Systemic Risk and the U.S. Insurance Sector

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Abstract

This paper examines the potential for the U.S. insurance industry to cause systemic risk events that spill over to other segments of the economy. We examine *primary indicators* that determine whether institutions are systemically risky as well as *contributing factors* that exacerbate vulnerability to systemic events. Evaluation of systemic risk is based on a detailed financial analysis of the insurance industry, its role in the economy, and the interconnectedness of insurers. The primary conclusion is that the core activities of the U.S. insurers do not pose systemic risk. However, life insurers are vulnerable to intra-sector crises because of leverage and liquidity risk; and both life and property-casualty insurers are vulnerable to reinsurance crises arising from counterparty credit exposure. Non-core activities such as derivatives trading have the potential to cause systemic risk, and most global insurance organizations have exposure to derivatives markets. To reduce systemic risk from non-core activities, regulators need to develop better mechanisms for insurance group supervision.

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1. Introduction

The financial crisis of 2007-2010 is a classic example of systemic risk, where problems in one sector of the economy, in this case housing, spread to other sectors and lead to general declines in asset values and real economic activity. Because the crisis began in the financial industry and one of the major firms that played a role in aggravating the crisis was an insurance company (American International Group), questions have been raised about whether the insurance industry is a major source of systemic risk. Answering this question has important implications for policy-makers, regulators, managers, and investors.

The purpose of this paper is to investigate whether the U.S. insurance sector poses a significant systemic risk to the economy. To answer this question, we define systemic risk and identify primary factors that can be used to measure the degree of systemic risk posed by specific markets and institutions (e.g., size, interconnectedness, and lack of substitutability). We also identify contributing factors that increase the vulnerability of markets and institutions to systemic shocks. Next, data are presented on the macro-economic role of insurers in the U.S. economy and the recent financial history of the insurance industry in terms of leverage and insolvency experience. Because inter-connectedness is one of the primary factors driving systemic risk, an important contribution of this study is to provide information on a form of interconnectedness unique to the insurance industry – reinsurance counterparty relationships. Finally, we draw conclusions regarding the potential for systemic risk events originating in the insurance industry.

Our analysis is focused on the core activities carried out by the U.S. life-health (L-H) and property-liability (P-L) insurance industries. However, our analysis of reinsurance counterparty exposure analyzes inter-relationships between U.S. licensed insurers and reinsurers world-wide. We also briefly discuss the participation by insurers in the market for credit default swaps

(CDS). The paper does not analyze the monolines, which are important but deserve to be analyzed separately in their own right.

By way of preview, the analysis suggests that the core activities of insurers are not a major source of systemic risk. However, there are several sources of exposure to intra-sector crises, which could potentially spill over into the broader economy if sufficiently severe. For example, a substantial proportion of insurers have very high exposure to one or a few reinsurance counterparties, suggesting the possibility of a *reinsurance spiral* that could lead to substantial financial deterioration. In the life insurance industry, the high leverage of the life insurers, exposure of surplus to reinsurance defaults, and insurer investment in mortgage backed securities raise concerns about sectoral stability.

The remainder of this paper is organized as follows. Section 2 presents a review of the literature on systemic risk in the insurance industry. Section 3 provides a brief synopsis of the financial crisis of 2007-2010 to provide background and context for our analysis of the insurance industry. Section 4 defines systemic risk and analyzes primary indicators that define systemically important institutions and markets and the principal contributing factors that exacerbate vulnerability to systemic shocks. Section 5 directly addresses the issue of whether U.S. insurers are systemically risky by analyzing the macro-economic role of insurers, insurer insolvency experience, and credit risk exposure to reinsurance counterparties. Based on the data presented, we provide an analysis of systemic risk in the insurance industry in terms of the primary and contributing factors. Section 6 concludes and provides some directions for future research.

2. Literature Review

There have been only a few prior studies of systemic risk in the insurance industry. Swiss Re (2003) investigates whether reinsurers pose a major risk for their clients, the financial system, or the economy. The study examines two major channels through which reinsurers

could create systemic risk – lack of reinsurance cover and insolvencies of primary insurers and banks triggered by reinsurer defaults. The study concludes that reinsurance insolvencies do not pose a systemic risk because primary insurers spread their reinsurance cessions across several reinsurers and the probability of reinsurer default is low. The conclusion is that "conditions for systemic risk . . . in terms of lack of cover, insolvency, or links to banks or capital markets, do not exist." However, the study concedes that reinsurers are linked to the banking sector via credit derivatives, the same instruments that brought down American International Group (AIG).

A study by the Group of 30 (2006) also investigates the degree to which the reinsurance sector may pose systemic risk. The study investigates three potential channels through which such a shock might impinge on the real economy: through its effects on the primary insurance sector, the banking sector, and the capital markets. The study concludes that "there is no evidence that the failure of an insurance or reinsurance company in the past has given rise to a significant episode of systemic risk." Because there have been no prior episodes of major reinsurance failures, the study presents the results of a "stress test" projecting the results of reinsurer failures equivalent to 20% of the global reinsurance market. The conclusions are that even failures of this magnitude would be unlikely to trigger widespread insolvencies among primary insurers and that the effects on the real economy would be minimal.

Bell and Keller (2009) investigate the systemic risk of the insurance industry. They point out that, unlike banks, insurers do not take deposits and do not play a role in the monetary or payment systems. The study concludes that "classic insurers therefore do not present a systemic risk and, as a consequence, are neither 'too big' nor 'too interconnected to fail'." However, they argue that insurers engaging in non-traditional activities such as credit derivatives can pose systemic risk, which can be controlled through more rigorous risk-based capital requirements.

Harrington (2009) conducts an extensive study of systemic risk in insurance, focusing on

the Federal bailout and takeover of AIG. He concludes that "the AIG crisis was heavily influenced by the CDS written by AIG financial products, not by insurance products written by regulated insurance subsidiaries. AIG also ran into major problems with its life insurance subsidiaries' securities lending program." He also concludes that systemic risk is relatively low in property-casualty insurance, compared to banking, because property-casualty insurers have much lower leverage ratios. However, he concedes that the potential for systemic risk is higher for the life insurance industry due to higher leverage, susceptibility to asset declines, and the potential for policyholder withdrawals during a financial crisis.

A recent study by the Geneva Association (2010), examines the role played by insurers during the financial crisis that began in 2007 as well as the potential for systemic risk originating from the insurance industry. The study concludes that insurance is significantly different from the banking industry in terms of its longer-term liabilities and strong operating cash flow. The study concludes that insurers did not play a major role in the financial crisis aside from the monolines and insurers engaging in non-traditional activities such as credit default swaps. Two non-core activities are identified as potential sources of systemic risk: (1) derivatives trading on non-insurance balance sheets, as in the case of AIG Financial Products, and (2) mis-management of short-term funding from commercial paper or securities lending.

Although the prior literature raises few concerns regarding systemic risk originating from the insurance sector, there are several reasons to evaluate the issue in more detail. First, a recent paper by Billio, et al. (2010) provides empirical evidence suggesting that linkages between insurance companies, banks, brokers, and hedge funds are more significant than prior research on the insurance industry would suggest. The study utilizes monthly stock returns on these four categories of financial intermediaries. Based on principal components analysis and Granger-causality tests, the study concludes that "a liquidity shock to one sector propagates to other

sectors, eventually culminating in losses, defaults, and a systemic event." The study also finds that companies in all four sectors have become more highly interrelated and generally less liquid during the past decade. Similarly, Acharya, et al. (2009), also using market data, find that several insurers ranked highly based on an econometric measure of systemic risk when compared to systemically important banks. They argue that this too-interconnected-to-fail problem is partly attributable to moral hazard stemming from the state system of post-assessment insurance guaranty funds and the lack of a Federal regulator who can assess systemic risk across states.

The second reason for conducting further analysis of the U.S. insurance industry is that most prior studies have been oriented towards the global insurance and reinsurance industries rather than conducting an in depth analysis of the U.S. industry. For example, Swiss Re (2003), the Group of 30 (2006), Bell and Keller (2009), and the Geneva Association (2010) primarily focus on insurance globally or in Europe. Harrington (2009) focuses on AIG rather than the U.S. insurance market in general. A third rationale for conducting further analysis of this issue is that several of the prior studies on the topic have been published or sponsored by the insurance industry (e.g., Swiss Re, 2003; Bell and Keller, 2009; Geneva Association, 2010). Therefore, it is important to provide an independent, third party analysis. The fourth reason to conduct additional analysis of systemic risk in the U.S. insurance industry is that the reinsurance counterparty exposure of U.S.-licensed insurers has never been investigated systematically in any detail. Inter-connectedness among insurers may pose a significant risk to the insurance sector with potential systemic implications.

3. The Financial Crisis of 2007-2010

The financial crisis that gripped U.S. and world markets from 2007 through 2010 was triggered by a liquidity shortfall in the U.S. banking system caused by the overvaluation of assets. The crisis resulted from the collapse of the global housing bubble, which peaked in the

U.S. in 2006, and led to sharp declines in the value of securities tied to real estate, particularly mortgage-backed securities (MBS) and collateralized debt obligations (CDOs). The crisis is generally considered to be the worst financial downturn since the Great Depression of the 1930s. It spread far beyond the housing and mortgage markets, leading to a general credit crunch and a loss in value of the U.S. stock market of more than $8 trillion in 2007-2008 (Brunnermeier, 2009). Real gross domestic product (GDP) in the U.S. was flat in 2007-2008, and real GDP declined by 2.6% in 2009 (BEA, 2010). The spillover of the housing and mortgage collapse into the broader credit market, the stock market, and the real economy is a classic example of systemic risk, as explained in more detail below.

In analyzing whether the insurance industry is systemically risky, it is helpful to briefly summarize how the housing and mortgage crisis spread to other parts of the economy, in order to understand whether an insurance crisis could spread to other economic sectors. The housing bubble was caused by the availability of easy credit, resulting from a low interest rate environment and large capital inflows into the U.S. from foreign countries, particularly from Asia. The low interest rates resulted both from U.S. monetary policy and the capital inflow from abroad. The foreign capital inflows were driven in part by the high U.S. current account trade deficit, which required the U.S. to borrow money from abroad, driving bond prices up and interest rates down (Bernanke, 2005).

The easy credit conditions encouraged debt-financed consumption in the U.S. and fueled the housing boom. Borrowers assumed difficult mortgages and home-buyers took out home equity loans in large volume, assuming that housing prices would continue to rise and they would be able to refinance on favorable terms. During the build-up to the housing collapse, banks had been moving from the traditional banking model, where banks make loans that are held to maturity, to the "originate and distribute" banking model, where loans are pooled and

resold through securitization (Brunnermeier, 2009). The originate and distribute model weakened incentives for originators and lenders to underwrite and monitor loans, and the parallel development of securitization increased the worldwide demand for MBS and CDO securities, facilitating the widespread distribution of these asset-backed securities. The result was a weakening of underwriting standards and dramatic expansion of subprime lending. Housing prices began to decline in 2006, and mortgage delinquency rates more than doubled between 2006 and 2008 (Mortgage Bankers Association, 2010).

As mortgage delinquency rates continued to rise, mortgage backed securities, particularly those backed by subprime mortgages, began to experience defaults and ratings downgrades. The resulting uncertainty about the value of structured securities and the reliability of financial ratings led to the freezing of the commercial paper market in mid-2007, as banks were unsure about the exposure of potential counterparties to mortgage-related asset problems. This created what amounted to a "run" on the *shadow banking system*, consisting of investment banks, hedge funds, and other institutions, which were heavily reliant on short-term borrowing to finance their operations.[1] As defaults and asset write-downs continued in 2008, the monoline insurers, which insured municipal bonds and structured financial products, began to be downgraded, threatening the bond ratings for hundreds of municipal bonds and asset-backed securities and putting further pressure on credit markets.

Among the first major casualties of the deteriorating market was Bear Stearns, which experienced a run by its hedge fund clients and other counterparties, leading to its Federally backed absorption into JPMorgan Chase in 2008. In September of 2008, problems with subprime

[1] The shadow banking system consists of financial intermediaries that provide banking-like services without access to central bank liquidity or explicit public sector credit guarantees. Shadow banks are less stringently regulated than commercial banks. Shadow banks include finance companies, structured investment vehicles, hedge funds, asset backed commercial paper conduits, money market mutual funds, securities lenders, and government-sponsored enterprises. For further information see Pozsar et al. (2010).

mortgages led to the Federal takeover of Fannie Mae and Freddie Mac, government sponsored enterprises, which at the time owned or guaranteed about half of the outstanding mortgages in the U.S. market (Wallison and Calomiris, 2008). Later that month, Lehman Brothers was forced into bankruptcy and American International Group (AIG) experienced a "margin run" (Gorton, 2008), leading to its bailout by the U.S. government.[2] Shadow bank runs also contributed to failures or severe financial deficiencies of other major institutions such as Washington Mutual, Wachovia, and Merrill Lynch. Thus, the crisis of 2007-2010 can be viewed as surprisingly similar to a classic bank run, with the exception being the important role played by securitization, the role played by excessive leverage, the degree of interconnectedness of institutions, and the mismatch of asset-liability maturities (Brunnermeier, 2009).

4. Systemic Risk: Definition and Primary Risk Factors

This section defines systemic risk and identifies primary risk factors for systemically important activities. In considering systemic risk, it is important to emphasize that *instigating* or *causing* a systemic crisis is not the same as *being susceptible* to a crisis. To instigate a systemic crisis the shock or event must first emanate from the insurance sector due to the specific activities conducted by insurers.

