WHAT DETERMINES PRIVATE DEBT HOLDINGS FOR LIFE INSURERS?

A LONGITUDINAL INVESTIGATION

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Abstract

A major investor in private debt market is life insurance companies. They have long-term, fixed-rate liabilities that are matched by private debt investment. Life insurance companies, as the lenders in the private debt market, have the ability to evaluate the credit quality of borrowers and to perform ongoing risk monitoring. In this study we examine the determinants of private debt holdings for life insurance companies. Using data of 667 life insurers' history of private debt holdings from 2003 to 2007, we find that the private debt holdings for life insurer are strongly associated with their financial strength, organization form, regulation stringency, group affiliation, liquidity level and geographic market structure. Mutual insurers, insurers that have higher financial quality, that face stringent regulation, that are affiliated with groups, and those with less liquidity and less concentrated geographic market structure are more likely to be lenders in the private debt market. The results highlight the role of firm characteristics in life insurers' private debt holdings.

Keywords: private placement market, private debt, life insurer, determinants, characteristics, unobserved heterogeneity

1. Introduction

Private placements, non-underwritten securities offering sold directly to a single investor or a small group of investors and exempt from registration with the Securities and Exchange Commission (SEC), are a significant source of funds for U.S. corporations from 1994 (Prowse and Carey 1994). Life insurers, with primarily long-term, fixed-rate liabilities which are conveniently matched by private placements investment, hold the majority of privately placed debt (Prowse and Carey 1994; Pottier 2007; Carey and Prowse 1993).

Prior studies on private debt market has already presented evidence on either a firm's mix between public and private debt from the borrow side or private market corporate lending from the lender side. However, the question of how life insurers as the major lenders in this market determine their private debt holdings is not well addressed by previous literature. In this paper, we provide evidence on the determinants of private debt holdings for life insurers in the market after controlling for unobserved effects.

We test our theoretical predictions by assembling a unique data set on 667 life insurance companies' history of private debt holdings over period 2003 to 2007, and collect data on their firm specific characteristics including financial strength ratings, organization form, regulatory environment, public ownership, life insurance contract, liquidity, geographic market structure, business concentration and group affiliation. By implementing both traditional Probit model and Chamberlain's random effects Probit model, we find that mutual insurers, insurers with high financial quality, insurers facing stringent regulation, insurers with less liquidity and less concentrated geographic market, and insurers affiliated with groups are more prevalent lenders in the private debt market. These results contribute to reveal and complete our understanding of key determinants of private debt holdings for life insurers in the market.

Our research adds to the extant body of literature on private debt market in several ways. First, our view of private debt market from the lender side reveals key determinants for a life insurer to be a prevalent lender in this market. Previous literature only considers firm specific characteristics on consolidated level. In contrast, our analysis is based on individual level which is recognized and proved to be more effective. In addition, we also discuss life insurer's affiliation and geographic diversification which are neglected in prior work. Second, while prior empirical research has examined how the life insurer's investment proportion in private debt conditional on their characteristics during early 90's, our study contributing to the current literature on life insurer and private debt market by providing analysis using latest longitudinal data over period 2003 to 2007. Considering the market for privately placed debt has undergone major changes in the past decades (Prowse and Carey 1994), latest longitudinal data set will be more efficient to capture the trends in this market. Third, previous literature only uses simple logistic regression[1] with a single year's data (Pottier 2007), and studies the relation between the proportion of private debt holdings and firm specific characteristics. Comparing to this simple econometric methodology, we implement Chamberlain's random effects Probit model based on panel data framework. By relaxing the strict assumptions of traditional Probit model, we control for unobserved heterogeneities of firms and thus provide more reliable empirical results to complete our understanding of life insurers as major lenders in the private debt market.

The rest of the paper is organized as follows. In the next section we review prior studies on private debt market. In section 3 we provide an overview of the private debt market as a background for our subsequent discussion. In section 4 we develop main hypotheses from various theories. Section 5 describes the data sample, variable specification and econometric

[1] Pottier (2007) also uses both Tobit regression and ordinary least squares regression, but still based on single year data frame and does not further control for unobserved heterogeneity.

methodology. We present the results, as well as a set of robustness checks in section 6. The final section concludes.

2. Literature Review

Previous studies on private debt financing focus mainly on the borrower side of the market. Blackwell and Kidwell (1988) examine the cost differences between public sales and private placements of debt for a sample of public utility issues and suggest that firms minimize the cost of issuing securities by selecting the market providing the lowest transaction costs. Houston and James (1996) examines the determinants of the mix of private and public debt using detailed information on the debt structure of publicly traded corporations. Krishnaswami, Spindt, and Subramaniam (1999) empirically examine the impact of flotation costs, agency conflicts, regulation, and information asymmetries on a firm's mix between public and private debt. Their results indicate that firms with larger issue sizes exploit the scale economies in flotation costs of public debt and firms with higher contracting costs due to moral hazard have higher proportions of private debt. They find little evidence that firms with favorable private information about future profitability choose more private debt. However, firms with favorable information about future profitability that also operate under great information asymmetry rely more on private debt. Denis and Mihov (2003) examine the choice among bank debt, non-bank private debt and public debt. They find the primary determinant of the debt source is the credit quality of the issuer. Firms with the highest credit quality borrow from public sources; firms with medium credit quality borrow from banks; and firms with the lowest credit quality borrow from non-bank private lenders. Non-bank private debt thus plays a unique role in accommodating the financing needs of firms with low credit quality. However, all these studies neglect the important role of lenders in the private debt market.

Two studies exceptionally focus on lender side of the market. Carey et al. (1998) present empirical evidence on the existence of specialization in private market corporate lending, adding a new dimension to the public versus private debt distinctions in the literature. Comparing corporate loans made by banks and those made by financial companies, they find that the two types of intermediaries are equally likely to finance information-problematic firms. But financial companies tend to serve observably riskier borrowers, particularly more leveraged borrowers. The evidence supports both regulatory and reputation-based explanations for this specialization. However, it remains unclear of the determinants of life insurers to be major lenders in this market.

