_Div	0.2980 *** (0.0631)	5.0711 ** (2.1803)	0.2602 *** (0.0677)	4.1751 ** (1.7885)
Leverage	0.2201 ** (0.1123)	70.7753*** (4.3558)	0.4903 *** (0.1260)	37.6857 *** (3.5628)
Reinsurance	−0.7907 *** (0.0645)	−6.1609 ** (2.4684)	−0.4486 *** (0.0699)	5.4578 *** (1.8884)
Combined_ratio	−0.2084 *** (0.0523)	0.3643 (2.2803)	−0.0038 (0.0574)	2.0372 (1.6171)
RBC_adjusted	0.0265 *** (0.0050)	−0.1975 (0.1857)	0.0105 * (0.0056)	−0.0240 (0.1866)
Financial_slack	−1.0508 *** (0.1094)	−20.6284 *** (5.3602)	−0.3180 ** (0.1318)	−9.2134 ** (4.6405)
Treasury_3m	0.0191 * (0.0106)	−0.7035 ** (0.3176)	0.0454 *** (0.0108)	−0.3022 (0.2813)
Constant	−3.3204 *** (0.4514)	−91.7357 *** (13.3605)	−8.0826 *** (0.5232)	−71.8032 *** (23.1229)
Sigma	21.8932 *** (0.5825)		12.7207 *** (4.8230)	
Fixed_State	Yes		Yes	
Fixed_Year	Yes		Yes	
Observations	31,129		31,129	

In the analysis of total equity investments, not only is the 3-month Treasury bill rate statistically significant, but also the sign of the coefficient is positive in the participation decision. The results indicate that insurers are more likely to initiate equity investments when market interest rates are high, which is counter-intuitive according to the discussion in the previous section. Insurers should have less incentive to decrease their investments on government bonds when interest rates are high. The existence of the internal capital market, however, can provide a plausible explanation for this puzzling result. In columns 4 and 5, we directly investigate the effects of ICMs by studying insurers that invest only in affiliated firms. Insurers increase capital contribution to the affiliates in need when interest rates are high because the cost of external financing increases with interest rates. Furthermore, as noted by Stein (2003), capital contributions via ICMs can be less costly than external capital. Given the significant amounts of equity investments through ICMs, they drive the positive coefficient in the participation decision for insurers’ total equity investments. In contrast,

in the volume decision, the coefficient remains negative, indicating that motivations for higher profit (risk appetite hypothesis) outweigh the effects of ICMs.

As expected, the firm size coefficient is positive and significant. As reported in column 4 of Table 6, larger insurers are more likely to engage in ICMs providing capital to the affiliated firms in need. The result on the ROA variable is also worth noting. Column 4 of Table 6 reports that the ROA variable is statistically significant and negative in the participation decision, while it lacked statistical significance in the previous section (in the analysis without ICMs.) This result shows that insurers with better performance contribute less capital to affiliates.

5.3.3. The Effects of the Outsourcing Option: Equity Investments Only on Mutual Funds

Columns 4 and 5 of Table 5 list the estimation results for insurers' decisions in equity investments only on mutual funds. Therefore, this section sheds light on our fourth research question. We find that firm size has no significant impact on the insurers' decision to participate in mutual funds. When insurers have an option to outsource equity investments that require substantial upfront costs to initiate, small insurers can have access to the equity market as easily as large insurers. In their volume decision, however, the firm size coefficient is negative and significant, indicating that given their decision to invest in mutual funds, smaller insurers invest more in mutual funds than larger insurers, as this option to outsource is more valuable for small insurers. It is harder for small insurers to have the expertise to actively invest in equity securities. Therefore, it makes sense for them to invest more in mutual funds. This negative and significant coefficient in firm size is what drives the puzzling result in Section 5.3.1, the negative firm size coefficient in the volume decision for investment in unaffiliated firms.

Moreover, it is important to note the negative and significant sign in the 3-month Treasury yield variable. This result indicates that insurers respond to the changes in the external market when deciding whether to invest in mutual funds. The results for the volume decision are consistent with the findings in the previous two sections. When interest rates are low (high), insurers reduce (increase) their investments in bonds and increase (decrease) their investments in risky assets, such as mutual funds.

