REGULATORY ENFORCEMENT AND OFF-BALANCE SHEET ENTITIES: EVIDENCE FROM THE "SHADOW INSURANCE" MARKET

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ABSTRACT

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Captive reinsurance ("shadow insurance") is a controversial form of non-traditional reinsurance that is associated with opaque statutory reporting in the insurance industry. Captive reinsurance subsidiaries are special purposes entities that are not consolidated under statutory accounting principles (SAP) and can be used to manage a firm's statutory reserve liabilities and premiums, which are reported net of reinsurance. This paper studies the relation between regulatory enforcement and an insurance firm's use of off-balance sheet captive insurance entities, as well as the implications of regulatory enforcement and captive reinsurance use for the firm's credit ratings and the degree of information asymmetry in the market for the firm's equity. I find that regulatory enforcement is negatively associated with the use of captive reinsurance among life insurers. Among life insurers, I find some evidence that credit rating agencies infer information about a firm's default risk from its regulatory enforcement environment, and that regulatory enforcement can reduce information asymmetry in the market. Contrary to what I hypothesize, the use of "shadow insurance" is negatively associated with proxies for information asymmetry in equity markets among pure property-casualty insurers. Overall, my findings suggest that regulated firms, credit rating agencies, and equity investors act as if regulatory enforcement increases the credibility of accounting reports and reduces information asymmetry in the market. Also, public awareness of accounting issues may be important for regulatory enforcement and its credibility. These findings should be of interest to regulators, investors, preparers, and other stakeholders impacted by accounting standards and their enforcement.

This thesis is dedicated to my family.

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CHAPTER 1: INTRODUCTION

In this paper, I examine regulatory enforcement of complex accounting standards pertaining to off-balance sheet transactions in the insurance industry (hereafter, ***shadow insurance***). U.S. insurance firms are regulated at the state level, and there is considerable heterogeneity across states in enforcement. I examine whether heterogeneity in regulatory enforcement is associated with insurers' use of off-balance sheet entities for statutory reporting. I also examine whether credit ratings and proxies for information asymmetry in equity markets reflect a firm's regulatory enforcement climate and its use of shadow insurance.[1]

Prior academic literature provides evidence on the role of regulatory enforcement. Some studies find that regulatory enforcement can significantly affect managers, auditors, underwriters, and market participants (Dechow et al. 1996; Beatty et al. 1998; Beneish 1999; Farber 2005). Regulatory enforcement is associated with a lower cost of capital (Leuz and Hail 2006), as well as a reduction in information asymmetry and incentives for tax avoidance (Guedhami and Pittman 2008; El Ghoul et al. 2011; Johnson and Petacchi 2014; Bens et al. 2016; Kubick et al. 2016). Other studies demonstrate some of the limits of regulatory enforcement (La Porta et al. 2006; Djankov et al. 2008) and that regulated firms anticipate regulatory enforcement (Dechow et al. 2016). Regulatory agencies can be captured by the industry they monitor (deHaan et al. 2015; Cornaggia et al. 2016), and regulatory enforcement can be limited due to information asymmetry between regulated entities and regulators.

[1] In the United States all insurance companies file regulatory reports to their state regulators under Statutory Accounting Principles (SAP). Public insurance companies also file financial reports to the Securities and Exchange Commission (SEC) under the U.S. GAAP. SAP and US GAAP differ in their requirements for the consolidation of variable interest entities (VIEs). Under SAP insurance companies have an option to not consolidate VIEs that must be consolidated under US GAAP. *Shadow insurance* represents transactions with related VIEs that are not consolidated, and hence off-balance sheet, under SAP.

One source of information asymmetry between regulators and regulated entities stems from accounting standards that allow off-balance sheet activities. For example, in the 2002 Enron scandal, “a Senate investigation found “systemic and catastrophic failure” by the Securities and Exchange Commission in its regulation of Enron Corp” that used off-balance sheet entities to hide losses and risks from the equity investors and various external monitors (Wall Street Journal 2002). Off-balance sheet activities in the financial sector have been implicated in the financial crisis of 2007-2008. The 2008 American International Group (AIG) bailout revealed that the company had liquidity issues in its non-insurance entity, which was not consolidated under Statutory Accounting Principles (SAP) and hence not subject to insurance regulation. The AIG was “doing stuff that was totally outside of what insurance regulators were looking for or able to look for” (Sage Business Researcher 2017). Since 2008 various regulators in the United States and abroad have taken steps to regulate off-balance sheet transactions in the financial sector. However, the shadow banking and insurance sectors are growing in the United State and abroad (e.g., UK, China, Ireland, Germany), and there is little evidence on whether regulatory enforcement addresses the use of off-balance sheet transactions in the financial sector (Sage Business Researcher 2017).

This study contributes to the debate about regulatory enforcement of accounting standards by examining captive reinsurance, a complex form of non-traditional reinsurance that is associated with statutory reporting opacity in the insurance industry. Captive reinsurers are subsidiaries organized by insurance companies to provide reinsurance services to the captive’s parent and its affiliates (i.e., sister subsidiaries). Similar to traditional reinsurance, captive reinsurance allows insurers to reduce reinsurance contracting costs, to decrease tax liabilities, and to manage statutory reserve liabilities through reinsurance accounting (see Appendix A for an example). Reinsurance accounting standards have some similarities across statutory accounting principles (SAP) and US GAAP.[2] Under both frameworks, if an insurer transfers insurance risk to other companies, it can use reinsurance accounting to reduce its net loss reserves; deposit accounting standards (i.e., no reinsurance credit) apply to reinsurance contracts that result in risk retention. One important difference, however, is that under SAP insurance reports are net of reinsurance, while under US GAAP financial reports are gross of reinsurance. As a result, insurance companies could have incentives to use reinsurance accounting to manage their reported numbers (e.g., net written premiums, net loss reserves) under SAP.

Unlike traditional third-party reinsurance, affiliated captive reinsurance can be opaque due to SAP consolidation standards and confidential reporting. In contrast to U.S. GAAP, variable interest entities such as affiliated captive reinsurance subsidiaries are not consolidated under SAP, allowing insurance firms to report on a stand-alone basis. As a result, the risk associated with captive reinsurance stays off-balance sheet. In most jurisdictions, captive reinsurers are not required to publicly release their financial statements and must privately (confidentially) report only to the state regulator that issued the original captive license (NAIC White Paper 2013)[3]. This statutory reporting opacity, in addition to the accounting complexity of captive reinsurance transactions, could limit policyholders', creditors', and equity holders' ability to determine the degree of risk retention by the captive's parent and its affiliates. Hence, stakeholders must rely on state insurance regulation for protection.

[2] Exceptions include retroactive reinsurance contracts, liability for overdue reinsurance receivables, and contracts that transfer underwriting risk but not timing risk.

[3] Only Iowa's captive standards allow the public release of captives' financial statements. In other captive jurisdictions, captives' financial statements can be released only under subpoena, unless the company permits its insurance commissioner to release the captive's financial data. In a few jurisdictions, captive standards do not allow the insurance commissioner to release captives' financial records even under subpoena (NAIC White Paper 2013).

Advocates of captive reinsurance argue that state insurance regulation provides adequate protection against risks imposed by captive reinsurance (Harrington 2015). Insurance regulators can disallow the transfer of reserves to affiliated captives, as captive reinsurance transactions require regulatory approval. However, regulatory approval of captive reinsurance is inherently subjective, and there is significant variation across states in enforcement incentives and opportunities. Critics allege that captive reinsurance allows an insurance company to engage in regulatory arbitrage of reserving standards by shifting risk into a market with high opacity and low regulatory oversight (Harrington 2015). Low regulatory oversight is driven by regulators' incentives to encourage economic development in their state and results in lax enforcement of reinsurance accounting standards (Schwarcz 2015). Overall, regulation of captive reinsurance has raised the question whether group regulation of insurers, which report on stand-alone basis, is adequate or results in lax regulatory enforcement environment.

Motivated by the debate about the adequacy of state insurance regulation, my thesis examines the association between regulatory enforcement and the use of captive reinsurers, as well as the implications of regulatory enforcement and captive insurance use for a firm's credit ratings and the degree of information asymmetry in the market for the firm's equity. Based on the prior academic literature and insights from the new institutional economics (NIE) framework (Richter 2015), I hypothesize that regulatory enforcement reduces incentives for captive reinsurance (**H1**) due to increases in firms' expected regulatory compliance and non-compliance costs.

Regulatory enforcement can be state-dependent. That is, regulators can use public information signals about the firm to condition their enforcement of accounting standards (Mills and Sansing 2000; Beck et al. 2000; Mills et al. 2010). Since surplus adequacy is important for solvency monitoring, I hypothesize that a firm's surplus position (constraint) moderates the association between regulatory enforcement and captive reinsurance. Insurers need "free" surplus to grow (i.e., increase capacity) and to manage their risk positions (Society of Actuaries 2000). Furthermore, capacity constraints can result in increased insurance prices and reduced insurance product availability (Doherty and Posey 1997), which are considered in insurance regulation. Hence, I expect that insurers with "constrained" surplus are more likely to receive regulatory attention, and thus, I hypothesize a stronger negative association between regulatory enforcement and captive reinsurance among insurers' with the surplus constraint (**H2**).

Based on the theory of hard and soft information (Bertomeu and Marinovic 2016), I argue that regulatory enforcement is a form of "soft" information that increases the credibility of insurers' financial reports to other stakeholders. I predict that regulatory enforcement is positively associated with credit ratings (**H3**). I also hypothesize that regulatory enforcement helps to reduce information asymmetry in the market (**H4**). Finally, I examine whether the use of *shadow insurance* is associated with information asymmetry in the capital markets (**H5**).

To test these hypotheses, I develop a measure of regulatory enforcement based on general theories of regulation from political science, sociology, law, and economics, which argue that regulatory enforcement is characterized by enforcement capacity (i.e., the regulator's ability to exert control over regulated entities), enforcement style (i.e. how a regulator interacts with regulated entities and enforces standards), and the broader political environment (Carrigan and Harrington 2015). Primary tests of my first two hypotheses (**H1** and **H2**) are based on a Tobit model that examines the use of captive reinsurance by sixty two large, public U.S. insurance groups between 2006 and 2015. The sample includes pure property-casualty (P/C), pure life-health (L/H), and diversified (i.e., both P/C and L/H) insurers. Since the debate about the risks imposed by captive reinsurance has been in the life insurance sector, I divide my sample into two parts: "Life" insurers include both pure L/H insurance groups and diversified insurers (i.e., thirty two insurance groups), and "P/C" insurers include only pure property-casualty insurance groups (i.e., thirty insurance groups). The tests of my credit rating hypothesis (**H3)** are based on the S&P credit ratings for these insurance groups between 2006 and 2015. The tests of the information asymmetry hypotheses (**H4** and **H5**) are based on the market liquidity tests for these insurance groups between 2006 and 2015.

Among life insurers, I find evidence supporting **H1**, **H3**, and **H4** and some preliminary evidence supporting **H2**. Consistent with my first hypothesis (**H1**), regulatory enforcement is negatively associated with the use of captive reinsurance subsidiaries among life insurers. That is, regulatory enforcement can constrain a parent's incentives to use off-balance sheet entities. I find some evidence of a direct positive relation between regulatory enforcement and credit ratings (**H3**). However, there is a weak evidence of a negative association between regulatory enforcement and market illiquidity (**H4**). I do not find support for **H5** (i.e., a positive association between captive reinsurance and market illiquidity) among life insurers. In my tests of H2, consistent with the general theories of regulation and prior research, I find that a firm's characteristic (i.e., in this setting, leverage) interacts with regulatory enforcement (i.e., regulatory enforcement is state-dependent). However, my model is based on ad-hoc threshold levels of leverage and some independent variables are highly correlated. Due to multi-collinearity between the variables of interest and possible model misspecification, I cannot draw conclusions regarding the role of an insurer's financial position in regulatory enforcement of reinsurance standards. All results on H2 should be interpreted with caution.

Among P/C insurers, I do not find support for **H1** and **H3 – H5**, but there is some preliminary evidence supporting **H2.** However, similar to life insurers, the model testing H2 is possibly misspecified and there is multicollinearity in the model. Furthermore, my statistical tests could lack power (e.g., due to the unreliable measure of captive reinsurance or regulatory enforcement). Alternatively, regulatory enforcement can vary across firm types. Since the use of captive reinsurance by the P/C insurers has not been scrutinized by the regulators or media, the role of regulatory enforcement could be limited in the P/C insurer sub-sample. I find that P/C insurers with a surplus constraint (**H2**) due to high premiums (i.e., premiums-to-surplus above the 90^{th} quantile), which are facing greater regulatory enforcement, are less likely to use captives. This result, once again, is inconclusive and needs to be interpreted with caution. Finally, contrary to what I predict, the use of captive reinsurance subsidiaries is negatively associated with proxies for information asymmetry in equity markets (**H5**) among P/C insurers. This result indicates that investors or other external monitors may substitute regulatory monitoring efforts for firms that may receive less regulatory attention.

This dissertation makes at least three contributions to the literature. First, it contributes to the debate about the role of regulatory enforcement in an accounting context. My findings are of interest to regulators, insurance policyholders, creditors, and academics. I complement the literature on firms' off-balance sheet financing (Shevlin 1987; Ely 1995; Beatty et al. 1995; Altamuro 2006; Dechow and Shakespeare 2009; Feng et al. 2009; Zechman 2010) and the effect of different regulators on firm level choice and outcomes (Bushman and Williams 2012; Huizinga and Laeven 2012; Acharya et al. 2013; Nicoletti 2015; Costello et al. 2016; Gallemore 2016). Regulatory enforcement constrains incentives to use off-balance entities and is contingent on a firm's financial position. Sub-sample analyses are consistent with prior papers in economics that find that institutional features and incentives can result in seemingly inconsistent implementation of regulation (Mishkin 2000; Weinberg 2002; Agarwal et al. 2014). My analyses indicate that regulatory enforcement can vary across firm types (i.e., property-casualty versus life insurers) and time periods (i.e., low versus high public scrutiny). The analyses also suggest that public scrutiny or awareness of accounting issues may be important for regulatory enforcement of accounting standards and regulatory enforcement credibility.

Second, this paper is related to the growing literature on the incorporation of hard and soft information by credit rating agencies (Bozanic and Kraft 2014; Kraft 2015). Information varies in its degree of hardness or softness, and differential resources used in the oversight and verification of hard information can result in the differential hardness of financial reports (Bertomeu and Marinovic 2016). Consistent with the theory of hard and soft information, I find some evidence that regulatory enforcement provides “soft” information on regulatory efforts to monitor firm risk. I find that the role of regulatory enforcement as an information source can vary across firm types and time periods. I find stronger evidence for my hypothesis (**H3**) in the time period characterized by increased public scrutiny of the use of captive reinsurance by life insurers (i.e., 2012 – 2015). This finding implies that public awareness of accounting issues and regulatory efforts could be important for regulatory enforcement and its credibility.

Finally, this paper contributes to the debate on the role of the institutional environment in capital markets (Leuz and Wysocki 2016). I find some evidence that regulatory enforcement is negatively associated with information asymmetry. This result, once again, emphasizes the importance of the institutional environment. Contrary to my expectations, I find that the use of captive reinsurance doesn’t result in increased market illiquidity. Instead, there is some evidence that captive reinsurance is negatively associated with market illiquidity among pure P/C insurers.

There are important limitations to this study. I examine a small sample of large public U.S. insurers that have affiliates in their structure. My findings may not generalize to other settings (e.g., smaller insurance companies and private insurers). In addition, my research design does not definitively rule out endogeneity concerns. While I do include main regulator fixed effects to control for common regulatory enforcement and firms' self-selection into a regulatory environment, I cannot rule out an omitted variable bias. I do, however, use various robustness checks including a falsification test, an instrumental variable estimation, simultaneous equations modelling, and propensity score matching. Finally, some of the models include highly collinear independent variables and could be misspecified. All results on H2 should be interpreted with caution.

The remainder of the dissertation is organized as follows. Chapter 2 provides background on insurance regulation and captive reinsurance and develops the hypotheses. Chapter 3 describes the sample and research design. Chapter 4 presents the main results, and Chapter 5 provides supplemental analyses. Chapter 6 concludes and discusses limitations and future work.

CHAPTER 2: BACKGROUND AND HYPOTHESIS DEVELOPMENT

I begin this chapter by discussing the nature of U.S. insurance regulation. Then, I describe the goals of insurance regulation and how they are reflected in insurance industry accounting standards. Next, I discuss the differences between traditional and captive reinsurance and explain the incentives for vertical integration of the reinsurance function through captive reinsurance. Finally, I discuss prior literature and develop my hypotheses.

2.1. U.S. Insurance Regulation

U.S. insurance regulation has its historic origins in the 1800s (Klein 2005). As a result of the *Paul v. Virginia* ruling by the U.S. Supreme Court in 1869, the U.S. insurance industry is regulated at the state level. To increase efficiency and reduce redundancy inherent in a system of 56 regulatory bodies, U.S. insurance regulators coordinate their efforts, often through the National Association of Insurance Commissioners (NAIC). Many statutory accounting standards are uniform across states, and insurance regulators freely share information (except for captive reinsurer data) with each other through a centralized financial database. Although insurance firms must meet the regulatory requirements of each state in which they operate, states can defer insurance regulation to the firm's domiciliary insurance regulator.

Insurance group supervision is based on the NAIC model law adopted in 1969, with subsequent revisions (NAIC 2012a). This model law applies to groups of two or more affiliates, at least one of which is an insurer. Each insurance group is assigned a lead (main) regulator, who coordinates enforcement efforts and cooperation among the domiciliary insurance regulators who monitor the various insurance affiliates in the group. Insurance group supervision is based on the "windows and walls" approach (NAIC 2012a). Regulators have "windows" to scrutinize an insurance group's activities (e.g., a shared information database, NAIC Schedule Y which provides a holding company organizational chart, and the right to examine the subsidiaries in the insurance group) and “walls” to protect surplus by requiring regulatory approval of material related-party transactions such as reinsurance and management agreements, cost sharing, investment purchases and intercompany investments, extraordinary dividends, and tax-allocation agreements. The protection of surplus is one of the key objectives of insurance regulation.

2.2. Solvency Regulation in the Insurance Industry

State insurance regulation is primarily focused on protecting policyholders from losses by ensuring the solvency, i.e., capital adequacy, of insurance companies (Galloway and Galloway 1986). Regulation of solvency is accomplished by conservative statutory accounting standards, cross-state review of insurers’ financial position with the domiciliary state taking a lead position, risk-focused examinations, actuarial certification of policy reserves, and capital requirements. Insurance regulators often impose capital adequacy, solvency, and liquidity requirements and restrictions on market entry, business activities, and investments (Galloway and Galloway 1986).

2.2.1. Statutory Accounting Principles (SAP) and Loss Reserving

Statutory accounting principles (SAP) are established by state insurance regulators and are required by state law. Since insurance is regulated at the state level, insurance regulators can set statutory accounting standards in their state that deviate from standards set in other state insurance jurisdictions. Also, insurers can request a permission from the domiciliary state regulator to depart from SAP. In general, insurers use SAP to report to insurance regulators and the Internal Revenue Service (IRS). Public insurers use US GAAP to report to the Securities and Exchange Commission (SEC).

Some statutory accounting principles (SAP) differ from US GAAP. SAP and US GAAP provide similar information about an insurer’s performance. But in contrast to US GAAP, SAP aims to reveal solvency and thus focuses more on the balance sheet than the income statement. Under SAP, insurers report more detailed financial statements, including a section on the Capital and Surplus account. The financial statements are presented on a net of reinsurance basis. Some assets are "non-admitted" under SAP and are assigned a zero value. Examples of non-admitted assets include: prepaid expenses, furniture and equipment, accounts receivable overdue 90 or more days, portions of deferred tax assets, and goodwill. Also, SAP results in a mismatch between acquisition expenses and revenues because acquisition costs are expensed as incurred, while premium revenues are deferred. As a result, insurers need "free" surplus to finance their future sales.

Under SAP, surplus equals "admitted" assets less liabilities. Statutory loss reserves usually represent the largest liability on insurers' balance sheets. Insurers can have multiple technical (statutory) loss reserves. In general, loss reserves are estimates of liabilities for future policyholder benefits or claims that reflect expectations, managers' discretion, and the quality of the formula used to estimate the losses. For property-casualty (P/C) insurers, loss reserves represent an estimate of incurred losses: both reported losses and unreported losses (i.e., incurred but not reported; future policyholder claims). For life-health (L/H) insurers, loss reserves can include reserves for incurred losses as well as actuarial reserves for future policyholder benefits on long-duration products (e.g., annuities, whole life insurance products). Loss reserves on long-duration products (e.g., FAS 60) are determined using a prospective method as the difference between the present value of future insurance benefits and the present value of expected future premiums (i.e., discounted loss reserves are affected by interest rates and mortality assumptions).

Both under-reserving and over-reserving are costly to the firm. Under-reserving increases insolvency and bankruptcy risk and is especially costly in the case of correlated risks. Over-reserving is costly to the firm as it limits surplus available for investment and can result in increased premiums (i.e., premiums are based on a firm's loss experience: over-reserving implies greater loss experience and hence higher insurance premiums in the future). Since loss reserves affect a firm's reported profitability, surplus, and taxes, managers have incentives to manage loss reserves through loss reserve accounting or reinsurance accounting. Prior research finds that P/C insurers use discretion in loss reserves accounting to achieve reporting goals (Petroni 1992; Petroni and Shackelford 1995; Adiel 1996). However, in the life insurance sector, in contrast to the P/C lines of business, there is limited discretion in loss reserve accounting standards. As a result, life insurers would need to rely on discretion in other accounting standards (e.g., reinsurance accounting) in order to relieve a capital constraint due to excessive reserves.

2.2.2. Risk-Based Capital (RBC)

To monitor the capital adequacy of insurers, regulators use a Risk-Based Capital (RBC) ratio in combination with other monitoring tools (e.g., Insurance Regulatory Information Systems (IRIS) ratios, Financial Analysis and Surveillance Tracking (FAST) scores, inspections). The RBC ratio is not designed to compare insurers and is used by regulators to identify weakly capitalized companies.

Approximately, the RBC ratio compares insurers' adjusted surplus to the Company Action Level (CAL) risk-based capital.[4] Required minimum capital is calculated using a risk-based formula established by the regulator and reflects material risks to which an insurer has

[4] In general, the RBC framework focuses on asset risk (affiliates and others), underwriting risk, and other risks to calculate the CAL risk-based capital (American Academy of Actuaries 2014). Life, property-casualty, health, and fraternal insurers have different RBC formulas. For example, life CAL capital is based on risks from affiliates, investment, interest, claims, and general business risks and excludes immaterial risks (i.e., short term), tail risks, and risks that cannot be pre-funded (e.g., liquidity risk). Life RBC calculates a post-tax amount while P/C and Health RBC formulas measure a pre-tax amount. Life RBC is measured at the legal entity level, and there are no requirements to calculate the group level RBC.

exposure. The RBC formula establishes the CAL capital which acts like a trigger in solvency regulation. When Total Adjusted Capital (TAC) falls below CAL, it triggers a regulatory action. Regulatory actions (e.g., an RBC plan, liquidation, regulatory control) depend on the ratio between TAC and CAL. For example, life RBC ratio is approximately as follows (American Academy of Actuaries 2014):

$$RBC = \frac{TAC}{\frac{1}{2}CAL} = \frac{CAL + free\ surplus + asset\ valuation\ reserve + 0.5\ divident\ liability}{\frac{1}{2}\ CAL}$$

The RBC formula assumes that insurers' policyholder loss reserves are sufficient to cover expected losses under moderately adverse conditions (e.g., 83th percentile for normally distributed risks) and establishes a requirement for additional capital necessary to sustain losses that would arise under more adverse conditions. Statutory reserves and minimum capital requirements are expected to be sufficient to protect insurer solvency 95% of the time.