Pottier (2007) extends the understanding of the private debt market by being the first to examine life insurer as the major lenders in the private debt market. His results suggest that larger mutual insurers, insurers facing stringent regulation, and insurers with great cash holdings are more prevalent lenders in the private debt market. However, without longitudinal data framework, it hardly separates unobserved firm effects which might explain true impacts of life insurers' characteristics that determine their investment decisions in the private debt market.

3. Overview of the Private Debt Market

Private placements, which can be either debt or equity securities, are securities that are exempt from registration with the Securities and Exchange Commission (SEC) by virtue of being issued in transactions that involve no public offerings[2]. In the absence of a public offering, private debt are typically offered only to a limited number of well-informed investors, usually institutions, which generally do not disclose information about their transactions. The private

[2] The adoption of Rule 144A, which permits unrestricted secondary trading of private placements among sophisticated institutional investors designed in the rule as qualified institutional buyers (QIBs), by the SEC in April 1990 paved the way for the development of a new market for private debt that is much more like the public bond market.

debt market is an important source of credit market funds for U.S. corporations. Over period 2003-2007, for example, the value of U.S. private debt averaged $539 billion per year (Table 1).

The typical borrower in the private debt market is a medium-sized corporation. Large firms tend to issue in the public bond market, and small firms generally borrow only in the bank loan market. An combination of issue size, issuing costs, and yields is often thought to be the major reason that medium-sized firms tend to offer their securities in the private rather than in the public market (Prowse and Carey 1994). Issuance costs are lower for a private debt in part because the issuer does not have to incur the considerable expense of registering the issue with the SEC. Also, private debt is not underwritten and thus has lower distribution expenses. For public and private issues that are of comparable size and quality, yields are generally higher on private debt than public debt.

Issue size itself, however, is not the main reason that medium-sized companies borrow in the private market. A more important reason is that borrows in the private debt market tend to be less well known companies such that lenders must perform extensive credit evaluations of such companies before loans can be extended to them(Carey and Prowse 1993). In any credit transaction, public or private, the lender must determine the financial condition and prospects of the borrower. For large and well-known companies, this task is facilitated by the ready availability of information from many sources. In contrast, for less well known companies, a lender cannot obtain information as easily and must collect the necessary information on its own. Moreover, the lender must continue his effort after the credit is extended in order to adequately monitor the borrower's ability to make timely payments of interest and principal. Because of the information asymmetry that less well known companies present to lenders, they are sometimes

referred to as information-problematic borrowers[3]. The total cost of credit analysis is reduced when each borrower deals with only a few intermediaries with the capacity to evaluate and monitor private debt transactions. Although information-problematic borrowers are generally not large firms, many large corporations have issued in the private market. Such companies normally issue straight debt in the public bond market but turn to the private market for complex transactions (for example, asset-backed securities). In addition to being able to accommodate information-problematic and specialized transactions, the private debt market offers borrowers the opportunity to establish relationship with lenders(Prowse and Carey 1994; Pottier 2007). The disadvantages from borrowers' point of view are the restrictive covenants and stiff prepayment penalties typically found in private debt contracts.

The lenders in the private debt market are among those financial intermediaries that specialize in lending to information-problematic borrowers. A financial intermediary is a financial institution that raises funds through the issuance of its own debt or equity and then reinvests the proceeds in financial assets. They have in common a capacity to evaluate and monitor complex credit transactions and can provide borrowers in the private debt market with more favorable terms partly because of their expertise and partly because they are large enough to buy significant fractions of any issue. Lenders are drawn to private debt by their favorable risk-return ratio. Yields on private debt are generally higher than those on comparable public bonds; the higher yield reflects both the lack of liquidity of private bonds and a return to the more intensive credit analysis required by investors in the private market. Credit risk is controlled through covenants. Depending on the circumstances of a covenant violation, the lenders may temporarily waive a covenant, renegotiate the terms of the security, or require immediate repayment of

[3] The emergence of the 144A market bridges a gap between the public and private markets, providing a more efficient means for large borrowers that do not have the informational problems of the typical issuers of private debt to issue in the private market.

principal if the borrower is unable to remedy the violation. Private market lenders are thought to have stronger incentives or great ability to monitor borrows, or to be better positioned than public creditor to renegotiate contract terms in the event of a problem (Denis and Mihov 2003).

The major investors in private debt market are life insurance companies (Prowse and Carey 1994; Pottier 2007; Carey and Prowse 1993). At year-end 2007, they held $522 billion (Table 2) of private debt. Holdings are highly concentrated: The top 20 holders of private debt have almost 60 percent of the industry total but only 45 percent of the industry total assets. Life insurance companies also attempt to match the duration of their holdings of private debt to the duration of their liabilities (Prowse and Carey 1994; Pottier 2007). In keeping with the longer-term nature of their liabilities, the average lives of private debt they purchase are mainly between 5 to 10 years. Life insurance companies normally prefer to hold private debt falling in the investment-grade range of credit ratings[4]. For example, 90 percent of life insurers' holdings were Class 1 and Class 2 at year-end 2007.

Table 1 PRIVATE PLACEMENTS 2003-2007
($ billions)

	Value of U.S. private placements			Number of U.S. private placements		
Year	**Debt**	**Equity**	**Total**	**Debt**	**Equity**	**Total**
2003	491.4	28.9	520.3	2,635	534	3,169
2004	570.4	32.1	602.5	2,729	560	3,289
2005	554.7	57.7	612.4	2,887	516	3,403
2006	523.7	73.5	597.2	2,705	596	3,301
2007	555.2	72.0	627.2	1,933	512	2,445

Source: Insurance Information Institute, Financial Service Fact Book

[4] NAIC bond classes are: Class 1-highest quality; Class 2-high quality; Class 3-medium quality; Class 4-low quality; Class 5-lower quality; Class 6-in or near default. Class 1 and 2 bonds are investment grade.