6. Empirical Analysis: Quit Decisions

In this section, we explore our fifth research question by examining the determinants of P&L insurers' quit decisions in their equity investments. After looking into all the insurers that cease to invest in equity in a given year, we separately investigate insurers that quit equity investments permanently from insurers that quit once but return in later years.

6.1. Time-Series and Univariate Analyses

In this section, we first look into the profiles of insurers that cease to invest in equity, and then conduct a univariate analysis to investigate whether the firm specific characteristic of insurers that quit equity investments in a given year are statistically different from the characteristics of insurers that remain in the equity market. We use parametric and non-parametric tests for the difference in means.

Table 7 and Figure 1 report time-series changes in the numbers of insurers who quit equity investments from 2003 to 2017. Noticeably, more insurers decided to terminate their positions in the equity market from 2007 to 2009, when the market was experiencing a severe financial crisis (Figure 1, Panel A). In 2009, the proportion of insurers that quit equity investments relative to all insurers who held equity investments in unaffiliated firms increased to 11% (from 5% prior to the crisis). Before the financial crisis, the majority of insurers that left the equity market did so on a temporary basis. However, during and after the crisis, we observe a drastic reversal in that trend, as the majority of these firms that quit equity investments did so on a permanent basis (Figure 1, Panel B). These observations suggest that insurers stop investing in equity when they experience large losses from equity

investments. Moreover, it is worth noting that in years with low market interest rates, relatively small numbers of insurers leave the equity market.