To improve their RBC ratios, insurers can enhance their surplus through structured finance, investments from a parent company (e.g., cash infusion into surplus), and reinsurance (Appendix A). Alternatively, insurers can restructure their liabilities by reducing excess liabilities, writing liabilities that use the properties of the RBC's covariance formula, using pooling or reinsurance, or by reducing growth in surplus-intensive insurance products. Insurers can reorganize their affiliates and can restructure their asset portfolio to include higher quality assets or increase portfolio diversification. Overall, product design, asset type and allocation, and liability management strategies (e.g., reinsurance) can be used to improve the RBC ratio.

2.3. Reinsurance and the Captive Reinsurance Market

2.3.1. Traditional vs. Captive Reinsurance

Insurance firms accept risk from market participants in exchange for a premium. If an insurer underprices a risk or accepts risks with high uncertainty, the insurer can incur distress costs such as volatile income and insolvency. To manage their risk exposure, insurance firms often transfer a part of their risk to other market participants such as reinsurers or investors. Thus, reinsurance is insurance coverage for insurers. Reinsurance allows insurers to increase their underwriting capacity (i.e., increase "free" surplus) and stabilize underwriting results. Reinsurance can also allow insurers to manage their statutory reserve levels, since reinsurance allows firms to reduce their net loss reserves and, thus, increase surplus (Appendix A).

Insurance firms can use both traditional (third-party) and non-traditional (affiliated) reinsurance for risk management purposes. Since there is no requirement for consolidation under SAP, the use of affiliated reinsurance results in the same statutory reporting outcomes as equivalent unaffiliated reinsurance. The non-consolidation of affiliated reinsurance allows insurers to transfer reserves to their affiliates, if affiliated reinsurance meets the reinsurance accounting standards. Regulators can allow affiliated reinsurance because, statistically, affiliated reinsurance can be used to manage risk, even though insurance affiliates belong to the same economic entity. For example, risk pooling can allow actuaries to better estimate expected losses (i.e., rely on the law of large numbers), and hence, premiums can more accurately price underwriting risk. Nevertheless, regulators still need to examine reinsurance contracts to assess risk transfer and use regulatory tools to monitor a firm's reinsurance choices.

To monitor firms' reinsurance transactions, insurance regulators set licensing standards for reinsurers. If reinsurance is purchased from a reinsurer authorized by the regulator, assurance is automatically assumed. Unauthorized reinsurance requires regulatory approval. A captive reinsurance license usually differs from a traditional reinsurance license, and as a result, captive reinsurance is usually unauthorized and requires regulatory approval.

A captive reinsurer is a reinsurance subsidiary licensed under captive insurance laws. Captive reinsurers are formed to provide reinsurance services to their parent and affiliates. Captives typically are financed through a parental guarantee, a letter of credit from a bank, or a surplus note issued to investors.[5] Thus, captive reinsurers can be "isolated" or can have exposure to capital markets.

The transaction that formed the captive must be filed with the parent's regulator(s), but is considered approved if not disapproved within a specified period of time. To receive a credit for reinsurance (i.e., to reduce net loss reserves), each captive reinsurance transaction is reviewed by the ceding insurer's domiciliary regulator and the captive's regulator to ensure that the transaction meets regulatory reinsurance standards. Captive reinsurance agreements used by an insurance group can be reviewed by the lead state regulator and other domiciliary state regulators monitoring the group.

The requirement for regulatory approval of captive reinsurance is due to the differences between captive and traditional reinsurers in their capital, reporting, and disclosure requirements. Captive insurance companies were originally created by non-insurance companies to insure risks that could not be covered by conventional insurance at reasonable cost. Since harm from insolvency of such a captive directly impacts only the non-insurance parent, captive solvency regulation is often lax. For regulatory reporting purposes, captive reinsurers can use US GAAP rather than SAP. As a result, captives can recognize assets on their balance sheets that are "non-admitted" under statutory accounting rules. For instance, captive reinsurers can use contingent

[5] Society of Actuaries 2014 (see References).

notes, parental guarantees, and deferred tax assets to support their reserves. In 2014, data released by the state of Iowa for eight captive reinsurers indicated an aggregate US GAAP surplus of $1.5 billion, in contrast to an estimated $2.7 billion deficit under statutory accounting rules (Koijen and Yogo 2016). Finally, captive reinsurers privately report only to their (captive) regulator, and captive insurance laws can limit access to a captive's financial reports even to traditional insurance regulators.

The significant growth in the use of captive reinsurance among life insurers has attracted attention from the media and regulators. In 2012, life insurers transferred an estimated $364 billion of liabilities to captive reinsurers in comparison to $11 billion transferred in 2002 (Koijen and Yogo 2016). The accounting complexity and reporting opacity of captive transactions has also resulted in public scrutiny of captive reinsurance due to disagreement about the magnitude of risk imposed by the captive reinsurance industry.[6] Strict capital standards and increased financial disclosure for captive reinsurers could reduce these risks but would also decrease capacity in the insurance industry. For example, it is estimated that in the absence of "shadow insurance", life insurance prices would rise by eighteen percent and the market would shrink by twenty three percent (Koijen and Yogo 2014). Thus, insurance regulators need to tailor their regulatory enforcement of reinsurance standards to achieve a balance between solvency and product pricing that is acceptable to insurance market participants. Also, a firm's economic motives for captive reinsurance can be considered in the regulatory process.

[6] See, e.g., studies and articles by NY Department of Financial Services (2013), the Financial Stability Oversight Council (2016), and the Federal Insurance Office (2013a).

2.3.2. Incentives for Captive Reinsurance

The choice to write a reinsurance contract with unaffiliated entities versus an affiliated captive reinsurer will depend on differences in the expected net benefits of the two options. In traditional reinsurance, an insurance firm shares its risk with an unaffiliated insurance company in exchange for a fee. Third-party reinsurance contracting involves various direct and indirect transaction costs. Ex ante reinsurance transaction costs involve reinsurer search and evaluation costs, negotiation, contract design, and reinsurance fees. Ex post transaction costs arise from reinsurers' credit risk and increased moral hazard risk.

Insurers can use affiliated captive reinsurance to reduce transaction costs. Incomplete contracting and the associated moral hazard risk due to reinsurance can be reduced by writing reinsurance contracts with affiliates. Reinsurance contracting with affiliates can be more efficient than third-party reinsurance due to lower information asymmetry between affiliated contracting parties, implying more efficient pricing of underwriting risk and counterparty credit risk. In addition, transactions with affiliates can lower search and negotiation costs and can change the bargaining position of the firm in the reinsurance market. However, ex ante contract design costs may increase, as risk sharing with affiliates has to be properly structured in order to achieve a statistical risk distribution. An example is additional reinsurance underwriting costs arising from the purchase of specialized services (e.g., actuaries, lawyers, accountants, captive managers).

In addition to reduced contracting costs, affiliated captive reinsurance can help firms reduce their tax liability by reducing the variability of pre-tax firm values when a firm's tax function is convex (Smith and Stulz 1985). Also, reinsurance premiums are deductible expenses and thus can be used to lower pretax income. Historically, the IRS disallowed reinsurance premium deductions in parent-child or brother-sister captive structures due to the economic family theory. As courts rejected this theory, the IRS has allowed deduction of reinsurance premiums when there is sufficient third party risk. While there is no bright line percentage test for third party risk, in the *Harper Group (1991)* ruling, the Tax Court found that 29% unrelated risk should be sufficient for risk distribution. Even if there are no outside policyholders, reinsurance among affiliates can qualify for tax deductibility if risk shifting and risk distribution are present (*Humana Inc*, 881 F.2d 247 (1989); *Kidde Industries v US*, 40 Fed Cl (1997)). IRS Revenue Ruling 2002-90 established a safe harbor of twelve affiliates for deductibility of captive reinsurance premiums. Finally, captive reinsurance jurisdictions usually offer favorable tax treatment of captive reinsurer income. Many captive reinsurer jurisdictions impose no premium taxes (e.g., Arizona) and no income or capital gain taxes (e.g., Bermuda, Cayman)[7]. In a concurrent working paper, Hepfer et al. (2016) find that life insurers with captive reinsurers have lower ex post GAAP ETRs.

In addition to contracting and tax costs, regulatory costs can create incentives for the vertical integration of reinsurance. Strict or inflexible regulation can impose high compliance and non-compliance costs on regulated firms, and these firms then have an incentive to take advantage of arbitrage opportunities. Regulatory arbitrage is a change in the structure of firm activities that reduces the cost of regulation. That is, regulated firms will attempt to find loopholes in the regulatory system to circumvent unfavorable regulation.

If insurers find reserving or pricing standards unfavorable, they can exit the market, bear the regulatory cost, or use a loophole in regulation to reduce this cost. For instance, if firms are required to hold excess reserves for certain products, they can stop selling those products, accept regulatory reserve requirements, or reduce reserves through a loophole. In the last case, insurers

[7] If a captive reinsurance subsidiary is located offshore, insurers might need to pay additional taxes. For instance, insurance companies need to pay federal excise taxes on reinsurance premiums paid to foreign reinsurers (i.e., 1%), unless the firm chooses the 953(d) election for its CFC (controlled foreign corporation) captive reinsurer.

can use discretion in loss reserve accounting or reinsurance accounting standards, which differ across risks and hence firm types. To decrease the cost of financing excess reserves through reinsurance, insurers can reinsure with affiliated captive reinsurers. However, in contrast to reinsurance with third parties or affiliated traditional insurers, affiliated captive reinsurance requires regulatory approval.

2.4. Hypothesis Development

There is a growing literature in accounting that examines the role of the regulatory environment in firms' decision making. There is an extent literature on the role of auditors, analysts, and credit rating agencies as external monitors. Currently, there is a growing interest in understanding enforcement and monitoring by the SEC and the IRS, as well as how those regulatory bodies affect firm behavior (Kedia and Rajgopal 2011; Ettredge et al. 2011; Robinson et al. 2011; Hoopes et al. 2012; Cassell et al. 2013; Hanlon et al. 2014; Bens et al. 2016).

These studies show that firms anticipate regulatory enforcement and change their behavior in response to a regulator's enforcement choice. Also, regulatory enforcement can change the information risk of accounting reports. For example, Dechow et al. (2016) find that firm managers opportunistically sell shares in anticipation of SEC comment letters on revenue recognition. Johnson and Petacchi (2014) show that earnings response coefficients increase and stock return volatility decreases around earnings announcements following the resolution of the SEC comment letters. The resolution of tax-related SEC comment letters is negatively associated with future tax avoidance (Kubick et al. 2016). Similarly, there is empirical evidence that IRS enforcement reduces information asymmetry and incentives for tax avoidance (Guedhami and Pittman 2008; El Ghoul et al. 2011).

Related research in banking and health care examines how different (multiple) regulators shape firms' reporting. The general inference is that regulators are heterogeneous due to institutional features and incentives and that enforcement depends on regulators' objectives. Regulators can be heterogeneous in their enforcement actions (Agarwal et al. 2014) and can selectively decouple and exhibit leniency in their enforcement (Heese et al. 2016).

2.4.1. Regulatory Enforcement and Captive Reinsurance

To develop my regulatory enforcement hypotheses, I rely on the NIE framework and the general theories of regulatory enforcement from economics, political science, law, and sociology. The NIE provides a general framework where formal institutions and their enforcement determine the incentives and constraints of economic actors and thus shape economic outcomes (North 1992; Williamson 2000; Acemoglu et al. 2004).

> "In the jargon of the economist, institutions define and limit the set of choices of individuals. Institutional constraints include both what individuals are prohibited from doing and, sometimes, under what conditions some individuals are permitted to undertake certain activities. ... They are perfectly analogous to the rules of the game in a competitive team sport" (North 1990, pp. 3-4).

The NIE framework allows me to draw inferences about the role of accounting regulation, a formal institution, on a firm's governance choice (i.e., the vertical integration of the reinsurance function). Accounting regulation consists of accounting standards and their enforcement. Accounting standards define and limit the set of choices firms can take. Accounting rules are a mapping of transaction characteristics into an accounting report (Gao 2013), and transaction characteristics can vary with a transaction type (Commons 1924). Accounting standards can be flexible to reflect transaction complexity and allow managerial judgement. To shape firm behavior and compliance, accounting standards can include various constraints or opportunities. For example, accounting standards can have exemptions or specific guidance that differs across entities. Accounting rules can also define the circumstances under which a certain activity will be permitted. In general, accounting rules result in a binary outcome: *ex post* compliance or non-compliance with a standard.

Prior literature on compliance and non-compliance spans many research areas and is too extensive to review here (e.g., see Scholz 1984; Edelman and Suchman 1997; Oded 2013). In general, standards determine compliance and non-compliance costs and thus can incentivize entities' compliance or non-compliance with standards. Strict (precise) standards result in a narrow range of compliance choices and a wide range of non-compliance behaviors, and thus, result in a wide range of probable penalties (i.e., assuming the penalty is not fixed). Imprecise standards can result in a "shadow region" chosen by the firm, which can be arguably either in the compliance or non-compliance region of acceptable behaviors. Also, ex ante conservative rules can limit managers' opportunities to "inflate transaction characteristics" (Gao 2013). Therefore, strict (imprecise) accounting standards reduce (increase) the incentives for non-compliance by increasing (decreasing) the expected non-compliance costs, which can be substantial (Karpoff et al. 2008).

The enforcement of accounting rules is also important as it determines expected non-compliance costs. Enforcement is defined as regulators' monitoring, inspection, and actual enforcement activities (e.g., warnings, fines) that aim to achieve regulatory outcomes (OECD 2014). Regulatory detection efforts (i.e., monitoring and inspection) and enforcement incentives affect the optimal probability of detecting a violation and imposing a penalty for non-compliance. That is, regulatory enforcement affects a firm's expected non-compliance costs (*NCC*) by determining the probability of detection ($p(D)$) and the probability of enforcing ($p(E)$)

a certain penalty (*P*). Thus, *ex ante* non-compliance costs can be determined as follows: $E\ (NCC) = P * p\ (D) * p\ (E)$.

Non-compliance costs vary with the penalty choice (*P*), which can be informal or formal. Regulatory penalties can range from regulatory non-approval and warnings to fines and criminal prosecutions. Penalty structure can include fixed, variable, or both components.

The probability of detection (*p(D)*) and the probability of enforcement (*p(E)*) depend on regulators' monitoring, inspection, and enforcement activities, which can be targeted, i.e., state-dependent (Landsberger and Meilijson 1982; Greenberg 1984; Harrington 1988). For instance, regulators can condition their enforcement choice on a firm's reputation for non-compliance (Malik 2014), the severity of violation, or regulatory objectives, etc. Competing priorities and external environment pressures can change the incentives to enforce accounting standards. Regulators' beliefs in the adequacy of accounting standards or in their ability to verify non-compliance with those rules could also shape regulators' incentives to enforce standards. Depending on the standard type, penalty structure, and institutional environment, accounting standards and regulatory enforcement can be either substitutes or complements (Laux and Stocken 2014). For example, when penalties are variable (fixed), accounting standards and regulatory enforcement are substitutes (complements) in their effect on misreporting.

In the context of captive reinsurance, accounting standards (i.e., reinsurance accounting) are very subjective and imprecise, allowing an opportunity to establish a lower "shadow threshold" for compliance purposes. To qualify for reinsurance accounting, a reinsurance contract has to transfer insurance risk. A reinsurance contract might not qualify for reinsurance accounting if the contract transfers insurance risk at the individual contract level, but not at the aggregate level when all reinsurance contracts are considered, and vice versa. Also, reinsurance contracts can have provisions that might limit risk transfer. Thus, regulators need to examine all reinsurance contracts with a reinsurer to ensure the compliance with risk transfer requirements. This, in turn, allows insurers to establish a "shadow threshold" in their compliance with reinsurance accounting standards.

As the result of subjectivity inherent in reinsurance accounting standards, the expected non-compliance costs associated with reinsurance accounting standards will vary with firm characteristics. While direct penalties (i.e., fines) are likely small, the indirect "penalty" (i.e., regulatory disapproval of a captive transaction and hence the requirement to put the transferred loss reserves back on the balance sheet of the parent company) could be large.

Prior literature finds that ambiguous standards create discretion to report aggressively (Beatty and Weber 2006; Dechow et al. 2010; Blacconiere et al. 2011, Bratten et al. 2013) unless regulatory enforcement constrains aggressive reporting by increasing non-compliance costs. Since captive reinsurance transactions require regulatory approval, the probability of regulatory detection and enforcement of compliance with reinsurance accounting standards can be high. I hypothesize that when regulatory enforcement is strong and hence the probability of detection and enforcement is high, the expected non-compliance costs (i.e., fines, disapproval of captive reinsurance transactions, bad reputation) are high and thus a firm is less likely to use captive reinsurance transactions. In other words, regulatory enforcement is negatively associated with the use of captive reinsurers. My first hypothesis is as follows (i.e., in the alternative form):

> **Hypothesis 1:** Ceteris paribus, the number of affiliated captive reinsurers is negatively associated with regulatory enforcement.

Since captive reinsurance transactions are complex and opaque, regulatory approval of captive reinsurance is inherently subjective. Regulatory enforcement actions towards captive reinsurance are likely state-dependent and thus can vary across firm types. Since captive reinsurance affects a firm's solvency, regulators will likely scrutinize captive reinsurance based on a firm's leverage position.

Anecdotal evidence suggests that captive reinsurance has been associated with regulatory arbitrage incentives to circumvent statutory reserve standards in the life insurance sector. Insurance regulators use assets-to-surplus to measure life insurers' leverage (Federal Insurance Office 2013B). High leverage indicates that a life insurer has a greater exposure to estimation errors (e.g., long-tail risks) and thus has to rely on having adequate reserve funds. Life insurers would need to have sufficient reserves before captive reinsurance could be used. I hypothesize that very high or very low leverage could attract regulatory attention to the use of captive reinsurance and thus could result in anticipated greater regulatory enforcement of reinsurance accounting standards.

Surplus constraints can also result from rapid growth. Prior research and numerous case studies have shown that rapid growth rates can result in financial problems, including bankruptcy, among P/C insurers (Fu 2012). Insurance regulators monitor premium-to-surplus ratios among P/C insurers (NAIC 2016). Insurers that issue long-tail risks are expected, in general, to maintain lower gross premiums-to-surplus and net premium-to-surplus ratios because it is more difficult to estimate losses for products with the long-tail risk (i.e., there is a greater variability of losses on these products) (NAIC 2016). Thus, a high premium-to-surplus ratio could attract regulatory attention to the use of captive reinsurance by P/C insurers (i.e., captive reinsurance affects reported net reserves and net premiums under SAP).

Since surplus monitoring is important in insurance solvency regulation, insurance regulators are likely to be critical of captive reinsurance for firms with potentially constrained surplus due to insolvency risk considerations. Thus, my second hypothesis is as follows (in the alternative form):

Hypothesis 2: Ceteris paribus, the negative association between captive reinsurance and regulatory enforcement is stronger for firms with potentially constrained surplus.

2.4.2. Regulatory Enforcement, Captive Reinsurance, and Credit Ratings

In addition to insurance regulators, credit rating agencies evaluate risks associated with captive reinsurance. Since captive transactions are complex and opaque, credit rating agencies will likely use subjectivity in their assessment of captive reinsurance risks. For example, in 2014, the S&P credit rating agency issued proposed guidance on its approach to evaluation of captive reinsurance. S&P examines captive reinsurance based on the economic view of the entity (Society of Actuaries 2014). The adjustments to the entity's statutory statements depend on regulatory approval of captive reinsurance credits. Similarly, Moody's adjusts credit ratings to reflect aggressive accounting, management quality, governance risk, etc. (Moody's 2007). Thus, credit rating agencies may infer "soft" information on firm risk based on regulatory enforcement environment.

Both hard (quantifiable) and soft (qualitative) information can be used in the evaluation of firm risk and performance. Kraft (2015) finds that credit rating agencies use both hard and soft information to better evaluate firms' default risks. However, the responsiveness of credit ratings can be limited. Post-issuance credit rating monitoring can be lax, especially in the presence of off-balance sheet items (Bonsall et al. 2015).

Credit rating agencies can rely on the monitoring and information intermediation efforts of other external monitors. Information acquisition efforts can depend on information available from other regulators (Bozanic et al. 2016). Cheng and Subramanyam (2008) find that the credit ratings of non-financial firms are associated with analyst following. However, in the captive reinsurance setting, analysts are an unlikely source of additional information due to the opacity of captive reinsurers. Regulators, on the other hand, have (limited) access to information on the "shadow insurance" market as well as the power to enforce reinsurance accounting standards and disallow captive reinsurance. Thus, credit rating agencies can infer soft information on a firm's default risk based on regulatory enforcement. Regulatory enforcement can decrease risks imposed by regulated entities through regulatory detection and actual enforcement actions. Thus, my third hypothesis is as follows (in the alternative form):

> **Hypothesis 3:** Ceteris paribus, credit ratings are positively associated with regulatory enforcement.

2.4.3. Regulatory Enforcement, Captive Reinsurance, and Capital Markets

Accounting standards and their enforcement are also important in equity markets. Accounting regulation can influence the level of information asymmetry between managers and investors (Healy and Palepu 2001, Beyer et al. 2010), as well as analyst information processing (Asbaugh and Pincus 2001, Wang et al. 2008, Tan et al. 2010). The quality of financial information is a function of both accounting standards and regulatory enforcement (Sunder 1997, Kothari 2000).

Regulatory enforcement can reduce the instances of financial reporting-related fraud and thus increase the reliability of financial reports (Ball 2001). For example, the increased reliability of reports can reduce financial analysts' uncertainty about the accounting methods used and thus make the task of forecasting earnings easier (Hope 2003). Also, regulatory enforcement can increase the credibility of reports based on imprecise standards (Kolev 2013; Bens et al. 2016). Furthermore, by preventing aggressive reporting, regulatory enforcement results in reports that inform investors about the lower bound (worst-case scenario), which increases liquidity because buyers are informed about credible minimum bids (Lunawat et al. 2014). Based on the prior literature, I hypothesize that regulatory enforcement can increase the credibility of financial reports and thus reduce information asymmetry. My fourth hypothesis is as follows (in the alternative form):

> **Hypothesis 4:** Ceteris paribus, market illiquidity is negatively associated with regulatory enforcement.

In addition to regulatory enforcement, market liquidity and the information environment are affected by the quality of accounting information. However, accounting reporting quality is a complex construct with multiple dimensions that include such attributes as earnings quality, disclosure quality, comparability, consistency, reliability, relevance, and various types of complexity (e.g., accounting, linguistic). In the case of *shadow insurance*, I argue that the use of captive reinsurance transactions can change firm's earnings quality, the reliability and comparability (i.e., the precision of across-firm information) of accounting reports, and information complexity. Captive reinsurance transactions impact a firm's estimation of loss reserves and hence the firm's earnings quality (i.e., captive reinsurance can be used to reduce the variability of estimated losses and hence to increase the "smoothness" of reported earnings). Captive reinsurance also can change the level of reliability, comparability, and complexity by changing uncertainty about users' information endowment. "Shadow" insurance transactions are complex and can represent information risk.

Prior literature finds that higher reporting quality is positively associated with firm valuations and liquidity (Lang et al. 2012) and smaller analyst forecast errors and dispersion (Behn et al. 2008). Furthermore, accounting reporting comparability is associated with better information processing by analysts (De Franco et al. 2011, Horton et al. 2013, Peterson et al. 2015) and lenders (Kim et al. 2013; Fang et al. 2016), market trading around earnings restatements (Campbell and Yeung 2016), reduced insider ability to exploit private information (Brochet et al. 2013), and improved market outcomes (Neel 2017). Information complexity, on the other hand, is negatively associated with analyst forecasting ability (Barth et al. 2001, Gu and Wang 2005, Hodder et al. 2008). Also, opportunities to exploit private information can result in lower analyst coverage (Bushman et al. 2005). Since captive reinsurance transactions can decrease report reliability and comparability, increase information complexity, and can be used by management to obfuscate value-relevant information, I hypothesize that the use of captive reinsurance subsidiaries can result in higher market illiquidity as well as a lower analyst following.[8] The fifth hypothesis as follows (i.e., in the alternative form):

> **Hypothesis 5:** Ceteris paribus, market illiquidity is positively associated with captive reinsurance.