Table 2 U.S. LIFE INSURER PRIVATE DEBT HOLDINGS 2003-2007
($ billions)

Year	Value of U.S. Life insurer private debt holdings
2003	437.0
2004	475.6
2005	489.3
2006	494.5
2007	522.7

Source: American Council of Life Insurance, Insurance Fact Book (2003-2007)

4 Hypotheses

In this section, we discuss specific firm characteristics that potentially influence life insurers' private debt holding status. Insurer specific characteristics are sufficiently captured at the individual company level rather than at the group level.

Financial Strength Ratings

Life insurers as lenders in the private debt market convey the positive information to financial and product markets about the borrower's prospects which resembles the function of credit rating agencies (Prowse and Carey 1994). A lender's financial strength ratings might be a proxy for its incentive to monitor borrowers because high rating lenders want to protect their credit rating. Life insurance companies are information intensive lenders; they conduct substantial due diligence on the borrower before making the loan and continuously monitor the borrower after the loan is made (Prowse and Carey 1994; Carey and Prowse 1993). Most insurers have traditionally had large staffs of credit analysts, who evaluate the credit quality of potential borrowers and monitor the health of firms to which credit has been extended. Nakamura (1993) argues that since the total number of lenders in private debt issues is small, the average default risk to private lenders is higher and there exist stronger incentives for monitoring. Furthermore,

life insurers with high financial strength ratings and superior credit evaluation expertise are likely to have had similarly superior past investment performance which in turn become positive factors for financial strength purpose (Pottier 2007). Therefore, the above discussion suggests *H1: The higher financial strength ratings the life insurance company has, the more likely that it will hold private debt in the market.*

Organization Form

Life-health insurers are organized primarily as either stock companies or mutual companies. Agency theory hypothesizes that certain ownership structures have advantages in engaging in particular activities due to the efficiency with which each ownership structure can control the incentive conflicts inherent in the relationships among owners, managers, and policyholders (Mayers and Smith Jr 1981; Pottier and Sommer 1997). The stock ownership form is more effective at controlling the owner-manager conflict, while the mutual form is more effective at controlling the owner-policyholder conflict. This suggests that stock firms should be more prevalent in activities that involve significant managerial discretion, since it is with these activities that potential owner-manager conflicts are most sever. In contrast, mutual firms might be expected to be more prevalent in lines of business involving long-term contracting, since long-term contracts increase potential owner-policyholder conflicts.

As noted earlier, private lenders have the ability to exert greater influence and pressure on borrowers than do public debt holders because of their concentrated holdings and access to information, and private debt is more frequently renegotiated and requires more ongoing monitoring than public debt (Denis and Mihov 2003). This increases the level of managerial discretion required with private lending, and leads to a positive relation between stock insurers and private debt. However, a risk shifting problem arises when expected claims cost are

sufficiently high relative to equity. Lee et al. (1997) argue that managers of stock insurers have greater incentive to take risk than managers of mutual insurers. Since the owner and policyholder functions for the stock insurer are separated rather than consolidated, shareholders can have an incentive to shift risk onto the policyholders after the policy is issued (Garven and Pottier 1995). If the opportunities for risk shifting are greater with private debt, then it suggests that mutual insurers should have a comparative advantage in private debt investments. Further, Pottier (2007) finds a positive relationship between mutual life insurer and the proportional of private debt holdings, which is consistent with prior hypothesis that the relative advantage of mutual insurers in reducing risk shifting incentives and associated agency costs is an important consideration in private debt investment decisions. Therefore, we propose

H2: The mutual form of life insurer is associated with higher likelihood of private debt holdings.

Regulatory Environment

The state of New York is generally acknowledged to have the most rigorous insurance regulatory scheme of any jurisdiction in the United States (Pottier and Sommer 1998; Meier 1988; Cummins and Sommer 1996). Besides general stringency, a unique feature of New York insurance law is its extraterritoriality[5]: an insurer licensed to do business in New York must substantially comply with any requirement applicable to similar domestic insurers in every state in which the insurer does business. For example, New York investment laws and agent compensation rules must be followed nationwide by insurers licensed in New York. Many industry authorities believe that being licensed to operate in New York is a positive indicator of financial quality (Black and Skipper 1994). Further, Pottier (2007) points out that if investments in private debt require more managerial discretion, regulation serves as a potential control

[5] The extraterritorial application of New York insurance law originated with an administrative ruling in 1900 known as the "Appleton Rule", which was made part of the New York insurance code in 1939.

mechanism over incentive conflicts that might arise. Regulatory efforts to limit excessive investment risk focus mostly on higher risk (i.e., below investment grade) debt in particular. Therefore, we hypothesize,

H3: Life insurer licensed in New York State is more likely to have private debt holdings.

Ownership

The wider investment analyst coverage and higher level of financial disclosure of publicly traded companies lessen the risk shifting potential related to private debt (Pottier 2007). The more extensive monitoring coupled with market valuation of the insurer makes the results of any risk shifting apparent in a timely manner, and therefore reduces the incentives for such opportunistic behavior. Consequently, public firms are expected to face lower costs of asymmetric information between the firm and the outside market. Thus, public ownership is likely to reduce information costs of investing in private debt while private firms face higher information asymmetry costs. Therefore, we propose

H4: Being a publicly traded life insurer is associated with higher likelihood of private debt holdings.

Life Insurance Contracts

The lines of business in which an insurer operates influence its duration matching needs. Life insurance contracts are usually of longer duration than annuity or health insurance contracts. Since most private debt is intermediate to long-term, and seldom prepaid, insurers that write relatively more life business have higher proportions of private debt holdings for liability duration matching reason (Pottier 2007). Therefore, we propose

H5: The higher premiums written the life insurer has for its life insurance contracts, the more likely that life insurer will have private debt holdings.

Liquidity

Liquidity measures a company's ability to meet its anticipated short and long term obligations to policy holders and other creditors. A company's liquidity depends upon the degree to which it can satisfy its financial obligations by holding cash and investments that are sound, diversified and liquid, or by operating cash flows. Considering the illiquid character of private placements, Pottier (2007) argues that higher cash holdings might offset the reduction in liquidity associated with relatively more private debt holdings, and that insurers with greater cash holdings[6] are more prevalent lenders in the private debt market. Thus, we propose

H6: The high liquidity level of life insurer is positively associated with its private debt holdings.