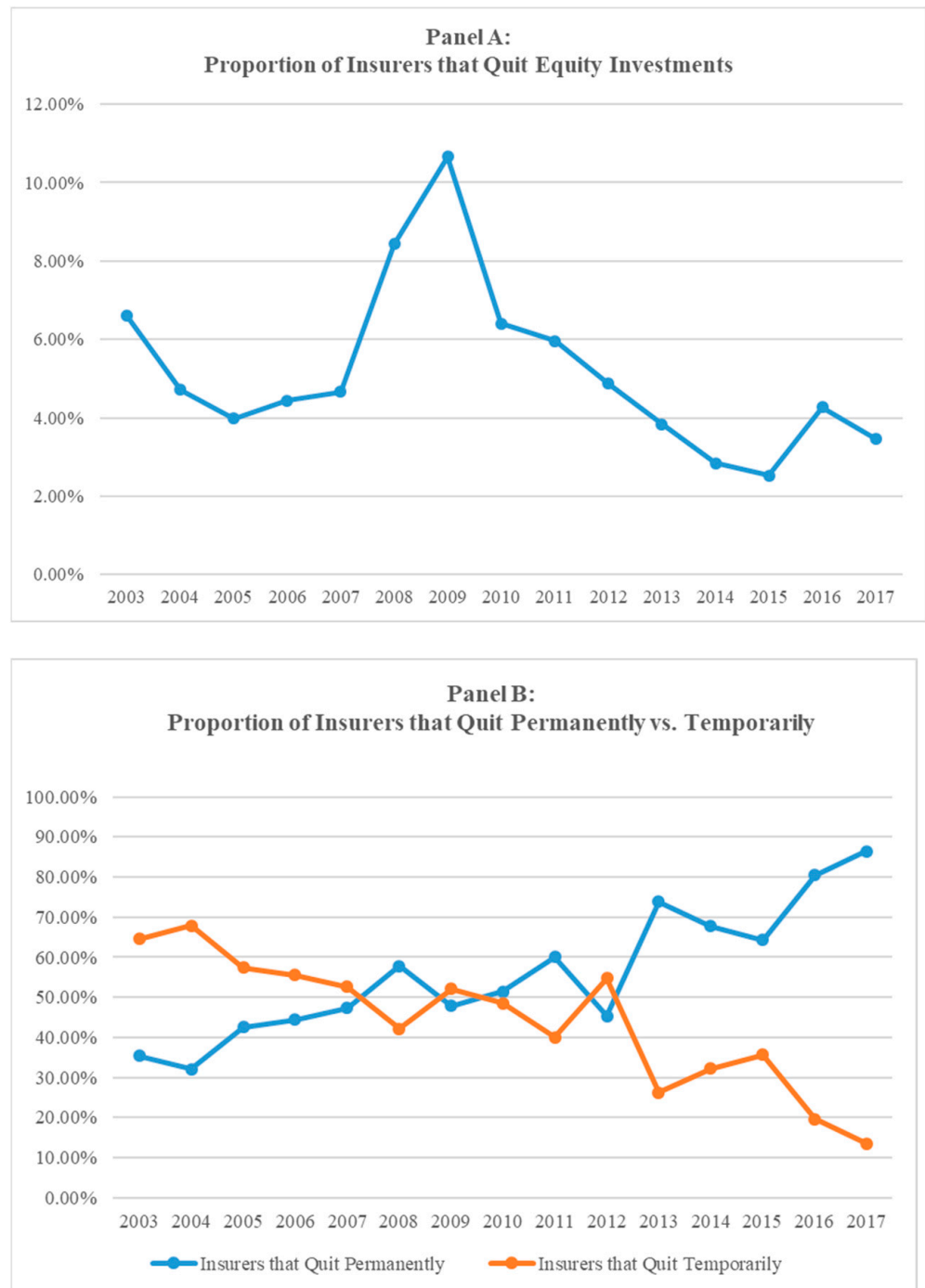


Figure 1. Time-series Changes in the Proportion of Insurers that Quit Equity Investments. The figures report the proportion of insurers that quit equity investments from 2003 to 2017. Panel (A) reports the insurers that quit equity investments as a proportion of all insurers that invest in the equity of unaffiliated firms. Panel (B) reports the insurers that quit permanently vs. those that quit temporarily as a proportion of all the insurers that quit in a given year. All numbers are in percentage terms.

Table 7. Profile of Insurers’ Quit Decision. This table reports time-series changes in the numbers of insurers who quit equity investments from 2003 to 2017. Column 2 presents the total numbers of insurers; column 3 presents the numbers of insurers that hold equity investments on unaffiliated firms; column 4 presents the number (and proportion) of all insurers that quit equity investments in a given year (relative to those who hold equity investments in unaffiliated firms); column 5 presents the number (and proportion) of insurers that quit equity investments permanently (relative to all the insurers that quit in the same year); column 6 presents the number (and proportion) of insurers that quit equity investments temporarily (relative to all the insurers that quit in the same year).

Year	Total	E_Unaffiliated	Quit_All	Quit_Permanent	Quit_Temporary
2003	1923	1194	79	6.62%	51
2004	1892	1189	56	4.71%	38
2005	1866	1182	47	3.98%	27
2006	1919	1218	54	4.43%	30
2007	1926	1224	57	4.66%	30
2008	1939	1209	102	8.44%	43
2009	1902	1117	119	10.65%	62
2010	1877	1093	70	6.40%	34
2011	1842	1090	65	5.96%	26
2012	1820	1088	53	4.87%	29
2013	1771	1094	42	3.84%	11
2014	1741	1090	31	2.84%	10
2015	1738	1108	28	2.53%	10
2016	1697	1079	46	4.26%	9
2017	1672	1069	37	3.46%	5

Table 8 reports mean difference test results for our three quit dependent variables. The net gains from equity investments as well as from underwriting for insurers that continue to invest in equity are, on average, statistically greater than the net gains for those who quit. Therefore, lower equity investment gains and net underwriting gains lead them to quit the equity market. Interestingly, the results indicate that the combined ratio and the net underwriting gains for insurers that only temporarily leave the equity market are not significantly different from those that continue investing in equity markets.