4.1. Definition of Systemic Risk

Our definition of systemic risk is analogous to the definition proposed in Group of Ten (2001, p. 126). Specifically,

> **Systemic risk** is the risk than an event will trigger a loss of economic value or confidence in a substantial segment of the financial system that is serious enough to have significant adverse effects on the real economy with a high probability.[3]

[2] AIG had issued large volumes of credit default swaps through a subsidiary, AIG Financial Products. As mortgage backed securities default rates increased, AIGFP faced margin calls from its counterparties. It also had engaged in asset lending operations with many of the same counterparties, who demanded that the positions be closed out as the crisis unfolded (Harrington, 2009).

[3] Similar definitions have been proposed by other organizations. See, for example, Financial Stability Board (2009).

Embedded in this brief definition are two important criteria: (1) Economic shocks become systemic because of the existence of spillover effects or negative externalities or market failure whereby there is a contagious loss of value or confidence that spreads throughout the financial system, well beyond the locus of the original precipitating shock. Thus, the failure of one financial institution, even a very large one, that does not spread to other institutions and the real economy is not a systemic event. (2) Systemic financial events are sufficiently serious to have significant adverse effects on real economic activity. For example, events such as the U.S. liability insurance crisis of the 1980s and Hurricane Andrew in 1992 would not be considered systemic events, even though they caused major disruptions of property-casualty insurance markets, because they did not have sufficient adverse effects on real economic activity.[4]

The financial crisis of 2007-2010 is a clear example of a systemic event, which began in the housing market, spread to other parts of the financial system, resulting in significant declines in stock prices and real GDP. Other systemic events of the past quarter century include the Japanese asset price collapse of the 1990s, the Asian financial crisis of 1997, and the Russian default of 1998, which was associated with the fall of Long-Term Capital Management. All of these events were characterized by an abrupt loss of liquidity, discontinuous market moves, extreme volatility, increases in correlation and contagion across markets, and systemic instability (World Economic Forum, 2008).

Systemic risk may arise from interconnectedness among financial institutions that cascades throughout the financial sector (akin to a domino effect) and/or from a significant

[4] Some economists have argued that even having an effect on the real economy is not sufficient to define an event as systemic. Rather, "the key characteristic of systemic risk is the movement from one stable (positive) equilibrium to another stable (negative) equilibrium for the economy and financial system" (Hendricks, Kambhu, and Mosser, 2007). According to this view, research and regulation should focus on causes and propagation mechanisms for the "phase transitions" that moves the economy from a desirable to a less favorable equilibrium.

common shock to which many financial firms have a large exposure (Helwege, 2009).[5] Traditionally, systemic risk has been considered important because it results in increases in the cost of capital or reductions in its availability, while being frequently accompanied by asset price volatility. The latter have spillover effects on the economy by affecting demand and/or supply of goods for an extended period (Financial Stability Board, 2009).

4.2. Systemic Risk: Primary Indicators and Contributing Factors

This analysis generally follows the Financial Stability Board (2009) in distinguishing between primary indicators of systemic risk and factors contributing to the development of systemic risk (contributing factors). The primary indicators are criteria that are useful in identifying systemically risky markets and institutions, whereas the contributing factors are criteria that can be used to gauge financial vulnerabilities and the capacity of the institutional framework to deal with financial failures. The primary indicators determine whether a market or institution is systemic, and the contributing factors determine vulnerability of the market or institution to systemic events. That is, it possible for an institution to be systemically important but not relatively vulnerable. Our discussion here is designed to provide conceptual background for the analysis of the systemic importance and vulnerability of the U.S. insurance industry.

4.2.1. Primary Indicators. The three primary indicators of systemic risk are: (1) size of exposures, volume of transactions or assets managed; (2) interconnectedness, and (3) lack of substitutability.[6] This section discusses the indicators and provides examples related to the financial crisis of 2007-2010. These factors have been identified as having a high *potential* for

[5] The shock may emanate from mispricing of assets as in an asset bubble or from unexpected exogenous events such as changes in oil prices. Note that not all asset bubbles are associated with systemic risk (e.g., the dot com bubble).

[6] Our primary indicators are based on those identified in Financial Stability Board (2009). The International Association of Insurance Supervisors (IAIS) (2009) proposes a fourth factor, *timing*, based on the argument that systemic insurance risk propagates over a longer time horizon than systemic risk in banking. The International Monetary Fund (IMF) considers size, interconnectedness, leverage, and (risky) funding structure in assessing the systemic importance of institutions (IMF, 2009). Our taxonomy also considers leverage and funding structures but classifies these as contributing factors rather than primary indicators.

generating systemic risk, i.e., they are not necessarily associated with systemic risk in every instance. This is especially true of size. For example, a large firm may not pose a systemic problem if it is not interconnected or if its products do not lack substitutes.[7] Thus, interactions among the factors also are important in identifying systemically risky institutions.

The size of the firm helps to determine whether it is "too big to fail." In fact, the term "too big to fail" came into existence from the bailout of Continental Illinois Bank and Trust Company of Chicago in 1984 (FDIC, 1997). Continental Illinois faced bank runs from its wholesale depositors, prompting the FDIC to guarantee all liabilities of Continental Illinois through a direct infusion of capital.[8] In general, size may be important in a failure if it is associated with large spillover effects. At the time of its failure, Continental Illinois was the seventh largest bank in the U.S. Large financial institution may be engaged in significant, large transactions with other financial institutions through interbank activities and securities lending, such that potential spillover effects into the general economy could occur with their failure.

The size of an institution can be measured by its assets or equity, in absolute terms or as a proportion of GDP. However, a lesson learned from the financial crisis of 2007-2010 is that size measured by conventional balance sheet measures may not capture the impact an institution can have on the market or economy. For example, the now defunct Financial Products division of AIG wrote hundreds of billions of dollars of credit default swap coverage with relatively little capitalization, suggesting that notional value of derivatives exposure and potential loss to a

[7] As pointed out in Financial Stability Board (2009, p. 9), "While size can be important in itself, it is much more significant when there are connections to other institutions. The relevance of size will also depend on the particular business model and group structure, and size may be of greater systemic concern when institutions are complex (see below). . . .for example, well capitalized large institutions with simpler business models and exposures can be a source of stability in times of stress."

[8] William Isaac, Head of the FDIC in the 1980s, was quoted in Robert Trigaux, "Isaac Reassesses Continental Bailout," *American Banker*, p. 6, July 31, 1989, as saying, "I wonder if we might not be better off today if we had decided to let Continental fall, because many of the large banks that I was concerned might fail have failed anyway. And they probably are costing the FDIC more money by being allowed to continue several more years than they would have had they failed in 1984."

firm's counterparties should also be considered when analyzing size. Gauges of size that may be more relevant than conventional financial statement measures are the value of off-balance sheet exposures of the institution and the volume of transactions it processes. Systemic risk associated with size can also arise from clusters of smaller institutions that have similar business models and highly correlated assets or liabilities, such that the cluster has the systemic impact of a much larger firm (Financial Stability Board, 2009). The term "too big to fail" is being replaced with "systemically important financial institution" (SIFI), because conventional size measures do not provide adequate proxies for spillover effects.

Interconnectedness is the second primary risk factor for systemic risk. Interconnectedness refers to the degree of correlation and the potential for contagion among financial institutions, i.e., the extent to which financial distress at one or a few institutions increases the probability of financial distress at other institutions because of the network of financial claims and other inter-relationships. This network or "chain" effect operates on both sides of the balance sheet as well as through derivatives transactions, off-balance sheet commitments, and other types of relationships. Although the classic example of contagion occurs in the banking sector as a "run on the bank" that cascades throughout the system, conventional depositor-driven bank runs have probably been eliminated by deposit insurance. However, as we have seen, the financial crisis of 2007-2010 was driven by other types of runs on the shadow banking system involving inter-bank lending, commercial paper, and the market for short-term repurchase agreements ("repos"). As pointed out by De Bandt and Hartmann (2000),

> While the 'special' character of banks plays a major role, . . . systemic risk goes beyond the traditional view of single banks' vulnerability to depositor runs. At the heart of the concept is the notion of contagion, a particularly strong propagation of failures from one institution, market, or system to another . . . . The way in which large value payment and security settlement systems are set up as well as the behavior of asset prices in increasingly larger financial markets can play an important role in the way shocks may propagate through the financial system. (p. 8).

The propagation of systemic problems through interconnectedness or contagion usually requires exposure to a common shock or precipitating event such as a depression in agriculture, real estate, or oil prices (Kaufman and Scott, 2003). In the crisis of 2007-2009, the common shock was the bursting of the housing price bubble.

The third primary indicator of systemic risk is lack of substitutability, where substitutability is defined as the extent to which other institutions or segments of the financial system can provide the same services that were provided by the failed institution or institutions. In order for lack of substitutability to pose a systemic problem, the services in question must be of critical importance to the functioning of other institutions or the financial system, i.e., other institutions must rely on the services to function effectively. Examples of critical financial services for which substitutability is a problem are the payment and settlement systems. The payment system is defined as "a contractual and operational arrangement that banks and other financial institutions use to transfer . . . funds to each other" (Zhou, 2000). The settlement system is the set of institutions and mechanisms which enable the "completion of a transaction, wherein the seller transfers securities or financial instruments to the buyer and the buyer transfers money to the seller" (BIS, 2003). Settlement is critical in the markets for stocks, bonds, and options and is usually carried out through exchanges. Failure of significant parts of the payment and settlement system would bring the financial world to a standstill. During the financial crisis, the freezing of the inter-bank lending and commercial paper markets were critical because there were no other significant sources of short-term credit for the shadow banks. Market-making (liquidity) is another service that is critically important and lacks substitutes.

In analyzing the systemic risk of the insurance industry, it is important to determine not only whether there are adequate substitutes for insurance but also whether insurance is actually

critical for the functioning of economic markets to the same degree as payments, settlements, liquidity, and short-term credit. To create a systemic risk through lack of substitutability, a financial service must be part of the infrastructure which permits markets to function or is essential for the operation of many firms in the economy.

A quantitative indicator of substitutability is market concentration, measured by the market shares of the leading firms or the Herfindahl index. Concentration in investments – either by type of investment or geographic location of the investment -- may have spillover effects if the investment or geographic area becomes problematic. Ease of market entry is also important, including technological, informational, and regulatory barriers that prevent new entrants from replacing the services of financially troubled firms. Qualitative evaluations of the degree to which key financial sector participants depend upon specified services also play a role in determining the degree of substitutability.

4.2.2. Contributing Factors. Although the number of factors contributing to the systemic risk of an institution or market is potentially much larger, four factors are emphasized in this discussion: (1) leverage, (2) liquidity risks and maturity mismatches, (3) complexity, and (4) government policy and regulation. These measures can be considered indicators of the vulnerability of systemically important institutions to financial distress resulting from idiosyncratic or system-wide shocks.

Leverage can be measured in various ways, including the ratio of assets to equity or debt to equity. However, ideally a measure of leverage would include both on and off-balance-sheet positions. Leverage can also be created through options, through buying securities on margin or through some financial instruments. Leverage is an indicator of vulnerability to financial shocks and also of interconnectedness, i.e., the likelihood that an institution will propagate distress in the financial system by magnifying financial shocks. Highly levered firms are vulnerable to *loss*

spirals because declines in asset values erode the institution's net worth much more rapidly than their gross worth (total assets) (Brunnermeier, 2008). For example, a firm with a 10-to-1 assets to equity ratio that loses half of its equity due to a loss of asset value would have to sell half of its assets to restore its leverage ratio after the shock. But selling assets after a price decline exacerbates the firm's losses. If many institutions are affected at the same time, the quest to sell assets puts additional downward pressure on prices, generating the loss spiral.[9]

Liquidity risk and asset-liability maturity mismatches also increase financial firm vulnerability to idiosyncratic and systemic shocks. Liquidity risk arises if an institution holds large amounts of illiquid assets. Such positions are vulnerable if the institution encounters difficulties obtaining financing, triggering the need to liquidate all or part of its asset holdings. Concentration in illiquid assets is especially problematical if other institutions also have significant exposure to the same classes of assets.

Liquidity risk is exacerbated by the extent of an institution's asset-liability maturity mismatch. One of the factors in the financial crisis of 2007-2009 was that shadow banks were financing long-term positions in mortgage-backed securities and other risky assets with short-term sources of financing. The shadow banks relied heavily on short-term commercial paper and short-term repurchase agreements ("repos"), whereby the bank raises funds by selling an asset and promising to repurchase it at a later date. A significant amount of shadow bank financing took the form of overnight repos. Use of these short-term financing vehicles exposed the shadow banks to *funding liquidity risk*, i.e., the risk that investors will stop investing in commercial paper and other short-term investments, requiring the bank to liquidate positions in longer-term assets.

[9] Excessive leverage played an important role in exacerbating the financial crisis of 2007-2010. In October of 2004, the Securities and Exchange Commission effectively suspended net capital regulations for the five leading investment banks. The banks responded by increasing leverage ratios to 20, 30, or even 40-to-1, purchasing mortgage backed securities and other risky assets. Three of the five banks – Bear Stearns, Lehman, and Merrill Lynch, eventually failed or encountered severe financial difficulties during the crisis.