[8] Captive reinsurance can represent an information risk due to statutory reporting opacity, which could result in the obfuscation of value-relevant information on firm risk and cash flows affected by captive reinsurance (e.g., parental guarantees or letters-of-credit used to form a captive).

CHAPTER 3: SAMPLE SELECTION AND RESEARCH DESIGN

Chapter 3 discusses sample selection and research design. First, I describe the sample used in this dissertation. Then, I describe the measurement of my independent variables, i.e., regulatory enforcement and captive reinsurance. Next, I present the empirical model used to test H1 and H2, which predict a negative association between regulatory enforcement and captive reinsurance, especially for firms with potentially constrained surplus. Then, I present the empirical model used to test H3, which predicts a positive association between regulatory enforcement and credit ratings. Next, I present the empirical model used to test H4 and H5, which predict a negative association between regulatory enforcement and information asymmetry and a positive association between captive reinsurance and market illiquidity, accordingly.

3.1. Sample Selection

I start hand-collecting firms' organizational data from CorporateAffiliations database (i.e., provided by LexisNexis). This database has information on corporate hierarchies, management, and board of directors for 1.9 million companies in the United States and internationally (as of 2017), both private and public. However, organizational data for private companies is limited, and as the result, I include only public companies in my sample. For public companies, CorporateAffiliations database has detailed organizational data (e.g., parent, subsidiary, affiliate, branch, division, group, plant) and identifies non-operating entities in a firm's structure. This serves as a good starting point in identifying captive reinsurance subsidiaries, which are often non-operating legal ("shell") entities. Nevertheless, I check all subsidiaries in a firm's structure to ensure the completeness of my data.

I start with the one hundred twenty largest by -- gross earned premiums -- public U.S. insurance groups in 2006 and collect ten years of panel data on these insurance groups (2006 – 2015. I identify insurance companies using the SIC codes provided in the CorporateAffiliations database. Insurance companies that have the SIC code 6331 are codified as P/C insurers, while insurers that have the SIC code 6311 are codified as life insurers. I include both P/C and life insurers for completeness, even though the public scrutiny of captive reinsurance has been in the life insurance sector. Pure P/C insurers in my sample have only the SIC code 6331, while all other companies (i.e., pure life insurers and diversified insurers) are classified as “life” insurers.

I start my sample in 2006 for a couple of reasons. First, there has been a substantial growth in the use of captive reinsurance among insurers only in the past ten or fifteen years. Second, I want to include firm observations both pre- and post- the public scrutiny of captive reinsurance (used by life insurers) starting in 2012. Finally, to ensure the reliability of my captive reinsurer data, I collect information in the most recent time period. There is some missing data on captive reinsurer licenses granted in the 1990s and earlier, especially in off-shore jurisdictions such as Bermuda, Cayman, Turks and Caicos, Guernsey, and Barbados.

In addition to the CorporateAffiliations database, I use other data sources to ensure that I can identify all captive reinsurance subsidiaries in a firm’s structure. For each sample insurer I examine Exhibit 21 in the 10-K filings, which are available from the SEC’s Edgar database. I also use the NAIC listing of insurance groups, a free report available on the NAIC’s website. This report lists only insurance subsidiaries in the firms’ structure. Since I am interested only in insurance subsidiaries, this is a useful information source. In this dissertation I study the role of regulatory enforcement by insurance regulators, and thus, I include only insurance subsidiaries in my analyses (e.g., I do not include banking or non-financial entities, which can be subject to regulation and enforcement by non-insurance regulators). Similarly, I supplement my data collection with information on the firm's organizational structure as identified by the insurance rating agency A.M. Best (i.e., the A.M. Best Corporate Structure file is available online). Finally, since my sample includes the largest (by gross earned premiums) public insurance groups in the United States, I was able to find some statutory filings data, including Schedule Y, online. For example, some companies provide both their 10-K and statutory filings on their website. Also, I use regulatory examination reports to identify subsidiaries in the firm's organizational structure and the existence of captive reinsurers (i.e., insurance regulatory examination reports have the Schedule Y and identify intercompany agreements, including reinsurance agreements; they are available online on state regulatory websites). Regulatory data on the insurance groups' organizational structure and the financial resources of the groups' regulators is obtained from the NAIC reports (i.e., NAIC products "Summary Listing of Companies", "Insurance Department Resources Report", and "State Insurance Regulation: Key Facts and Market Trends").

To identify captive reinsurers, I check the subsidiaries' licenses (i.e., type, effective date, and parent) on regulatory websites. Then, I remove insurers that were acquired by another company or went through financial distress (i.e., in liquidation) between 2006 and 2015. I lose thirty seven insurance groups. Finally, I obtain financial data from the WRDS Compustat database, which has US GAAP and some statutory insurance data. Compustat has statutory data on insurers' surplus and net income (i.e., from a footnote disclosure). Compustat has detailed US GAAP data but does not have some detailed data reported under SAP (e.g., premiums by state or line of business, reserve estimates by policy period and their revisions, and type of reinsurance). Also, there is missing statutory data. I lose twenty one insurance groups due to the missing required financial statements data. The final sample includes sixty two insurance groups between 2006 and 2015 (see Appendix D). The credit ratings data is obtained from the S&P Global Market Intelligence database. The credit rating tests are based on sixty two insurance groups between 2006 and 2015. Finally, stock price and market liquidity data are obtained from CRSP, analyst forecast data from I/B/E/S, and institutional ownership data from Thomson Reuters.

3.2. Regulatory Enforcement Variable

My proxies for regulatory enforcement are based on the characteristics of an insurance groups' domicile states (i.e., the states where subsidiaries, excluding captive reinsurers, are domiciled). While insurance regulators can oversee insurers licensed to sell products in their state (i.e., both domestic and foreign), they usually defer regulation to the domiciliary regulator. Furthermore, under Section 531(a) of the Dodd-Frank Act, regulatory approval of reinsurance credit is deferred to domiciliary insurance regulators (Government Publishing Office 2010).

I use seven proxies to capture regulatory enforcement, which depends on regulatory enforcement capacity, enforcement style, and the broader political environment (Carrigan and Harrington 2015). Regulatory enforcement capacity refers to regulators' ability to exert control over regulated entities and depends on regulators' legal autonomy, direct capacity to operate public enterprises, capacity to collect information, and financial resources (Hood and Margetts 2007). Regulatory enforcement authority (i.e., legal autonomy) gives regulators the legal power to enforce standards. State insurance departments have the legal authority to set and enforce insurance standards as established by the 1945 McCarran-Ferguson Act (NAIC 2011). Insurance regulators have the full legal capacity to enforce standards, as well as the capacity to publicly provide insurance services. However, in the United States, insurance regulators prefer to defer insurance services to the private market, if possible (Kunreuther et al. 2013). I measure regulatory enforcement capacity with two proxies: *Overlapping Regulators*, which proxies for the capacity to collect information, and *Regulatory Resources*, which measures financial resources available to the regulator. *Overlapping Regulators* equals the number of unique domiciliary insurance regulators with jurisdiction over an insurance group. *Regulatory Resources* are measured as the regulatory budget (per $1,000 of premiums) of the insurance group's domiciliary regulators.

Regulatory enforcement style refers to a continuum of behaviors on how regulators interact with regulated entities (Carrigan and Harrington 2015). There are two broad enforcement styles: a deterrence mode of regulation (legalistic style) and an accommodative mode of regulation (cooperative style) (Coglianese and Kagan 2007). A legalistic style is based on the stringent and inflexible interpretation of standards, while a cooperative style accommodates the regulated entities' arguments and is flexible in its interpretation of rules (Kagan 1989). Regulators may use both styles of enforcement (i.e., flexible enforcement style) but may still prefer one enforcement style over the other (Hutter 1989).

I measure regulatory enforcement style with two proxies. Legalistic enforcement style (*Strict Regulators*) is measured as the number of domiciliary insurance regulators who monitor an insurance group and have a reputation for strict enforcement. Based on the NAIC state report cards (NAIC "State Insurance Regulation: Key Facts and Market Trends"), New York, Florida, Taxes, and California jurisdictions rank the highest in terms of insurance premiums sold, consumer complaints, regulators' inquiries, and total budgets (per premium) available for regulation. Also, there is some anecdotal evidence that these four states (CA, FL, NY, and TX) are "strict" in their enforcement. For example, according to the R Street Institute – an American conservative and libertarian think tank dedicated to "free markets" – CA, FL, NY, TX, HI, LA, and MT had a "D" grade as insurance jurisdictions in 2015, which implied limited "free markets" in these states (R Street 2015). Hawaii, Louisiana, and Montana, however, have smaller budgets per premium than California, Florida, New York, and Texas, and thus, are not coded as *Strict Regulators*.

Since cooperative enforcement style relies on trust between the regulator and regulated entities, I measure a cooperative enforcement style (*Captive Law Regulators*) as the number of domiciliary insurance regulators in the group's oversight who have captive insurance laws in their jurisdiction (Insurance Information Institute 2015). I assume that the presence of captive laws signals regulators' willingness to accommodate firms' reinsurance preferences. However, the presence of captive laws does not imply a "favorable" treatment of reinsurance transactions for all firms.

Finally, I use three proxies to measure the broader political environment. Regulatory enforcement depends on regulators' reelection incentives (Besley and Case 1985; Alt et al. 2011; Beland 2015). *Elected Regulators* equals the number of domiciliary insurance regulators in the firm's structure who are elected to their office (NAIC 2015b). Insurance commissioners are elected in California, Delaware, Georgia, Kansas, Louisiana, Mississippi, Montana, North Carolina, North Dakota, Oklahoma, and Washington.

Also, regulatory enforcement can be sensitive to interest group pressures and regulatory priorities (Carrigan and Harrington 2015). In insurance, regulators need to balance solvency regulation and rate regulation: regulators cannot decrease insolvency risk without affecting product pricing. Stringent solvency requirements can decrease insolvency risk but will also result in higher premiums charged to consumers and reduced product availability. As the result, regulators need to trade off an acceptable level of insolvency risk against product availability and affordability. Insurance buyers are aware of and care about insurance product availability and affordability (Jaffee and Russell 1998). I expect that regulators may have incentives to be strict in enforcing captive reinsurance standards due to their regional geographic pressures to protect policyholders from high premiums. In the United States, coastal areas are characterized by a large and growing population and an exposure to natural disasters, and therefore, the demand for consumer rate protection is likely to be high in coastal insurance jurisdictions. *Coastal Regulators* capture domiciliary states' geographic location in the U.S. sea-water coastal areas. Finally, insurance regulators' enforcement actions towards captive reinsurance can depend on local citizens' risk or regulation preferences. States can be characterized as Republican-leaning or Democrat-leaning. A 2016 survey by Gallup on Americans' views found that Democrats worry about climate change and regulation of Wall Street and banks, while Republicans worry about economic growth, government intervention, and inefficiency (Gallup 2016). Republican-learning and Democrat-leaning citizens can also differ in their risk preferences. *Republican Regulators* measures the number of domiciliary insurance regulators in Republican-learning states based on the citizens' votes in the eight U.S. presidential elections between 1984 and 2012 (U.S. Electoral College 2016).

I use two specifications of the enforcement proxies: unique values and total values. In the main tests, the regulatory enforcement factor is based on the total values of enforcement proxies. I use total values as insurance subsidiaries are individually regulated and thus each insurance affiliate has an opportunity to interact with its domiciliary regulator. Similarly, since credit ratings are based on the entire insurance group's structure, I use total regulatory values in the credit rating analyses. In sensitivity tests, I use unique regulatory enforcement values to reduce potential double-counting. An example of the regulatory variable calculation is presented in Appendix B.

3.3. Captive Reinsurance Determinants

The first two hypotheses relate to the effect of regulatory enforcement on the use of captive reinsurers. The main tests use a panel Tobit estimation. In all tests, I regress the dependent variable on the firm's incentives to use captive reinsurance and control variables. I use the following model to test **H1** and **H2**:

$$Captive\ Reinsurance = \alpha + \beta_1 Enforcement + \beta_2\, Surplus\ Constraint + \\ + \beta_3 Enforcement * SurplusConstraint + \sum \beta(Controls) + \varepsilon \quad (1)$$

My first hypothesis implies a negative coefficient on β_1, and my second hypothesis implies a negative coefficient on β_3. I use various measures of captive reinsurance presence in an insurance group's organizational structure. In the main tests, I use *C_Number*, which equals the number of captive reinsurance subsidiaries in the group's structure in a given year. In sensitivity tests, I also examine the probability of the captive status (*Captive*), an indicator variable that equals one if an insurance group has at least one captive reinsurer in their organizational structure in a given year, and zero otherwise. I also examine insurers' choice with regards to their captive reinsurer(s) location with *C_Foreign*, a dummy variable that equals two if an insurance group has captives both in the United States and abroad, one if all captives are licensed in the United States, and zero if there are no captive subsidiaries in a firm's corporate structure. The reason I examine whether an insurance group has captive reinsurance abroad is the regulatory scrutiny of captive reinsurance via off-shore jurisdictions due to the confidentiality concerns. For example, on August 15, 2015 the NAIC signed a memorandum of understanding with the

Bermuda Monetary Authority (i.e., the insurance regulator overseeing insurance companies, including captives, domiciled in Bermuda) to increase cooperation between these two regulators; previously U.S. insurance regulators had limited access to the financial reports of captive reinsurers domiciled in Bermuda (NAIC 2015a).

To measure regulatory enforcement, I aggregate seven regulatory enforcement proxies into a single regulatory enforcement factor (*Enforcement*) using principal component analysis. Regulatory enforcement proxies measure regulatory enforcement capacity, enforcement style, and the broader political environment. I interact the regulatory enforcement factor with the proxies for potential surplus constraint.

To measure a potential surplus constraint, I use assets-to-surplus among life insurers and premium-to-surplus among P/C insurers (Federal Insurance Office 2013b). While insurance regulators use assets-to-surplus to assess the leverage of life insurers, I did not find authoritative guidance on the levels of leverage that represent either excessive or low leverage for life insurers. As the result, I use the ad-hoc levels of leverage (i.e., above 90^{th} or 75^{th} quantile and below the 25^{th} quantile) in my study. Specifically, *Surplus Constraint* is a dummy variable that equals one if a life insurer has assets-to-surplus above the 90^{th} quantile or below the 25^{th} quantile (see Appendix C). I argue that the excessive leverage could attract regulatory attention because it implies that a life insurer has a greater exposure to the reserve estimation errors (i.e., and captive reinsurance affects a parent's reserve levels and increases information asymmetry between insurance regulators and insurers about the reserve adequacy to due to the confidential reporting). I further argue that low leverage could also attract regulatory attention because regulators could be concerned about the under-reserving risk (i.e., insufficient reserves) since reserves-to-surplus are highly correlated with assets-to-surplus and captive reinsurance affects the parent's reported reserve levels and hence leverage.

In the P/C insurance sector, premiums-to-surplus ratio is important in monitoring leverage as a large ratio implies greater underpricing risk (i.e., a higher risk that the surplus could be insufficient to cover expected losses) (NAIC 2016). *Surplus Constraint* is a dummy variable that equals one if a P/C insurer has premium-to-surplus above the 90^{th} quantile (see Appendix C).

I test the model separately for the sample of P/C insurers (i.e., pure property-casualty) and Life insurers (i.e., pure L/H and diversified insurers) to control for the significant differences in their operations and financial structure. In the model, I control for economic incentives for captive reinsurance, which are represented by proxies for contracting costs (i.e., reinsurance underwriting and investment inefficiency) and taxes. The control variables also include proxies for firm size, reinsurance, profitability, investment yields, internal funds, and leverage. Regulators monitor firms' profitability and hence investment yields. I control for firm's size since large firms might have incentives to use captive reinsurance to relieve their surplus constraint for growth purposes. Firm performance could be negatively associated with captive reinsurers because captives can be used to manage a firm's statutory performance. However, since captive reinsurers are consolidated under US GAAP, insurers cannot 'hide' the poor performance of their captive reinsurers. Thus, better performing firms might opt for "shadow insurance." Cash availability could also explain firms' expansion into the "shadow insurance" market. There are jurisdictions that allow captive reinsurer formation with letters of credit or naked parental guarantees. Thus, cash-constrained firms could be more likely to use captive reinsurance than non-cash-constrained firms. Alternatively, non-cash-constrained firms could be more likely to use captive reinsurance since the formation and operation of a captive requires a capital investment. Debt could creative incentives for captive reinsurance. While captive reinsurance could reduce a reinsurance counterparty's credit risk, overall risk can be higher if captive reinsurance is not properly structured. Thus, creditors' oversight could be either positively or negatively associated with captive reinsurance.

I test my first two hypotheses using a Tobit model. I select the Tobit model because my dependent variable is truncated at zero as firms cannot have a negative number of captives, while the latent variable (e.g., financial reporting aggressiveness; risk preferences) could be below zero. As a result, my dependent variable equals zero when the latent variable is negative. In this case, Tobit estimates are consistent and asymptotically normal, while OLS estimates are inconsistent and downward biased (Amemiya 1973). Also, since most insurers organize captive reinsurers at the end of the year, my main tests use contemporaneous measures of regulatory enforcement and surplus constraint. I use lagged control variables. In untabulated results, I test other specifications of the independent variables to see whether my results are sensitive to model specification. I include year fixed effects to control for common macroeconomic effects and trends. I include main-regulator fixed effects to control for a common regulatory environment, as well as firms' self-selection into a regulatory regime. I cluster errors by firm in the main tests and by main (lead) regulator in the sensitivity tests.

3.4. Captive Reinsurance, Regulatory Enforcement, and Credit Ratings

To test **H3** I examine the association between regulatory enforcement and credit ratings. I also test whether captive reinsurance is associated with S&P credit rating. To test H3, I use the following cross-sectional panel OLS regression model:

$$S\&P\ Credit\ Rating = \alpha + \beta_1 C\_Number\ (CN) + \beta_2\ Enforcement\ + \\ + \sum \beta\ \ (Controls) + \varepsilon \qquad (2)$$

In equation (2), the dependent variable equals the S&P long-term issuer credit rating assigned to an insurance group (*CR_All*). I translate twenty two categories into numerical values with one assigned to the highest credit rating score (AAA) and twenty two to the lowest credit rating (D). Non-rated insurers receive the numerical score of twenty-three as non-rated securities are often considered to be speculative grade. In my sample, non-rated insurance groups do not have captive reinsurers in their structure, with the exception of one firm. Nevertheless, there can be multiple reasons why an insurance group is non-rated by a credit rating agency. Non-rated issuers either did not request a rating or the credit rating agency did not have enough information to assign a credit rating. As the result, I exclude non-rated issuers in sensitivity tests, in order to examine the association between captive reinsurance and credit ratings among rated firms (*CR_Rated*). I multiply credit rating scores by negative one so that the associations are increasing in credit ratings.

The regulatory enforcement factor (*Enforcement*) is my proxy for regulatory enforcement. My third hypothesis implies a positive coefficient on β_2. Captive reinsurance is measured as the number of captive reinsurers (*C_Number*). Since captive reinsurance could result either in risk reduction or risk retention, the coefficient on β_1 could be either positive or negative. I control for firm size, performance, contracting inefficiency, reinsurance, internal funds, leverage, and retained earnings. I include year fixed effects to control for common macroeconomic effects and trends. I include main-regulator fixed effects to control for a common regulatory environment as well as firms' self-selection into a regulatory regime. All variables are contemporaneous, except for control variables, which are lagged. I cluster errors by firm in the main tests and by main regulator in the sensitivity tests.

3.5. Captive Reinsurance, Regulatory Enforcement, and Information Asymmetry

In the second set of consequence tests (**H4** & **H5**), I examine whether captive reinsurance is associated with information asymmetry proxies. I also test the association between regulatory enforcement and market illiquidity. To test H5 and H6, I use a cross-sectional panel OLS regression and the following first-differences model:

$$\Delta\ Market\ Illiquidity = \alpha + \beta_1\ \Delta\ Enforcement + \beta_2\ \Delta\ C\_Number + \\ + \sum \beta\ (Controls) + Year\ FE + Regulator\ FE + \varepsilon \qquad (3)$$

In equation (3), the dependent variable is the change in market illiquidity, which I measure with three information asymmetry proxies. First, I use bid-ask spreads (*Δ Log (Spread)*) that are defined as the yearly median of daily quoted spreads divided by the midpoint. Bid-ask spreads increase with the level of information asymmetry and illiquidity because the spreads are used to address adverse selection in the presence of asymmetrically informed investors (Callahan et al. 1997). Second, I use zero-return days (Δ *ZeroReturn*), defined as the proportion of trading days with zero daily stock returns out of all possible trading days in a year. The frequency of zero return days increases with market illiquidity (i.e., transaction costs deter marginal investors from trading) (Chen et al. 2007). Third, I use the yearly median of the Amihud's (2002) illiquidity measure (Δ *PriceImpact*), which is measured as the firm's daily absolute stock return divided by US$ trading volume and multiplied by 1,000,000. High *PriceImpact* implies higher illiquidity because it indicates a low ability of investors to trade in a stock without moving its price (i.e., hence, high transaction costs). Finally, I use principal component analysis to aggregate the three market illiquidity proxies into a single illiquidity factor (Δ *Illiquidity*).

Captive reinsurance is measured as the number of captive reinsurers (*C_Number*). I use the regulatory enforcement factor (*Enforcement*) as a proxy for regulatory enforcement. The control variables include firm characteristics that likely affect the information environment and thus market liquidity (Kim et al. 2015): book-to-market ratio (*BM*), debt- to-assets ratio (*Leverage*), and return on assets (*ROA*). I control for market capitalization (*MV*), share turnover (*Turnover*), return variability (*SD_Ret*), stock momentum (*ABN_Ret*), and the proportion of informed traders (*InstOwn%*), all of which have been shown in prior research to affect market liquidity (Leuz and Verrecchia 2000; Sadka 2006; Daske et al. 2008; Christensen et al. 2013). All control variables are lagged by one year. All variables are defined in Appendix C.

In addition to market liquidity tests, I use a similar model to examine changes in analyst following subsequent to changes in the number of captive reinsurance subsidiaries. I control for changes in firm size, book-to-market ratio, leverage, return on assets, share turnover, return variability, stock momentum, and institutional ownership. I test the following model:

$$\Delta\, Analysts = \alpha + \beta_1 \Delta\, CNumber + \beta_2 \Delta Captive + \beta_3 \Delta\, Enforcement + \\ + \sum \beta\ (Controls) + Year\ FE + Regulator\ FE + \varepsilon \qquad (4)$$

CHAPTER 4: MAIN RESULTS

In Chapter 4, I provide the main results. I begin with descriptive statistics and univariate tests. Then, I present the main multivariate tests of H1 through H5.

4.1. Descriptive Statistics

Panel A of Table E1 provides descriptive statistics for the two sub-samples: P/C insurers and Life insurers. On average, specialized property-casualty insurers have 0.5 captives whereas specialized life insurers and diversified insurers have 1.79 captive reinsurers in their insurance group's structure. An average P/C and life insurance group has approximately ten insurance affiliates in the structure and five overlapping insurance regulators.

There is considerable variability in regulatory enforcement and illiquidity. Life insurers, on average, have better *CR_All* than P/C insurers, but both firm types have similar *CR_Rated* (i.e., -8 or BBB+ rating). On average, *CR_All* is -10.8 (i.e., BB+ rating) for life insurers and –13.2 (i.e., BB- rating) for P/C insurers. There are a few P/C insurers in my sample that were assigned the Non-Rated (NR) "rating" by the S&P credit rating agency.