5 Methods and Measures

Data

Our data on life insurer private debt holdings and firm-specific characteristics come from the National Association of Insurance Commissioners' (NAIC) life-health database which contains data from 2003 statement year to 2007 statement year. In addition, financial strength ratings, ownership and current liquidity for each insurer are obtained from Best's Key Rating Guide (A. M. BEST) Life-Health Edition database over the same period. We use data for all firms that had non-negative private debt holdings[7], positive net admitted assets, positive net premiums, and that were rated by A. M. BEST with a rating of at least F. For the purposes of our analysis, private debt holdings are defined as non-Rule 144A private debt consistent with the earlier discussion regarding Rule 144A private debt (Carey and Prowse 1993; Prowse and Carey 1994; Pottier 2007). At individual company level, the final sample consists of 667 life insurers with 3055 firm-year private debt investment observations. The data is structured as an unbalanced panel.

[6] Pottier (2007) uses cash holdings as a proxy for liquidity in his paper.
[7] We excluded short position in private debt holdings.

The quality and maturity distribution of private debt holdings of sample life insurers are shown in Table 3 and Table 4, respectively. Overall, the maturity of private debt is mostly between 5 years and 10 years which accounts for 35 percent of total private debt holdings. For credit quality of life insurer private debt holdings, 46 percent and 42 percent are classified as investment grade Class 1 and Class 2, respectively, while 73 percent and 21 percent of public debt holdings are in the same investment grades respectively (American Council of Life Insurance 2003-2007). This indicates that the average credit quality of life insurer private debt holdings is substantially lower than that of their public debt holdings.

Table 3 QUALITY DISTRIBUTION

Class	**Private Debt Holdings Year 2003**	**Private Debt Holdings Year 2004**	**Private Debt Holdings Year 2005**	**Private Debt Holdings Year 2006**	**Private Debt Holdings Year 2007**
Class 1	42.20%	45.84%	48.64%	48.21%	48.92%
Class 2	43.91%	43.61%	41.92%	42.18%	41.42%
Class 3	7.53%	5.76%	5.40%	5.38%	5.72%
Class 4	3.78%	3.26%	2.96%	3.17%	2.64%
Class 5	1.78%	1.01%	0.72%	0.83%	1.09%
Class 6	0.80%	0.53%	0.37%	0.22%	0.21%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Table 4 MATURITY DISTRIBUTION

Maturity	**Private Debt Holdings Year 2003**	**Private Debt Holdings Year 2004**	**Private Debt Holdings Year 2005**	**Private Debt Holdings Year 2006**	**Private Debt Holdings Year 2007**
<1	6.68%	5.87%	6.99%	6.53%	7.00%
>1, <5	29.68%	29.73%	28.82%	30.15%	29.31%
>5,<10	35.84%	35.41%	36.54%	37.11%	37.06%
>10,<20	16.66%	16.82%	15.18%	14.24%	14.27%
>20	11.14%	12.17%	12.47%	11.97%	12.36%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Dependent Variable

The dependent variable is whether a life insurance company had private debt holdings in its investment portfolio in a year. The observation unit for the dependent variable is firm-year, with the variable set to one if the insurer had private debt holdings in that year; zero otherwise.

Independent Variable

RATING_SCORE: We generate variables for life insurers' financial strength ratings as numbers from one (Best's Level F -- In Liquidation) to nine (Best's Level A++ -- Superior) according to A. M. BEST Financial Strength Ratings. A. M. BEST Financial Strength Ratings system is an independent opinion of an insurer's financial strength and ability to meet its ongoing insurance policy and contract obligations. It is based on a comprehensive quantitative and qualitative evaluation of a company's balance sheet strength, operating performance and business profile. An important component of the evaluation process is an interactive exchange of information with the insurance company's management. The Best's Financial Strength Ratings scale is comprised of 16 individual ratings grouped into 10 categories, consisting of three secure categories of "Superior," "Excellent" and "Good", and seven vulnerable categories of "Fair," "Marginal,", "Weak," "Poor," "Under Regulatory Supervision," "In Liquidation" and "Rating Suspended[8]."

MUTUAL: Organization form information is obtained from NAIC demographic database. We define variable equals one for mutual insurers and zero for non mutual firms[9].

NY_LIC: In order to construct a binary variable signifying whether an insurer is licensed in New York State, as many empirical researchers have attempted to explore the impact of such regulation in studies of various insurance issues, we obtain the information from NAIC Schedule

[8] In our analysis, insurers with rating suspended and cases not rated are excluded from sampling.
[9] We categorize Stock, BC/BS Stock, Non-profit, Risk Retention Group as non-mutual organization form.

T table. The variable is set to one if the life insurer is licensed in New York State, and zero otherwise.

TRADED: One important measure of a firm's public ownership is firm's publicly traded corporation information provided by A. M. BEST database in which corporation name is listed for publicly traded firms and blank otherwise. In our paper, a binary variable with its value set to one if the insurer is listed on A. M. BEST as publicly traded life insurer, and to zero otherwise, is used to measure public ownership.

LIFE: We derive insurer's life contract variable by using NAIC Analysis of Operations by Lines of Business table. The direct premiums for life contract include industrial life, ordinary life, credit life (group and individual) and group life insurance. Further, we use log transformation of it to control for over dispersion and skewness.

LIQUIDITY: In addition to using cash holdings to measure life insurer's liquidity level, we obtain liquidity information directly from A. M. BEST in which current liquidity is defined as the ratio of unaffiliated invested assets to liabilities. This measures the proportion of liabilities (excluding AVR, conditional reserves and separate account liabilities) covered by cash and unaffiliated holdings, excluding mortgages and real estate.

Control Variables

The appropriate role of foreign ownership in life insurance markets continues to be a topic of great interest. As life insurers with foreign ownership are often part of much larger international insurance groups, their risk pooling activities might be particularly helpful, thus offering the potential for greater pricing and investment stability (Skipper 1997). Furthermore, life insurers gather substantial information to conduct their evaluations of firms, projects and managers, both in deciding whether to issue insurance and in their role as lenders and investors. Thus, a binary

variable, FOREIGN, which is set to one for life insurers with foreign ownership, and to zero otherwise, is included to control for life insurer's foreign ownership.