Complexity of a financial institution and/or its asset and liability positions also can exacerbate vulnerability to financial shocks. Complexity has several important dimensions – (1) Complexity of the organization, including its group structure and subsidiaries. For example, diversified financial services firms offering banking, insurance, and investment products are more complex than single industry firms. (2) Geographical complexity. That is, firms operating internationally are more complex than those focusing only on one or a few national markets. Multi-national firms are exposed to a wider variety of local and regional risk factors as well as multi-jurisdiction regulatory risk. (3) Product complexity. Firms that are highly exposed to new and complex financial products are more vulnerable to shocks. Such products expose firms to risks that may not be completely understood. Complexity played a major role in the AIG debacle during the financial crisis. AIG was a large and complex organization, and its Financial Products division was heavily involved in complex CDS operations without fully understanding the risks. The complexity of the organization and its products impeded monitoring by both management and regulators, contributing to the crisis.

Related to complexity is opacity, i.e., the degree to which market participants have access to information about transactions and positions taken by an institution or trader in specific markets and instruments. Because CDS transactions are not cleared through an exchange, the volume and pricing of these transactions is opaque, preventing markets from adjusting to overly levered positions such as that taken by AIG Financial Products. Complex, multi-national organizations are inevitably more opaque than focused national or regional organizations.

Government policy and regulation also can contribute to financial system fragility. For example, deposit insurance and insurance guaranty fund protection reduces the probability of runs but also creates moral hazard for banks and insurers, increasing the risk of financial distress. Regulation can also create other types of adverse incentives. AIG sold large quantities of CDS

to European banks that were using the contracts to reduce their required capital through regulatory arbitrage. The complexity and opacity of AIG Financial Products contributed to creating a regulatory blind-spot that permitted the subsidiary to operate with excessive leverage. Further, regulation intended to enhance the solvency of the regulated financial institution actually can exacerbate a crisis. For example, an increase in capital requirements can occur in times of financial distress, resulting in asset sales or further restrictions on the ability to create credit. I.e., capital requirements can be pro-cyclical.

5. Systemic Risk in Insurance: An Empirical Analysis

This section presents empirical information on the systemic importance of the insurance industry, emphasizing the U.S. life and property-casualty industries. The section begins by considering the macroeconomic importance of the insurance industry in terms of contribution to GDP and a source of investable funds for credit and equity markets. We then conduct a comparative analysis of the financial statements of banks and insurance companies to gauge leverage and liquidity risks. Historical insolvency data on U.S. insurers is presented to gauge the vulnerability of insurers to financial distress. An analysis of the causes of insolvencies provides information on interconnectedness and other factors as sources of insolvency risk in the industry. Finally, we conduct an analysis of intra-industry interconnectedness in the insurance industry by analyzing the exposure of insurers to reinsurance counterparties, a form of interconnectedness unique to the insurance industry.

5.1. The Macro-Economic Importance of Insurance: Size Risk

Analyzing the macro-economic role of the insurance industry is helpful in determining whether insurance poses a systemic risk due to the volume of transactions or sources of investable funds for other economic sectors. World life and non-life insurance premiums are shown in Table 1. Total world insurance premiums in 2009 are $4.1 trillion, approximately 57%

life and 43% non-life insurance. Total world insurance premiums amounted to about 7% of world gross domestic product. North America is the world's largest non-life insurance market, accounting for 40.5% of total non-life premiums, and Western Europe is the largest life insurance market, accounting for 40.1% of premiums. In terms of total premium volume, therefore, insurance is important, but insurance premium payments are small compared to GDP.

Although comparing premiums to GDP is useful to measure the relative importance of the insurance industry, premiums do not measure the contribution of the insurance industry to GDP. Rather, the contribution to GDP is the value-added by the insurance industry. The percentages of U.S. GDP attributable to insurance and other financial services firms are shown in Figure 1. The lower line in the figure represents the contribution of the insurance industry to GDP and the upper line represents the contribution of the total financial services industry to GDP, where financial services are defined to exclude real estate and leasing. The figure shows that insurance contributes between 2 and 3% of GDP, with a slight upward trend during the past twenty years. Financial services in general represented about 6% of GDP in 1986, increasing to about 8% by 2008. Thus, insurance is a relatively small contributor to overall GDP, representing about one-third of the GDP contribution of the overall financial services sector. Although it is important to understand the size of the financial sector relative to the economy, the financial crisis reveals that firms representing a relatively small part of GDP can trigger systemic risk.

To measure the importance of the insurance industry as a source of credit, the major holders of outstanding U.S. credit market debt are shown in Table 2. More than $52 trillion in credit market debt was outstanding in 2009. The major holders of credit market debt were commercial banks (17.2%), government sponsored enterprises (GSEs) (15.4%), the "rest of the world" (non-U.S. investors) (15.0%), and domestic non-financial sectors (12.2%). By this measure too, insurers are important but not among the leading sources of credit market debt –

life insurers hold 5.9% of total outstanding debt and property-casualty insurers hold 1.7%.

More details on the role of insurers in the securities markets are provided in Table 3, which shows the percentage share of banks and insurers in the markets for various types of assets. Property-casualty insurers are not a very important source of funds in any of the asset categories shown, with the exception of municipal securities, where they account for 13.2% of outstanding asset holdings in 2009. Life insurers are more important, accounting for 16.7% of corporate and foreign bonds, 10.3% of commercial mortgages, and 6.2% of corporate equities.

Although Table 3 shows that insurers play an important role in the markets for some types of securities, this does not necessarily imply that they pose a systemic threat to the stability of these markets. As discussed further below, insurer liabilities are relatively long-term, in comparison with banks and shadow banks. Moreover, liquidations of insolvent insurers tend to be orderly and take place over long periods of time (CEA, 2009). Hence, the probability is very low that an insurer would need to liquidate a large quantity of assets quickly. Thus, by this measure as well, the insurance industry does not pose a systemic threat solely because of its size.

5.2. Financial Risk: Maturity Structure, Leverage, and Counterparty Risk

Information on the balance sheets of insurers and banks is presented in Table 4, which shows the principal assets and liabilities for 2008. Table 4 shows that insurers pose lower size risk to the economy than commercial banks. Total assets of life and property-casualty insurers are about $6.1 trillion, about half of commercial bank assets of $12.3 trillion.

Another important conclusion to be drawn from Table 4 is that asset and liability maturities are both long-term for insurers, whereas banks have short-term liabilities and longer-term assets. In addition, a high proportion of bank liabilities are "instantaneously puttable," meaning that depositors can cash out their accounts at any time. Liabilities in property-casualty insurance do not have this feature – in order to obtain payment from the insurer, the claimant has

to experience an insured loss and present a claim for payment. Most life insurance liabilities are also long-term and not puttable, with the exception of life insurance cash values and some types of variable annuities. Hence, except for a severe "run" on life insurance, insurers are not likely to have to liquidate large amounts of assets to satisfy policyholder demands for cash.

Exploring Table 4 in more detail, we see that property-casualty insurers hold 57.8% of their assets in bonds, most of which are long-term and highly liquid. Life insurers hold 66.4% of their general account assets in bonds.[10] Property-casualty insurers have about 13% of assets in common and preferred stocks and about 16.5% in reinsurer receivables, agents' balances, and other non-earning assets. Property-casualty insurers hold only 1% of assets in mortgages and real estate. Life insurers have 7.2% of assets in mortgages and only 3.7% in stocks. In contrast to the mostly bond and stock portfolios of insurers, banks hold 25.8% of assets in loans and 29.8% in mortgages. This is noteworthy because bonds and stocks tend to be highly liquid, whereas loans and mortgages are illiquid. Life insurers also hold significant amounts of illiquid assets, however, as discussed below.

On the liability side of the balance sheet, loss and policy reserves account for 54.6% of liabilities for property-casualty insurers and 88.4% of non-separate account liabilities for life insurers. Thus, insurers are primarily funded through long-term sources that cannot be withdrawn on demand by policyholders. Hence, insurer assets and liabilities tend to be matched. For banks, on the other hand, 65.7% of liabilities represent deposits, most of which are short-term and withdrawable on demand. Hence, banks have higher liquidity risk and maturity mismatch risk.

Although insurer assets are generally liquid and of high quality, there are some danger

[10] Life insurers' assets are divided between the *general account*, which consists of assets backing policies sold by the company, and *separate accounts*, which represents funds under management by insurers. Most separate account assets come from corporate pension plans, individual retirement accounts, and variable (investment linked) contracts. Insurers are asset managers but not risk-bearers for separate accounts, where there generally is no mortality or longevity risk taken by the insurer and the investor bears the investment risk.

signals with respect to the life insurance industry. The middle section of Table 5 breaks out insurer assets in more detail.[11] The table reveals that life insurers hold 23.9% of their bonds (15.9% of assets) in mortgage-backed securities, including pass-through securities, CMOs, and REMICs. Even more startling, the amounts invested in mortgage-backed securities represent 167.2% of life insurer equity capital (policyholders surplus). Life insurers also invest heavily in privately placed bonds, which tend to pose significant liquidity risk. Total holdings of private placements represent 171.5% of life insurer equity capital. Thus, mortgage-backeds and private placements represent a total of 338.7% of life insurer surplus. Property-casualty insurers are much less exposed to mortgage-backed securities and privately placed bonds. For property-casualty insurers, mortgage-backed securities represent only 34.5% of surplus, and private placements represent only 7.2% of surplus. Hence, life insurers face higher exposure to housing markets and significant asset liquidity risk, in comparison with property-casualty insurers.

Somewhat offsetting their asset liquidity risk, life insurers receive a significant amount of net cash from operations, defined as premiums plus investment income net of benefit payments, expenses, and taxes. Life insurers net cash from operations represents 26.3% of benefit payments and 46.1% of equity capital (Table 5). Thus, life insurers could withstand significant increases in benefit payments without liquidating assets, but the coverage of cash flow to surplus is not sufficient to offset their asset liquidity risk. Property-casualty insurers also have significant net cash from operations but, as mentioned, do not face significant liquidity risk.

Systemic risk due to interconnectedness also can arise to the extent that financial institutions invest in the stock and bonds of other financial institutions. However, the exposure of U.S. insurers to bank and securities firm investments is rather limited. Of the total U.S. corporate and foreign bonds owned by U.S. insurers in 2008, 5.6% was invested in various types

[11] The discussion of the reinsurance data in Table 5 is deferred to later in the paper.

of bank bonds, while less than 1% of corporate equities held by U.S. insurers were invested in bank stocks. U.S. insurers hold a small proportion of their invested assets in the bonds of securities firms (1.6%), and a negligible proportion in stocks of securities firms (1%).[12]

Regarding the importance of insurers as sources of funds for other financial institutions, U.S. insurers held approximately 9.4% of banks' "other borrowed money" in 2008. However, as noted above, borrowed money is not the primary source of financing to banks, amounting to only 10% of liabilities. U.S. insurers held 14.1% of securities firms' outstanding corporate bond debt in 2008, but bonds represent only 11.2% of securities firms' financings (liabilities).[13] U.S. insurers hold only negligible portions of securities firms' and banks' stock outstanding. Hence, interconnectedness risk from security holdings in other types of financial firms does not seem to be a significant problem for insurers.

The leverage ratios of insurers and banks are presented in Figure 2. The figure shows book value equity capital-to-asset ratios for life insurers, property-casualty insurers and commercial banks for the period 1985 through 2009. One important conclusion from Figure 2 is that property-casualty insurers are much more highly capitalized than life insurers or banks, and their capital-to-asset ratios have been increasing over time. The capital-to-asset ratio for property-casualty insurers was 27.8% in 1985, increasing to 39.2% by 2009. Of course, one reason property-casualty insurers hold more capital than life insurers or banks is that they are subject to catastrophe risk from events such as hurricanes and earthquakes.

The capital-to-asset ratio of life insurers has been nearly constant at around 5% since

[12] That is, approximately $119.5 billion of insurer investments were invested in bank bonds in 2008, and U.S. insurers held a total of $2,116.1 billion in U.S. corporate and foreign bonds. Approximately $0.122 billion of total U.S. insurers' investments in equities ($1,161.0 billion) were held in bank stocks. The amount of U.S. insurers' investment in U.S. securities firms' bonds is $33,856.2 million, while the amount invested in securities firms' stock is $746.9 million. The data regarding banks and securities firms are unpublished data from the NAIC. The remaining data were obtained from Insurance Information Institute (2010).

[13] The information in this paragraph is based on unpublished data from the NAIC.

1985. The ratio for banks was slightly below the ratio for life insurers until 1989, but since that time, the banks' capital-to-asset ratio has increased to 11.5%. Therefore, at the present time, banks have about twice as much capital relative to assets as life insurers. Life insurers are probably excessively leveraged, especially considering their exposure to mortgage-backed securities and privately placed bonds.

The premiums-to-surplus ratios for life and property-casualty insurers from 1986-2009 are presented in Figure 3. There has been a steady long-term decline in the premiums-to-surplus ratio for property-casualty insurers from 1.88 in 1986 to 0.82 in 2009. The ratio for life insurers has also trended downwards but increased sharply in 2008 and 2009 because life insurers were more strongly affected by the financial crisis than property-casualty firms. The life insurer premiums-to-surplus ratio was 2.25 in 2009. Thus, by this measure as well, life insurers are much more highly leveraged than property-casualty insurers.