Table 8. Mean Difference Tests: Quit Decision. This table reports the mean difference test results for all the firm-specific variables depending on the classification of the Quit Decision variables. The difference in means is tested with a *t*-test. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Quit_Not	Quit_All		Quit_Permanent		Quit_Temporary	
	Mean	Mean	Diff.	Mean	Diff.	Mean	Diff.
Firm_size	18.642	18.223	0.42 (***)	18.254	0.39 (***)	18.139	0.50 (***)
Ownership	0.311	0.099	0.21 (***)	0.062	0.25 (***)	0.201	0.11 (***)
Group	0.657	0.699	−0.04 (***)	0.751	−0.09 (***)	0.553	0.10 (***)
Long_tail_ratio	0.807	0.761	0.05 ()	0.757	0.05 ()	0.774	0.03 ()
Risykbond_ratio	0.011	0.006	0.00 (***)	0.006	0.00 (***)	0.006	0.01 (***)
ROA	0.024	0.016	0.01 (***)	0.016	0.01 (***)	0.018	0.01 (**)
Lines_Div	0.417	0.355	0.06 (***)	0.357	0.06 (***)	0.352	0.06 (***)
Geo_Div	0.411	0.425	−0.01 ()	0.439	−0.03 (*)	0.385	0.03 ()
Leverage	0.452	0.442	0.01 ()	0.440	0.01 ()	0.448	0.00 ()
Reinsurance	0.322	0.387	−0.07 (***)	0.398	−0.08 (***)	0.356	−0.03 ()
Combined_ratio	1.019	1.067	−0.05 (***)	1.076	−0.06 (***)	1.040	−0.02 ()
RBC_adjusted	16.993	16.023	0.97 (***)	15.994	1.00 (***)	16.106	0.89 (***)
Financial_slack	0.107	0.137	−0.03 (***)	0.128	−0.02 (***)	0.160	−0.05 (***)
Net_G_Naff_IC	0.560	0.164	0.40 (***)	0.145	0.41 (***)	0.214	0.35 (***)
Net_G_Total_IC	0.692	0.238	0.45 (***)	0.226	0.47 (***)	0.272	0.42 (***)
Net_G_Naff_ICu	0.784	0.137	0.65 (***)	0.130	0.65 (***)	0.158	0.63 (***)
Net_G_Total_ICu	1.016	0.221	0.79 (***)	0.207	0.81 (***)	0.262	0.75 (***)
Net_G_Udw	−0.008	−1.079	1.07 (***)	−1.287	1.28 (***)	−0.505	0.50 ()

6.2. Multivariate Analysis

In this section, we conduct a Logit regression analysis in order to examine our fifth research question in a multivariate context.

Columns 2 and 3 of Table 9 report the Logit estimation results for P&L insurers’ quit decisions that are based on net gains from equity investments. The results show an inverse and statistically significant relationship between insurers’ quit decision and net gains both from equity investments and underwriting. Moreover, firm environment variables and risk measures affect the decision to quit. It is also worth noting that the Treasury bill rate variable is statistically insignificant in both the analyses of E_Unaffiliated and E_Total. The insignificant result on E_Unaffiliated indicates that market interest rates do not affect insurers’ decisions to quit their investments in unaffiliated firms, while the insignificant result on E_Total indicates that the effects of ICMs on insurers’ quit decisions is limited in that insurers do not retract their capital contributions to the affiliated firms only due to the fact that interest rates are low (i.e., the cost of external capital has become inexpensive). The fact that the absolute size of the coefficient on net gains from equity investment is larger for E_Unaffiliated (4.1010) than E_total (1.5510) shows that ICMs still matter for quit decisions, in which some insurers are more likely to terminate their position on unaffiliated equity assets due to the capital contributions to the affiliated firms. The analysis on equity investment net gains that are adjusted for capital gains (columns 4 and 5), reports similar results except for less pronounced effects of equity investment gains in terms of magnitude.