Some life insurers are organized as single firms, while others are organized as a group of companies. To control for any systematic relationship between the probability of being a group member and the probability of holding private debt, a dummy variable is included. GROUP_LEVEL is set to one for group affiliated life insurers, and to zero for unaffiliated insurers.

Mayers and Smith (1994) argue that selling business of different lines requires more managerial discretion in setting rates and underwriting, and that the cost of monitoring managers increases with the number of lines-of-business. A Herfindahl index based on direct premiums written across lines of business, BUSINESS_CONCENTRATION, is defined as

$$\sum_{i=1}^{11}\left(\frac{Premiums\ in\ line\ of\ business_i}{\sum_{i=1}^{11} Premiums\ in\ line\ of\ business_i}\right)^2 \quad (1)$$

and is used to control for the line-of-business concentration for each life insurer.

Carson and Hoyt (2000) posit that an insurer that is geographically concentrated may gain a competitive advantage over other insurers and, thus, have a lower probability of insolvency. Alternatively, a geographically concentrated life insurer may face a higher likelihood of failure due to its greater sensitivity to changes in local market conditions, including adverse mortality, morbidity changes, negative regulatory effects or deterioration in the economic environment. Thus, a Herfindahl index based on direct premiums written by state[10], GEO_MKT_CONCENTRATION, is defined as

[10] We include both U.S. State and U.S. Possessions.

$$\sum_{i=1}^{58}\left(\frac{Direct\ premums\ in\ state_i}{\sum_{i=1}^{58} Direct\ premiums\ in\ state_i}\right)^2 \quad (2)$$

and is used to control for the geographic concentration for each life insurer.

Summary Statistics

The selected summary statistics for the sample of insurers with private debt holdings and those without private debt holdings are shown in Table 5. Table 6 gives the correlation matrix.

The difference in means and medians between life insurers with private debt holdings and those without any private debt holdings are mostly as expected and are significant at the p=.05 or better, with the exception of the variable LIQUIDITY, which is expected to be higher for insurers with private debt. As Table 5 shows, the median rating of life insurers with private debt is an A, and the median rating of life insurers without private debt is a B+. Almost 27 percent of life insurers holding private debt are licensed in New York State, comparing with only 18 percent without private debt holdings. Insurers with private debt holdings are prevalent among publicly traded insurers (15%) versus insurers without private debt (11%). Nearly 11 percent of insurers holding private debt are mutual firms, comparing to 4 percent for insurers holding no private debt. Lastly, it is worth noting that firms holding private debt tend to be affiliated with groups, have foreign ownership, diversify geographically, and have higher concentration in business and higher life insurance contract premiums.

Table 5 SUMMARY STATISTICS 2003-2007

Variable	No-Private-Debt Holding	Private-Debt Holding	t-value	
BUSINESS_CONCENTRATION				
Mean	0.51	0.58	-6.07	***
Median	0.50	0.57	-5.74	***
LIQUIDITY				

Mean	1.86	0.95	17.60	***
Median	1.18	0.81	25.29	***
FOREIGN				
Mean	0.11	0.20	-6.62	***
Median	0.00	0.00	-6.58	***
GEO_MKT_CONCENTRATION				
Mean	0.43	0.25	14.89	***
Median	0.29	0.08	13.12	***
GROUP_LEVEL				
Mean	0.79	0.92	-10.12	***
Median	1.00	1.00	-9.96	***
LIFE				
Mean	13.31	16.56	-17.20	***
Median	15.14	17.67	-24.12	***
MUTUAL				
Mean	0.04	0.11	-7.45	***
Median	0.00	0.00	-7.39	***
NY_LIC				
Mean	0.18	0.27	-6.34	***
Median	0.00	0.00	-6.30	***
RATING_SCORE				
Mean	7.36	8.14	-19.99	***
Median	7.00	8.00	-22.50	***
TRADED				
Mean	0.11	0.15	-3.22	**
Median	0.00	0.00	-3.22	**

The Wilcoxon z-statistics is reported for medians.

The Chi-square statistics is reported for variables those are categorical.

** Significant at five percent level. *** Significant at one percent level.

Table 6 CORRELATION MATRIX

VARIABLE	1	2	3	4	5	6	7	8	9	10
1 RATING_SCORE	1									
2 MUTUAL	-0.0017	1								
3 NY_LIC	0.2255	0.1035	1							
4 TRADED	0.0247	-0.1075	0.072	1						
5 LIQUIDITY	-0.0741	-0.0978	-0.0484	-0.0495	1					
6 LIFE	0.2823	0.0821	-0.0052	0.0714	-0.3551	1				
7 FOREIGN	0.1598	-0.1107	0.0214	-0.0594	-0.0959	0.058	1			

8 GROUP_LEVEL	0.2634	-0.178	0.1114	0.0776	0.0513	-0.0148	0.107	1		
9 GEO_MKT_CONCENTRATION	-0.0907	-0.1239	0.1853	-0.065	0.1255	-0.1142	-0.1102	-0.0975	1	
10 BUSINESS_CONCENTRATION	0.1547	-0.035	0.0679	-0.0858	-0.0687	-0.0176	0.1035	0.0115	-0.0005	1

Model Specification

Because we have significant number of firms with time-invariant dependent variables, using fixed effects regression model is infeasible. Therefore, we propose to estimate the model using two different non linear random effects Probit models.

A traditional random effects Probit model based on the longitudinal data is used as the basic model for estimation, and we include both firms that hold private debt and firms that do not hold private debt as samples. The generic model is specified as

$$P(y_{it} = 1|X_i, \alpha_i) = P(y_{it} = 1|X_{it}, \alpha_i) = \Phi(X_{it}\beta + \alpha_i), t = 1, \dots, T \quad (3)$$

where α_i is treated as the unobserved random variable draw along with (X_i, y_i) and X_i contains X_{it} for all t. The first equality says that X_{it} is strictly exogenous conditional on α_i and the second equality is the standard probit assumption, with α_i appearing additively in the index inside $\Phi(.)$.