5.3. Vulnerability to Crises and Insolvency Experience

The vulnerability of insurers and banks to financial turmoil can be clarified by investigating their stock price performance in the period spanning the crisis. Figure 4 shows insurer and bank stock indices for the period 12/31/2004 through 8/24/2010. The stock indices shown in the figure are the A.M. Best U.S. life insurer index (AMBUL), the A.M. Best U.S. property-casualty insurer index (AMBUPC), the Standard & Poor's (S&P) bank stock index (BIX), and the S&P 500 stock index, representing the market.

The sharp decline in the bank stock index began earlier than the declines in the insurance stock indices and the S&P 500. The bank index peaked on February 20, 2007 and then began to decline as the subprime crisis unfolded. Another steep decline began in August 2007, reflecting the worldwide "credit crunch" and further announcements of losses on mortgage-backed securities. The next major decline in the bank index occurred in September and October of 2008

with the collapse of Lehman, Merrill Lynch, and AIG.

Insurance stock indices peaked later in 2007 than the bank index – October 31 for life insurers and December 6 for property-casualty insurers, and the S&P 500 index peaked on October 1, 2007. Unlike banks, the insurance stock indices did not experience major losses in value until the major stock market crash of October 2008. Another sharp decline occurred in January of 2009, as several British financial institutions experienced financial distress.

From peak-to-trough, for the period shown in Figure 4, the life insurer index lost 85% of value and the bank index lost 88% of value. Banks and life insurers were hit harder than the market as a whole – the S&P 500 lost 57% of its value from peak-to-trough. Property-casualty insurers fared relatively better during the crisis, losing "only" 47% of value, peak-to-trough. Both the assets and liabilities of property-casualty insurers were less exposed than those of banks and life insurers to elements of the crisis such as subprime mortgages and the credit crunch.

The failure rates of U.S. insurers and commercial banks are shown in Figure 5, where failure rate is defined as the number of failures divided by the total number of institutions. Figure 5 confirms that life insurers and banks were much more strongly affected by the financial crisis than were property-casualty insurers. The bank failure rate increased by a factor of 10, from 0.2% in 2006 to nearly 2% in 2009, while the life insurer failure rate quadrupled from 0.2% in 2006 to 0.8% in 2009. By contrast, the property-casualty insurer failure rate in 2008-2009 was about the same as the failure rate in 2005-2006 and remained significantly below earlier peaks in 1989-1993 and 2000-2003.

An important distinction is that bank and life insurer failures are driven almost exclusively by financial markets, whereas underwriting losses (e.g., from catastrophes) play a more important role for property-casualty insurers. The correlations between the failure rates for banks and insurers, also shown in the table, range from 45% for banks and life insurers to 49%

for banks and property-casualty insurers. This provides evidence that banks and insurers are interconnected, at least to the degree represented by susceptibility to common financial shocks.

The life insurer failure rate is explored in more detail in Figure 6, which plots the life insurer failure rate versus life insurers' after-tax profit margin, expressed as a percentage of revenues. Life insurers' after-tax profits fell from about 4% in 2006-2007 to less than zero in 2008. Although profits recovered in 2009, the life insurance failure rate continued to increase, because failures tend to lag economic developments. The property-casualty insurer failure rate is plotted against the combined ratio (the sum of losses and expenses as a ratio to premiums) in Figure 7. The figure shows a strong correlation between the combined ratio and the property-casualty failure rate (the bivariate correlation is 63%), confirming that underwriting results are the principal driver of insolvencies for property-casualty insurers. Life insurer failure rates are less highly correlated with after-tax profits (bivariate correlation of -38%).

To provide information on interconnectedness in the insurance industry, the principal triggering events for life and property-casualty insolvencies are shown in Table 6, where the life insurance data are for the period 1976-2009 and the property-casualty data are for 1969-2009. Table 6 shows that interconnectedness with reinsurers historically has not been a major factor in triggering life insurer insolvencies. Only 2% of life insurer insolvencies were associated with the failure of reinsurers. However, life insurers have been vulnerable to interconnectedness with affiliates – affiliate problems are associated with 18.6% of life insurer failures. Life insurers are also susceptible to asset quality issues – investment problems trigger 15.4% of insolvencies. The primary triggers of life insurance insolvencies arise from bad management decisions such as under-pricing (27.5% of insolvencies), excessive growth (14.5%) and alleged fraud (9.1%). Likewise, for property-casualty insurers, under-pricing, excessive growth, and fraud together account for 61.5% of insolvencies. Interconnectedness with reinsurers and affiliates together are

the triggering events for 11.4% of property-casualty insurer insolvencies.[14] Unlike life insurers, property-casualty insurers are vulnerable to catastrophes, which account for 7.2% of failures.

Insurers that are seriously financially impaired are handled in one of two ways. The insurer may be placed into receivership while the liabilities are "run-off."[15] As indicated above, loss payments under policies do not actually become due until some point in the future (often years), so the receiver operates the insurer to pay off (or run off) losses as they actually come due. Alternatively, especially for life-health insurers, the business of the insolvent insurer may be sold to another insurer, with the policies continued under the new insurer. Thus, liquidation of assets at distressed prices usually does not occur nor are immediate settlements to all policyholders made at that time.[16] In property-casualty insurance it is necessary to have a valid claim, which is processed through an orderly settlement process, in order to obtain payment from the insurer. Some claims on life insurers do represent withdrawable assets, and there is some risk that many policyholders would surrender their policies as an insurer becomes financially distressed, causing a liquidity problem. However, insolvent insurers typically have substantial assets on hand to cover liabilities when they fail because losses are prepaid through premiums.

In many countries, a safety net exists to provide protection for policyholders of insolvent insurers in the form of guaranty funds. Each state in the U.S. operates a life insurance guaranty fund and at least one property-casualty guaranty fund. The typical funding approach in the U.S. is post-assessment – solvent insurers are assessed each year to cover shortfalls in loss payments for insolvent insurers, subject to annual maxima.[17] Thirteen of the 27 member states of the European Union operate at least one insurance guaranty scheme, with prefunded programs being

[14] Based on international data, Swiss Re (2003) also concludes that reinsurance failures historically have not been an important cause of insolvencies in the primary insurance industry.
[15] An insolvent insurer is defined to be an insurer which is in receivership or liquidation.
[16] Policyholder claim/benefit payments are typically frozen for a period of time, except for death and financial need.
[17] New York is an exception. The rationale for ex post assessments is that, unlike the obligations of the FDIC, insurance payments under policies are spread over many years in the future as claims arise.

prevalent (Oxera, 2007). There are restrictions on guaranty funds coverage, e.g., on maximum loss payable; and coverage generally does not apply to all lines of business.[18]

In the U.S., guaranty funds do not make settlements with policyholders for all losses covered at the time of insolvency. Instead, guaranty funds assessments are levied as losses actually need to be paid in a specific payment year.[19] For a life insurer insolvency resolved by selling the insolvent insurer's business to another insurer, the guaranty fund assesses an amount sufficient to make the sale attractive to the acquirer.[20]

The assessment system is designed to place minimal stress on solvent insurers while protecting the policyholders of insolvent insurers. Guaranty funds in the U.S. have the ability to borrow against future assessments in the event that losses covered by the guaranty fund in any one year would place a financial strain on solvent insurers. To date, in the U.S., guaranty funds have successfully paid claims of several large insolvent insurers, including Reliance, Executive Life, and Mutual Benefit Life. In 2009, the maximum assessment capacity of life-health insurers was estimated to be $8.8 billion (Gallanis, 2009), and assessment capacity of property-casualty guaranty funds was about the same.[21] Of course, insolvencies larger than the annual assessment capacity could be financed because insurer insolvencies tend to be resolved over several years and because the shortfall between liabilities and assets typically is not very large.[22] Thus, assessments would be likely to continue until all claims are paid (Gallanis, 2009).

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[18] In the U.S. small policyholders are typically protected by guaranty funds. Commercial insurance is covered also, but more than half of the states have a net worth restriction, such that if a company has net worth above some threshold (usually $25-50 million) they are excluded from coverage. In addition, workers compensation insurance is always covered, while a few lines such as title insurance and mortgage guaranty insurance are not covered. For a description of guaranty funds and fund limitations in Europe, see Oxera (2007).

[19] There is a cap on the amount of premiums an insurer can be assessed in an individual year, which varies by state. In life insurance, the cap is typically in the range of 2% of covered premiums (Gallanis, 2009).

[20] In other words, guaranty funds replace policyholders' coverage not policyholders' cash.

[21] Most property-casualty guaranty fund assessments are limited to 2% of premiums per year. Based on 2009 industry-wide premiums, this would put property-casualty guaranty fund capacity at $8.8 billion (see A.M. Best Company, *Best's Aggregates and Averages: 2010*).

[22] For example, in a life insurer insolvency, the shortfall in assets relative to liabilities is typically in the 5 to 10% range, and seldom as high as 15% (Gallanis, 2009, p. 7).

Putting guaranty fund capacity in context, MetLife, the largest U.S. life insurer had $436 billion in assets at the end of 2009 (A.M. Best, 2010e). Thus, annual assessment capacity could be exhausted by a failure of MetLife that wiped out its equity and led to a shortfall of assets in comparison to liabilities, if it resulted in assessments in excess of guaranty fund annual capacity. Thus, although the system has functioned effectively to date, "a completely unprecedented, worst-case crisis for the life industry could in theory challenge the liquidity of the guaranty system" (Gallanis, 2009, p. 4); and the same is true for the property-casualty guaranty funds.[23]

Table 7 provides statistics regarding guaranty fund assessments for the period 1988 to 2008. Because of prompt corrective action by regulators and the orderly resolution of insurer insolvencies, guaranty funds assessments in both life and property-casualty insurance historically have been quite small. The total amounts of assessments from life-health and property-casualty guaranty funds from 1988-2008 were $6.5 billion and $11.4 billion, respectively; and the average annual assessments were $325 million for life insurers and $571 million for property-casualty insurers. Annual assessments never exceeded 0.35% of total premiums for either life or property-casualty insurers. Thus, over its history, the guaranty fund system has stood up very well; but the system has never been required to deal with a widespread crisis in insurance markets.

5.4. Interconnectedness: Reinsurance Counterparty Risk

This section begins by providing information on reinsurance counterparty risk based on balance sheet and income statement aggregates. The discussion then turns to a more detailed analysis of reinsurance counterparty exposure at the individual firm level.

Underpinning this analysis is the fact that reinsurance is the primary source of interconnectedness in the insurance industry. Reinsurer failures have not been a primary factor

[23] AIG, the largest U.S. property-casualty group in 2008, had assets of $121.3 billion in its U.S. property-casualty subsidiaries. A small percentage shortfall in assets for AIG could exhaust the annual assessment capacity of the property-casualty guaranty fund system, depending on the volume of claims becoming due annually.

historically in U.S. insurer insolvencies, and there is no evidence internationally that the failure of a reinsurer has given rise to a systemic event (Group of 30, 2006). Nevertheless, the reinsurance market has become increasingly concentrated over time, through mergers and acquisitions and organic growth (Cummins and Weiss, 2000; Cummins, 2007). In addition, interlocking relationships permeate the industry, such that reinsurers *retrocede* reinsurance to other reinsurers, who then retrocede business to still other reinsurers, in a pattern reminiscent of the counterparty interrelationships that brought down the shadow banking system.[24] Thus, the reinsurance market is vulnerable to a *retrocession spiral* whereby the failure of major reinsurers triggers the failure of their reinsurance counterparties, who in turn default on their obligations to primary insurers, resulting in a crisis permeating the insurance industry on a worldwide scale.[25]

An example of a reinsurance spiral is the London Market Excess (LMX) spiral that unfolded in the late 1980s and early 1990s (Neyer, 1990). The LMX spiral involved retrocessions of excess of loss reinsurance (primarily for property catastrophes) among Lloyd's syndicates and the London Market in the 1980s in which reinsurers participated in different layers of the same exposures, often unknowingly. As reinsurance recoveries were triggered, losses worked their way through the "spiral," often passing back and forth through the same reinsurers. As catastrophe losses mounted, the spiral began to unwind, resulting in the most severe financial crisis in Lloyd's 300 year history with losses exceeding £8 billion in 1988-1992 (Schwartzman, 2008). Although the LMX crisis was confined primarily to reinsurers and hence not systemic, reinsurance markets today are even more concentrated and interconnected,

[24] Some have likened the retrocession market to interbank lending and borrowing in the banking industry. As such it is sometimes thought to be a transmission mechanism for contagion and systemic risk within the reinsurance industry. But unlike mortgage backed securities leading up to the recent crisis, retroceders still retain part of the risk (to reduce adverse selection).

[25] Vulnerability to spirals is also exacerbated by the increasing use of *ratings triggers* in the reinsurance contracts. A reinsurance policy with a ratings trigger allows the primary company to cancel the policy if the reinsurer experiences a rating downgrade below a threshold indicated in the policy. Triggering of this rating clause would likely place the reinsurer in runoff when it was already experiencing financial difficulty.

suggesting that spirals are a serious threat to insurance markets. Therefore, further analysis of reinsurance counterparty relationships is essential in understanding systemic risk in insurance.

Insurers conduct reinsurance transactions with both affiliates and non-affiliates. Although non-affiliate reinsurance is generally considered to pose more counterparty risk than affiliate reinsurance, the analysis of insurer insolvency history shows that affiliate problems can pose an insolvency threat to insurers. Therefore, this analysis considers reinsurance with both affiliates and non-affiliates. The analysis also focuses on primary insurer cessions into the reinsurance market rather than reinsurance assumed. Ceding reinsurance creates more counterparty risk than assuming reinsurance because the ceding insurer is dependent upon the reinsurer to pay claims, and the reinsurance counterparty usually holds the funds, unlike reinsurance assumed, where the assuming insurer usually holds the funds.