A median P/C insurer has $5.6 billion in assets with ROA of three percent and investment yield of eight percent. A median life insurer has $22.8 billion in assets, $14.7 billion in reserves, and $2.4 billion in surplus. Life insurers have larger investment yields and higher investment efficiency but lower return on assets than P/C insurers. A median P/C (life) firm reinsures fourteen (ten) percent of its premiums. Life insurers have larger values for regulatory enforcement than P/C insurers. Overall, the variables have considerable variation (spread) around their mean based on the between group standard deviation.

Panel B of Table E1 reports pair-wise correlations among some variables. Among life insurers captive reinsurance is positively correlated with regulatory enforcement, analyst following, size, and reinsurance activity and is negatively correlated with illiquidity and surplus constraint. Captive reinsurance is also positively correlated with leverage (i.e., assets-to-surplus and reserves-to-surplus, which have a correlation of 0.9754). Among P/C insurers captive reinsurance is positively correlated with size and credit ratings and is negatively correlated with premiums-to-surplus and assets-to-surplus. Credit ratings are positively correlated with enforcement among P/C insurers.

Furthermore, I find that among life insurers *C_Number* is positively correlated with investment inefficiency and is negatively correlated with investment yields and return on assets. Among P/C insurers, captive reinsurance is positively correlated with reinsurance inefficiency and return on assets and is negatively correlated with the tax rate. Interestingly, enforcement is negatively correlated with reserves-to-surplus among life insurers. This result suggests that insurance regulators could be more concerned (i.e., more enforcement) about under-reserving than over-reserving in the life insurance sector.

Table E2 reports the differences in means between insurers with captives and those without captives. Panel A of Table E2 reports the result for life insurers. Life insurers with captives are larger and have higher market liquidity. Also, they have more debt, less cash (as a percentage of assets), and lower investment yields. They are subject to greater regulatory enforcement and have higher S&P credit ratings. Panel B of Table E2 reports the results for P/C insurers. P/C insurers with captives are larger but have higher market illiquidity. They have higher credit ratings (*CR_All*), more cash, less debt, greater return on assets, and higher reinsurance inefficiency. There is no difference in regulatory enforcement between P/C insurers with and without captives. P/C insurers with captives have fewer subsidiaries domiciled in states coded as *Strict Regulators* (i.e., CA, FL, NY, and TX).

4.2. Main Results

4.2.1. Regulatory Enforcement and Captive Reinsurance

Table E3 reports results of the principal component analysis (PCA) of seven regulatory enforcement proxies (i.e., based on total regulatory scores). The first principal component corresponds to the linear combination of regulatory enforcement proxies with maximum variance. The first principal component, PC1, has an eigenvalue of 5.0978 and explains 72.8% of the variation. I use this component (scoring factor) as a proxy for regulatory enforcement. There is a moderate correlation between the regulatory enforcement proxies and PC1, with correlation coefficients ranging from 0.14 to 0.18.

Table E4, Panel A presents the results of estimating equation (1) with the dependent variable that measures the number of captive reinsurance subsidiaries in a firm's corporate structure, *C_Number*. The results are based on the Tobit estimation. Consistent with H1, I find that regulatory enforcement is negatively associated with captive reinsurance among life insurers.

However, regulatory enforcement is positively associated with captive reinsurance among P/C insurers (i.e., p-value < 0.10). This result suggests that regulatory enforcement can vary across firm types. It is consistent with spill-over effects: regulatory attention and monitoring of captive reinsurance among life insurers could decrease expected regulatory non-compliance costs among P/C insurers because insurance regulators have limited resources for monitoring and inspection. Furthermore, P/C insurers are on average smaller than life insurers, and the P/C insurance sector in general consists of a larger number of companies (i.e., 2,544 P/C insurers in 2015) than the life insurance sector (i.e., 872 life insurers in 2015) (Insurance Information Institute 2017). Industries composed of predominantly small firms receive less regulatory monitoring because it is more costly to monitor these firms (Basu and Dixit 2014). Small firms are subject to less regulatory monitoring by the IRS (Hoopes et al. 2012). Resource-constrained regulators cannot perfectly monitor all firms, and thus, P/C insurers may expect smaller non-compliance costs associated with reinsurance standards and the use of captives than life insurers. Similarly, regulatory attention to the use of captives in the life insurance sector could have a spill-over effect in the insurance sector: the increase in information on captive reinsurance could deter potential non-compliance among firms with life operations (i.e., pure life and diversified insurers). Regulatory attention and monitoring can deter potential non-compliance of peers within the same industry (Block and Feinstein 1986; Schenck 2012).

Furthermore, I find preliminary evidence that the effect of regulatory enforcement on the use of captive reinsurance is state-dependent. However, it is important to note that I cannot draw any conclusions because the test of H2 is not well specified and uses ad-hoc levels of leverage. The results discussed below are very preliminary and should be interpreted with caution. I find that life insurers with assets-to-surplus ratio above the 90th quantile or below the 25th quantile are less likely to use captive reinsurance, and this association is stronger in the presence of greater regulatory enforcement. Consistent with some anecdotal evidence, insurance regulators did not perceive life insurers' reserves as redundant under the existing reserving standards (NAIC 2017). Thus, low leverage could attract regulatory attention to the use of captive reinsurance (i.e., increased expected compliance and non-compliance costs could reduce incentives to use captive reinsurance). However, excessive leverage could imply a higher insolvency risk due to the surplus inadequacy concerns, and thus could attract regulatory attention to the use of captives. In untabulated results, I also use reserves-to-surplus ratio because it is positively correlated with assets-to-surplus (i.e., reserves are backed up by assets) and there is anecdotal evidence of reserve reporting as an incentive for captive reinsurance among life insurers (NAIC 2012b, 2017). I find qualitatively similar results. However, the results are based on the model that is not well specified, and thus, I cannot draw any conclusions regarding H2.

Similarly, I find some preliminary evidence that the effect of regulatory enforcement on the use of captive reinsurance may be state-dependent among P/C insurers. Again, all results discussed below should be interpreted with caution. I find that among P/C insurers premiums-to-surplus is negatively correlated with captive reinsurance. Insurance regulators use premiums-to-surplus ratio to monitor P/C insurers' leverage. Once again, I use an ad-hoc level of "surplus constraint" to proxy for excessive growth among P/C insurers. P/C insurers need "free" capital to grow and could use captive reinsurance to reduce their capacity constraints. Anecdotal evidence suggests that some insurers use captive reinsurers to relieve their capacity constraints (NAIC 2012b). I assume that when premiums-to-surplus are above the 90th quantile, the use of captive reinsurance by P/C insurers could attract regulatory attention due to the rapid growth concerns (i.e., underpricing risk). I find that P/C insurers with premium-to-surplus ratio above the 90th quantile (in my sample) are more likely to have captive reinsurers, but this association is weaker in the presence of greater regulatory enforcement. This result is consistent with H2. I also find that captive reinsurance is positively associated with firm size and reinsurance among both life and P/C insurers. There is some evidence that life insurers with lower investment inefficiency and P/C insurers with higher reinsurance inefficiency are more likely to use captive reinsurance. Note, however, due to problems with my model that tests the interaction between enforcement and capital constraints, it is not appropriate to draw conclusive inferences.

Next, I examine the use of captive reinsurance across two time periods. In 2011, the use of captive reinsurance by life insurers received considerable attention from media and regulators. In October of 2011, the NAIC formed a committee to study the use of captive reinsurers in the life insurance sector. In 2013, the New York Department of Financial Services published a report on "shadow insurance" in which the NY insurance regulator advocated a national moratorium on captive reinsurance until regulators could better assess captive reinsurance risk. Since then, there have been several class action law suits filed against some insurers for their use of captive reinsurance. Insurance regulators also have been criticized for lax enforcement and a regulatory race-to-the-bottom as more jurisdictions have passed captive insurance laws since 2012.

Panel B of Table E4 reports the cross-sectional results for two time periods. Column (2) reports the results for the 2006 – 2011 time period ("low public scrutiny") while Column (3) reports the results for the 2012 – 2015 time period ("high public scrutiny"). Among life insurers, regulatory enforcement is negatively associated with captive reinsurance in both time periods. The coefficient on the interaction term between surplus constraint and regulatory enforcement is negative in both time periods, but it is statistically significant only between 2006 and 2011. The results suggest that public awareness and scrutiny of accounting standards and regulators (who set and enforce those standards) can be important for regulatory enforcement and its credibility. For example, public scrutiny of insurance regulation and insurance regulators' inquiries into captive reinsurance in the life insurance sector could increase the information uncertainty among life insurers about regulatory enforcement and its credibility.

Similarly, I find that among P/C insurers the coefficient on the interaction term between surplus constraint and regulatory enforcement is negative (i.e., p-value < 0.01) only between 2006 and 2011, and it is positive (i.e., p-value < 0.01) between 2012 and 2015. This result suggests that regulatory attention to the use of captives by life insurers could have a spill-over effect in the P/C insurance sector: regulatory attention to life insurers could decrease expected non-compliance costs among P/C insurers (e.g., lower probability of regulatory monitoring and enforcement when regulators are resource-constrained). However, it is important to note, these results are preliminary, and I cannot draw any conclusive inferences on H2 due to the concerns over the specification of the model.

4.2.2. Regulatory Enforcement, Captive Reinsurance, and Credit Ratings

The third hypothesis (**H3**) examines the role of regulatory enforcement in the credit rating process. Table 5 reports the results of estimating equation (2) with a panel OLS regression. The dependent variable is *CR_All*. Panel A of Table E5 reports the sub-sample results by firm type. Column (1) reports the results for life insurers. Consistent with H3, regulatory enforcement is positively associated (p-value < 0.01) with credit ratings (*CR_All*). Column (2) reports the result for P/C insurers. I do not find support for H3 among P/C insurers. This result suggests that public awareness of accounting issues and regulatory actions may be important for regulatory enforcement credibility.

Panel B of Table E5 reports the cross-sectional results by firm type and time period. The results indicate that the role of regulatory enforcement can vary across firm types and type periods. I find that regulatory enforcement is positively associated with credit ratings among life insurers in both time periods, but the association is statistically significant (p-value < 0.01) only between 2012 and 2015. Once again, the result indicates that public awareness of regulatory attention or actions could be important for the credibility of regulatory enforcement.

In contrast, I find that regulatory enforcement is negatively associated (p-value < 0.10) with credit ratings among P/C insurers between 2006 and 2011. In prior tests, I found a positive association between regulatory enforcement and the use of captive reinsurance among P/C insurers between 2006 and 2011. These results indicate that regulatory enforcement may have different implications for different firms.

4.3.2. Regulatory Enforcement, Captive Reinsurance, and Information Environment

The fourth and fifth hypotheses (**H4** & **H5**) examine the role of regulatory enforcement and captive reinsurance in equity markets. I use three market illiquidity proxies, which are combined in one illiquidity factor (see Table E6 for the Principal Component Analysis results). Table E7 presents primary regression results from tests of H4 and H5 using the three market illiquidity proxies and illiquidity factor. Panel A of Table E7 presents the results for life insurers. Consistent with H4, I find that the change in regulatory enforcement is negatively associated (p-value < 0.10) with the change in market illiquidity. While I do not examine the channel, this result is consistent with regulatory enforcement reducing the probability of misreporting and increasing the credibility of financial reports.

Contrary to my hypothesis H5, I find that the change in the number of captive reinsurance subsidiaries is also negatively associated with the change in market illiquidity, however this association is not statistically significant among life insurers. In terms of control variables, share turnover, as expected, is significantly and negatively associated with market illiquidity. As expected, an increase in return variability is positively associated with market illiquidity. Larger firms have higher market liquidity. Interestingly, I find that the increase in the percentage of sophisticated investors (Δ *InstOwn%*) is positively associated with the increase in illiquidity (i.e., more zero-return days). This result is consistent with prior studies which show that liquidity risk varies across different types of institutional owners (Sias 2004; Gatev and Strahan 2006, Brunnermeier and Pederson 2009).

Panel B of Table E7 presents the results for P/C insurers. The coefficient on regulatory enforcement is negative but not statistically significant. In contrast to H5, I find that the increase in the number of captive reinsurers is negatively associated (p-value < 0.01) with the changes in market illiquidity. A possible explanation of this result is that the use of captive reinsurance by

P/C insurers attracts the attention of analysts and investors, who increase their private data collection efforts and hence the firm's liquidity improves. In contrast to life insurers, there is less public awareness and information on the incentives for captive reinsurance among P/C insurers. Thus, an increase in captive reinsurers among P/C insurers could attract analysts or investors. Also, in prior tests I find that P/C insurers facing greater regulatory enforcement are more likely to use captive reinsurance and have lower credit ratings between 2006 and 2011. Other external monitors can act as substitutes to formal regulatory monitoring (Miller 2006; Dyck et al. 2008).

Table E7, Panel C reports the results of estimating equation (4). The dependent variable is the change in analyst following (Δ *Analysts*). Column (1) and (2) report the results for life and P/C insurers, accordingly. The coefficient on captive reinsurance is negative but not significant. However, I find some evidence that analyst following is positively and statistically associated with captive reinsurance when a life insurer initiates captive reinsurance transactions (Δ *Captive*).

CHAPTER 5: SUPPLEMENTAL ANALYSES

In Chapter 5, I perform additional robustness tests. First, I analyze the sensitivity of my main results to the specification of the dependent and independent variables. Then, I examine the sensitivity of my main results to alternative functional forms. Finally, I discuss the results of various robustness tests addressing endogeneity.

5.1. Alternative Specifications of Captive Reinsurance

To check the sensitivity of my results to the dependent variable specification, I use two additional measures of captive reinsurance. Since there are not many firm-year observations in my sample where a new captive reinsurer is organized (*C_Form*), I report the results only with the dependent variables *Captive* and *C_Foreign*. Table E8, Panel A reports the results of estimating equation (1) where captive reinsurance is measured as *Captive* and *C_Foreign*. I use a probit model in Columns (1) and (3) and an ordered logit in Columns (2) and (4). Consistent with H1, I find that among life insurers regulatory enforcement is negatively associated with captive reinsurance. I do not find results supporting H2. Among P/C insurers, I find that firms with a surplus constraint and facing greater regulator enforcement are less likely to have captives. I do not find support for H1 and H2 when *C_Foreign* is the dependent variable.

To check the sensitivity of my results to the independent variable specification, I use unique regulatory values (see Appendix B for an example) to measure regulatory enforcement. I aggregate these unique values of regulatory enforcement proxies into one regulatory enforcement factor (*Enforcement 2*) using the Principal Component Analysis. Table E8, Panel C reports the results of estimating equation (1) using he alternative specification of regulatory enforcement. The results are consistent with my prior findings. I find support for H1 and H2 among life insurers and for H2 among P/C insurers. Important to note, nevertheless, that the model is probably misspecified, and it is inappropriate to draw any conclusive inferences.

5.2. Alternative Functional Form

In Table E9, I present the results of estimating equation (1) with a quantile estimation. The quantile estimation allows a description of the entire conditional distribution. Also, the parameters in the quantile regression are relatively robust to outliers and can be more efficient than the OLS estimators when the error terms are not normally distributed (Buchinsky 1998). Table E9, Panel A reports the results with a quantile Tobit model in the sub-sample of life insurers. Among life insurers, I find support for H1 at all quantiles between 2006 and 2011 and at the median and the 75^{th} quantile between 2012 and 2015. There is some evidence that regulatory enforcement is state-dependent. Once again, I find support for H2 but only at the 25^{th} quantile and the median (i.e., the coefficient is negative but not statistically significant at the 75^{th} quantile) between 2006 and 2011 and only at the 75^{th} quantile between 2012 and 2015. Interestingly, the coefficient on the interaction term between surplus constraint and regulatory enforcement is positive and statistically significant at the 25^{th} quantile between 2012 and 2015. The results suggest that regulatory attention to the use of captive reinsurance by life insurers with multiple captive subsidiaries could have a spill-over effect in the life insurance sector. Once again, this result is very preliminary, and I cannot draw any conclusions regarding H2 and spill-over effects.

I also find results consistent with a spill-over effect in the P/C insurance sector. Table E9, Panel B reports the results of estimating equation (1) with a quantile Tobit regression among P/C insurers between 2006 and 2011. The results are statistically insignificant in the 2012 – 2015 time period and are untabulated. I find that among P/C insurers between 2006 and 2011, the coefficient on enforcement is positive at the 25th quantile. Consistent with H2, the coefficient on the interaction term between surplus constraint and regulatory enforcement is negative and statistically significant at all quantiles only between 2006 and 2011. Regulatory attention to the use of captives by life insurers between 2012 and 2015 could have a spill-over effect in the P/C insurance sector. Once again, this result is very preliminary, and I cannot draw any conclusions regarding H2 and spill-over effects.

5.3. Endogeneity Robustness Tests

5.3.1. Instrumental Variable, SURE, and Heckman Estimation

To address endogeneity concerns, I include main-regulator fixed effects to control for a common regulatory environment and firms' self-selection into a regulatory regime. However, there still can be unobservable characteristics that are associated with the firm's regulatory enforcement and captive reinsurance choices. In the robustness testes, I use instrumental variable (IV) regression, simultaneous equation modeling, and Heckman estimation.

In the instrumental variable test, I use a firm's market power and *Strict Regulators* as instruments for regulatory enforcement. I measure market power using the Lerner index, a negative inverse of the price elasticity of demand.[9] The price-cost margin (PCM) is frequently used in the empirical industrial organization literature as a proxy for market power (Bikker and van Leuvensteijn 2008). I find that my measure of market power is correlated with the regulatory enforcement factor, but it is not associated with the number of captive reinsurers. Similarly, *Strict Regulators* are correlated with the regulatory enforcement factor but are not directly associated with captive reinsurance.

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[9] The lack of detailed data in my sample limits the opportunity to use other proxies of market power (e.g., concentration) in sensitivity tests. I plan to hand-collect the data in the future work on this topic.

Table E10, Panel A reports the result for life insurers. Column (1) reports the results of estimating equation (1) with an instrumental variable model where market power and *Strict Regulators* are used as instruments for regulatory enforcement. The F-statistic for the weak identification test is 30.5090. The rule of thumb is that the F-statistic should be greater than ten to make sure that the maximum bias in IV estimators is less than 10% (Staiger and Stock 1997). Thus, market power and *Strict Regulators* are likely not a weak instrument for regulatory enforcement in this test. I also find some evidence that the model is neither underspecified (KP test p-value = 0.0040) nor over-specified. In the instrumental variable test, I find results that are consistent with my main model.

Column (2) of Table E10, Panel A reports the results of estimating equation (1) with simultaneous equation modelling (i.e., seemingly unrelated regression). Here, regulatory enforcement is modeled as a function of firm size, reserve and surplus adequacy, tax rates, performance, investment yields, internal funds, and leverage. I include the main regulator indicators. I find preliminary support for H1 and H2.

Column (3) of Table E10, Panel A reports the results of estimating equation (1) with a Heckman two-step procedure. Similar to the SURE estimation, the probability of regulatory enforcement is modeled as a function of firm size, reserve and surplus adequacy, tax rates, performance, investment yields, internal funds, and leverage. Based on the Inverse-Mills ratio, I do not find support for self-selection. I find preliminary support for both H1 and H2. Regulatory enforcement is negatively associated with the use of captive reinsurers among life insurers. There is preliminary evidence that the strength of this association may vary across firms' characteristics.

Table E10, Panel B reports the results of estimating equation (1) with IV, SURE, and Heckman regression among P/C insurers. Similar to my previous findings, I do not find support for H1 but there is limited preliminary evidence supporting H2. As predicted, the coefficient on the interaction term between surplus constraint and regulatory enforcement is negative, but it is not statistically significant. Nevertheless, the coefficient on the interaction term between premium-to-surplus and enforcement is negative and statistically significant (i.e., p-value < 0.10). I cannot draw any conclusive inferences due to the model misspecification concerns.

5.3.2. Falsification Test

Table E11 reports the results of a falsification test. If insurers who select specific regulatory enforcement are inherently different, I expect to see the effects of regulatory enforcement on other decisions. Here, I use the same approach as in Nicoletti (2015), with variables appropriate to the insurance industry. Security gains and losses are subject to managerial discretion, but are unlikely to be influenced by regulators (Beatty and Harris 1998). This test is designed to check whether the association between realized gains on securities and income before realized gains is moderated by the regulatory enforcement. An insignificant interaction term implies that regulatory enforcement characteristics do not represent firm characteristics (i.e., self-selection) and, instead, capture regulatory enforcement.

I estimate the following model which captures the determinants of realized capital gains and losses (*RealGAIN*):

$$\begin{aligned} RealGAIN_{i,t} = \; & \alpha + \beta_1 Regulatory\ Enforcement_{i,t}\ (RE) + \beta_2 EBGAINS_{i,t} \\ & + \beta_3\ EBGAINS_{i,t} * RE_{i,t} + \beta_4\ Capital_{i,t} + \beta_5\ UnrealGAIN_{i,t-1} + \beta_6\ IA_{i,t-1} \\ & + \beta_7\ InvInc_{i,t-1} + \beta_8\ Liq_{i,t-1} + \beta_9\ Size_{i,t-1} \\ & + \sum \beta\ (Interactions\ \&\ Controls) + \varepsilon \qquad (5) \end{aligned}$$

where variables are defined as follows:

RealGAIN = realized capital gains (losses) scaled by total assets
EBGAINS = earnings before capital gains (losses) scaled by total assets
Capital = surplus before capital gains (losses) scaled by total assets
UnrealGAIN = unrealized capital gains (losses) scaled by total assets
IA = invested assets scaled by total assets
InvInc = investment income scaled by total assets
Liq = reserves scaled by total assets (or surplus)

Unfortunately, the Compustat data on realized security gains and losses for insurance companies is limited and, thus, I have to rely on all realized capital gains and losses (*RealGAIN*), which could be affected by an insurer's investments in a captive. I include *EBGAIN* and *Capital* to control for the incentives to manage earnings and capital, respectively. I include controls that capture the opportunity to manage earnings through asset sales. Insurers with larger unrealized capital gains or losses and a larger proportion of invested assets have a greater ability to manage earnings through capital asset sales. I control for investment income generated by the invested assets, firm size, and liquidity position. I include year and main regulator fixed effects. Robust standard errors are clustered by firm.

Column (1) of Table E11 reports the results of estimating equation (5). The coefficient on the interaction between the income reporting incentive and regulatory enforcement is statistically insignificant. In Column (2), I report the results of estimating equation (5) with an instrumental variable regression where regulatory enforcement is instrumented with market power. The inferences do not change. The result suggests that regulatory enforcement is unlikely to represents firm characteristics.

5.3.3. Propensity Score Matching (PSM)

I use propensity score matching in the credit rating and market liquidity tests. I match firms based on their size under the assumption that firm size is the predictor of captive reinsurance (*Captive*). The differences in size are insignificant between the treatment and control sample (two-tailed p-value > 0.1). I use nearest neighbor matching.

Table E12 reports the results of estimating equation (2) with panel OLS using a matched control sample. In Column (1) and (3), the regression is adjusted for the propensity score, while in Column (2) and (4) I use propensity score weighting (i.e., inverse-probability weightings). The matched-pairs' credit rating tests result in inferences that are qualitatively similar to those from the cross-sectional tests. I find support for H3, but only among life insurers.