Table 9. Quit Decisions: Quit_All. This table reports the estimates of the Quit Decision for all insurers that cease to invest in equity in a given year using Logit regressions with random effects, clustered at the firm level. “Equity Investment” refers to net investment gains from equity investments, “Underwriting” refers to net underwriting income, all other variables are defined in Table 1. Columns 2 and 3, “Net Gains,” report the estimates where the variable “Equity Investment” is unadjusted for capital gains. Columns 4 and 5, “Net Gains (Capital gain adjusted),” report the estimates where the variable “Equity Investment” is adjusted for realized and unrealized capital gains. “E_Unaffiliated” represents equity investment in unaffiliated stocks and “E_Total” denotes equity investment in unaffiliated and affiliated stocks. Robust standard errors are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Net Gains		Net Gains (Capital Gain Adjusted)	
	E_Unaffiliated	E_Total	E_Unaffiliated	E_Total
Equity Investment	−4.1010 *** (−0.2799)	−1.5510 *** (−0.1523)	−0.1401 *** (0.0244)	−0.1227 *** (0.0199)
Underwriting	−0.0429 *** (−0.0119)	−0.0480 *** (−0.0118)	−0.0370 *** (0.0116)	−0.0384 *** (0.0116)
Firm_size	−0.2615 *** (−0.0382)	−0.2069 *** (−0.0379)	−0.2222 *** (0.0391)	−0.2125 *** (0.0391)
Ownership	−1.3619 *** (−0.1499)	−1.4450 *** (−0.1499)	−1.5982 *** (0.1552)	−1.5904 *** (0.1552)
Group	0.3045 *** (−0.1167)	0.3600 *** (−0.1158)	0.4602 *** (0.1194)	0.4584 *** (0.1192)
Long_tail_ratio	−0.2093 (−0.1549)	−0.2682 * (−0.1528)	−0.3227 ** (0.1570)	−0.3194 ** (0.1569)
Riskybond_ratio	−11.4558 *** (−2.6822)	−13.1091 *** (−2.6574)	−16.4539 *** (2.6699)	−16.2892 *** (2.6683)
ROA	8.4256 *** (−1.8199)	9.6594 *** (−1.816)	8.1631 *** (1.7517)	8.4688 *** (1.7633)
Lines_Div	−0.3288 ** (−0.1617)	−0.3654 ** (−0.1605)	−0.4374 *** (0.1655)	−0.4339 *** (0.1654)
Geo_Div	0.223 (−0.1474)	0.2931 ** (−0.1476)	0.2425 (0.1537)	0.2499 (0.1536)
Leverage	0.0813 (−0.2852)	−0.0246 (−0.2861)	−0.4727 (0.2901)	−0.4251 (0.2904)

Table 9. Cont.

	Net Gains		Net Gains (Capital Gain Adjusted)	
	E_Unaffiliated	E_Total	E_Unaffiliated	E_Total
Reinsurance	0.6346 *** (−0.1608)	0.8189 *** (−0.1607)	0.9958 *** (0.1639)	1.0002 *** (0.1640)
Combined_ratio	0.4838 *** (−0.1865)	0.4881 *** (−0.1858)	0.5019 *** (0.1886)	0.4811 ** (0.1886)
RBC_adjusted	−0.0296 ** (−0.0127)	−0.0334 *** (−0.0125)	−0.0358 *** (0.0127)	−0.0352 *** (0.0127)
Financial_slack	1.1124 *** (−0.3147)	1.1806 *** (−0.3101)	1.3012 *** (0.3160)	1.3035 *** (0.3161)
Treasury_3m	−0.0281 (−0.2567)	−0.0162 (−0.2542)	−0.3571 (0.2603)	−0.3208 (0.2584)
Constant	3.0751 *** (−1.0555)	1.5252 (−1.0511)	2.2437 ** (1.0798)	1.9593 * (1.0788)
Fixed_State	Yes	Yes	Yes	Yes
Fixed_Year	Yes	Yes	Yes	Yes
Observations	17,590	18,210	18,210	18,210

Columns 2 and 3 in Table 10 document the estimation results for P&L insurers that cease to invest in equity for a given year and never return during the entire sample period (Quit_Permanent), while columns 4 and 5 report the estimation results for P&L insurers that once quit equity investments but return in later years (Quit_Temporary). The analyses are based on net gains from equity investments on unaffiliated firms.