There are several important financial statement variables that measure an insurer's exposure to reinsurance counterparty risk. One measure that is important in both life and property-casualty insurance is reinsurance premiums ceded, and another measure that is important in life insurance is insurance in force ceded, where in force refers to the policy face value. Reinsurance receivables, which represent funds currently owed by reinsurers to the ceding company, are also an important measure of exposure. Finally, one of the benefits of buying reinsurance is that the buyer is generally permitted to reduce its reserve liabilities to the extent of the reinsurer's liability, improving its leverage ratio and expanding its capacity to write insurance. [26] For life insurers, the result of the write-down is called the "reserve credit taken," which represents estimated liabilities of the primary insurer that have been assumed by the reinsurer; and for property-casualty insurers the account is called "net amount recoverable from

[26]U.S. insurers can take balance sheet credit for reinsurance as long as the reinsurer is "authorized," i.e., licensed in the ceding insurer's state of domicile, accredited in the ceding insurer's state of domicile, or licensed in a state with substantially similar credit for reinsurance laws. Insurers can take credit for unauthorized reinsurance only if the reinsurer posts collateral, in the form of funds held in the U.S. or letters of credit from U.S. banks.

reinsurers." Because policyholder claims on an insurer are not affected by reinsurance, the insurer remains liable for the policyholder obligations if the reinsurer defaults even though the balance sheet credit for reinsurance can be substantial.[27]

The relevant financial statement data relating to reinsurance are shown in the bottom section of Table 5, which is based on balance sheet and income statement aggregates for the industry. More details on counterparty exposure among insurers are provided below.

Table 5 shows that life insurers ceded $122.7 billion in reinsurance premiums in 2008, representing 17.9% of direct premiums written and 40.0% of surplus. Property-casualty insurers ceded $412.5 billion in reinsurance premiums, representing 83.7% of direct premiums written and 86.8% of surplus. Hence, property-casualty insurers are more exposed to reinsurance counterparty risk than life insurers, but both types of insurers rely heavily on reinsurance.

Reinsurance recoverables and funds held by reinsurers represent about 8.7% of equity capital for life insurers and 8.4% of equity for property-casualty insurers (Table 5). Hence, purely in terms of current receivables, insurer equity is not seriously exposed to counterparty risk. However, the reinsurance counterparty exposure for estimated future losses and benefits is much higher. For life insurers, the reserve credit taken due to transactions with non-affiliate reinsurers is 57.0% of surplus and the credit taken for affiliate reinsurance is 71.8% of surplus. These liabilities would reappear on insurer balance sheets if the reinsurers were to default. Thus, insurer leverage gross of reinsurance is much higher than leverage net of reinsurance. Property-casualty insurers are less exposed to non-affiliated reinsurers in terms of the net reinsurance recoverable than life insurers (32.5% of surplus) but are more exposed to affiliated reinsurers

[27] The difference between receivables, on the one hand, and reserve credit taken and net amount recoverable, on the other hand, is that receivables represent amounts currently owed and payable, whereas reserve credit taken and net amount recoverable largely represent estimated reserve liabilities for future losses. Receivables are shown in lines 14.1, 14.2, and 14.3 of the asset page of the annual statement for both life and property-casualty insurers. Other reinsurance variables come from Schedule S for life insurers and Schedule F for property-casualty insurers.

(128.9% of surplus). Finally, in terms of insurance in force for life insurers, 48.9% of reinsurance in force is ceded to reinsurers. These numbers suggest a high degree of interconnectedness within the insurance industry due to reinsurance transactions.

Summary statistics on reinsurance premiums ceded and reinsurance receivables by company for the property-casualty insurance industry are shown in Table 8. The table is based on non-affiliated reinsurance counterparties. At the median, insurers cede 9.1% of direct and assumed premiums to the top four non-affiliated reinsurers and only 13.1% to all non-affiliated reinsurers. Reinsurance cessions are heavily concentrated in a few counterparties. At the median, insurers ceded 43.6% of total reinsurance cessions to the top counterparty, 87.4% to the top four counterparties, and 100% to the top ten counterparties.[28] The Herfindahl index of premiums ceded at the median is 2,917, an index value equivalent to ceding equal amounts of reinsurance to 3.4 reinsurers. Concentration of receivables in the top counterparties is also high. The proportion of the total receivables owed by the top one, four, and ten counterparties at the median is 47.4%, 90.5%, and 100.0%, respectively. The Herfindahl index for receivables at the median is 3,248, equivalent to having receivables equally divided among three counterparties.

Exposure of surplus to reinsurance receivables from non-affiliates varies widely across the property-casualty industry (Table 8). At the median, exposure does not seem excessive – the ratio of reinsurance receivables-to-surplus for all counterparties is 21.0%. However, at the 75th percentile, receivables-to-surplus from all counterparties is 52.2%. Therefore, at least one-fourth of property-casualty insurers would be seriously at risk if several large reinsurers were to fail.

The exposure to non-affiliated reinsurance counterparties in the life insurance industry is shown in Table 9. Life reinsurance premium cessions are even more concentrated in the top

[28] The data in Table 8 are obtained by ranking each ceding insurers data by the amount ceded (or receivables) from that ceding insurer's top counterparties. The counterparties therefore are not necessarily the same across ceding insurers. We are currently researching exposure across the industry to specific named counterparties and that information will be provided in subsequent versions of this paper.

counterparties than for property-casualty insurers. At the median, 53.0% of premiums are ceded to the top reinsurer, 93.5% to the top four reinsurers, and 100.0% to the top ten. However, the premiums ceded at the median are not high for life insurers – the percentage of direct premiums and reinsurance assumed that is ceded to all reinsurers is only 11.3%. As a result, the ratios of reserve credit taken to surplus at the median also are not very high – e.g., 20.9% for the top four and 24.5% for all reinsurers. However, a substantial proportion of companies in the industry have very high ratios of reserve credit taken to surplus – at the 75th percentile, the ratio is 58.2% for the top reinsurer and 110.3% for the top four reinsurers. Thus, at least 25% of insurers would find their surplus severely eroded if a crisis developed in the reinsurance industry.

5.5. Interconnectedness: Non-Core Activities

Unlike the aggregate economic and financial statement data discussed above, information on insurer non-core activities is not readily available. Ultimately, obtaining a full evaluation of an insurer's non-core systemic risk exposure requires a detailed case study approach as in Harrington (2009). However, we are able to provide some information about an important non-core activity engaged in by many prominent insurers – trading in credit default swaps (CDS).

Table 10 shows total outstanding CDS by counterparty type semiannually over the period 2005-2009, based on surveys conducted by the Bank for International Settlements (BIS). Total CDS outstanding were $58.2 trillion in the second half of 2007, declining to $32.7 trillion by 2009 as a result of the financial crisis. The majority of CDS were held by reporting dealers, which are mainly large commercial and investment banks that have an active business with large customers (BIS, 2007). Insurers, including monolines, held $492 billion in CDS outstanding in 2007 and $331 billion in 2009. Thus, insurers have remained active in the CDS market even after the AIG debacle. Although insurers represent a small part of the CDS market, $330 billion is a large exposure relative to industry capitalization.

Information on specific insurers that are active in the CDS market is provided in Table 11, which is taken from a list of the top 1,000 traders of single name CDS reported by the Depository Trust and Clearing Corporation (DTCC).[29] The table, which is based on aggregated transaction data for the period June 20, 2009 through March 19, 2010, shows that there are 46 large insurers among the top 1,000 traders of single name CDS. Insurers account for 4.4% of the total notional value during the reference period. Perhaps surprisingly, AIG is still the leading insurer participating in the CDS market, ranking 33rd on the list of the top 1,000. Allianz, AXA, Generali and major reinsurers such as Swiss Re, Munich Re, and Hannover Re are also prominent traders of CDS. The CDS positions taken by these insurers exacerbate their interconnectedness with the financial system and help to explain the finding of Billio, et al. (2010) that insurance industry shocks propagate to other parts of the financial industry.

6. Do Insurers Pose Systemic Risk?

This section analyzes the issue of whether insurers pose systemic risk, i.e., whether an event originating in the insurance sectors could propagate to other parts of the financial sector or the real economy. To draw conclusions about systemic risk in insurance, we consider the primary indicators and contributing factors in the light of the data analysis presented above. We first discuss the core activities of the insurance sector and then consider non-core activities.

6.2. Core Activities

The first primary indicator of systemic risk is size. In terms of balance sheet aggregates, insurers are smaller than banks, with about $6 trillion of assets compared to $12 trillion for banks. The largest U.S. insurer, MetLife, had $422 billion in assets in 2008, compared with

[29] Single name CDS are those contracts which protect against defaults of a single reference entity, usually a corporation or government. That is, the reported contracts do not include CDS on index tranched or untranched transactions or transactions on asset-backed securities such as CMBS or RMBS.

more than $2.3 trillion for the top bank, Bank of America.[30] Insurance contributes about 2.6% of total U.S. GDP, and insurers hold 7.6% of U.S. credit market debt outstanding. Insurers hold more than 10% of financial assets only for municipal bonds (13.2% held by property-casualty insurers), corporate bonds (16.7% held by life insurers), and commercial mortgages (10.3% held by life insurers). However, because insurer insolvency resolutions are orderly and take place over a lengthy period of time, the amount of assets that would be liquidated in even the largest insurer insolvency would be small relative to securities markets. Therefore, in terms of their core activities, insurers are generally not large enough to be systemically important, although the failure of a large insurer such as MetLife would undoubtedly cause significant dislocations in the insurance market and could threaten the liquidity position of insurance guaranty funds.

Insurer core activities also do not seem to be systemically important in terms of the second primary indicator, interconnectedness. The cross-holdings of stocks and bonds between the insurance and banking industries are small, and neither industry provides a significant source of financing for the other. Thus, a commercial paper-like credit crunch arising from the insurance industry is highly unlikely. The bivariate correlations of the failure rates of banks and insurers are around 45%, however, suggesting that banks and insurers are interconnected at least with respect to their susceptibility to common economic and financial shocks.

Interconnection risk *within* the insurance industry is considerably higher than that between insurance and banking, although it is to be emphasized that risk confined within a specific sector is not systemic by definition. Life insurer liability write-downs due to reinsurance are about 130% of surplus, and property-casualty write-downs are 160% of surplus, although non-affiliate write-downs are "only" 57% of surplus for life insurers and 33% of surplus for

[30] The other three mega-banks are J.P. Morgan Chase, Citigroup, and Wells Fargo each of which had more than $1 trillion of assets in 2009 (Standard & Poor's ,2010).

property-casualty insurers. About 25% of property-casualty insurers have reinsurance recoverables of more than 40% of surplus, and 25% of life insurers have reinsurance recoverables of more than 100% of surplus. Hence, an insolvency crisis in the reinsurance market potentially could cause an intra-sector crash in the insurance industry. Nevertheless, purely from their core activities, insurers are not sufficiently interconnected with non-insurance institutions such that the reinsurance problems would spill-over into the banking and securities industries. There is some risk, however, that a reinsurance crisis would cause spill-over risk due to interconnectedness of insurers and other institutions through insurers' non-core activities.

Is insurance a systemic threat due to lack of substitutability? For an activity to pose a systemic threat due to lack of substitutability, it is necessary not only that the activity not have substitutes but also that it is critical to the functioning of the economy. Banks pose substitutability problems because they are part of the payment and settlement systems, play an important role in transmitting central bank monetary policy, and provide a critical source of liquidity and financing for consumers and businesses. Although insurance plays an important role in the economy, it does not suffer from lack of substitutability to the same extent as banking.

In terms of life insurance, lack of substitutability does not pose a systemic problem. The largest volume of assets and financial transactions in life insurance relate to asset accumulation products rather than mortality/longevity risk bearing, and there are many substitutes for investing through life insurance and annuities. For mortality/longevity risks, which are unique to insurance, many insurers are available to fill coverage gaps created by the failure of one or a few firms. Thus, life insurance has substitutes and is not critical to the functioning of other firms.

Unlike life insurance, property-casualty insurance exists primarily to provide risk management and risk bearing services rather than serving an asset accumulation function. Certainly for individual insurance customers, there is no substitute for products such as

automobile and homeowners insurance. However, even if individual property-casualty products were to disappear entirely, it is unlikely that real economic activity would be affected significantly. In the more likely event that several major insurers were to encounter severe financial difficulties, many other insurers are available to fill the coverage gap. The same would be true for small and medium-size commercial buyers. Large corporate buyers have many effective substitutes for property-casualty insurance, including self insurance, captive insurance companies, and securitization of insurance-type risks. There has been considerable debate in the finance literature about whether widely held corporations should even buy insurance, other than to access the risk management and claims settlement expertise of the insurance industry and perform other functions relating to corporate risk management (MacMinn and Garven, 2000). Thus, lack of substitutability does not seem to create a systemic risk as it relates to insurance.

Because the core activities of insurers generally do not lead to the identification of insurers as systemically important according to the primary indicators, the discussion of the contributing factors mainly relates to their role in creating financial vulnerabilities within the insurance industry. In this respect, we consider life and property-casualty insurers separately, except for regulation, where we discuss the regulatory framework more generally.