In addition to propensity score matching, I use the instrumental variable estimation. Table E13 reports the results of estimating equation (2) using an instrumental variable regression where *Enforcement* is instrumented with market power. In Column (1) and (3) the dependent variable is *CR_All*, and in Column (2) and (4) the dependent variable is *CR_Rated*. I exclude insurance groups with a "non-rated" credit rating and use *CR_Rated* as the dependent variable. The results are based on the sample of forty eight insurance groups (i.e., I lose fourteen insurance groups that have been assigned a "Non-Rated" rating by the S&P credit rating agency). I find support for H3 among life insurers with both dependent variables. Market power is probably not a weak instrument for enforcement in these tests (i.e., F-statistic in the weak identification test is above ten). However, market power could be a weak instrumental variable in the tests among P/C insurers. I find support for H3 among P/C insurers when the dependent variable is *CR_All*, but not *CR_Rated* (i.e., the coefficient is positive but not significant).

Finally, I use propensity score matching in the market liquidity tests (i.e., H4 and H5). I use a similar approach as in the PSM tests of H3. Table E14 reports the results of estimating equation (3) where the regression is adjusted for the propensity score. I find limited support for H4 among life insurers: the change in regulatory enforcement is negatively associated with the change in market illiquidity. Contrary to H5, I find that changes in captive reinsurers are negatively associated with market illiquidity among P/C insurers (i.e., the coefficient is negative but not significant among life insurers). This result indicates that the use of captive reinsurance (so-called *shadow insurance*) does not necessarily result in greater opacity and lower market liquidity. Investors and analysts can substitute regulatory monitoring efforts, especially for firms potentially receiving less regulatory attention (i.e., NAIC has been examining the use of captive reinsurers by life insurers but not P/C insurers).

However, matching on observables does not rule out an omitted variable bias, and the propensity score results are sensitive to the test specification. Also, propensity score methods work better in large samples which allows the model to achieve distribution balance of observed covariates. Nevertheless, propensity scores can be used for regression adjustment, stratification, and weighting (King and Nielsen 2016).

CHAPTER 6: CONCLUSIONS

This dissertation examines the association between regulatory enforcement and the firm's use of off-balance sheet entities. I use regulatory enforcement capacity, enforcement style, and the broader political environment to measure regulatory enforcement of "shadow insurance," a non-traditional reinsurance that is associated with opaque statutory reporting in the insurance industry. In general, I find that the effect of regulatory enforcement varies across firm types and time periods, and public awareness of accounting issues could be important for regulatory enforcement.

Among life insurers, I find that regulatory enforcement is negatively associated with captive reinsurance at all quantiles between 2006 and 2011 and at the median and the 75^{th} quantile between 2012 and 2015. The negative association between regulatory enforcement and captive reinsurance is stronger among life insurers with very high or low leverage (i.e., assets-to-surplus above the 90^{th} quantile or below the 25^{th} quantile). This association is statistically significant at the 25^{th} quantile and the median between 2006 and 2011 and only at the 75^{th} quantile between 2012 and 2015. The result is consistent with a spill-over effect. Important to note, nevertheless, that my findings on H2 should be interpreted with caution due to the model misspecification and endogeneity concerns.

P/C insurers, on the other hand, are more likely to use captive reinsurance in the presence of greater regulatory enforcement between 2006 and 2011, especially at the 25^{th} quantile. This result is consistent with a spill-over effect: regulatory attention to the use of captives by life insurers could decrease (anticipated) regulatory attention to the use of captive reinsurance by P/C insurers because insurance regulators are resource-constrained. Also, there are more P/C insurance companies than life insurers, and P/C insurers are usually smaller than life insurers. In general, monitoring smaller firms can be more costly. However, in robustness tests I do not find conclusive evidence of the positive association between regulatory enforcement and captive reinsurance among P/C insurers. Nevertheless, there is some preliminary evidence that regulatory enforcement could be state-dependent (H2) among P/C insurers. I find that P/C insurers with the high premium-to-surplus ratio (i.e., surplus constraint) are more likely to use captive reinsurance, but this association is weaker among P/C insurers facing stronger regulatory enforcement (i.e., at all quantiles between 2006 and 2011).

Furthermore, I find some evidence that credit rating agencies rely on regulatory enforcement to infer information on a firm’s default risk. I find support for H3 (i.e., a positive association between regulatory enforcement and credit ratings) among life insurers between 2012 and 2015. This finding is consistent with public scrutiny of captive reinsurance in the life insurance sector since 2012. This result also implies that public scrutiny or awareness could be important for regulatory enforcement of accounting standards and hence regulatory enforcement credibility. In contrast, among P/C insurers, regulatory enforcement is negatively associated with credit ratings between 2006 and 2011 (i.e., the time period where I also find a positive association between regulatory enforcement and captive reinsurance among P/C insurers). However, in the robustness tests I do not find support for the negative association between regulatory enforcement and credit ratings among P/C insurers. Overall, results indicate that public attention or awareness of regulatory efforts could be important for regulatory enforcement credibility.

Finally, I find some evidence that the changes in regulatory enforcement are negatively associated with the changes in market illiquidity among life insurers. In contrast to my hypothesis (H5), I find that captive reinsurance is negatively associated with market illiquidity, but this result is statistically significant only among P/C insurers. Thus, there is some evidence that shadow insurance is not as opaque as I predicted. I find that among life insurers the use of captives (i.e., *Δ Captive*; when a firm licenses the first affiliated captive reinsurer) is positively associated with the changes in analyst following.

However, my analysis is subject to a few important caveats. My results may not be generalizable to other settings. I perform various robustness tests including instrumental variable estimation, falsification tests, and propensity score matching and include main regulator fixed effects. But I cannot rule out endogeneity concerns pertaining to firms' self-selection into a regulatory enforcement environment. Furthermore, some of the models used to test the hypotheses have multicollinearity and could be misspecified. As such, all results should be interpreted with caution.

In future work, I plan to reassess my models. For example, to reduce multicollinearity I can use a centered leverage. Also, I will change the model structure to test for a non-linear effect of leverage (e.g., interact leverage with the surplus constraint indicator variable). I will improve the specification of my models (e.g., include additional controls that could be correlated with the firms' financial position or enforcement and the use of captive reinsurance). I will also test additional specifications of the independent variables of interest (i.e., insurers' financial position and regulatory enforcement).

There are a few lines of research that could be pursued from this work. First, in this setting it is possible to examine the determinants of regulatory enforcement (i.e., regulatory enforcement is heterogeneous across states) and the effects of various dimensions of regulatory enforcement on the use of off-balance sheet entities. Second, future research could examine whether the use of captive reinsurance entities – that are off-balance sheet under SAP but are on the balance sheet under US GAAP – is associated with the disagreement among credit rating agencies and among analysts. Finally, future work could study whether the use of captive reinsurers is associated with the firms' disclosure choice and financial reporting quality.

APPENDICES

APPENDIX A

Reinsurance Example

Company A sold $20 in premiums and incurred $8 in policy acquisition expenses. Without loss of generality, assume that the company received cash when the policy was sold and paid cash for its acquisition expenses. Also, assume that by the end of the year, the entire premium of $20 was earned and recognized as revenue.

The company reinsures 100% of its policies with reinsurer B. The company paid $10 for the 100% coinsurance coverage and estimated that this coverage would reduce its expected losses by $15. That is, initially the company expected a net profit of $12 (i.e., $20 - $8), while at the end of the year the expected losses on the policy are $15 (i.e., $12 - $15 = ($3) loss). The purpose of the reinsurance contract is to share the insurance risk (i.e., a probable $3 loss) with another party for a fee. In this case, Company A paid $10 for reinsurance; thus, it can book a $2 gain (i.e., $12 - $10) on the reinsurance transaction. The $2 gain and the reduction in expected losses of $3 will result in a $5 increase in Surplus. The effect of this reinsurance transaction on the company's Balance Sheet is presented below.

TABLE A1

Reinsurance Effect on the Balance Sheet Accounts

	BB	**Cash/ Premiums Earned**	**Expense/ Cash**	**Estimated Losses/Loss Reserves**	**EB (without)**	**Reinsurance**	**EB (with)**
Cash (A)	$100	$20	($8)		$112	($10)	$102
Gross Loss Reserves (L)	$40			$15	$55		$55
Loss Reserve Ceded (CL)	0				0	$15	$15
Net Loss Reserves (L)	$40				$55		$40
Surplus (SE)	$60	$20	($8)	($15)	$57	$5	$62
Gross Reserves / Surplus:					0.9649		0.8871
Net Loss Reserves / Surplus:					0.9649		0.6452
Assets / Liabilities:					2.0364		2.5500

The reinsurance does not change Gross Loss Reserves, but it reduces Net Loss Reserves and increases Surplus. The increase in Surplus will improve both the Gross Reserves-to-Surplus and Net Loss Reserves-to-Surplus ratios. Also, reinsurance will reduce Net Premiums; and therefore, Gross Premiums-to-Surplus and Net Premiums-to-Surplus ratios will also improve.

TABLE A2

Reinsurance Journal Entries

Account	**Dr**	**Cr**	**Account**	**Dr**	**Cr**
Premiums Ceded	$20		Loss Reserve Ceded	$15	
Expenses Ceded		$8	Surplus		$15
Cash		$10			
Gain		$2			

APPENDIX B

Calculation of Regulatory Variables

Assume that a fictitious firm A has seven insurance subsidiaries in its group structure and NY is its designated main regulator. These seven subsidiaries are under the supervision of the following regulators: 1 in Michigan, 1 in California, 2 in New York, 1 in Indiana, 1 in Georgia, and 1 captive reinsurer in South Carolina. I do not include the South Carolina captive reinsurer in the regulatory score.[10] The number of insurance affiliates in the groups' structure that could potentially use captive reinsurance equals six. The number of overlapping regulators equals four.

Total scores count the number of insurance subsidiaries facing certain regulatory enforcement environment characteristics. Unique regulatory variable scores measure the number of unique insurance regulators' with a given set of regulatory enforcement characteristics.

TABLE B1

Regulatory Score Calculation

	Unique	Total
Overlapping Regulators	4	4
Regulatory Resources	Average regulatory budget	Total regulatory budget
Captive Law Regulators	2 (MI, NY)	3 (1 MI + 2 NY)
Strict Regulators	2 (CA, NY)	3 (1 CA + 2 NY)
Elected Regulators	2 (CA, GA)	2 (1 CA + 1 GA)
Coastal Regulators	3 (CA, NY, GA)	4 (1 CA + 2 NY + 1 GA)
Republican Regulators	2 (IN, GA)	2 (1 IN + 1 GA)

[10] While insurers can choose among captive regulators and that choice could reflect firm characteristics or incentives, I do not differentiate among captive regulators in this paper. I do acknowledge that it might be interesting to examine a firm's choice of captive regulator and whether that choice matters for the firm's reputation (and, hence, interaction with other regulators and credit rating agencies' assessments).

APPENDIX C

Variables

TABLE C1
Variable List

Variable	Definition
P/C Insurers	pure property-casualty insurers (SIC code 6331)
Life Insurers	pure life insurers (SIC code 6311) and diversified insurers (SIC codes 6311 and 6331).
C_Number (CN)	the number of captive reinsurance subsidiaries in the insurance group's structure
Captive	an indicator variable that equals one if an insurance group has at least one captive reinsurance subsidiary in their structure, and is zero otherwise
C_Form	an indicator variable that equals one if an insurance group licenses a captive reinsurance subsidiary, and is zero otherwise
C_Foreign	an indicator variable that equals zero when there are no captive reinsurance subsidiaries in the group's structure, equals one if all captive reinsurance subsidiaries are licensed in the U.S., and two if captive reinsurance subsidiaries are all located abroad or both in the U.S. and abroad
Enforcement	a factor score derived from a principal component factor analysis of the standardized measures of the regulatory enforcement variables: *Overlapping Regulators*, *Regulatory Resources*, *Captive Law Regulators*, *Strict Regulators*, *Elected Regulators*, *Coastal Regulators*, *Republican Regulators*
Affiliates	the number of insurance affiliates in the group's structure, excluding captive reinsurers
Overlapping Regulators	the number of unique overlapping insurance regulators who monitor insurance affiliates in the group’s structure, excluding captive reinsurers' regulators
Regulatory Resources	mean regulatory budget per $1,000 of premiums for regulators that monitor the insurance group
Captive Law Regulators	the number of unique regulators in the group's structure that have captive laws in their state
Strict Regulators	the number of unique regulators in the group's structure that are strict in their enforcement
Elected Regulators	the number of unique regulators in the group's structure that are appointed through an election
Coastal Regulators	the number of unique regulators in the group's structure whose state is located in a coastal area
Republican Regulators	the number of unique regulators in the group's structure whose state’s citizens has been Republican-leaning based on their voting in the past eight U.S. presidential elections
Surplus Constraint	an indicator variable that equals one if the premiums-to-surplus ratio is above the 90^{th} quantile among P/C insures, and zero otherwise; an indicator variable that equals one if the assets-to-surplus ratio is above the 90^{th} quantile (ASR90) or below the 25^{th} quantile (ASR25) among life insurers, and zero otherwise.

TABLE C1 (cont'd)

Variable	Definition
Assets / Surplus Ratio (ASR)	an indicator variable that equals one if the assets-to-surplus ratio is: above the 90th quantile (i.e., ASR90); above the 75th quantile (ASR75); or below the 25th quantile (ASR 25).
RSR / Surplus Ratio (RSR)	an indicator variable that equals one if the reserves-to-surplus ratio is greater than three (i.e., RSR2: when reserves-to-surplus are greater than five; RSR3: when reserves-to-surplus are greater than ten; RSR4: when reserves-to-surplus are greater than eighteen; and RSR5: when reserves-to-surplus are greater than fourteen or less than four).
Premiums / Surplus Ratio (PSR)	an indicator variable that equals one if a P/C insurer has premium-to-surplus ratio above the 90th quantile, and zero otherwise.
Log (Premiums)	natural logarithm of the insurance group's total gross written premiums
Surplus	the insurance group's statutory surplus (SRT in WRDS Compustat)
Reinsurance Inefficiency	reinsurance underwriting expenses scaled by total ceded premiums
Investment Inefficiency	investment expenses scaled by total investment income
Reinsurance	a ratio of ceded premiums to total gross written premiums
ROA	net statutory income (NITS in WRDS Compustat) divided by total assets
Investment Yield	investment income scaled by invested capital
Tax Rate	tax expenses (i.e., net income less pre-tax income) scaled by pre-tax income
Cash / Total Assets	cash scaled by total assets
Debt / Total Assets	long-term debt scaled by total assets
CR_All	S&P long-term issuer credit rating assigned to the insurance group; the highest rating (AAA) is encoded 1 while the lowest rating (D) is encoded 22. Non-rated insurers are assigned a credit rating score 23. Then, the credit rating scores are multiplied by – 1
CR_Ranked	S&P long-term issuer credit rating assigned to the insurance group if there is a rating. Non-rated insurers are not included. The highest rating (AAA) is encoded 1 while the lowest rating (D) is encoded 22. Then, the credit rating scores are multiplied by – 1
MV	market value of equity
B/M	book-to-market ratio
Turnover	annual US$ trading volume divided by market cap
SD_Return	standard deviation of daily stock returns
ABD_Return	cumulative size and book-to-market adjusted stock return

TABLE C1 (cont'd)

Variable	Definition
InstOwn%	outstanding shares owned by institutional investors as a percentage of total shares
Spread	yearly median of daily quoted spreads (i.e., the difference between the bid and ask price divided by the midpoint)
ZeroReturn	proportion of trading days with zero daily stock returns out of all potential trading days
PriceImpact	yearly median of Amihud's (2002) illiquidity measure (i.e., daily absolute stock return divided by US$ trading volume), multiplied by 1,000,000
Illiquidity	a factor score derived from a principal component factor analysis of three standardized measures of market illiquidity: *Spead*, *ZeroReturn*, *PriceImpact*
Analysts	number of analysts following the firm each month, averaged over the year
RealGAINS	realized capital gains (losses) scaled by total assets
EBGAINS	earnings before capital gains (losses) scaled by total assets
Power	product pricing power, i.e, Lerner index, measured as the difference between premiums and reserves divided by total premiums

APPENDIX D

Sample Selection

The table below details the sample selection process. I use CorporateAffiliations database to collect data on the firms' organizational structure. I start with 120 largest by gross premiums (as reported in the CorporateAffiliations database) public insurance groups between 2006 and 2015. I use multiple sources to verify companies in the firms' corporate structure: Exhibit 21 in the 10-K filings, the NAIC listing of insurance groups, A.M. Best Corporate Structure file, and the Y-Schedule from statutory filings (e.g., collected from firms' official websites and regulatory examination reports). I verify the subsidiaries' licenses (i.e., type, effective date, and parent) from regulatory websites.

Then, I remove insurance companies that were acquired by another company. Also, I remove insurers that went through reorganization or liquidation since financial distress would also affect regulatory supervision and enforcement incentives. I lose twenty one insurers due to data limitations (i.e., Compustat has missing statutory data for some public insurers). As the result, I have sixty two insurance groups in the final sample.

TABLE D1

Sample Selection Steps

		# Unique Firms
Largest (by gross premiums) public insurance groups in 2006		120
Less:		
Mergers & Acquisitions (M&A) between 2006 and 2015	(33)	
Financial distress (liquidation, bankruptcy) between 2006 and 2015	(4)	
Missing required financial statement data	(21)	
Final Sample		62

APPENDIX E

Main Results

TABLE E1

Pooled Sample Descriptive Statistics and Correlations

Panel A: Descriptive Statistics

Panel A of Table E1 provides descriptive statistics for the pooled sample of large public insurers between 2006 and 2015. N is the number of firm-year observations. All variables are defined in Appendix C.

Variable	N	Mean	SD	P25	P50	P75
Captive (P/C)	260	0.3962	0.4900	0	0	1
Captive (Life)	264	0.4318	0.4963	0	0	1
C_Number (P/C)	260	0.4769	0.6542	0	0	1
C_Number (Life)	264	1.7879	3.4233	0	0	2
C_Foreign (P/C)	260	0.7000	0.9060	0	0	2
C_Foreign (Life)	264	0.6932	0.8592	0	0	2
C_Form (P/C)	260	0.0192	0.1376	0	0	0
C_Form (Life)	264	0.1098	0.3133	0	0	0
Enforcement (P/C)	260	-0.2420	0.5881	-0.6042	-0.4626	-0.0315
Enforcement (Life)	264	-0.0358	0.8296	-0.6564	-0.3616	0.5368
Illiquidity (P/C)	192	0.2331	1.3016	-0.2011	-0.1214	0.0544
Illiquidity (Life)	190	-0.1098	0.1900	-0.2024	-0.1690	-0.0950
Log (Spread) (P/C)	192	-9.0582	2.4538	-10.7501	-9.0756	-7.9671
Log (Spread) (Life)	190	-10.725	1.6853	-11.2963	-10.4961	-9.2048
ZeroReturn (P/C)	192	0.0562	0.0618	0.0151	0.0361	0.0758
ZeroReturn (Life)	190	0.0349	0.0373	0.0142	0.0234	0.0400
PriceImpact (P/C)	192	32.7902	186.3751	0.0170	0.2472	0.9909
PriceImpact (Life)	190	0.9602	3.7199	0.0154	0.0346	0.1649
Analysts (P/C)	165	9.2217	4.5794	6.5	9	12
Analysts (Life)	201	9.6269	3.8157	7	10.25	12
CR_All (P/C)	247	-13.1903	7.1568	-23	-9	-8
CR_All (Life)	255	-10.8118	5.9568	-11	-9	-7
CR_Rated (P/C)	167	-8.4910	2.7040	-9	-9	-7
CR_Rated (Life)	212	-8.3396	2.5102	-9	-8	-7
Premiums / Surplus (P/C)	260	1.1653	0.6643	0.6311	1.0651	1.5085
PSR (P/C)	260	0.0577	0.2336	0	0	0
Assets / Surplus (Life)	264	15.7315	13.9224	5.6082	12.5257	20.0628
ASR (> 90%)	264	0.1023	0.3036	0	0	0
ASR (> 75%)	264	0.2500	0.4338	0	0	0.5
ASR (< 25%)	264	0.0720	0.2589	0	0	0
ASR (25% < > 90%)	264	0.1742	0.3800	0	0	0
Reserves / Surplus (Life)	264	9.8078	7.5413	3.2861	8.0028	14.0022
RSR2 (Life)	264	0.6667	0.4723	0	1	1

TABLE E1 (cont'd)

Variable	N	Mean	SD	P25	P50	P75
RSR3 (Life)	264	0.3939	0.4895	0	0	1
RSR4 (Life)	264	0.1250	0.3313	0	0	0
RSR5 (Life)	264	0.5378	0.4995	0	1	1
Total Assets ($ millions) (P/C)	260	13727	22936	1809	5632	16108
Total Assets ($ millions) (Life)	264	77895	140353	9748	22793	64151
Gross Premiums ($ millions) (P/C)	260	3238	5326	532.7	1049	2963
Gross Premiums ($ millions) (Life)	264	6252	8904	656.9	3068	7369
Total Assets ($ millions) (P/C)	260	13727	22937	1809	5632	16108
Total Assets ($ millions) (Life)	264	77895	140353	9748	22792	64151
Surplus ($ millions) (P/C)	260	3185	4999	510.4	1261	3507
Surplus ($ millions) (Life)	264	4527	6132	828.7	2437	5469
Reserves ($ millions) (P/C)	260	7902	14294	970	2857	9154
Reserves ($ millions) (Life)	264	42464	67372	6255	14720	48882
Reinsurance (P/C)	260	0.2332	0.2557	0.0677	0.1410	0.3430
Reinsurance (Life)	264	0.2128	0.2700	0.0565	0.1036	0.2514
ROA (P/C)	260	0.0249	0.0396	0.0149	0.0287	0.0447
ROA (Life)	264	0.0136	0.0153	0.0037	0.0101	0.0227
Investment Yield (P/C)	260	0.0762	0.0511	0.0575	0.0792	0.0973
Investment Yield (Life)	264	0.2069	0.1891	0.1102	0.1717	0.2453
Reinsurance Inefficiency (P/C)	260	0.1426	0.5577	0	0	0
Reinsurance Inefficiency (Life)	264	0.6837	3.3180	0	0	0
Investment Inefficiency (P/C)	260	0.0762	0.0511	0.0575	0.0792	0.0973
Investment Inefficiency (Life)	264	0.0496	0.2920	0.0134	0.0240	0.0378
Cash / Total Assets (P/C)	260	0.0414	0.0660	0.0057	0.0238	0.0520
Cash / Total Assets (Life)	264	0.0252	0.0281	0.0062	0.0189	0.0362
Debt / Total Assets (P/C)	260	0.0741	0.0825	0.0353	0.0549	0.0767
Debt / Total Assets (Life)	264	0.0415	0.0266	0.0231	0.0371	0.0578
Retained Earnings / Total Assets (P/C)	258	0.1617	0.2447	0.1214	0.1909	0.2702
Retained Earnings / Total Assets (Life)	264	0.0982	0.0912	0.0260	0.0918	0.1616
Tax Rate (P/C)	260	0.1910	1.7566	0.0577	0.2507	0.4110
Tax Rate (Life)	264	-0.2067	8.4338	0.0761	0.2817	0.4677

TABLE E1 (cont'd)

Variable	N	Mean	SD	P25	P50	P75
Enforcement2 (P/C)	260	-0.1337	0.7961	-0.6147	-0.3824	0.3553
Enforcement2 (Life)	264	0.1317	1.1530	-0.7099	-0.1580	0.7504
Affiliates (P/C)	260	10.4692	10.4110	4	7	13
Affiliates (Life)	264	10.5151	9.4140	4	7	15.5
Overlapping Regulators (P/C)	260	4.6346	3.2121	2	4	6
Overlapping Regulators (Life)	264	5.1591	4.1536	2	4	7
Regulatory Resources (Total) (P/C)	260	11.9406	7.4595	7.8496	9.7016	12.7117
Regulatory Resources (Total) (Life)	264	12.5508	7.0382	7.2459	9.3441	17.1354
Captive Law Regulators (Total) (P/C)	260	2.1154	1.5848	1	2	3
Captive Law Regulators (Total) (Life)	264	3.1894	3.2561	1	2	4
Strict Regulators (Total) (P/C)	260	1.7808	2.4277	0	1	2
Strict Regulators (Total) (Life)	264	2.0189	2.3617	1	1	2
Coastal Regulators (Total) (P/C)	260	1.8077	1.7089	0	2	3
Coastal Regulators (Total) (Life)	264	2.4470	2.3032	1	2	4
Elected Regulators (Total) (P/C)	260	0.8000	1.0427	0	1	1
Elected Regulators (Total) (Life)	264	1.1402	1.7461	0	0	2
Republican Regulators (Total) (P/C)	260	3.7533	2.5004	1.92	3.03	5.92
Republican Regulators (Total) (Life)	264	5.2161	4.3620	1.88	3.96	6.12
Regulatory Resources (Aver.) (P/C)	260	1.5408	0.7034	0.9947	1.3440	1.8567
Regulatory Resources (Aver.) (Life)	264	1.6818	0.8397	1.1491	1.4704	2.0200
Captive Law Regulators (Uniq.) (P/C)	260	1.3115	1.4727	0	1	2
Captive Law Regulators (Uniq.) (Life)	264	2.2159	2.2341	1	2	3
Strict Regulators (Uniq.) (P/C)	260	1.0269	1.1129	0	1	2
Strict Regulators (Uniq.) (Life)	264	1.3447	1.1093	1	1	2
Coastal Regulators (Uniq.) (P/C)	260	2.3731	1.9301	1	2	3
Coastal Regulators (Uniq.) (Life)	264	2.9129	2.3195	1.5	2	4
Elected Regulators (Uniq.) (P/C)	260	0.8000	1.0427	0	1	1
Elected Regulators (Uniq.) (Life)	264	1.0379	1.3920	0	0	2
Republican Regulators (Uniq.) (P/C)	260	1.9077	1.6057	1	2	2
Republican Regulators (Uniq.) (Life)	264	2.6061	2.5492	1	2	4

TABLE E1 (cont'd)

Panel B: Correlation Matrix

Panel B of Table E1 provides correlations for the pooled sample of large public insurers between 2006 and 2015. Pearson (Spearman) correlations are presented above (below) the diagonal. Correlations in bold are significant at the 5% level or better. All variables are defined in Appendix C. Continuous variables are winsorized at the 1st and 99th percentiles.