For the unobserved effects in this Probit model, we must make an assumption about the relationship between α_i and X_i. The traditional Probit model has the assumption that

$$\alpha_i|X_i \sim Normal\ (0, \sigma_\alpha^2)\ and\ Cov(X_{it,}\alpha_i) = 0 \quad (4)$$

This is a strong and critical assumption in order to get consistent estimates of the βs, as it implies that α_i and X_i are independent, uncorrelated and that α_i has a normal distribution.

In our second and more advanced estimation model, the point of introducing the unobserved effects α_i is to explicitly allow unobservables to be correlated with some elements of X_{it}. Chamberlain (1980) suggests to allow for correlation between α_i and X_i by assuming that

$$\alpha_i | X_i \sim Normal\ (\varphi + \bar{X}_i\delta, \sigma_a^2) \tag{5}$$

where $\overline{X}_i$ is the average of $X_{it}, t = 1, \dots, T$ and σ_a^2 is the variance of a_i in the equation $\alpha_i = \varphi + \bar{X}_i\delta + a_i$ (In other words, σ_a^2 is the conditional variance of a_i, which is assumed not to depend on X_i). Wooldridge (2005) refers to this model as Chamberlain's random effects Probit model. While the above assumption is restrictive in that it specifies a distribution for α_i given X_i, it at least allows for some dependence between α_i and X_i. Adding $\overline{X}_i$ as a set of controls for unobserved heterogeneity is very intuitive: we are estimating the effect of changing X_{it} but holding the time average fixed.

Applying this Chamberlain's random effects Probit model to our specifications, we have latent variable version of the model[11] as

$$\begin{aligned} y_{it}^* = {} & \beta_0 + \beta_1 RATING\_SCORE_{it} + \beta_2 MUTUAL_{it} + \beta_3 NY\_LIC_{it} + \beta_4 TRADED_{it} \\ & + \beta_5 LIQUIDITY_{it} + \beta_6 LIFE_{it} + \beta_7 FOREIGN_{it} \\ & + \beta_8 GROUP\_LEVEL_{it} + \beta_9 GEO\_MKT\_CONCENTRATION_{it} \\ & + \beta_{10} BUSINESS\_CONCENTRATION_{it} \\ & + \beta_{11}\overline{LIQUIDITY_i} + \beta_{12}\overline{LIFE_i} \\ & + \beta_{13}\overline{BUSINESS\_CONCENTRATION_i} + \beta_{14-17} YEAR_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

$$y_{it} = \begin{cases} = 0\ if\ y_{it}^* \leq 0 \\ = 1\ if\ y_{it}^* > 0 \end{cases}$$

In the next section, we analyze the empirical estimation with these two models separately and the sensitivity of the results under different specifications is also explored.

[11] Only three variables can be treated as time-varying.

5 Empirical Results

Findings

The results of traditional Probit model and Chamberlain's random effects Probit model are presented in Table 7. From both two Probit models, we find that life insurers with higher financial quality are more likely to invest in private debt, as the coefficient on variable RATING_SCORE is positive and highly significant. This supports our conjecture that high quality lenders convey more accurate information about the borrower's risk and value, and that firms seeking a credible signal of positive private information will use high quality lenders.

Contrary to our expectations, the coefficient of the insurer liquidity variable, LIQUIDITY, is negative, after controlling for firm's other characteristics. Considering liquidity is an important determinant for life insurer's private debt holdings, the negative coefficient might be explained by the preference and willingness of life insurers to bear the risk of private debt holdings. Even though high liquidity itself could support more private debt holdings, insurers with high liquidity level are less willing to hold private debt in the market because of the illiquidity of private debt compared to other investments, and these insurers are more consistently inclined to sustain their high liquidity level. In addition, from cross-sectional analysis, we find that insurers who sustain high liquidity levels are actually insurers with lower credit ratings[12], which also indicate their decisions of holding less or no private debt.

The coefficient of the organizational form variable, MUTUAL, is positive and highly significant. This result is consistent with the theory that the relative advantage of mutual insurers in reducing risk-shifting incentives is an important consideration in private debt investment decisions.

[12] Life insurers sustain high liquidity level have credit ratings averaged B while those sustain low liquidity level have credit ratings averaged A.

The coefficient of the regulatory environment variable, NY_LIC, is positive and significant at 5 percent level. This result provides evidence to support the hypothesis that New York regulators act as surrogate to monitor and supervise management's decisions that private debt holdings require.

Coefficients on both the ownership variable TRADED and control variable FOREIGN are positive but not significant. Although we expect to see positive and significant relation between publicly traded companies and private debt holdings, life insurers' financial quality might be a proxy for publicly traded companies' wider investment analyst coverage and higher level of financial disclosure.

The positive and significant coefficient on the group level variable, GROUP_LEVEL, can be explained by the fact that life insurers that are organized as a group of companies have the capacity to make investments in millions of dollars while maintaining portfolio diversification targets. Moreover, group affiliated insurers often have higher financial quality and are more likely to be able to maintain a internal staff of investment analysts and credit specialists required in the private debt market. Consequently, life insurers that are organized as a group of companies hold relatively more private debt.

The significant coefficient on geographic market structure variable, GEO_MKT_CONCENTRATION, is consistent with our previous differences in means/medians. Its negative relationship to private debt holdings supports of the argument that a geographically concentrated life insurer may face a higher likelihood of failure due to its greater sensitivity to changes in local market conditions, and thus holds less private debt in the market.

Two other variables, LIFE and BUSINESS_CONCENTRATION, which capture life insurance contracts and business concentration for life insurers, respectively, only show positive

and significant effects in the traditional Probit model and these effects vanish in the Chamberlain's random effects Probit model. Moveover, we observe that as we use means of time-varying variables[13] to separate the unobserved heterogeneity, these mean variables show very significant effects on the probability of private debt holdings. Obviously, this result suggests that the significant effects of LIFE and BUSINESS_CONCENTRATION in the traditional Probit model actually come from the unobserved individual firm heterogeneities and Chamberlain's Probit model is more efficient at estimating the true effects of the time-varying variables than traditional Probit model. On the other hand, for variable LIQUIDITY, even after we control for the unobserved heterogeneity, it still shows a significant and negative effect on the probability of private debt holdings.