As we have seen, life insurers have higher leverage (lower capital-to-asset ratios) than property-casualty insurers and commercial banks. In addition, life insurers reserve credit taken amounts to approximately 130% of surplus. The reserve credit taken represents additional leverage that would come back onto life insurer balance sheet to the extent that there are reinsurance failures. Thus, life insurers have high leverage on their stated balance sheet and the potential for even higher leverage due to reinsurer defaults. As we have seen, life insurers also have high liquidity risk because of their exposure to mortgage-backed securities and privately placed bonds. Life insurer operations are also complex, especially in terms of offering life

insurance and annuity products with embedded options such as minimum interest rate guarantees. The only contributing factor that does not seem to be a major problem for life insurers is maturity risk, in that their asset and liability maturities seem to be well-matched.

Property-casualty insurers appear less financially vulnerable than life insurers in terms of the contributing factors. Their leverage ratios are low and have been improving over time. In addition, they do not have much exposure to asset liquidity risk from mortgage-backed securities or private placements. They do, however, have high exposure to reinsurance recoverables, indicating potential vulnerability to a reinsurance spiral. Finally, property-casualty insurers core activities have low to moderate complexity, in comparison with complex banking products such as asset-backed securities and life insurance products with embedded options. Property-casualty insurers are vulnerable to catastrophe risk but have been able to withstand large catastrophes such as Hurricanes Andrew and Katrina in the past. Therefore, property-casualty insurers' vulnerability to an intra-sector crisis appears low, except for reinsurance.

U.S. insurance regulation, which tends to be very conservative, prevented insurers from engaging in the dramatic increases in leverage that occurred for the shadow banks during the period leading up to the crisis. The effectiveness of regulation is demonstrated by the low insurance insolvency rates in the U.S. Although U.S. regulation is "Balkanized" and the cumbersome regulatory structure often impedes necessary reforms, Federal bank regulators did not perform well in the period leading up to the financial crisis, and it is not clear that Federal regulators would be more effective than state regulators. Although the lack of a single overseer does create problems in managing multi-state insolvency risk (Acharya, et al., 2009), nationally significant insurers are reviewed every quarter by the National Association of Insurance Commissioners (NAIC), and those that appear to be performing poorly are prioritized for detailed analysis by a group of experienced regulators (the Financial Analysis Working Group).

As in banking, moral hazard is created by the existence of insurance guaranty funds; more specifically, guaranty fund premiums are not risk-based. This feature of guaranty funds can lead to excessive risk-taking in insurers. However, moral hazard is mitigated somewhat by the fact that insurance guaranty funds have claim payment limits, giving policyholders an incentive to monitor insurers. Hence, relatively more market discipline is present for insurers than for other financial institutions such as banks (Harrington, 2009).

6.2. Non-Core Activities

The AIG debacle revealed that non-core activities of insurance companies can create systemic risk. Among the high risk activities that have been identified are trading in derivatives such as CDS, over-leveraging of non-core subsidiaries, and conducting bank-like activities such as asset-lending. These sources of risk are present for many global financial services conglomerates. As we have seen, there are at least 46 major insurance organizations with significant exposure to CDS at the present time. Trading in other types of derivatives such as foreign exchange and interest rate derivatives, providing financial guarantees, and engaging in asset management also can create systemic exposures.

Because non-core activities conducted by insurance groups do create systemic risk, regulators need to improve the effectiveness of group supervision. Large, globally-oriented insurance groups have insurance subsidiaries that are regulated in the U.S. but also have financial subsidiaries located in other countries. Its London-based Financial Products division brought down AIG due to a failure of regulation, such that U.S. insurance regulators did not have jurisdiction and U.S. banking regulators failed to require adequate capitalization. The NAIC, IAIS, and other regulatory bodies are currently working on improvements in group supervision. The key is to design a regulatory system that effectively encompasses both the core and non-core enterprises of the insurance sector. Given the limited information currently available on

derivatives, asset lending, and other non-core activities of insurers, regulators should require more disclosure of these types of transactions. More disclosure enhances transparency and hence reduces the probability of the development of systemic crises. Regulators should also have the authority to regulate leverage by non-core subsidiaries of insurance firms.

7. Conclusion

This paper has examined the potential for the insurance industry to cause systemic risk events that spillover to other segments of the financial industry and the real economy. We examine *primary indicators* that can be used to determine whether markets, industries, or institutions are systemically risky as well as *contributing factors* that exacerbate vulnerability to systemic events. The paper presents a detailed financial analysis of the insurance industry, its role in the economy, and its interconnectedness with other economic sectors. The paper focuses on the U.S. insurance industry and primarily analyzes the core activities of insurers.

The primary conclusion of the paper is that the core activities of the U.S. insurers do not create systemic risk. In terms of the primary indicators, insurers are not sufficiently large or interconnected with other firms in the economy to pose a systemic risk. Except for property-casualty insurance for individuals and smaller businesses, lack of substitutability is not a serious problem in insurance. There are ample substitutes for life insurance asset accumulation products and commercial property-casualty insurance for large firms; and for personal property-casualty insurance, even the failure of several large insurers would not be likely to create a substitutability problem, because there are many other insurers that could step in to fill the coverage gap.

Because the core activities of insurers are not systemically risky in terms of the primary indicators, the analysis of contributing factors mainly relates to their creation of vulnerability to intra-sector crises for insurers. Here we find that life insurers are much more vulnerable to crises than property-casualty insurers. Life insurers are highly levered and are exposed to severe

liquidity risk due to their holdings of mortgage-backed securities and privately placed bonds. They also offer complex financial products with numerous embedded derivatives. Both life and property-liability insurers are vulnerable to reinsurance crises and spirals because of their exposure to reinsurance counterparty credit risk, the main source of interconnectedness for insurers. Because counterparty credit risk is highly concentrated, a reinsurance spiral could be triggered by the failure of one or more leading reinsurers, triggering an insolvency crisis in the insurance industry. We find that regulation is not an important source of sectoral financial risk with respect to the core activities of insurers.

As was amply demonstrated by the AIG case, the non-core activities of insurers do constitute a source of systemic risk. Non-core activities include trading in derivatives, such as credit default swaps, asset lending, asset management, and providing financial guarantees. Although systematic information on non-core activities is difficult to obtain, our analysis indicates that the leading global insurance organizations have significant exposure to credit default swaps. Most of the non-core activities are beyond the traditional purview of insurance regulators and have not been rigorously regulated by banking authorities. Therefore, on a world-wide scale, regulators need to significantly improve their capabilities in group supervision.

Further research is needed to further explore systemic risk in the insurance industry. In terms of reinsurance spirals, additional research is needed to examine the extent of the reinsurance relationships among insurers and to examine their impact on firm performance in a multi-variate context. Analysis of market level data on stock returns and credit default swap prices could help to provide further information on the interconnections between insurers and other types of financial institutions. Additional research is also needed on the non-core activities of insurance groups. This probably would require detailed case studies of major insurance organizations and possibly direct participation of the insurance industry.

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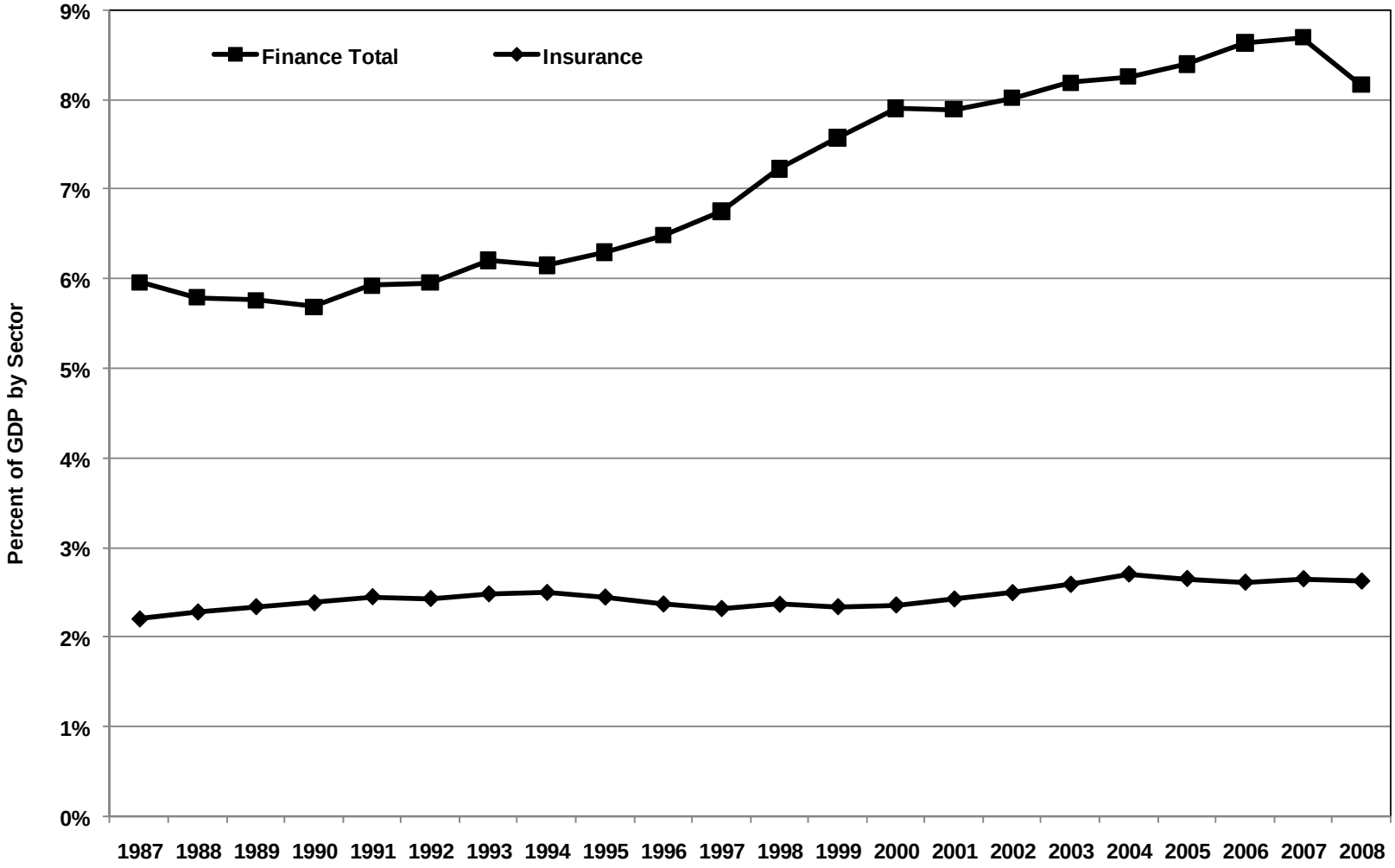
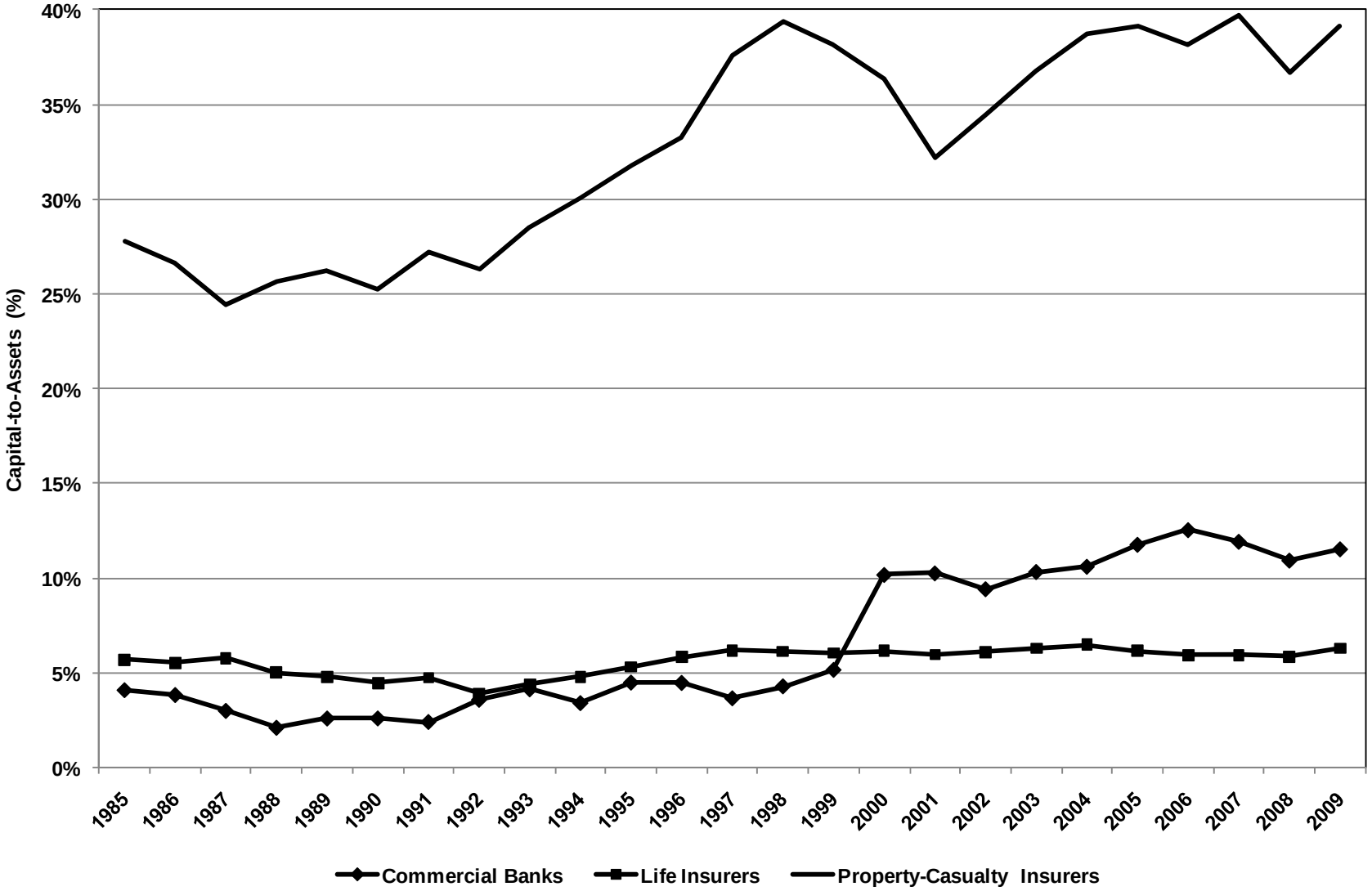
Figure 1: U.S. GDP Attributable to Financial Services