		Life Insurers										
	Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	Captive		**0.6002**	**0.4980**	-0.1381	0.0794	**0.1860**	-0.0639	**-0.1585**	**-0.1231**	**0.2168**	**0.3764**
2	C_Number	**0.9246**		**0.3032**	-0.0585	0.0586	**0.2022**	**0.2069**	0.0753	**0.1998**	0.0728	**0.1532**
3	Enforcement	**0.5126**	**0.4616**		-0.0989	0.1038	0.1161	-0.1122	**-0.1526**	**-0.1718**	**0.3371**	**0.2260**
4	Illiquidity	**-0.2088**	-0.1529	0.0265		-0.1491	-0.0540	0.0207	**0.1730**	-0.0508	-0.0774	-0.0194
5	Analysts	**0.1837**	**0.1798**	**0.1687**	-0.1543		**0.3419**	**0.4995**	**0.1579**	**0.4598**	**0.4991**	-0.1010
6	CR_All	0.1126	**0.1797**	-0.0849	-0.0032	**0.4101**		**0.1894**	0.1013	0.1120	**0.3660**	**-0.1759**
7	Assets / Surplus	0.0244	**0.1752**	0.0349	-0.0327	**0.3128**	**0.2316**		**0.4497**	**0.9326**	0.3107	-0.0002
8	Surplus Constraint	**-0.2261**	-0.1303	-0.1350	**0.2535**	**0.1797**	**0.1890**	0.1489		**0.3368**	**0.1302**	-0.0654
9	Reserves / Surplus	0.0007	0.1421	-0.0881	-0.0863	**0.3349**	**0.2346**	**0.9754**	0.1560		**0.2003**	0.0100
10	Premiums	**0.3974**	**0.4079**	**0.4804**	0.1027	**0.4833**	**0.4855**	0.1030	**0.2722**	0.0282		**-0.1979**
11	Reinsurance	**0.3956**	**0.3609**	**0.3536**	-0.0849	0.0740	**-0.1691**	0.1057	-0.1131	0.1007	-0.1055	

		P/C Insurers										
	Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	Captive		**0.9017**	0.0173	**0.1492**	0.0934	**0.1720**	-0.0523	**-0.1330**	-0.0519	0.0914	-0.0612
2	C_Number	**0.9849**		-0.0387	0.0824	0.0903	**0.1847**	-0.0475	**-0.1302**	-0.0474	0.0345	-0.0708
3	Enforcement	0.0121	-0.0237		0.0771	-0.0261	**0.3954**	-0.0092	**0.3208**	-0.0117	**0.6849**	**-0.2090**
4	Illiquidity	-0.1285	-0.1240	0.1356		0.0528	0.0041	-0.0237	-0.0182	-0.0231	-0.0777	-0.0209
5	Analysts	-0.1368	-0.1505	0.0464	0.1066		-0.0668	**-0.2757**	-0.1376	0.1142	-0.1013	-0.1005
6	CR_All	**0.3950**	**0.4149**	**0.3323**	0.0134	-0.1619		0.0376	**0.2085**	0.0365	**0.4310**	**-0.2251**
7	Premiums / Surplus	**-0.4084**	**-0.4304**	0.1068	**-0.2087**	-0.0525	**-0.2133**		**0.2545**	**0.9998**	-0.0247	-0.0558
8	Surplus Constraint	0.0447	0.0334	0.0469	0.0089	-0.1073	0.0429	**0.2346**		**0.2525**	**0.3712**	**-0.1731**
9	Assets / Surplus	**-0.3060**	**-0.3445**	0.0661	**0.3473**	0.1494	-0.1682	0.1012	0.1229		-0.0263	-0.0561
10	Premiums	**0.3664**	**0.3827**	**0.3908**	-0.1148	**-0.2275**	**0.8139**	**-0.2273**	0.0156	-0.1361		**-0.2409**
11	Reinsurance	-0.1056	-0.0964	**-0.3515**	-0.1441	-0.0824	**-0.3157**	**-0.1945**	**-0.2033**	0.0019	-0.1300	

TABLE E1 (cont'd)

	Life Insurers											
	Variable	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
12	C_Number		**0.3032**	0.0728	**0.1998**	-0.0271	-0.0320	0.0515	**-0.3102**	**-0.1336**	0.0290	**0.2350**
13	Enforcement	**0.5526**		**0.3371**	**-0.1718**	**-0.1327**	0.0315	-0.0145	**0.1922**	**-0.3293**	**0.2371**	**0.4027**
14	Premiums	**0.4062**	**0.5020**		**0.2003**	-0.0316	-0.0083	0.0300	-0.0080	**-0.1579**	-0.1069	0.0808
15	Reserves / Surplus	0.0807	**-0.1367**	-0.0551		**-0.1975**	-0.0574	0.1079	**-0.5986**	**0.5145**	**-0.2241**	**-0.1709**
16	Reinsurance Inefficienc	0.0138	0.0143	**0.2382**	**-0.3882**		0.0462	-0.0011	**0.2792**	-0.1184	**0.1858**	0.0440
17	Investment Inefficiency	**0.1321**	**0.2252**	**0.3198**	-0.0552	**0.1743**		0.0035	0.0051	-0.0826	0.0959	**0.1554**
18	Tax Rate	0.1192	-0.0209	0.0903	**0.2134**	**-0.1851**	-0.0801		-0.0610	0.0331	-0.0331	0.0707
19	ROA	**-0.1471**	**0.1860**	**0.1280**	**-0.7235**	**0.2567**	-0.0409	**-0.3322**		**-0.3650**	**0.2193**	**0.2650**
20	Investment Yield	**-0.1682**	**-0.4744**	**-0.3062**	**0.7099**	**-0.2602**	**-0.1692**	0.0747	**-0.4800**		**-0.2793**	**-0.3498**
21	Cash / Total Assets	-0.0437	**0.2390**	0.1158	**-0.2741**	**0.3674**	0.1050	-0.0795	**0.1617**	**-0.5203**		**0.3814**
22	Debt / Total Assets	**0.2873**	**0.5424**	**0.4404**	**-0.2641**	**0.2829**	-0.0144	-0.0182	**0.2615**	**-0.5034**	**0.3418**	

	P/C Insurers											
	Variable	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
12	C_Number		-0.0387	0.0345	-0.0475	**0.2610**	-0.0045	-0.0799	**0.1506**	0.0017	0.0753	-0.1201
13	Enforcement	0.0142		**0.6849**	-0.0092	**-0.1234**	**-0.2084**	0.0385	0.0908	-0.0094	**-0.1329**	-0.0941
14	Premiums	**0.1898**	**0.5096**		-0.0247	0.0175	**-0.1767**	0.0188	**0.1551**	0.0484	**-0.2310**	-0.0592
15	Premiums / Surplus	**-0.4264**	**0.1715**	**0.1540**		-0.0159	-0.0075	0.0045	-0.0090	-0.0209	0.0021	0.0204
16	Reinsurance Inefficienc	**0.4437**	**-0.2714**	**0.2806**	**-0.2078**		-0.0185	0.0397	0.0240	0.0475	-0.0499	-0.0828
17	Investment Inefficiency	0.0891	**-0.2933**	**-0.2204**	0.0631	**0.1567**		-0.0088	**-0.1553**	-0.1184	**0.1477**	**0.2234**
18	Tax Rate	**-0.1986**	-0.0110	**-0.1719**	**0.2974**	**-0.1993**	**-0.1343**		-0.0345	**-0.1350**	-0.0495	0.0551
19	ROA	**0.2103**	0.0218	**0.1463**	**-0.1984**	**0.1500**	**-0.1525**	**-0.3427**		**0.1250**	**0.1250**	**-0.4101**
20	Investment Yield	-0.0183	0.0364	**0.1456**	0.0801	0.0845	**-0.3330**	0.0035	**0.1658**		**-0.1670**	**-0.2311**
21	Cash / Total Assets	0.0423	-0.0994	**-0.3093**	-0.0020	-0.0011	**0.1449**	0.0038	-0.0152	**-0.2944**		**0.2137**
22	Debt / Total Assets	-0.0297	**0.2888**	**0.1615**	**0.1648**	**-0.2127**	-0.0638	0.0412	**-0.2159**	**-0.2760**	0.1142	

TABLE E1 (cont'd)

	Life Insurers											
	Variable	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
23	C_Number		**0.6151**	**0.3032**	**0.2069**	0.0753	0.0728	-0.0271	-0.0320	0.0515	**-0.3102**	**-0.1336**
24	C_Foreign	**0.9217**		**0.5168**	-0.0862	**-0.1501**	**0.1695**	-0.0484	-0.0497	0.0431	0.0149	**-0.3176**
25	Enforcement	**0.5526**	**0.5570**		-0.1122	**-0.1526**	**0.3371**	**-0.1327**	0.0315	-0.0145	**0.1922**	**-0.3293**
26	Assets / Surplus	**0.1822**	0.0060	-0.0326		**0.4497**	**0.3107**	**-0.1721**	-0.0379	0.0653	**-0.5095**	**0.3419**
27	Surplus Constraint	-0.0972	**-0.1549**	**-0.1301**	0.1143		**0.1302**	**0.1479**	-0.0080	0.0674	-0.0219	0.0436
28	Premiums	**0.4062**	**0.3603**	**0.5020**	0.0276	**0.1782**		-0.0316	-0.0083	0.0300	-0.0080	**-0.1579**
29	Reinsurance Inefficiency	0.0138	-0.0012	0.0143	**-0.4298**	0.0887	**0.2382**		0.0462	-0.0011	**0.2792**	-0.1184
30	Investment Inefficiency	**0.1321**	0.0768	**0.2252**	0.0082	0.1030	**0.3198**	**0.1743**		0.0035	0.0051	-0.0826
31	Tax Rate	0.1192	0.0728	-0.0209	**0.2301**	**0.1309**	0.0903	**-0.1851**	-0.0801		-0.0610	0.0331
32	ROA	**-0.1471**	0.0120	**0.1860**	**-0.7073**	-0.1018	**0.1280**	**0.2567**	-0.0409	**-0.3322**		**-0.3650**
33	Investment Yield	**-0.1682**	**-0.3214**	**-0.4744**	**0.6499**	0.0153	**-0.3062**	**-0.2602**	**-0.1692**	0.0747	**-0.4800**	

	P/C Insurers											
	Variable	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
23	C_Number		**0.8937**	-0.0387	-0.0475	**-0.1302**	0.0345	**0.2610**	-0.0045	-0.0799	**0.1506**	0.0017
24	C_Foreign	**0.9696**		-0.0256	-0.0497	**-0.1368**	**0.1349**	**0.3558**	0.0173	-0.1081	0.1772	0.0224
25	Enforcement	0.0142	0.0011		-0.0092	**0.3208**	**0.6849**	**-0.1234**	**-0.2084**	0.0385	0.0908	-0.0094
26	Premiums / Surplus	**-0.4264**	**-0.3548**	**0.1715**		**0.2545**	-0.0247	-0.0159	-0.0075	0.0045	-0.0090	-0.0209
27	Surplus Constraint	**-0.1353**	**-0.1370**	**0.2625**	**0.4038**		**0.3712**	-0.0525	-0.0811	0.0610	0.0917	-0.0763
28	Premiums	**0.1898**	**0.2324**	**0.5096**	**0.1540**	**0.2718**		0.0175	**-0.1767**	0.0188	**0.1551**	0.0484
29	Reinsurance Inefficiency	**0.4437**	**0.4996**	**-0.2714**	**-0.2078**	-0.0866	**0.2806**		-0.0185	0.0397	0.0240	0.0475
30	Investment Inefficiency	0.0891	0.0892	**-0.2933**	0.0631	-0.0992	**-0.2204**	**0.1567**		-0.0088	**-0.1553**	-0.1184
31	Tax Rate	**-0.1986**	**-0.2124**	-0.0110	**0.2974**	**0.1401**	**-0.1719**	**-0.1993**	**-0.1343**		-0.0345	**-0.1350**
32	ROA	**0.2103**	**0.2093**	0.0218	**-0.1984**	0.1173	**0.1463**	**0.1500**	**-0.1525**	**-0.3427**		**0.1250**
33	Investment Yield	-0.0183	0.0058	0.0364	0.0801	-0.0595	**0.1456**	0.0845	-0.3330	0.0035	**0.1658**	

TABLE E1 (cont'd)

	Life Insurers											
	Variable	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
34	Enforcement		-0.0989	0.1038	-0.1122	0.1161	0.0889	**-0.1327**	0.0315	-0.0145	**0.1922**	**-0.3293**
35	Illiquidity	-0.0033		-0.1491	0.0207	-0.0540	0.0083	-0.0370	-0.0390	-0.0482	0.0779	-0.0311
36	Analysts	0.1406	**-0.2586**		**0.4995**	**0.3419**	**0.1670**	**-0.1609**	-0.0669	0.0608	**-0.2507**	0.0697
37	CR_All	0.0639	0.0559	**0.2898**		**0.1894**	-0.0877	**-0.1721**	-0.0379	0.0653	**-0.5095**	**0.3419**
38	CR_Rated	-0.0662	-0.0288	**0.3544**	-0.0365		**1.0000**	**0.1524**	-0.1138	0.0469	0.0743	-0.0285
39	Assets / Surplus	-0.0662	-0.0288	**0.3544**	-0.0365	**1.0000**		**0.1800**	**0.2669**	-0.0004	**0.2742**	**-0.4585**
40	Reinsurance Inefficiency	**-0.1978**	-0.0932	-0.1545	**-0.5557**	**0.2624**	**0.2624**		0.0462	-0.0011	**0.2792**	-0.1184
41	Investment Inefficiency	**0.3048**	0.0987	0.1445	-0.0746	**0.4528**	**0.4528**	**0.2073**		0.0035	0.0051	-0.0826
42	Tax Rate	0.0038	0.1117	0.1342	**0.2537**	-0.1092	-0.1092	**-0.1889**	-0.1499		-0.0610	0.0331
43	ROA	0.1826	0.1323	**-0.2298**	**-0.6569**	0.0039	0.0039	**0.2770**	0.1460	**-0.3966**		**-0.3650**
44	Investment Yield	**-0.4568**	-0.0396	0.1126	**0.5175**	0.0339	0.0339	**-0.2850**	**-0.3294**	0.0507	**-0.3342**	

	P/C Insurers											
	Variable	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
34	Enforcement		0.0771	-0.0261	**0.3954**	**0.3517**	-0.0092	**-0.1234**	**-0.2084**	0.0385	0.0908	-0.0094
35	Illiquidity	0.1944		0.0528	0.0041	-0.0171	-0.0237	-0.0094	0.0455	-0.0280	0.0883	0.0522
36	Analysts	-0.0485	0.1382		-0.0668	**-0.4341**	**-0.2757**	-0.1484	-0.0815	0.0301	**-0.2195**	-0.0537
37	CR_All	**0.2727**	**-0.3519**	-0.1091		**1.0000**	0.0376	**0.2037**	**-0.2031**	0.0461	**0.1496**	-0.0048
38	CR_Rated	**0.2727**	**-0.3519**	-0.1091	**1.0000**		-0.0137	0.1424	-0.0322	**-0.2114**	**0.3647**	0.0993
39	Premiums / Surplus	**0.2634**	-0.0424	-0.1176	-0.1002	-0.1002		-0.0159	-0.0075	0.0045	-0.0090	-0.0209
40	Reinsurance Inefficiency	**-0.4507**	**-0.3468**	**-0.3250**	**0.3823**	**0.3823**	**-0.4527**		-0.0185	0.0397	0.0240	0.0475
41	Investment Inefficiency	**-0.5110**	-0.1764	-0.0254	-0.1599	-0.1599	**-0.2970**	**0.3408**		-0.0088	**-0.1553**	-0.1184
42	Tax Rate	0.2309	0.1414	0.1326	-0.0526	-0.0526	**0.4868**	**-0.4212**	**-0.3876**		-0.0345	**-0.1350**
43	ROA	0.1515	**-0.2837**	-0.0653	**0.4775**	**0.4775**	**-0.2859**	0.2066	**-0.2459**	**-0.3386**		**0.1250**
44	Investment Yield	0.0199	-0.2175	-0.0494	0.2018	0.2018	0.1038	-0.0533	**-0.3439**	0.0920	**0.3680**	

TABLE E2

Descriptive Statistics and Univariate Tests of Differences

Panel A: Life Insurers

Panel A of Table E2 reports the results for the sub-sample of life insurers. This table reports the mean differences across two groups: insurance groups with at least one captive reinsurer in their structure (*Captive*) and insurance groups with no captive reinsurance subsidiaries. In reported results, I do not control for the main regulator. The differences between variable means differ from the results reported below when I compare firms with the same main regulator. All variables are defined in Appendix C. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

Variable	**Mean [Captive = 1]**	**Mean [Captive = 0]**	**Difference**	**t-stat**	
Enforcement	0.4372	-0.3952	0.8324	9.2952	***
Illiquidity	-0.1387	-0.0860	-0.0527	1.9116	**
Log (Spread)	-10.4760	-9.9215	-0.5545	2.2822	***
PriceImpact	0.8767	1.0292	-0.1525	-0.2807	
ZeroReturns	0.0301	0.0388	-0.0085	1.6048	*
Analysts	9.9495	9.3435	.6060	1.1242	
S&P Credit Ratings (CR_All)	-9.5625	-11.7902	2.2277	3.0105	***
S&P Credit Ratings (CR_Rated)	-7.6429	-8.9386	1.2957	3.8692	***
Premiums	8462	4572	3890	3.5949	***
Assets / Surplus	14.7113	16.5068	-1.7955	1.0366	
Surplus Constraint	0.1053	0.2267	-0.1214	2.5990	***
Reserves / Surplus	8.7445	10.6159	-1.8714	2.0086	**
RSR5	0.4825	0.5800	-0.0975	1.5761	*
Reinsurance	0.3292	0.1244	0.2058	6.5770	***
Reinsurance Inefficiency	0.5304	0.8003	-0.2699	-0.6539	
Investment Inefficiency	0.0337	0.0617	-0.0279	-0.7695	
ROA	0.0138	0.0135	0.0003	0.1212	
Investment Yield	0.1460	0.2533	-0.1073	-4.7481	***
Cash / Total Assets	0.0221	0.0276	-0.0055	-1.6014	*
Debt / Total Assets	0.0467	0.0375	0.0092	2.8027	***
Affiliates	15.7105	6.5667	9.1439	8.9052	***
Overlapping Regulators	7.2017	3.6067	3.5950	7.6992	***
Regulatory Resources (Total)	16.9108	9.2372	7.6736	10.4143	***
Captive Law Regulators (Total)	4.7895	1.9733	2.8162	7.6918	***
Strict Regulators (Total)	2.6228	1.5600	1.0628	3.7086	***
Elected Regulators (Total)	1.6491	0.7533	0.8958	4.2616	***
Coastal Regulators (Total)	3.7192	1.4800	2.2392	8.9161	***
Republican Regulators (Total)	8.0082	3.0939	4.9143	10.9158	***
Regulatory Resources (Ave.)	1.3034	1.9694	-0.6660	6.9306	***
Captive Law Regulators (Uniq.)	3.3684	1.3400	2.0284	8.1696	***
Strict Regulators (Uniq.)	1.7281	1.0533	0.6747	5.1251	***
Elected Regulators (Uniq.)	1.4122	0.7533	0.6589	3.9120	***
Coastal Regulators (Uniq.)	4.1403	1.9800	2.1603	8.4369	***
Republican Regulators (Uniq.)	3.7456	1.7400	2.0056	6.8650	***

TABLE E2 (cont'd)

Panel B: P/C Insurers

Panel B of Table E2 reports the results for the sub-sample of P/C insurers. This table reports the mean differences across two groups: insurance groups with at least one captive reinsurer in their structure (*Captive*) and insurance groups with no captive reinsurance subsidiaries. In reported results, I do not control for the main regulator. The differences between variable means differ from the results reported below when I compare firms with the same main regulator. All variables are defined in Appendix C. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

Variable	**Mean [Captive = 1]**	**Mean [Captive = 0]**	**Difference**	**t-stat**	
Enforcement	-0.2295	-0.2502	0.0207	0.2777	
Illiquidity	0.4918	0.0880	0.4038	2.0802	**
Log (Spread)	-8.7889	-9.2092	0.4203	1.1399	
PriceImpact	85.8335	3.0341	82.7994	3.0156	***
ZeroReturns	0.0630	0.0525	0.0105	1.1343	
Analysts	9.7376	8.8690	0.8685	1.1980	
S&P Credit Ratings (CR_All)	-11.7128	-14.2123	2.4995	2.7337	***
S&P Credit Ratings (CR_Rated)	-8.5696	-8.4205	-0.1492	-0.3550	
Premiums	38372	2844	3238	1.4742	*
Premiums / Surplus	0.8783	1.3547	-0.4764	6.0224	***
Surplus Constraint	0.0194	0.0828	-0.0634	2.1548	**
Reinsurance	0.2139	0.2458	-0.0319	0.9841	
Reinsurance Inefficiency	0.3520	0.0052	0.3468	5.1388	***
Investment Inefficiency	0.0450	0.0479	-0.0029	-0.4015	
ROA	0.0312	0.0207	0.0105	2.1080	**
Investment Yield	0.0778	0.0751	0.0027	0.4153	
Cash / Total Assets	0.0477	0.0371	0.0106	1.2561	*
Debt / Total Assets	0.0642	0.0806	-0.0164	-1.5656	*
Affiliates	11.0388	10.0955	0.9433	0.7139	
Overlapping Regulators	4.9320	4.4395	0.4925	1.2104	
Regulatory Resources (Total)	12.8619	11.3362	1.5257	1.6181	*
Captive Law Regulators (Total)	2.4660	1.8854	0.5806	2.9316	***
Strict Regulators (Total)	1.2913	2.1019	-0.8106	2.6642	***
Elected Regulators (Total)	0.8447	0.7707	0.0740	0.5586	
Coastal Regulators (Total)	1.8641	1.7707	0.0934	0.4302	
Republican Regulators (Total)	3.4109	3.9780	-0.5671	1.7965	**
Regulatory Resources (Ave.)	1.5484	1.5358	0.0126	0.1418	
Captive Law Regulators (Uniq.)	2.0777	0.8089	1.2688	7.4802	***
Strict Regulators (Uniq.)	0.9515	1.0764	-0.1249	-0.8852	
Elected Regulators (Uniq.)	0.8447	0.7707	0.0740	0.5586	
Coastal Regulators (Uniq.)	2.3204	2.4076	-0.0873	-0.3559	
Republican Regulators (Uniq.)	1.9903	1.8535	0.1368	0.6711	

TABLE E3

Regulatory Enforcement Factor

Panel A: Eigenvalues in the Principal Component Analysis

Table E3 reports the results from the principal component analysis (PCA) of seven regulatory enforcement proxies. Panel A of Table E3 reports the eigenvalues of the factors identified in the principal component analysis. All variables are defined in Appendix C.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	5.0978	4.1772	0.7283	0.7283
Factor 2	0.9205	0.5743	0.1315	0.8598
Factor 3	0.3462	0.0909	0.0495	0.9092
Factor 4	0.2553	0.0367	0.0365	0.9457
Factor 5	0.2186	0.1078	0.0312	0.9769
Factor 6	0.1108	0.0600	0.0158	0.9927
Factor 7	0.0508		0.0073	1.0000

Panel B: Coefficients in the Principal Component Analysis

Table 3 reports the results from the principal component analysis (PCA) of seven regulatory enforcement proxies. Panel B of Table 3 presents the factor loadings for Factor 1 (Enforcement). All variables are defined in Appendix C.