Table 10. Quit Decisions: Quit_Permanent & Quit_Temporary. This table reports the estimates of the Quit Decision for all insurers that cease to invest in equity permanently and temporarily using Logit regressions with random effects, clustered at the firm level. Columns 2 and 3, “Quit_Permanent,” report the estimates for the permanent Quit Decision. Columns 4 and 5, “Quit_Temporary,” report the estimates for the temporary Quit Decision. “Equity Investment” refers to net investment gains from equity investments, “Underwriting” refers to net underwriting income, all other variables are defined in Table 1. Columns 2 and 4, “Net Gains,” report the estimates where the variable “Equity Investment” is unadjusted for capital gains. Columns 3 and 5, “Net Gains (Capital gain adjusted),” report the estimates where the variable “Equity Investment” is adjusted for realized and unrealized capital gains. Robust standard errors are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Variables	Quit_Permanent		Quit_Temporary	
	Net Gains	Net Gains (Capital Gain Adjusted)	Net Gains	Net Gains (Capital Gain Adjusted)
Equity Investment	−5.4505 *** (0.4818)	−0.2398 *** (0.0402)	−2.5840 *** (0.3206)	−0.1036 *** (0.0336)
Underwriting	−0.0560 *** (0.0163)	−0.0543 *** (0.0176)	−0.0242 (0.0167)	−0.0240 (0.0164)
Firm_size	−0.3604 *** (0.0587)	−0.3894 *** (0.0739)	−0.1369 *** (0.0516)	−0.0996 * (0.0515)
Ownership	−2.3206 *** (0.2960)	−3.0719 *** (0.3769)	−0.7675 *** (0.1792)	−0.8618 *** (0.1793)
Group	0.8735 *** (0.1811)	1.2703 *** (0.2299)	−0.2938 * (0.1555)	−0.2100 (0.1548)
Long_tail_ratio	−0.1574 (0.2215)	−0.3051 (0.2662)	−0.2029 (0.2121)	−0.2727 (0.2100)
Riskybond_ratio	−11.0092 *** (3.8304)	−17.3900 *** (4.1700)	−9.4501 ** (3.7341)	−13.5781 *** (3.6853)
ROA	10.7285 *** (2.5452)	11.7285 *** (2.6940)	4.3377 * (2.5217)	4.7592 * (2.4432)

Table 10. Cont.

Variables	Quit_Permanent		Quit_Temporary	
	Net Gains	Net Gains (Capital Gain Adjusted)	Net Gains	Net Gains (Capital Gain Adjusted)
Lines_Div	−0.5033 ** (0.2343)	−0.6597 ** (0.2852)	−0.0652 (0.2193)	−0.1964 (0.2177)
Geo_Div	0.1278 (0.2067)	0.2049 (0.2587)	0.3147 (0.2035)	0.3417 * (0.2061)
Leverage	0.2064 (0.3967)	−0.3112 (0.4726)	0.0040 (0.4009)	−0.3943 (0.3999)
Reinsurance	0.6287 *** (0.2270)	1.1732 *** (0.2749)	0.6332 *** (0.2254)	0.9165 *** (0.2247)
Combined_ratio	0.6489 *** (0.2466)	0.7871 *** (0.2838)	0.1276 (0.2817)	0.1266 (0.2840)
RBC_adjusted	−0.0443 ** (0.0177)	−0.0661 *** (0.0212)	−0.0018 (0.0179)	−0.0029 (0.0176)
Financial_slack	1.0813 ** (0.4481)	1.3283 ** (0.5186)	1.2590 *** (0.4164)	1.4348 *** (0.4124)
Treasury_3m	−0.1416 (0.4441)	0.0382 (0.4651)	−0.8896 (0.9251)	−0.8832 (0.9233)
Constant	−12.7337 (2799.2725)	−16.9625 (9430.8936)	−0.1970 (1.3216)	−1.2196 (1.3171)
Fixed_State	Yes	Yes	Yes	Yes
Fixed_Year	Yes	Yes	Yes	Yes
Observations	16,154	16,154	15,437	15,437

The results for insurers that quit permanently are essentially the same as those reported in Table 9, in terms of the signs and significance of the explanatory variables, including those for Treasury bills interest rates. The results on the main variables suggest that insurers that suffer great losses both in equity investments and underwriting are more likely to leave the equity market permanently. However, we see a clear difference between permanent and temporary quitters. Not only are temporary quitters less severely influenced by the losses in equity investments (i.e., the coefficient is smaller in magnitude than for permanent quitters) and not affected at all by fluctuations in the underwriting business, but their quit decisions also appear to be less impacted by firm risk measures. Specifically, variables, such as Lines_Div, Combined_ratio, and RBC_adjusted do not seem to affect the decision to temporarily quit equity investments. An interesting result is that the Financial_slack variable is positive and significant in the temporary quit decision (as well as in the permanent decision) suggesting that insurers with high cash holdings and short-term assets are more likely to quit (i.e., invest less in equity).