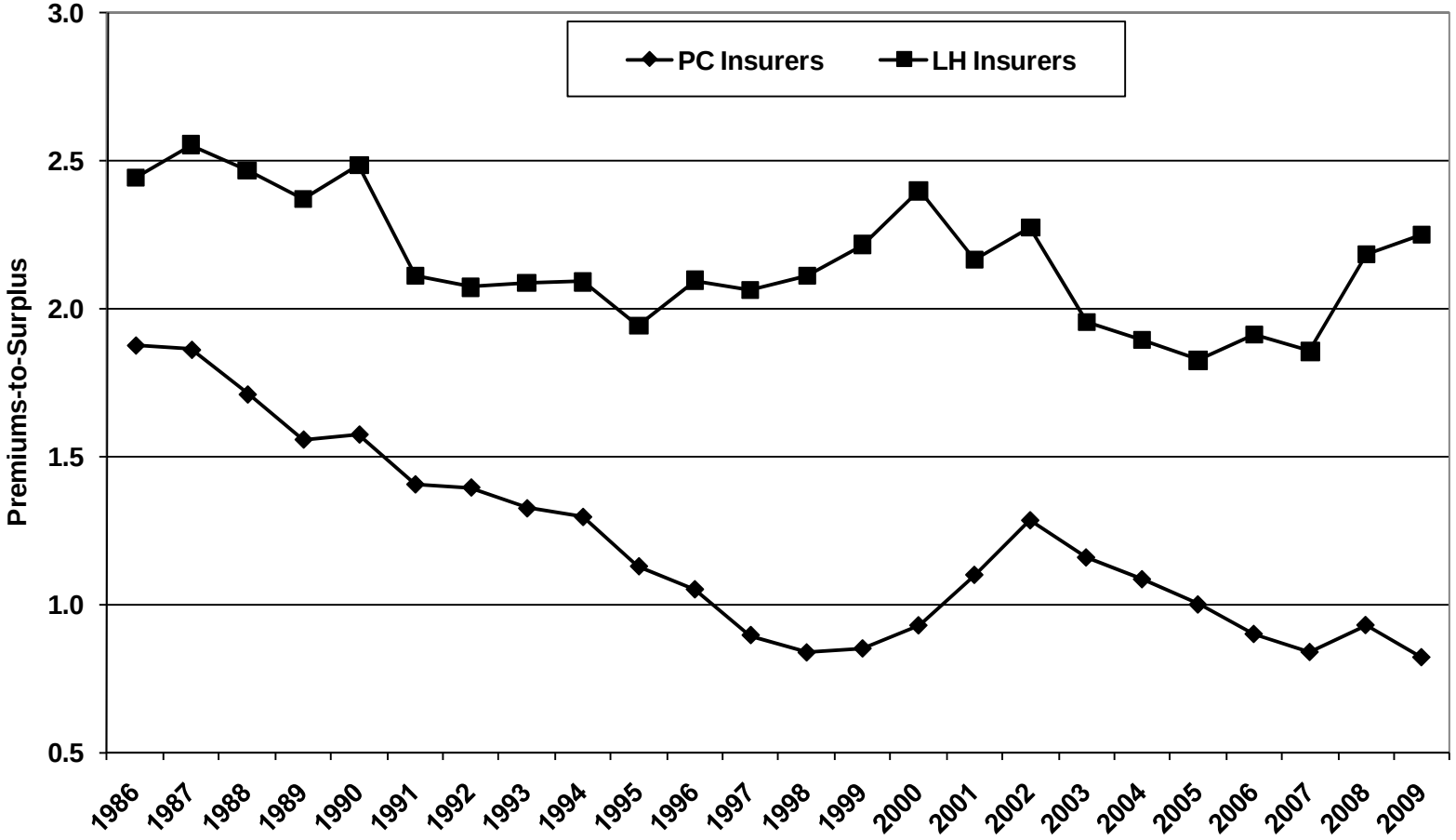
Source: U.S. Department of Commerce, Bureau of Economic Analysis. GDP shown is for the "Finance and Insurance" sector, line 51 of the GDP accounts. Real estate and leasing are excluded from the totals.

Figure 2: Equity Capital-to-Asset Ratios



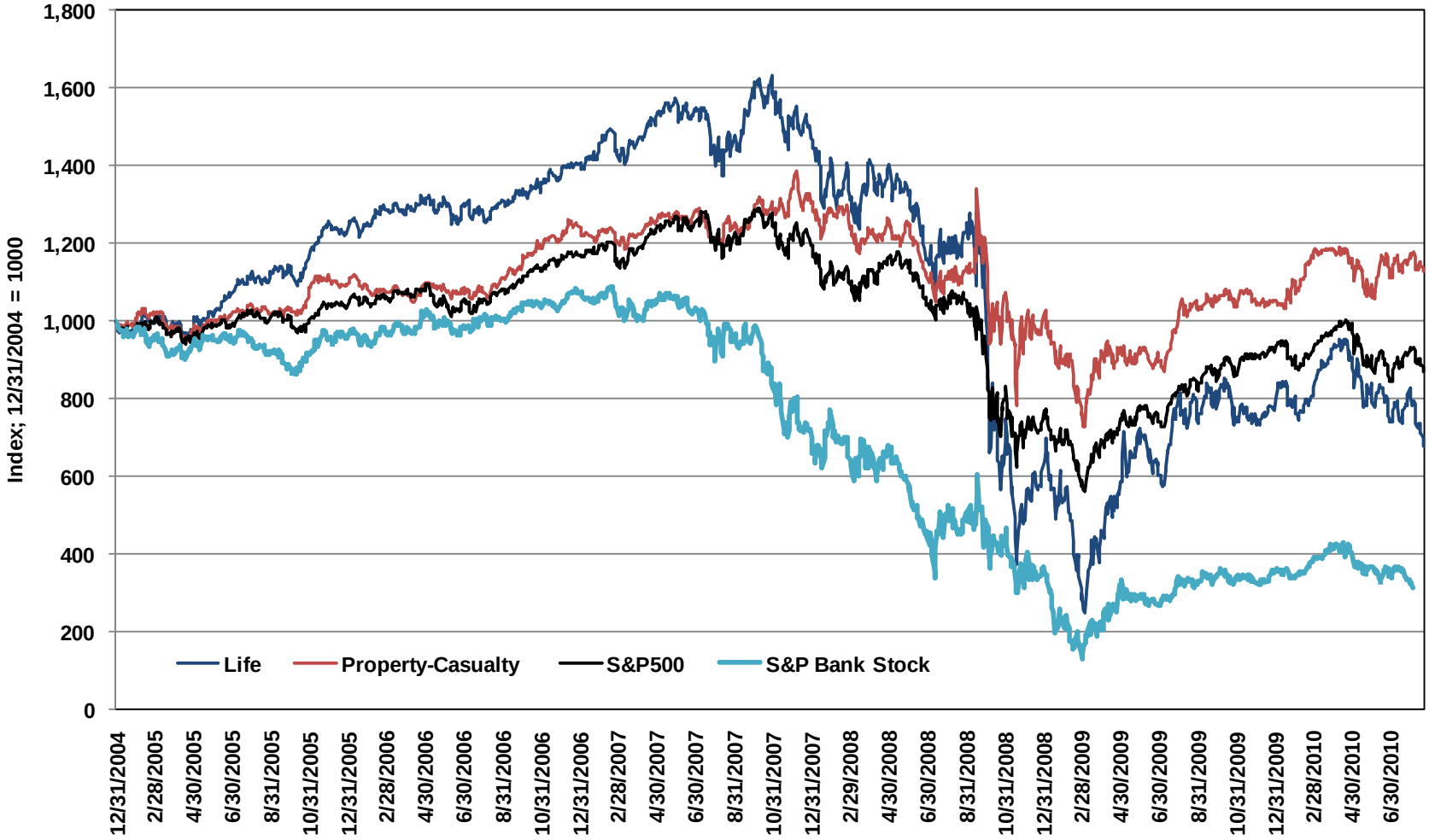
Source: Board of Governors of the Federal Reserve System, Federal Reserve Flow of Funds Accounts (Washington, DC).

Figure 3
Premiums-to-Surplus Ratios: Life-Health and Property-Casualty Insurers



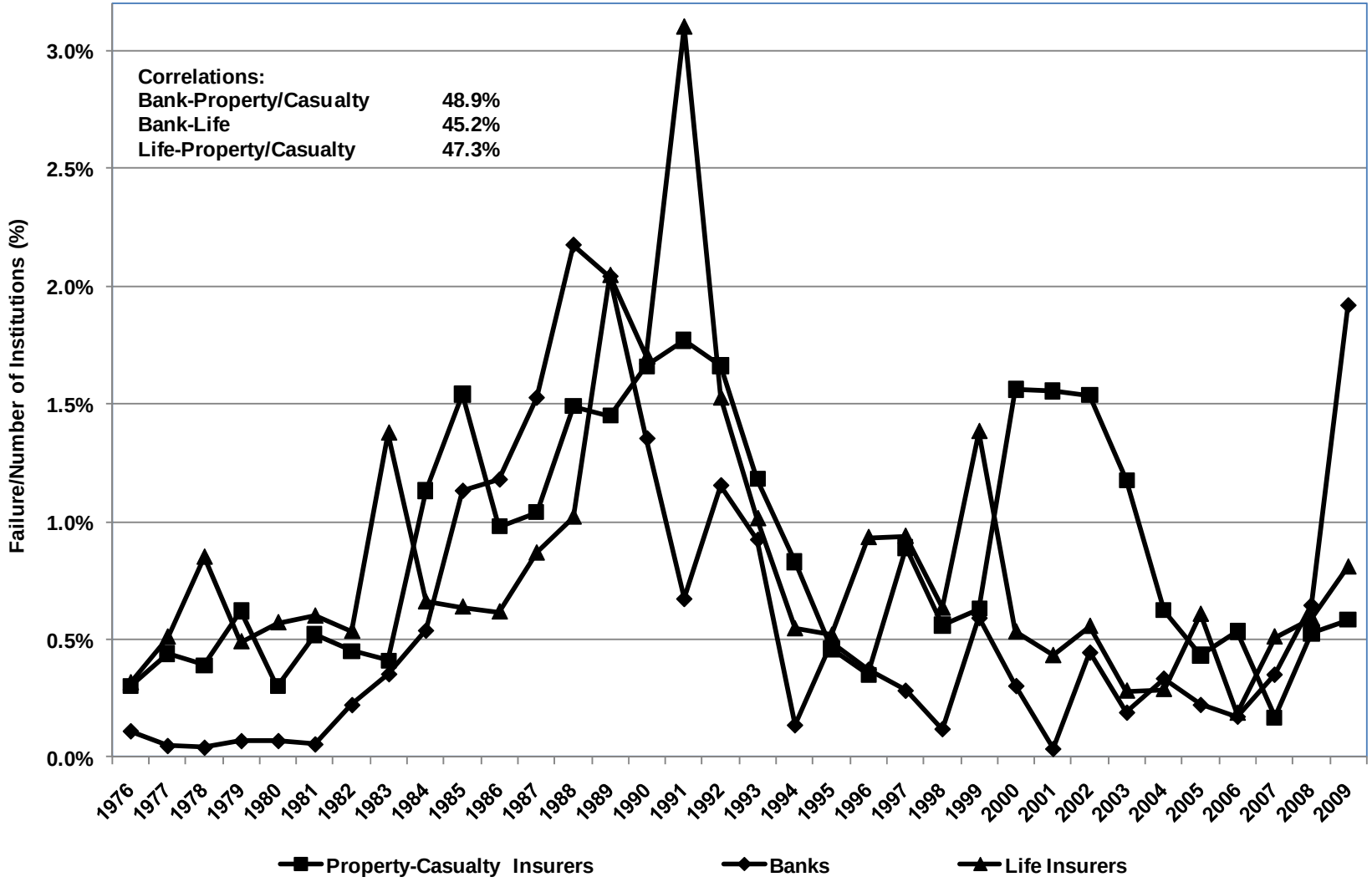
Source: A.M. Best Company (2009a, 2009d), American Council of Life Insurance (2009). National Association of Insurance Commissiolners.