Variable	Coefficient
Overlapping Regulators	0.14
Regulatory Resources	0.17
Captive Law Regulators	0.18
Strict Regulators	0.17
Elected Regulators	0.16
Coastal Regulators	0.17
Republican Regulators	0.17

TABLE E4

Regulatory Enforcement and Captive Reinsurers

Panel A: Firm Type and Captive Reinsurance

Panel A of Table E4 reports the results from the estimation of equation (1) using a Tobit model. The dependent variable is *C_Number*. Columns (1) – (3) report the results for pure life-health (L/H) insurers and diversified insurers (P/C + L/H) between 2006 and 2015. Column (4) reports the results for pure property-casualty (P/C) insurers between 2006 and 2015. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number											
		Life Insurers									P/C Insurers		
		(1) ASR > 90%			(2) ASR > 75%			(3) ASR < 25%			(4) PSR > 90%		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**				
Enforcement	H1 (-)	-2.0606	0.8101	***	-1.9242	1.3307		-4.0348	0.8467	***	0.6488	0.3595	*
Assets-to-Surplus Ratio (ASR)		-0.6082	0.2714	**	1.6668	1.2728		-11.1209	4.2026	***			
ASR * Enforcement	H2 (-)	-1.4287	0.6573	**	6.3089	2.8144	**	-14.9582	6.5325	**			
Assets / Surplus (AS)		-0.0319	0.0483		-0.0134	0.1082		0.1374	0.0765	*			
AS * Enforcement		0.1424	0.0521	***	0.0929	0.1541		0.1730	0.1094				
Premium-to-Surplus Ratio (PSR)											0.8313	0.3521	**
PSR * Enforcement	H2 (-)										-1.7503	0.9547	*
Premiums / Surplus (PS)											-1.2702	0.2261	***
PS * Enforcement											-0.7211	0.2701	***
Log (Premiums)		1.2807	0.3244	***	1.6707	0.5632	***	2.2824	0.6442	***	0.7997	0.1132	***
Reinsurance Inefficiency		0.9722	0.4707	**	0.0017	0.1301		-0.1112	0.1336		0.1116	0.0592	*
Investment Inefficiency		-5.7474	3.4891	*	-13.2160	7.1892	*	-12.4245	5.7281	**	-1.1244	1.3817	
Tax Rate		0.0115	0.0051	**	-0.0019	0.0081		0.0007	0.0085		0.0827	0.0273	***
Reinsurance		2.9708	0.9425	***	1.1255	1.1906		2.0777	1.2358	*	2.0478	0.6741	***
ROA		0.2456	8.4064		-39.8335	22.4781	*	-26.7995	29.5120		0.4612	1.1751	
Investment Yield		-0.9868	0.8609		-1.9673	2.4988		-2.4844	2.8323		1.1586	1.4758	
Cash / Total Assets		-3.0264	3.3566		2.9694	11.8126		9.7898	14.0289		0.0727	3.7826	
Debt / Total Assets		-19.7433	8.4615	**	-6.7551	20.6981		-6.8758	21.3924		-1.0790	1.8679	
Constant		-7.4371	2.4878	***	-9.8426	3.8409	***	-16.0329	4.5371	***	-2.7553	0.8882	***
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		264			264			264			260		
Adjusted R-squared		0.4476			0.4604			0.4595			0.5708		
Log pseudolikelihood		-255.8343			-249.9175			-250.3552			-119.3915		
Left / Right - censored		150 / 114			150 / 114			150 / 114			157 / 103		

TABLE E4 (cont'd)

Panel B: Captive Reinsurance across Time Periods

[Life Insurers]

Panel B of Table E4 reports the results from the estimation of equation (1) using a Tobit model. The dependent variable is *C_Number*. Column (1) reports the results for the entire time period between 2006 and 2015 for life insurers. Column (2) reports the results for the 2006-2011 time period for life insurers. Column (3) report the results for the 2012 – 2015 time period. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number								
		(1) [2006-2015]			(2) [2006-2011]			(3) [2012 - 2015]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	-4.2150	1.2212	***	-6.1263	0.6950	***	-3.2884	1.4344	**
Surplus Constraint (SC)		-3.2601	0.9951	***	-2.5498	0.5027	***	-2.5316	0.8671	***
SC * Enforcement	H2 (-)	-0.6738	1.8237		-4.3358	0.9534	***	-1.2983	1.8748	
Assets / Surplus (AS)		0.2118	0.1039	**	0.0405	0.0484		0.4285	0.1377	***
AS * Enforcement		0.2354	0.1495		0.4056	0.0811	***	0.1938	0.1593	
Log (Premiums)		1.8157	0.5043	***	2.2710	0.4006	***	1.2176	0.5723	**
Reinsurance Inefficiency		-0.0324	0.1260		0.0394	0.2982		0.3932	0.2301	*
Investment Inefficiency		-13.2146	5.8663	**	-3.8002	1.9059	**	-38.5848	14.1597	***
Tax Rate		0.0012	0.0075		0.0982	0.0273	***	0.0005	0.0106	
Reinsurance		1.0041	1.1691		2.1468	0.7240	***	-0.7747	1.3327	
ROA		-15.2373	28.6243		-26.1213	16.3260		-7.0481	23.4287	
Investment Yield		-2.9150	3.1145		0.9122	0.7078		-22.5374	9.7201	**
Cash / Total Assets		7.4127	13.0073		16.0210	5.4072	***	46.1049	23.5189	**
Debt / Total Assets		7.2795	18.1473		-13.4395	10.6703		17.4617	28.9450	
Constant		-13.6579	4.0634	***	-14.9616	2.5547	***	-8.3902	3.7463	**
Year & Regulator FE		Yes			Yes			Yes		
Observations		264			151			113		
Adjusted R-squared		0.4636			0.7979			0.5216		
Log pseudolikelihood		-248.4673			-50.9031			-100.8728		
Left / Right - censored		150 / 114			90 / 61			60 / 53		

TABLE E4 (cont'd)

Panel B: Captive Reinsurance across Time Periods

[P/C Insurers]

Panel B of Table E4 reports the results from the estimation of equation (1) using a Tobit model among P/C insurers. The dependent variable is *C_Number*. Column (1) reports the results for the entire time period between 2006 and 2015.Column (2) reports the results for the 2006-2011 time period for P/C insurers. Column (3) report the results for the 2012 – 2015 time period. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number								
		(1) [2006-2015]			(2) [2006-2011]			(3) [2012 - 2015]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	0.6488	0.3595	*	0.9360	0.0189	***	4.1944	0.0063	***
Surplus Constraint (SC)		0.8313	0.3521	**	-0.2300	0.0145	***	2.6677	0.0099	***
SC * Enforcement	H2 (-)	-1.7503	0.9547	*	-1.7558	0.0233	***	9.7839	0.0191	***
Premium / Surplus (PS)		-1.2702	0.2261	***	-1.8959	0.0164	***	-2.8758	0.0044	***
PS * Enforcement		-0.7211	0.2701	***	-0.9990	0.0174	***	-6.7813	0.0048	***
Log (Premiums)		0.7997	0.1132	***	1.0970	0.0026	***	1.2252	0.0010	***
Reinsurance Inefficiency		0.1116	0.0592	*	0.0354	0.0047	***	1.3196	0.0063	***
Investment Inefficiency		-1.1244	1.3817		-0.6724	0.2906	**	0.5652	0.0708	***
Tax Rate		0.0827	0.0273	***	0.1654	0.0072	***	-0.7362	0.0029	***
Reinsurance		2.0478	0.6741	***	3.2020	0.0536	***	-0.2788	0.0350	***
ROA		0.4612	1.1751		-3.2348	0.1286	***	-0.3813	0.1708	**
Investment Yield		1.1586	1.4758		0.1203	0.1656		1.5905	0.0893	***
Cash / Total Assets		0.0727	3.7826		-5.7938	0.3592	***	-31.4475	0.0248	***
Debt / Total Assets		-1.0790	1.8679		-3.6097	0.2376	***	10.1062	0.0608	***
Constant		-2.7553	0.8882	***	-3.9231	0.0200	***	-3.3841	0.0083	***
Year & Regulator FE		Yes			Yes			Yes		
Observations		260			155			105		
Adjusted R-squared		0.5708			0.7581			0.9427		
Log pseudolikelihood		-119.3915			-39.5959			-6.5515		
Left / Right - censored		157 / 103			95 / 60			62 / 43		

TABLE E5

Regulatory Enforcement, Captive Reinsurers, and Credit Ratings

Panel A: Firm Type

Panel A of Table E5 reports the results from the estimation of equation (2) using a panel OLS regression. The dependent variable is CR_All. Column (1) reports the results for life insurers, and Column (2) reports the results for P/C insurers between 2006 and 2015. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = CR_All					
		(1) "Life"			(2) "P/C"		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**	
C_Number		0.56910	0.21848	***	0.3083	1.1037	
Enforcement	H3 (+)	3.14347	1.04997	***	-1.0189	0.7618	
Reserves/Surplus (RS)		0.40597	0.10186	***	0.0013	0.0014	
Reserves/ Surplus Ratio (RSR)		1.52640	1.77986		-2.1348	1.7183	
Premium / Surplus Ratio		-3.77849	2.00398	*	-0.5078	1.5204	
Log (Premiums)		0.75300	0.59677		3.6772	0.9092	***
Reinsurance Inefficiency		0.38958	0.16101	**	0.2768	0.4078	
Investment Inefficiency		-2.93106	1.18028	**	-11.7287	6.9006	*
Reinsurance		-5.38211	2.80569	*	3.1897	2.6793	
ROA		17.31507	28.30302		-6.7887	6.4882	
Cash / Total Assets		8.88173	18.49395		55.0608	20.9066	***
Debt / Total Assets		28.56863	26.45679		14.2136	10.0524	
Retained Earnings / Total Assets		16.76629	10.56653		12.3022	3.9608	***
Constant		-28.72266	6.21876	***	-35.9458	5.7743	***
Year & Regulator FE		Yes			Yes		
Observations		255			247		
Adjusted R-squared		0.7004			0.7888		

TABLE E5 (cont'd)

Panel B: Firm Type and Public Scrutiny of Captive Reinsurance

Panel B of Table E5 reports the results from the estimation of equation (2) using a panel OLS regression. The dependent variable is *CR_All*. Column (1) and (3) report the results for the 2006-2011 time period for life and P/C insurers, accordingly. Column (2) and (4) report the results for the 2012 – 2015 time period for life and P/C insurers, accordingly. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = CR_All											
		(1) "Life" [2006 - 2011]			(2) "Life" [2012 - 2015]			(3) "P/C" [2006 - 2011]			(4) "P/C" [2012 - 2015]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
C_Number		0.8484	0.3887	**	0.4941	0.2973		-0.4828	1.2329		-0.4401	2.5451	
Enforcement	H3 (+)	1.7281	1.2680		5.5380	1.7199	***	-1.4213	0.8042	*	0.2918	3.6167	
Reserves/Surplus (RS)		0.3796	0.0951	***	0.4589	0.1866	**	0.0023	0.0011	*	-0.6528	1.0102	
Reserves/ Surplus Ratio (RSR)		-0.2815	2.8282		1.2869	2.4593		-3.2135	1.9449		2.6764	3.4295	
Premium / Surplus Ratio		-2.5479	1.6778		-5.9456	4.3731		-1.6013	1.2899		4.9871	10.2810	
Log (Premiums)		0.9427	0.7690		0.6158	0.6080		4.1836	0.7613	***	1.8075	2.7633	
Reinsurance Inefficiency		0.2135	0.1535		1.8583	0.6219	***	-0.0351	0.2644		9.1560	7.6430	
Investment Inefficiency		-1.7155	1.1071		-26.3426	27.4792		-4.9086	9.6810		-22.0090	11.1051	*
Reinsurance		-4.6304	2.7908		-4.8122	4.1433		-1.7172	3.1750		1.5836	3.5729	
ROA		23.2079	39.5089		-41.1119	48.4133		-13.8270	8.7492		3.5817	17.6741	
Cash / Total Assets		14.1471	11.9148		-21.6989	43.4989		53.7631	18.8957	***	73.2519	46.4554	
Debt / Total Assets		3.1336	34.8702		38.8464	41.4884		4.0893	9.5908		23.5273	24.1607	
Retained Earnings / Total Assets		18.8038	14.8289		6.0777	10.7232		15.1464	6.1493	**	11.4589	14.8093	
Constant		-19.3388	9.4719	**	-36.7751	9.0852	***	-37.4780	5.1317	***	-24.1410	16.6836	
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		149			106			150			97		
Adjusted R-squared		0.7063			0.8290			0.8926			0.7871		

TABLE E6

Illiquidity Factor

Panel A: Eigenvalues in the Principal Component Analysis

Table E6 reports the results from the principal component analysis (PCA) of three information asymmetry proxies. Panel A of Table E6 reports the eigenvalues of the factors identified in the principal component analysis. All variables are defined in Appendix C.

Factor	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Factor 1	1.9092	1.1310	0.6364	0.6364
Factor 2	0.7783	0.4657	0.2594	0.8958
Factor 3	0.3125	.	0.1042	1.0000

Panel B: Factor Loadings and Scoring Coefficients

Table E6 reports the results from the principal component analysis (PCA) of three information asymmetry proxies. Panel B of Table E6 presents the scoring coefficients for Factor 1 (i.e., *Illiquidity*). All variables are defined in Appendix C.

Variable	**Coefficient**
Log (Spread)	0.4520
ZeroReturn	0.4642
PriceImpact	0.3226

TABLE E7

Regulatory Enforcement, Captive Reinsurers, and Information Asymmetry

Panel A: Life Insurers

Panel A of Table E7 reports the results from the estimation of equation (3) using a first-differences regression among life insurers between 2006 and 2015. Column (1) reports the results for the dependent variable *Spread*, Column (2) reports the results for the dependent variable *ZeroReturns*, Column (3) reports the results for the dependent variable *PriceImpact*, and Column (4) reports the results for the dependent variable *Illiquidity*. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = Δ Market Illiquidity											
		(1)			(2)			(3)			(4)		
		Δ Log(Spread)			Δ ZeroReturn			Δ PriceImpact			Δ Illiquidity		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Δ Enforcement	H4 (-)	-0.3296	0.1418	**	-0.0113	0.0036	***	-0.8519	0.5398		-0.0392	0.0203	*
Δ C_Number	H5 (+)	-0.2975	0.1822		-0.0009	0.0074		-1.4469	0.7099	**	-0.0389	0.0401	
Δ Log (MV)		-1.7145	0.3649	***	-0.0336	0.0128	***	-9.5082	3.7510	**	-0.2883	0.1097	***
Δ B/M		0.0000	0.0000		0.0000	0.0000		0.0000	0.0001		0.0000	0.0000	
Δ Leverage		-2.0509	7.2294		-0.4515	0.1884	**	-82.8914	42.2584	*	-2.5119	0.9332	***
Δ ROA		-2.5547	3.2068		0.1223	0.1181		-12.4157	16.9640		0.5659	0.5621	
Δ Log (Turnover)		-0.1599	0.1285		-0.0098	0.0048	**	-2.3208	1.1393	**	-0.0931	0.0468	*
Δ Log (SD_Return)		0.4366	0.2110	**	0.0065	0.0110		2.9401	2.3258		0.1433	0.0941	
Δ Log (ABN_Return)		-11.5103	58.7851		2.5559	2.2720		120.2460	218.5353		6.7568	16.7823	
Δ InstOwn%		-0.0018	0.0008	**	0.0005	0.0001	***	-0.0002	0.0063		0.0019	0.0003	***
Constant		17.2816	5.4077	***	0.5633	0.1992	***	160.6998	58.5080	***	4.9418	1.9753	**
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		130			130			130			130		
Within R-squared		0.7752			0.5970			0.5094			0.4958		
Between R-squared		0.7542			0.5815			0.3937			0.5217		

TABLE E7 (cont'd)

Panel B: P/C Insurers

Panel B of Table E7 reports the results from the estimation of equation (3) using a first-differences regression among P/C insurers between 2006 and 2015. Column (1) reports the results for the dependent variable *Spread*, Column (2) reports the results for the dependent variable *ZeroReturns*, Column (3) reports the results for the dependent variable *PriceImpact*, and Column (4) reports the results for the dependent variable *Illiquidity*. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = Δ Market Illiquidity											
		(1)			(2)			(3)			(4)		
		Δ Log(Spread)			Δ ZeroReturn			Δ PriceImpact			Δ Illiquidity		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Δ Enforcement	H4 (-)	-0.3198	0.1680	*	-0.0135	0.0101		13.0016	16.8803		-0.2697	0.4795	
Δ C_Number	H5 (+)	-0.5979	0.0928	***	-0.0252	0.0080	***	0.1955	13.7757		-0.5499	0.1841	***
Δ Log (MV)		-1.9387	0.0754	***	-0.0764	0.0151	***	-16.5566	31.3996		-0.9737	0.3802	**
Δ B/M		0.0000	0.0000		0.0000	0.0000		0.0001	0.0001		0.0000	0.0000	*
Δ Leverage		-0.3719	1.0069		-0.1358	0.0345	***	-150.9025	95.9216		-1.7713	1.0062	*
Δ ROA		-1.8341	0.8547	**	-0.1631	0.0868	*	-95.2662	121.1160		-4.2323	1.8967	**
Δ Log (Turnover)		-0.2551	0.1187	**	-0.0248	0.0226		-16.6236	18.7399		0.0671	0.2039	
Δ Log (SD_Return)		0.4477	0.0973	***	-0.0309	0.0127	**	36.5550	33.3026		-0.0462	0.2790	
Δ Log (ABN_Return)		-12.4000	29.5044		-6.0026	3.6522		-12168.9100	4848.5070	**	-389.7654	139.4336	***
Δ InstOwn%		-0.0092	0.0024	***	-0.0006	0.0004		-1.8243	1.2550		0.0024	0.0060	
Constant		20.7428	1.3503	***	1.1240	0.2753	***	602.1364	530.0397		13.8652	4.6420	***
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		142			142			142			142		
Within R-squared		0.9222			0.4291			0.2695			0.5429		
Between R-squared		0.6477			0.2498			0.2641			0.3701		

TABLE E7 (cont'd)

Panel C: Captive Reinsurance and Analyst Environment

Panel C of Table E7 reports the results from the estimation of equation (3) using a first-differences regression. The dependent variable is *Analysts.* Column (1) reports the results for life insurers, and Column (2) reports the results for P/C insurers. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = Δ Analysts				
		(1) "Life"			(2) "P/C"	
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**
Δ C_Number		-0.8925	0.8378		omitted	
Δ Captive		3.0373	0.5607	***	omitted	
Δ Enforcement		0.8129	0.7525		-1.0306	1.6010
Δ Log (MV)		-2.9094	2.5776		-0.0782	1.5251
Δ B/M		-0.0001	0.0001		0.0000	0.0000
Δ Leverage		18.0534	10.9150		1.3637	5.7079
Δ ROA		-3.6467	15.6578		-7.7302	9.1039
Δ Log (Turnover)		0.2974	0.4297		0.7765	0.8735
Δ Log (SD_Return)		0.6895	0.8590		-0.8043	0.6978
Δ Log (ABN_Return)		-457.7250	124.6623	***	-340.0047	214.4161
Δ InstOwn%		0.0020	0.0032		-0.0054	0.0283
Constant		51.0619	34.5642		1.7952	14.8770
Year & Regulator FE		Yes			Yes	
Observations		105			77	
Within R-squared		0.5068			0.5921	
Between R-squared		0.2349			0.0041	

TABLE E8

Alternative Specifications

Panel A: Alternative Specifications of Captive Reinsurance and Firm Type

Panel A of Table E8 reports the results from the estimation of equation (1) using two measures of captive reinsurance. The dependent variable is *Captive* in Columns (1) and (3) and *C_Foreign* in Columns (2) and (4). The results in Columns (1) and (3) are based on the probit estimation and in Columns (2) and (4) on ordered logit model. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		Life Insurers						P/C Insurers					
		(1) DV = Captive			(2) DV = C_Foreign			(3) DV = Captive			(4) DV = C_Foreign		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	-3.4359	0.9713	***	-4.0365	3.0161		0.1388	0.5652		0.5812	1.6522	
Surplus Constraint (SC)		-0.0685	1.6766		1.9846	0.9473	**	1.4647	1.2298		-8.4089	7.8921	
SC * Enforcement	H2 (-)	6.3104	3.1167	**	-2.2759	4.3946		-11.6679	1.9925	***	1.0411	6.8576	
Assets / Surplus (AS)		0.0482	0.0527		-0.2362	0.1686							
AS * Enforcement		0.4447	0.1163	***	0.5535	0.3030	*						
Premium / Surplus (PS)								-1.0954	0.4830	**	-1.1591	1.6895	
PS * Enforcement								0.2092	0.5712		0.2678	2.6649	
Log (Premiums)		0.9409	0.2971	***	0.5042	0.9838		0.1700	0.2819		1.2489	0.9274	
Reinsurance Inefficiency		0.1580	0.0823	*	-0.0276	0.2109		5.9649	2.3411	***	156.6384	7.4317	***
Investment Inefficiency		-1.6422	0.4601	***	-13.7305	10.9989		0.9114	3.1502		-8.1286	4.2121	**
Tax Rate		0.0115	0.0133		0.0096	0.0113		-0.0606	0.0416		-0.1691	0.1717	
Reinsurance		8.7310	1.9124	***	3.0960	2.2248		0.0068	0.7857		2.5801	2.6602	
ROA		9.0657	19.6510		-9.2051	33.5872		1.2369	3.2266		1.2885	5.3885	
Investment Yield		-2.8133	3.3106		-18.0431	5.7293	***	1.5035	2.1760		0.2787	10.1664	
Cash / Total Assets		-54.7024	18.3284	***	-15.5656	20.3303		4.9073	2.6396	*	-40.3431	52.5041	
Debt / Total Assets		-20.7379	11.4395	*	-37.9844	26.2416		0.2737	1.9579		-4.7036	6.6365	
Constant / Cut 1		-8.8447	2.3092	***	-9.7394	13.5607		-1.0206	2.2288		4.0139	6.3127	
Year / Regulator FE		Yes / No			Yes / Yes			Yes / No			Yes / Yes		
Observations		264			264			260			260		
Adjusted R-squared		0.7763			0.6417			0.4070			0.7210		
Log pseudolikelihood		-40.3855			-92.0885			-103.5254			-64.2998		