7. Discussion and Conclusions

In this study, we investigate US P&L insurance companies to determine the incentives of operating firms to participate in their equity investments. In particular, we examine how their decisions to participate may differ from their and volume decisions using Cragg’s two-part model that allows parameter vectors to differ between participation and volume decisions. Using a rich data set of the P&L insurance industry, we further investigate the effects of pure investment strategies, ICM, as well as outsourcing options on the equity investment decisions, taking into account the potential impact of external market environments. Finally, we look into the determinants of their quit decision. We find that market interest rates can be a significant determinant of how ICMs work; that ICMs play a significant role in firms’ equity investment decision making process impeding their optimal strategies; that when outsourcing equity investments is available, firm size is not relevant for their decisions; and that operational institutional investors decide to leave equity markets when they experience great losses from equity investments and their operation

side, and are more likely to exit if they are financially constrained and have weak risk capacity from their core business.

Our study moves the body of knowledge forward in several ways. While prior literature does not distinguish between participation and volume determinants for equity investments, we explicitly model these decisions as separate and show that the factors affecting the decision to invest in equities differ from the factors that determine how much to invest. We also provide evidence regarding the manner in which P&L insurers invest in equities and show that firm and market characteristics have different impacts for each investment strategy. Finally, our study provides novel evidence regarding the decision by P&L insurers to quit equity investments following the financial crisis.

Our study has several limitations. First, we focus on investors in one industry only and our results may not be generalizable to other institutional investors. Second, some of the motivations for equity investments may be affected by regulation which may not be relevant for other institutional investors. Third, due to the fact that our data are annual and cover a period that includes only one financial crisis, our results on interest rates and investment shocks may not be entirely representative. Despite these limitations, we believe that our research provides additional insight into the investment behavior of P&L insurers.

Future research directions include an analysis of equity investments by other institutional investors, ideally in settings where regulation is less prominent. This analysis would likely require proprietary data since we are only able to perform our analysis due to the regulatory requirement that insurance companies report detailed data on underwriting and investments.

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Notes

- ¹ <https://www.iii.org/publications/a-firm-foundation-how-insurance-supports-the-economy/investing-in-capital-markets/property-casualty-industry-investments>; (accessed on 5 March 2023).
- ² For reference, hedge funds liquidated about 29% of their aggregate portfolio in 2008: Q3–Q4 (Ben-David et al. 2012).
- ³ Ge and Weisbach (2020) report that property and liability (also termed property and casualty) insurers held invested assets worth USD 6.5 trillion at the end of 2017, 30% of the total US assets held by endowments, foundations, pension funds, and insurance companies in the same year.
- ⁴ In insurance jargon, this is called the “float”.
- ⁵ The fraction of equity investing P&L insurers in this study’s sample fluctuates from 52.10% to 62.74%. The sample reports lower ratios in more recent years.
- ⁶ More than two thirds of the P&L insurers are affiliated, thus providing an ideal setting to study the potential impact of ICMs on equity investment decisions.
- ⁷ P&L insurers of this study’s sample invest on average about 3.29% of their total investments in affiliated firms in the form of equity investments, where the total equity investments take up about 11.87% of the total investments. Therefore, approximately 27.69% of P&L insurers’ equity investments are actually executed via ICMs in the form of capital contributions. Among the equity investments in affiliates, the vast majority of funds are invested in privately traded affiliates and proportions of publicly traded stocks are trivial.
- ⁸ The term “pure” is used in order to differentiate P&L insurers’ motivations to invest in equity investments from the work of ICMs, capital contributions, which are also recorded as equity investments. Pure equity investments denote equity investments in unaffiliated firms.