Table 7 FULL SAMPLE REGRESSION RESULTS[14]

VARIABLES	MODEL 1 Traditional Probit	MODEL 2 Chamberlain Probit
RATING_SCORE	0.554***	0.487***
	(0.0838)	(0.0879)
MUTUAL	1.289***	1.231***
	(0.370)	(0.381)
NY_LIC	0.516**	0.555**
	(0.234)	(0.242)
TRADED	0.221	0.235
	(0.250)	(0.258)
LIQUIDITY	-0.683***	-0.383***
	(0.0940)	(0.115)
LIFE	0.0572***	-0.00762
	(0.0147)	(0.0218)
FOREIGN	0.156	0.0745
	(0.219)	(0.224)
GROUP_LEVEL	1.002***	1.130***
	(0.254)	(0.262)
GEO_MKT_CONCENTRATION	-1.325***	-1.262***
	(0.256)	(0.266)
BUSINESS_CONCENTRATION	0.426*	-0.224
	(0.250)	(0.382)
d2004	0.0287	0.101

[13] For Geo_mkt_concentration, we observe that more than 80% of variation is between -1% and +1% which can be treated as no time-varying in our case.
[14] Coefficients are reported with standard error in the parentheses below.

	(0.119)	(0.122)
d2005	-0.0422	0.0418
	(0.123)	(0.126)
d2006	0.0493	0.113
	(0.125)	(0.128)
d2007	-0.000389	0.0627
	(0.127)	(0.130)
LIQUIDITY_m[15]		-0.405***
		(0.145)
LIFE_m		0.119***
		(0.0316)
BUSINESS_CONCENTRATION_m		1.099**
		(0.515)
Constant	-4.766***	-5.320***
	(0.672)	(0.719)
Observations	3055	3055

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Sensitivity & Robustness

Our findings are robust to various model specifications and variable definitions, as we show in the following.

First, Pottier (2007) uses the variable, CASH, which is defined as the ratio of cash and short-term investments to total invested assets, to measure liquidity and finds that it has a positive relationship with the proportion of private debt holdings. In order to determine whether our results are robust to different specifications of insurer's liquidity, we rerun the analysis on the full sample with alternative definition of life insurer's liquidity which is similar to the one used in Pottier (2007). The results are presented in the Table 8.

The results of the traditional Probit model using this new definition of liquidity are similar to those with A.M. BEST definition of liquidity. The coefficient of CASH is negative and significant at 1 percent level. This supports our hypothesis on the liquidity sustenance. Further,

[15] Individual firm effects are allowed to depend on overtime means of all time-varying explanatory, variables each suffixed by m in all tables.

after we control for unobserved heterogeneity by using Chamberlain's random effects Probit model, we observe the coefficient of CASH is still negative albeit insignificant, while the controlled unobserved heterogeneity part is significantly negative. Thus, our results are generally robust to different specifications of the liquidity measures.

Table 8 RESULTS WITH NEW VARIABLE SPECIFICATION

VARIABLES	MODEL 1 Traditional Probit	MODEL 2 Chamberlain Probit
RATING_SCORE	0.474***	0.364***
	(0.0813)	(0.0862)
MUTUAL	1.373***	1.121***
	(0.365)	(0.379)
NY_LIC	0.575**	0.574**
	(0.225)	(0.236)
TRADED	0.293	0.281
	(0.245)	(0.258)
CASH	-2.626***	-0.101
	(0.550)	(0.628)
LIFE	0.0774***	-0.00355
	(0.0142)	(0.0217)
FOREIGN	0.279	0.204
	(0.213)	(0.222)
GROUP_LEVEL	0.893***	0.985***
	(0.251)	(0.264)
GEO_MKT_CONCENTRATION	-1.384***	-1.298***
	(0.248)	(0.262)
BUSINESS_CONCENTRATION	0.551**	-0.124
	(0.241)	(0.371)
d2004	0.148	0.178
	(0.116)	(0.120)
d2005	0.0811	0.130
	(0.119)	(0.123)
d2006	0.166	0.188
	(0.122)	(0.125)
d2007	0.145	0.149
	(0.124)	(0.127)
CASH_m		-8.407***
		(1.344)
LIFE_m		0.130***
		(0.0310)
BUSINESS_CONCENTRATION_m		1.280**
		(0.505)
Constant	-5.219***	-5.033***
	(0.659)	(0.723)
Observations	3055	3055

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

Second, our main empirical analysis includes all life insurers regardless of firm size. As a result, our tests do not tell whether insurers do not invest in private debt because they do not have access to private debt investments, or because they choose not to invest in private debt even though they have access to private debt investments. Therefore our main findings might be driven by cases in which insurers do not have access to private debt investment. To address this issue, further analysis of the relation between size and access to private debt investments is performed.

We define insurer firm size as the nature logarithm of its total net admitted assets. We assume that a minimum firm size is needed to undertake ex ante credit analysis, perform on-going monitoring of borrowers, and achieve portfolio diversification (Prowse and Carey 1994; Pottier 2007; Carey and Prowse 1993). A sub-sample which includes firms with size greater than the minimum size of firms with positive private debt holdings is created and further analysis is performed using this sub-sample. The smallest life insurer in the sample with private debt investments has size approximately 16.25 (around 11.4 million total net admitted assets). The number of firm-year observations that meet this minimum size requirement is 2939 out of 3055 full sample. From Table 9, results of the two Probit models are qualitatively unchanged comparing with our earlier results. Overall, these results suggest that our main findings are not driven by insurers that do not have access to private debt investments.