TABLE E8 (cont'd)

Panel B: Alternative Regulatory Enforcement Specification and Captive Reinsurers

Panel B of Table E8 reports the results from the estimation of equation (1) using a Tobit model. The dependent variable is *C_Number*. Columns (1) and (2) report the results for pure life insurers and diversified insurers (P/C + L/H). Columns (3) and (4) report the results for pure property-casualty (P/C) insurers. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number											
		(1) "Life" [2006-2011]			(2) "Life" [2012-2015]			(3) "P/C" [2006-2011]			(4) "P/C" [2012-2015]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement2	H1 (-)	-4.8198	0.6238	***	-2.7245	1.1006	**	1.2040	0.0111	***	1.0178	0.0093	***
Surplus Constraint (SC)		-2.2916	0.7564	***	-2.6533	0.8450	***	1.6876	0.0207	***	6.4718	0.0115	***
SC * Enforcement2	H2 (-)	-2.1059	0.5713	***	-1.6016	1.5218		-3.7207	0.0318	***	-1.4349	0.0265	***
Assets / Surplus (AS)		0.0624	0.0564		0.4979	0.1421	***						
AS * Enforcement2		0.2332	0.0609	***	0.1668	0.1113							
Premium / Surplus (PS)								-2.0390	0.0209	***	-2.9299	0.0119	***
PS * Enforcement2								-1.4262	0.0121	***	-2.0845	0.0115	***
Log (Premiums)		3.6233	0.5357	***	0.9379	0.5302	*	1.2727	0.0035	***	0.0390	0.0029	***
Reinsurance Inefficiency		-0.4706	0.4553		0.3951	0.2233	*	0.0221	0.0079	***	1.2221	0.0173	***
Investment Inefficiency		-2.3544	0.8948	***	-39.2007	14.8645	***	0.5217	0.4179		1.6593	0.1302	***
Tax Rate		0.0971	0.0323	***	-0.0049	0.0124		0.2241	0.0087	***	-0.1120	0.0004	***
Reinsurance		3.2201	1.1024	***	-1.3729	1.1559		4.0860	0.0711	***	0.3187	0.0576	***
ROA		-11.4019	15.3859		20.6999	20.7852		-4.2287	0.1734	***	2.8708	0.2760	***
Investment Yield		0.4507	0.4856		-27.0875	11.9162	**	0.1079	0.2142		-5.4674	0.2280	***
Cash / Total Assets		15.4148	5.4350	***	70.3334	23.6617	***	-4.2580	0.4231	***	3.2041	0.0519	***
Debt / Total Assets		-11.4138	12.4097		34.8813	25.6321		-2.6206	0.3249	***	-3.8477	0.1547	***
Constant		-24.1688	3.8420	***	-7.2958	3.7547	*	-5.1305	0.0270	***	3.2545	0.0225	***
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		151			113			155			105		
Adjusted R-squared		0.8070			0.5324			0.7705			0.9305		
Log pseudolikelihood		-48.6086			-98.6094			-37.5601			-7.9534		
Left / Right - censored		90 / 61			60 / 53			95 / 60			62 / 43		

TABLE E9

Quantile Tobit Model: Regulatory Enforcement and Captive Reinsurers

Panel A: Life Insurers

Panel A of Table E9 reports the results from the estimation of equation (1) using a quantile Tobit estimation in the sub-sample of life insurers between 2006 and 2011. The dependent variable is *C_Number*. Column (1) reports the results at the 25th quantile for life insurers. Column (2) reports the results at the median, and Column (3) reports the results at the 75th quantile. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number								
		(1) 25% [2006 - 2011]			(2) 50% [2006 - 2011]			(3) 75% [2006 - 2011]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	-3.8347	1.9560	**	-2.7498	0.8150	***	-2.6344	1.4557	*
Surplus Constraint (SC)		-2.2811	1.1640	**	-2.3147	0.2309	***	-1.6208	1.3793	
SC * Enforcement	H2 (-)	-3.8808	1.8935	**	-3.1696	0.5856	***	-2.3921	1.7252	
Assets / Surplus (AS)		0.1472	0.0950		0.1184	0.0273	***	0.1012	0.0692	
AS * Enforcement		0.2897	0.1761	*	0.2141	0.0524	***	0.1851	0.1390	
Log (Premiums)		0.6582	0.3819	*	0.5936	0.1526	***	0.6312	0.1196	***
Reinsurance Inefficiency		-0.0790	0.1125		-0.0596	0.0227	***	-0.0677	0.0954	
Investment Inefficiency		-0.2500	0.0944	***	-0.2809	0.0437	***	-0.1055	0.6809	
Tax Rate		0.0006	0.0236		-0.0098	0.0206		-0.0221	0.1765	
Reinsurance		-0.0015	1.5428		0.4492	0.7716		-0.7831	0.4427	*
ROA		-1.6374	12.5327		1.6597	11.0331		-6.7699	8.2089	
Investment Yield		0.0301	0.2397		0.0069	0.6330		0.1597	0.9480	
Cash / Total Assets		4.1127	2.7581		-1.8022	1.2527		-0.2108	2.5124	
Debt / Total Assets		13.8701	15.9685		11.5241	8.7377		13.2491	31.6579	
Constant		-10.3615	5.1408	**	-7.0076	2.0465	***	-7.2116	4.1342	*
Year & Regulator FE		Yes			Yes			Yes		
Observations		151			151			151		
Adjusted R-squared		0.9364			0.9195			0.9266		
Objective function		0.1576			0.2099			0.1645		

TABLE E9 (cont'd)

		DV = C_Number								
		(1)			(2)			(3)		
		25%			50%			75%		
		[2012 - 2015]			[2012 - 2015]			[2012 - 2015]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	-0.9095	0.8497		-4.8359	1.6117	***	-4.5410	0.2959	***
Surplus Constraint (SC		2.7870	1.3607	**	-1.5561	1.6294		-1.3947	0.2098	***
SC * Enforcement	H2 (-)	7.2278	2.9542	**	-2.7153	2.4982		-3.1564	0.3352	***
Assets / Surplus (AS)		0.0846	0.0194	***	0.2116	0.0656	***	0.2199	0.0130	***
AS * Enforcement		0.1330	0.0662	**	0.3609	0.2417		0.3647	0.0245	***
Log (Premiums)		0.4410	0.3562		0.6870	2.5513		0.5194	0.1055	***
Reinsurance Inefficien		0.3131	0.1998		0.0608	1.9231		0.3274	0.0883	***
Investment Inefficiency		-15.2705	8.5286	*	-15.7173	183.2298		-17.9916	4.3700	***
Tax Rate		-0.0053	0.0050		-0.0042	0.0158		0.0004	0.0035	
Reinsurance		0.4908	0.9068		-0.5371	2.0024		-0.6976	0.4755	
ROA		-16.9798	20.7359		-7.7942	72.0825		-10.5253	11.2610	
Investment Yield		-0.7463	2.1772		-0.2820	4.0575		-0.6451	0.6334	
Cash / Total Assets		4.0484	12.3232		12.0806	41.3604		6.0700	13.4801	
Debt / Total Assets		13.7834	10.7662		38.3405	82.2298		41.2770	9.9198	***
Constant		-2.1207	3.8007		-10.9878	22.1660		-9.5967	0.9082	***
Year & Regulator FE		Yes			Yes			Yes		
Observations		113			113			113		
Adjusted R-squared		0.7135			0.8898			0.8807		
Objective function		0.2196			0.3084			0.2265		

TABLE E9 (cont'd)

Panel B: P/C Insurers

Panel B of Table E9 reports the results from the estimation of equation (1) using a quantile Tobit estimation in the sub-sample of P/C insurers between 2006 and 2011. The dependent variable is *C_Number*. Column (1) reports the results at the 25th quantile for P/C insurers. Column (2) reports the results at the median, and Column (3) reports the results at the 75th quantile. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number								
		(1) 25% [2006 - 2011]			(2) 50% [2006 - 2011]			(3) 75% [2006 - 2011]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	0.3334	0.0931	***	0.3392	0.2606		0.1200	0.2596	
Surplus Constraint (SC)		0.4013	0.1013	***	0.4472	0.1437	***	0.3895	0.1249	***
SC * Enforcement	H2 (-)	-1.0063	0.3647	***	-0.7333	0.2933	***	-0.8489	0.3304	***
Premium / Surplus (PS)		-0.0064	0.0673		-0.1129	0.0952		-0.0404	0.1037	
PS * Enforcement		-0.0177	0.1973		-0.3300	0.2792		-0.1173	0.3043	
Log (Premiums)		0.0566	0.1226		0.3476	0.4301		0.2717	0.2321	
Reinsurance Inefficiency		0.0069	0.0163		0.0173	0.0244		0.0411	0.1076	
Investment Inefficiency		0.0954	0.3788		-0.6676	1.0878		-1.1087	1.7503	
Tax Rate		-0.0188	0.0350		0.0159	0.0476		-0.0465	0.0472	
Reinsurance		0.4099	0.5956		1.4159	1.1057		0.8370	1.0314	
ROA		0.0867	0.4058		-0.3566	4.0920		0.5974	1.0773	
Investment Yield		-0.0393	0.1280		-0.3419	0.6744		-0.7662	0.4927	
Cash / Total Assets		-0.0316	0.5477		1.7099	5.9761		5.2635	1.3814	***
Debt / Total Assets		-0.2959	0.4862		-0.2776	1.1961		-0.9815	0.9590	
Constant		0.7756	0.8691		-1.0693	2.4515		0.3013	1.4069	
Year & Regulator FE		Yes			Yes			Yes		
Observations		155			155			155		
Adjusted R-squared		0.3326			0.5488			0.5297		
Objective function		0.0721			0.1147			0.0934		

TABLE E10

IV, SURE, and Heckman Estimation: Regulatory Enforcement and Captive Reinsurers

Panel A: Life Insurers

Panel A of Table E10 reports the results from the estimation of equation (1) using an instrumental variable (IV), seemingly unrelated regression (SURE), and Heckman estimation. The sample includes life insurers between 2006 and 2015. The dependent variable is *C_Number*. Column (1) reports the results using IV regression, where *Enforcement* is instrumented with market power (*Power*) and *Strict Regulators*. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number								
		(1) IV			(2) SURE			(3) Heckman		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	-3.7155	0.8332	***	-3.7233	0.2595	***	-3.8068	0.2597	***
Surplus Constraint (SC)		-1.9046	0.6353	***	-1.9245	0.3349	***	-1.9443	0.3351	***
SC * Enforcement	H2 (-)	-2.1470	0.5281	***	-2.2263	0.5746	***	-2.2326	0.5750	***
Assets / Surplus (AS)		0.1544	0.0331	***	0.1545	0.0145	***	0.1562	0.0145	***
AS * Enforcement		0.2626	0.0328	***	0.2670	0.0211	***	0.2682	0.0211	***
Log (Premiums)		0.7872	0.1903	***	0.7811	0.1040	***	0.7980	0.1040	***
Reinsurance Inefficiency		-0.0683	0.0280	**	-0.0718	0.0319	**	-0.0728	0.0319	**
Investment Inefficiency		-0.2318	0.0886	***	-0.2345	0.2695		-0.2286	0.2697	
Tax Rate		-0.0056	0.0046		-0.0053	0.0065		-0.0055	0.0065	
Reinsurance		-0.8061	0.5009		-0.7800	0.3812	**	-0.7891	0.3814	**
ROA		-16.6004	12.5062		-16.2970	8.2953	**	-15.7086	8.2967	*
Investment Yield		0.3979	0.5030		0.4157	0.5980		0.4285	0.5980	
Cash / Total Assets		1.2807	8.7333		1.4434	3.8725		1.4602	3.8727	
Debt / Total Assets		28.2645	10.5686	***	27.8118	4.5229	***	28.2390	4.5235	***
Constant		-5.8780	1.6350	***	-7.3717	0.9537	***	-7.5673	0.9539	***
Year & Regulator FE		Yes			Yes			Yes		
Observations		264			264			264		
Adjusted R-squared		0.8863			0.8863					
Chi-squared					2048.96			2059.63		
Underidentification test (KP)		0.0040								
Weak identification (F stat)		30.5090								

TABLE E10 (cont'd)

Panel B: P/C Insurers

Panel B of Table E10 reports the results from the estimation of equation (1) using an instrumental variable (IV), seemingly unrelated regression (SURE), and Heckman estimation. The sample includes pure P/C insurers between 2006 and 2015. The dependent variable is *C_Number*. Column (1) reports the results using IV regression, where *Enforcement* is instrumented with market power (*Power*) and *Strict Regulators*. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = C_Number								
		(1) IV			(2) SURE			(3) Heckman		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
Enforcement	H1 (-)	0.7016	0.2647	***	0.1517	0.1281		0.1254	0.1281	
Surplus Constraint (SC)		0.1597	0.0977	*	0.0075	0.2085		0.0045	0.2085	
SC * Enforcement	H2 (-)	-0.3788	0.2940		-0.1473	0.3879		-0.1518	0.3879	
Premium / Surplus (PS)		-0.1356	0.0795	*	-0.0800	0.0441	*	-0.0790	0.0441	*
PS * Enforcement		-0.3973	0.2332	*	-0.2346	0.1295	*	-0.2316	0.1295	*
Log (Premiums)		0.3226	0.1624	**	0.2536	0.0564	***	0.2568	0.0564	***
Reinsurance Inefficiency		-0.2714	2.7409		0.1944	0.0677	***	0.1945	0.0678	***
Investment Inefficiency		-1.3467	0.8100	*	-0.6643	0.6363		-0.6561	0.6364	
Tax Rate		0.0134	0.0070	*	-0.0045	0.0159		-0.0043	0.0159	
Reinsurance		0.2519	0.2198		0.4851	0.1777	***	0.4845	0.1778	***
ROA		0.0463	0.6314		1.7845	0.8716	**	1.7578	0.8717	**
Investment Yield		-0.2635	0.6540		-0.0510	0.6303		-0.0409	0.6303	
Cash / Total Assets		2.0611	1.1746	*	1.3335	1.0425		1.3326	1.0425	
Debt / Total Assets		0.8721	0.9490		-0.7929	0.4933		-0.8278	0.4933	*
Constant		0.1157	1.1429		0.0832	0.4057		0.0531	0.4057	
Year & Regulator FE		Yes			Yes			Yes		
Observations		260			260			260		
Adjusted R-squared		0.7613			0.6079					
Chi-squared					402.78			403.29		
Underidentification test (KP)		0.0308								
Weak identification test (F stat)		63.2730								

TABLE E11

Falsification Test: Regulatory Enforcement and Capital Gains

Table E11 reports the results from the estimation of equation (4) which examines the effect of regulatory enforcement on the realization of gains or losses (*RealGAIN*). *EBGAINS* masures earnings before capital gains (losses) scaled by total assets. Controls include *Capital* (i.e., surplus before capital gains (losses) scaled by total assets), *UnrealGAIN* (i.e., unrealized capital gains (losses) scaled by total assets), *IA* (i.e., invested assets scaled by total assets), *InvInc* (i.e., investment income scaled by total assets), and Liq (i.e., reserves scaled by total assets (or surplus)). Column (1) reports the results using panel OLS estimation while Column (2) reports the results using instrumental variable (IV) regression. *Enforcement* is instrumented with market power (*Power*). Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

	DV = *RealGAIN*			
	(1) *OLS*		*(2)* *IV*	
Variables	**Coeff.**	**SE**	**Coeff.**	**SE**
Enforcement	0.0001	0.0009	0.0007	0.0012
EBGAINS	0.0022	0.0027	0.0017	0.0021
EBGAINS* Enforcement	-0.0011	0.0038	-0.0021	0.0036
Controls & Interactions	Yes		Yes	
Year & Regulator FE	Yes		Yes	
Observations	461		461	
Adjusted R-squared	0.9925		0.9925	
Underidentification (KP LM)			23.227 (p-value = 0.0000)	
Weak identification (KP Wald F)			29.564	

TABLE E12

PSM: Regulatory Enforcement, Captive Reinsurers, and Credit Ratings

Table E12 reports the results from the estimation of equation (2) using a panel OLS regression. In Column (1) and (3), the regression is adjusted for propensity scores for Captive. In Column (2) and (4), I use propensity score weighting. The dependent variable is *CR_All*. Control sample is matched based on size. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = CR_All											
		(1) "Life" [Adjusted]			(2) "Life" [Weighting]			(3) "P/C" [Adjusted]			(4) "P/C" [Weighting]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
C_Number		0.6478	0.1868	***	0.5324	0.1901	***	0.0969	1.0456		0.1504	0.9096	
Enforcement	H3 (+)	2.7517	0.9352	***	3.4218	0.8496	***	-0.7959	0.6717		-0.9153	0.8075	
Reserves/Surplus (RS)		0.4015	0.0652	***	0.4478	0.0936	***	0.0016	0.0018		0.0011	0.0013	
Reserves/ Surplus Ratio (RSR)		3.1377	1.8795		1.2288	1.7077		-1.5799	1.7257		-2.7788	1.3950	*
Premium / Surplus Ratio		2.1064	1.6505		-3.3802	1.7190	*	-0.0189	1.7912		0.0721	1.8187	
Log (Premiums)		-3.6427	0.6372	***	0.8033	0.6180		2.7445	0.9950	***	3.2384	0.9664	***
Reinsurance Inefficiency		0.2415	0.1219	*	0.3503	0.1588	**	0.2395	0.3983		0.2972	0.4725	
Investment Inefficiency		-2.9749	0.9185	***	-2.3202	1.3058	*	-10.2996	7.3634		-13.9150	7.4249	*
Reinsurance		-5.1411	1.9806	***	-6.0418	2.5414	**	3.0731	2.5168		0.2079	4.7327	
ROA		33.9343	27.7527		16.9638	32.9194		-8.8666	6.7799		-0.1880	6.2169	
Cash / Total Assets		3.2134	14.7452		-0.3010	19.6143		52.9629	21.5246	**	53.0277	17.9105	***
Debt / Total Assets		50.8120	19.2644	***	25.0718	29.6709		13.3737	10.5202		13.7437	11.0180	
Retained Earnings / Total Assets		28.4362	10.9813	**	21.9404	10.1358	**	12.5827	3.8595	***	10.8295	4.9601	**
Constant		-12.1178	5.7375	**	-26.9776	4.1114	***	-31.9421	5.7574	***	-32.2607	6.3616	***
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		255			255			247			247		
Adjusted R-squared		0.7829			0.7795			0.7909			0.7926		

TABLE E13

Instrumental Variable Regression: Regulatory Enforcement, Captive Reinsurers, and Credit Ratings

Table E13 reports the results from the estimation of equation (2) using instrumental variable (IV) regression, where *Enforcement* is instrumented with market power (*Power*) and *Strict Regulators*. The dependent variable is *CR_All* in Column (1) and (3) and *CR_Rated* in Column (2) and (4). Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = Credit Ratings											
		(1) DV = CR_All ["Life"]			(2) DV = CR_Rated ["Life"]			(3) DV = CR_All ["P/C"]			(4) DV = CR_Rated ["P/C"]		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**		**Coeff**	**SE**	
C_Number		1.7019	0.3793	***	0.0405	0.1291		1.5488	0.8987	*	0.4533	0.7740	
Enforcement	H3 (+)	16.4203	3.5108	***	1.8327	0.9321	**	11.6978	5.4358	**	1.1771	3.0506	
Reserves/Surplus (RS)		0.4200	0.1135	***	0.1097	0.0427	***	0.0033	0.0019	*	0.0000	0.0006	
Reserves/ Surplus Ratio (RSR)		-0.4122	2.3655		-0.4570	0.5433		-0.2052	1.2320		-0.7089	0.4582	
Premium / Surplus Ratio		-18.7032	4.8936	***	-2.3161	0.8855	***	-2.8084	2.7192		-0.1143	0.7871	
Log (Premiums)		-2.9271	1.0942	***	0.6328	0.2864	**	0.4282	1.5879		1.5096	1.0842	
Reinsurance Inefficiency		0.6453	0.1923	***	0.1222	0.0482	***	0.9442	0.8403		0.1252	0.1040	
Investment Inefficiency		-2.2883	0.8438	***	-4.5265	2.8671		-18.4376	7.0603	***	-9.1092	4.2602	**
Reinsurance		-12.6133	2.7392	***	-2.3230	0.9114	***	1.0580	2.9796		0.3163	1.8260	
ROA		14.8848	45.3207		-14.2759	15.8298		-6.5919	15.3843		-1.8624	5.2712	
Cash / Total Assets		59.6843	25.6620	**	2.0285	7.1458		61.9057	14.0496	***	8.8084	8.8517	
Debt / Total Assets		-54.8030	34.3091		-34.5116	9.4029	***	38.7784	15.5235	***	11.1915	10.9955	
Retained Earnings / Total Asset		4.5932	8.8159		11.0854	3.5173	***	21.4645	6.2581	***	13.8107	2.8946	***
Constant		13.7892	9.0664		-9.7590	2.2281	***	-15.4665	11.0793		-21.9449	6.9675	***
Year & Regulator FE		Yes			Yes			Yes			Yes		
Observations		255			212			247			167		
Adjusted R-squared		0.2483			0.6740			0.5774			0.7505		
Underidentification test (KP)		p-val = 0.0000			p-val = 0.0131			p-val = 0.0027			p-val = 0.0043		
Weak identification (F stat)		60.0190			17.0280			6.6250			8.5440		

TABLE E14

PSM: Regulatory Enforcement, Captive Reinsurers, and Information Asymmetry

Table E14 reports the results from the estimation of equation (3) using a first-differences regression, which is adjusted for propensity scores for *Captive*. The dependent variable is the change in *Illiquidity*. Column (1) reports the results for life insurers and Column (2) reports the results for P/C insurers between 2006 and 2015. Robust standard errors are clustered by firm. All variables are defined in Appendix C, and continuous variables are winsorized at the 1st and 99th percentiles. Significance at the .10, .05 and .01 level for two-sided tests is denoted by *, ** and ***, respectively.

		DV = Δ Illiquidity					
		(1) "Life"			(2) "P/C"		
Variable	**Predict.**	**Coeff**	**SE**		**Coeff**	**SE**	
Δ Enforcement	H4 (-)	-0.0561	0.0281	*	-0.1746	0.4442	
Δ C_Number	H5 (+)	-0.0332	0.0413		-0.6596	0.2079	***
Δ Log (MV)		-0.2870	0.1104	**	-1.0118	0.3437	***
Δ B/M		0.0000	0.0000		0.0000	0.0000	*
Δ Leverage		-2.2848	0.9698	**	-1.3481	1.1678	
Δ ROA		0.4206	0.5693		-4.6626	2.4442	*
Δ Log (Turnover)		-0.0945	0.0470	*	0.1543	0.2215	
Δ Log (SD_Return)		0.1410	0.0941		-0.1710	0.2613	
Δ Log (ABN_Return)		6.4384	16.8204		-384.1571	146.3586	***
Δ InstOwn%		0.0019	0.0003	***	0.0086	0.0065	
Constant		4.7757	1.9810	**	13.2268	3.9571	***
Year & Regulator FE		Yes			Yes		
Observations		130			142		
Within R-squared		0.4989			0.5631		
Between R-squared		0.5491			0.3568		

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