- ⁹ [Rauh \(2009\)](#) studies the asset allocation of defined benefit pension and finds that risk management theory plays a considerably larger role than risk shifting theory in explaining variation in pension fund investment policy. [Almeida et al. \(2011\)](#) also show that firms may reduce rather than increase risk when leverage increases exogenously, thus supporting risk management theory but not risk shifting theory.
- ¹⁰ [Che and Liebenberg \(2017\)](#) find that multi-line (more diversified) insurers invest more in risky assets than do single-line (less diversified) insurers, providing supporting evidence for the coordinated risk management theory, but not for risk management theory. Moreover, [McShane et al. \(2012\)](#) test and document evidence for the coordinated risk management theory, reporting that insurers hedge investment risk using derivatives, while simultaneously increasing underwriting risk.
- ¹¹ This study's sample reports that P&L insurers invest on average 39.40% of their funds on government bonds that include municipal bonds, while they invest 17.56% and 10.86% on corporate bonds and equity, respectively. The fraction decreased to 35.17% in 2018, arguably due to the low market interest rates.
- ¹² [Lian et al. \(2019\)](#) demonstrate that individual investors have a greater appetite for risk-taking when interest rates are low.
- ¹³ Prior studies document a wide range of determinants of ICMs, such as group financial constraints and status, product market competition, risk sharing, and growth prospects. See for example, [Almeida et al. \(2015\)](#), [Kuppuswamy and Villalonga \(2016\)](#), [Gopalan and Xie \(2011\)](#), [Matvos and Seru \(2014\)](#), [Campello \(2002\)](#), [Maksimovic and Phillips \(2008\)](#), [Belenzon and Berkovitz \(2010\)](#). In the insurance literature, [Powell et al. \(2008\)](#) provide supporting evidence that P&L insurance firms used internal capital markets to transfer capital to the affiliated firms with the best investment opportunities. However, [Niehaus \(2018\)](#) finds that insurance groups provide a risk-sharing mechanism for life insurers. Moreover, [Chiang \(2020\)](#) finds that life insurers with bank affiliates use internal capital market to reallocate resources to weaker divisions. Most recently, [Fier and Liebenberg \(2023\)](#) show that P&L insurers use internal capital markets to manage the risk of regulatory scrutiny.
- ¹⁴ [Guiso et al. \(2018\)](#) state that the distribution of wealth and background risks of investors can initiate different changes in their risk aversion.
- ¹⁵ For further details, refer to [Wooldridge \(2010\)](#), pp. 692–94).
- ¹⁶ Under the “summary investment schedule” in the statutory annual statements, equity investments are reported as following, 3.1 Investments in mutual funds, 3.2 Preferred stocks (3.21 Affiliated, 3.22 Unaffiliated), 3.3 Publicly traded equity securities (excluding preferred stocks) (3.31 Affiliated, 3.32 Unaffiliated), 3.4 Other equity securities (3.41 Affiliated, 3.42 Unaffiliated), 3.5 Other equity interests, including tangible personal property under lease (3.51 Affiliated, 3.52 Unaffiliated).
- ¹⁷ Due to lack of within variation, firm fixed effects to be conditioned out of likelihood do not exist. The reported random effects model results are robust to the pooled regression model that is clustered at firm level. The analysis controls for unobservable year and state effects and it is conducted at the insurers' level.
- ¹⁸ The initial sample comprises 2717 different firms, on average, per year and 46,182 total firm-year observations over the entire sample period.
- ¹⁹ The line diversification calculation is,

$$\text{Lines_Div} = 1 - \sum_{j=1}^{24} (NPW_{i,j,t}/NPW_{i,t})^2$$

where, $NPW_{i,j,t}$ indicates the net premiums written by an insurer i in line $j = 1, \dots, 24$ in year t ; $NPW_{i,t}$ denotes the insurer's total net premiums written in a given year t . Insurers with larger value are relatively more diversified. See [Berry-Stölzle et al. \(2012\)](#) for details on grouping similar business lines.

- ²⁰ As in the line of business diversification, the geographical diversification measure is calculated as:

$$\text{Geo_Div} = 1 - \sum_{k=1}^{58} (DPW_{i,k,t}/DPW_{i,t})^2$$

where $DPW_{i,k,t}$ indicates the direct premiums written by an insurer i in state $k = 1, \dots, 58$ in year t ; and $DPW_{i,t}$ denotes the insurer's total direct premiums written in a given year t . Insurers with larger value are relatively more diversified.

- ²¹ Following [Phillips et al. \(1998\)](#), long-tail lines consist of Farm Owners Multiple Peril, Homeowners Multiple Peril, Commercial Multiple Peril, Ocean Marine, Medical Professional Liability, Workers' Compensation, Other Liability, Product Liability, Automobile Liability, Aircraft, Boiler and Machinery, International, and Reinsurance.
- ²² The E_Affiliated mean of 3.286 divided by the E_Total mean of 11.868.

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