Table 9 RESULTS ON SUB-SAMPLE FOR FIRM SIZE

VARIABLES	MODEL 1 Traditional Probit	MODEL 2 Chamberlain Probit
RATING_SCORE	0.520***	0.457***

	(0.0854)	(0.0896)
MUTUAL	1.259***	1.207***
	(0.370)	(0.381)
NY_LIC	0.493**	0.538**
	(0.235)	(0.243)
TRADED	0.185	0.206
	(0.251)	(0.258)
LIQUIDITY	-0.647***	-0.389***
	(0.0964)	(0.121)
LIFE	0.0571***	-0.00674
	(0.0149)	(0.0223)
FOREIGN	0.153	0.0730
	(0.220)	(0.225)
GROUP_LEVEL	1.004***	1.110***
	(0.258)	(0.266)
GEO_MKT_CONCENTRATION	-1.244***	-1.209***
	(0.261)	(0.270)
BUSINESS_CONCENTRATION	0.431*	-0.225
	(0.255)	(0.397)
d2004	0.0176	0.0867
	(0.120)	(0.123)
d2005	-0.0440	0.0348
	(0.124)	(0.127)
d2006	0.0506	0.110
	(0.126)	(0.129)
d2007	0.00869	0.0638
	(0.128)	(0.130)
LIQUIDITY_m		-0.351**
		(0.153)
LIFE_m		0.117***
		(0.0320)
BUSINESS_CONCENTRATION_m		1.085**
		(0.529)
Constant	-4.514***	-5.065***
	(0.682)	(0.727)
Observations	2939	2939

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Third, to determine whether our results may vary between stock and mutual insurers, or between affiliated and non-affiliated insurers, analyses are performed by using the subsets of sample life insurers that are stock insurers and affiliated insurers, respectively. Table 10 and Table 11 reveal that results of both traditional and Chamberlain's random effects Probit model using these two sub-samples are qualitatively similar to the full sample results which include both stock and mutual insurers, and both affiliated and non-affiliated insurers. The coefficient on

the regulatory environment variable, NY_LIC is no longer significant for affiliated subset. This might be explained by the fact that insurers are regulated primarily at the individual company level rather than group level (Pottier and Sommer, 1998).

Table 10 RESULTS ON SUB-SAMPLE FOR STOCK COMPANY

VARIABLES	MODEL 1 Traditional Probit	MODEL 2 Chamberlain Probit
RATING_SCORE	0.531***	0.466***
	(0.0860)	(0.0882)
NY_LIC	0.467*	0.483*
	(0.246)	(0.249)
TRADED	0.228	0.243
	(0.253)	(0.256)
LIQUIDITY	-0.653***	-0.352***
	(0.0830)	(0.107)
LIFE	0.0548***	-0.00727
	(0.0149)	(0.0215)
FOREIGN	0.155	0.0875
	(0.221)	(0.222)
GROUP_LEVEL	1.097***	1.209***
	(0.283)	(0.287)
GEO_MKT_CONCENTRATION	-1.246***	-1.175***
	(0.262)	(0.266)
BUSINESS_CONCENTRATION	0.494*	-0.146
	(0.255)	(0.381)
d2004	0.127	0.197
	(0.123)	(0.124)
d2005	0.0403	0.122
	(0.126)	(0.128)
d2006	0.0900	0.149
	(0.129)	(0.130)
d2007	0.0605	0.119
	(0.130)	(0.132)
LIQUIDITY_m		-0.314**
		(0.123)
LIFE_m		0.112***
		(0.0313)
BUSINESS_CONCENTRATION_m		1.044**
		(0.510)
Constant	-4.804***	-5.383***
	(0.692)	(0.729)
Observations	2802	2802

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11 RESULTS ON SUB-SAMPLE FOR AFFILIATED INSURERS

VARIABLES	MODEL 1 Traditional Probit	MODEL 2 Chamberlain Probit
RATING_SCORE	0.562***	0.498***
	(0.0877)	(0.0925)
MUTUAL	1.693***	1.677***
	(0.499)	(0.525)
NY_LIC	0.366	0.398
	(0.243)	(0.253)
TRADED	0.188	0.206
	(0.257)	(0.266)
LIQUIDITY	-0.683***	-0.377***
	(0.0964)	(0.117)
LIFE	0.0566***	-0.00331
	(0.0150)	(0.0225)
FOREIGN	0.104	0.0159
	(0.224)	(0.230)
GEO_MKT_CONCENTRATION	-1.023***	-0.942***
	(0.271)	(0.284)
BUSINESS_CONCENTRATION	0.453*	-0.150
	(0.266)	(0.409)
d2004	0.0875	0.168
	(0.128)	(0.131)
d2005	-0.0188	0.0697
	(0.131)	(0.135)
d2006	0.0689	0.139
	(0.135)	(0.138)
d2007	0.0470	0.118
	(0.137)	(0.140)
LIQUIDITY_m		-0.427***
		(0.147)
LIFE_m		0.109***
		(0.0324)
BUSINESS_CONCENTRATION_m		1.032*
		(0.553)
Constant	-3.894***	-4.247***
	(0.700)	(0.747)
Observations	2638	2638

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

We analyze the determinants of private debt holdings for life insurers as major lenders in the market with a sample of 667 life insurers over the period of 2003 to 2007. Unlike prior studies on private debt holdings, we examine the investment portfolio using longitudinal data rather than

cross-sectional data. By implementing Chamberlain's random effects Probit model, we disentangle the effects of specific firm characteristics on private debt holdings from that of unobserved heterogeneity that might cause biased estimation.

Our findings indicate that the decision of private debt holdings for life insurer is most strongly associated with their financial strength, organization form, regulation stringency, group affiliation, liquidity level and geographic market structure. Firms that 1) have higher financial quality, 2) are mutual insurers, 3) face stringent regulation, 4) have less liquidity and less concentrated geographic market structure, and 5) are affiliated with groups are more prevalent lenders in the private debt market. Moreover, these findings are robust to a battery of additional robustness checks.

Finally, our findings raise several interesting questions for future research. First, private debt encompasses a variety of lending instruments, such as term loans, revolvers, and senior notes, which appear to be very different in terms of placement structure, maturity, and identity of lenders. Further investigation of these types of private debt could enhance our understanding of this market. Second, it would be interesting to investigate whether the relations documented in this study change over time, or vary according to changes in the macroeconomic environment.

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