Figure 4
US Insurer and Bank Stock Indices vs. S&P 500



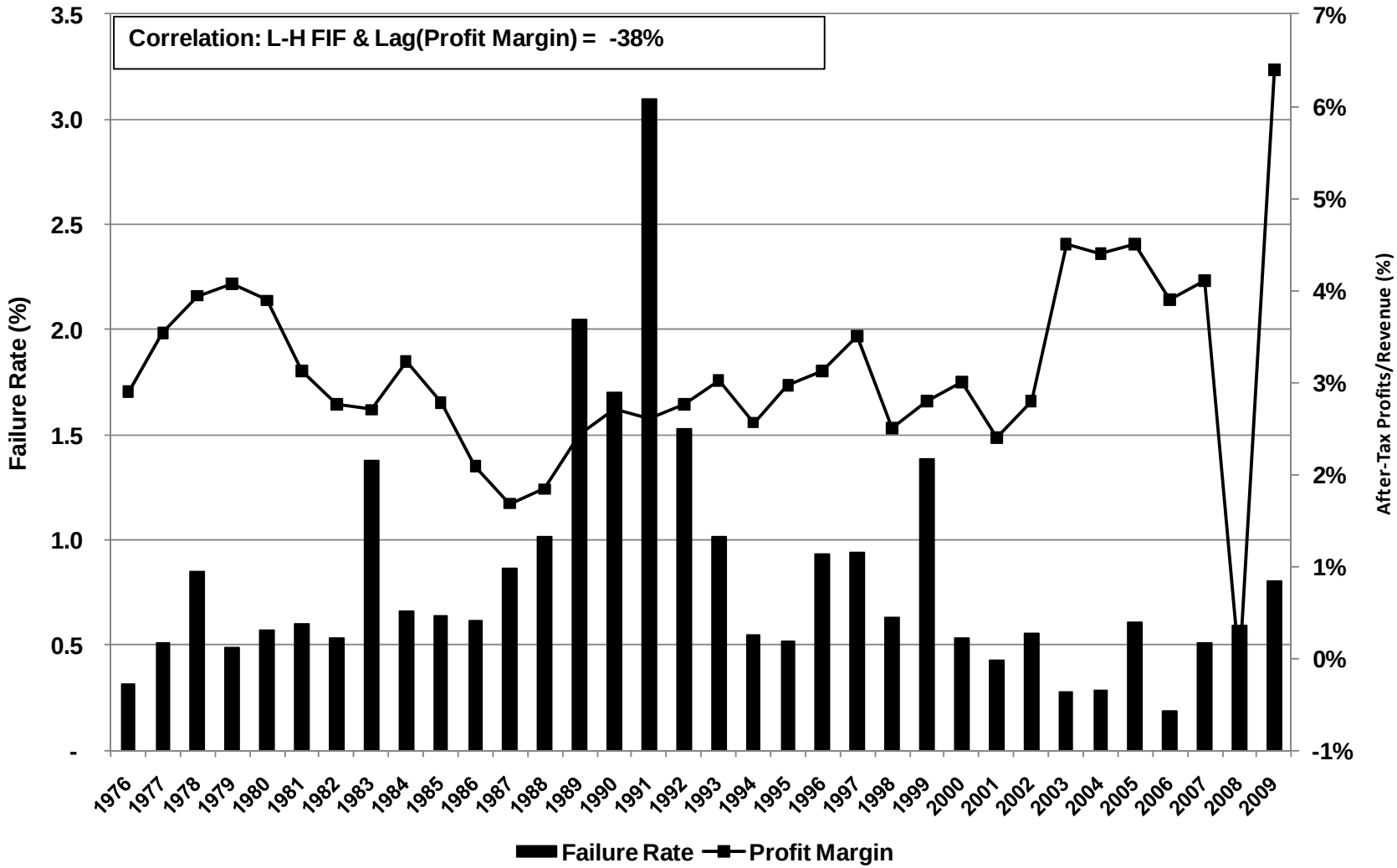
Source: A.M. Best Company: A.M. Best U.S. life insurer index (AMBUL), A.M. Best U.S. property-casualty insurer index (AMBUPC). S&P bank stock index (BIX). http://finance.yahoo.com/q?s=%5EBIX.

Figure 5: Failure Rates of U.S. Banks and Insurers



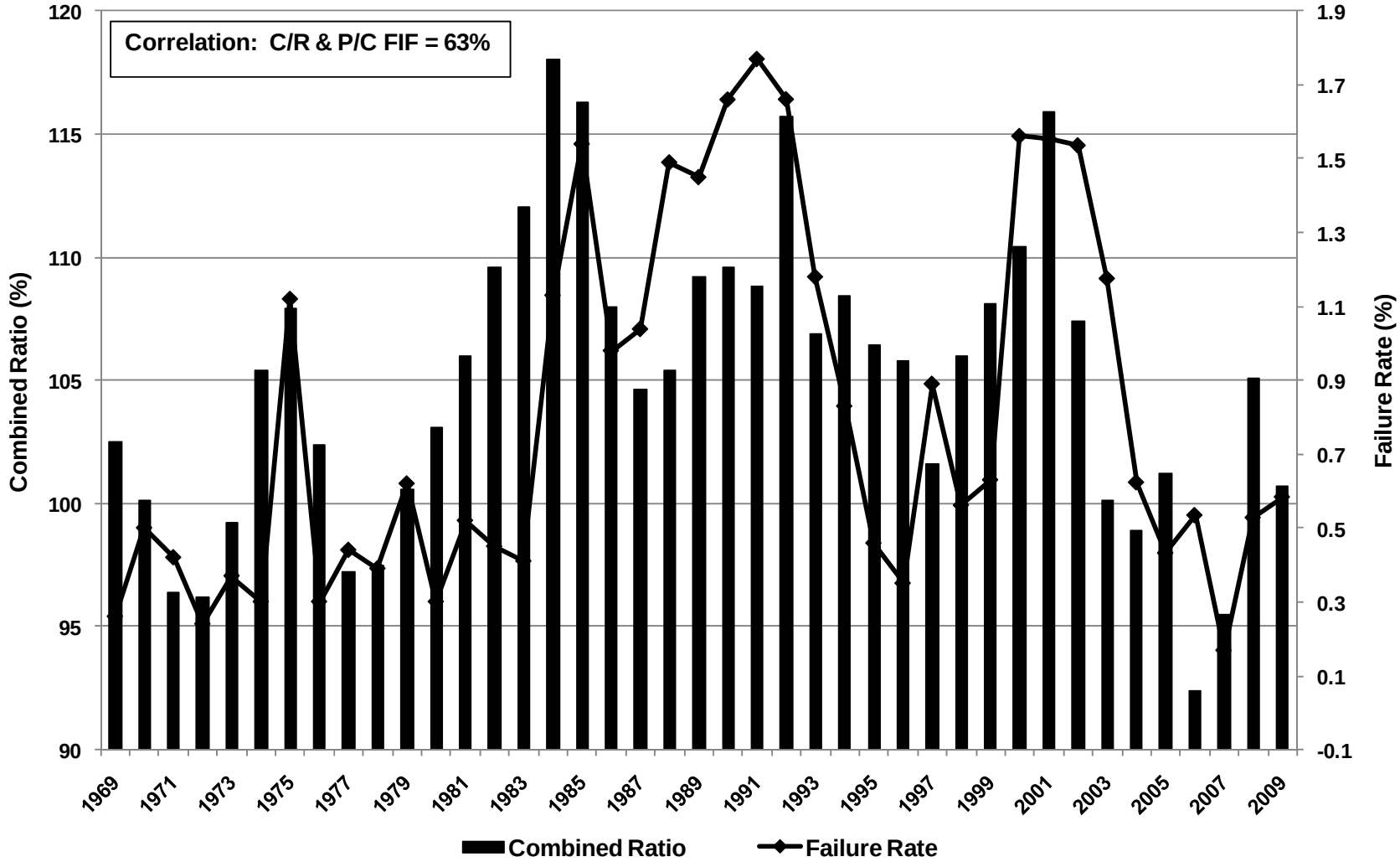
Sources: A.M. Best Company (2010b, 2010c), Federal Deposit Insurance Corporation.

Figure 6
Life Insurer Impairment Frequency and After-Tax Profit Margin



Source: A.M. Best Company (2010b). Failure rate is the ratio of the number of financially impaired insurers to total number of insurers in the industry in a given year.

Figure 7: Property-Casualty Insurer Failure Rate and Combined Ratio



Source: A.M. Best Company (2010a). Failure rate is the ratio of the number of financially impaired insurers to total number of insurers in the industry in a given year.

Table 1: World insurance: Premiums, Penetration, and Density by Region, 2009

	Life Insurance				Non-Life Insurance			
Region	**Premiums**	**Share of world market (%)**	**Premiums % of GDP**	**Premiums per capita**	**Premiums**	**Share of world market (%)**	**Premiums % of GDP**	**Premiums per capita**
America	579,626	24.9%	3.0%	631.5	769,869	44.4%	3.9%	838.76
North America	536,001	23.0%	3.4%	1,572.8	702,584	40.5%	4.5%	2061.66
Latin America and Caribbean	43,625	1.9%	1.1%	75.6	67,285	3.9%	1.7%	116.59
Europe	953,515	40.9%	4.5%	1,111.0	657,105	37.9%	3.1%	750.55
Western Europe	935,520	40.1%	5.2%	1,811.1	590,433	34.0%	3.2%	1111.30
Central and Eastern Europe	17,995	0.8%	0.6%	55.8	66,672	3.8%	2.2%	206.87
Asia	732,267	31.4%	4.5%	180.3	257,184	14.8%	1.6%	62.80
Japan & Indus Asia	538,067	23.1%	8.0%	2,553.8	160,946	9.3%	2.4%	753.78
South and East Asia	187,355	8.0%	2.5%	52.9	74,532	4.3%	1.0%	21.05
Middle East and Central Asia	6,845	0.3%	0.4%	22.1	21,706	1.3%	1.2%	69.96
Africa	32,564	1.4%	2.2%	32.3	16,723	1.0%	1.1%	16.57
Oceania	33,592	1.4%	3.1%	930.7	33,649	1.9%	3.1%	932.22
World	2,331,566	100.0%	4.0%	341.2	1,734,529	100.0%	3.0%	253.85

Source: Swiss Re (2010).

Note: All monetary valued statistics are in U.S. dollars (millions).

Table 2

Major Holders of U.S. Credit Market Debt Outstanding

Debt Outstanding/Holders	2005	2006	2007	2008	2009
Total Credit Market Debt Outstanding	41,280,259	45,359,446	50,051,172	52,588,987	52,328,431
Percent held by:					
Domestic Nonfinancial Sectors	13.1%	12.5%	12.5%	11.6%	12.2%
Rest of World	12.6%	13.7%	14.5%	14.4%	15.0%
Commercial Banks	17.6%	17.7%	17.5%	17.9%	17.2%
Savings Institutions & Credit Unions	5.4%	4.8%	4.5%	3.8%	3.5%
Property-Casualty Insurers	2.0%	1.9%	1.7%	1.6%	1.7%
Life Insurers	6.7%	6.1%	5.7%	5.5%	5.9%
Private Pension Funds	1.7%	1.7%	1.7%	1.8%	2.0%
State & Local Government Pension Funds	1.7%	1.8%	1.6%	1.6%	1.6%
Money Market Mutual Funds	3.2%	3.4%	3.9%	5.1%	3.9%
Mutual Funds	4.2%	4.3%	4.4%	4.3%	5.1%
ABS Issuers	8.0%	9.0%	8.8%	7.7%	6.3%
Finance Companies	4.2%	4.0%	3.7%	3.3%	2.9%
GSEs & Agency and GSE Pools	14.8%	14.2%	14.6%	15.2%	15.4%
All Others	4.9%	5.0%	4.8%	6.1%	7.4%

Note: Outstanding debt in millions of dollars.

Source: Federal Reserve Flow of Funds Accounts (Washington, DC: Board of Governors of the Federal Reserve System.

Table 3

Holdings of Financial Assets By Insurers and Commercial Banks

Asset/Holdings	2005	2006	2007	2008	2009
Treasury Securities	4,678,033	4,861,747	5,099,199	6,338,184	7,781,929
Commercial Banks	2.1%	2.0%	2.2%	1.5%	2.4%
Property-Casualty Insurers	2.3%	2.3%	1.4%	1.0%	1.1%
Life Insurers	2.0%	1.8%	1.4%	1.7%	2.3%
Agency & GSE Securities	6,164,547	6,492,439	7,397,749	8,166,697	8,106,479
Commercial Banks	17.7%	17.5%	13.8%	14.3%	15.8%
Property-Casualty Insurers	1.9%	1.9%	1.7%	1.4%	1.4%
Life Insurers	6.0%	5.8%	5.2%	4.5%	4.4%
Municipal Securities	2,225,888	2,403,265	2,618,883	2,676,007	2,803,689
Commercial Banks	7.1%	7.5%	7.4%	8.1%	7.8%
Property-Casualty Insurers	14.1%	13.9%	14.2%	14.3%	13.2%
Life Insurers	1.5%	1.5%	1.6%	1.8%	2.6%
Corporate and Foreign Bonds	8,694,615	9,982,176	11,426,136	11,158,810	11,482,061
Commercial Banks	7.9%	7.8%	8.6%	8.8%	7.6%
Property-Casualty Insurers	3.0%	2.8%	2.5%	2.4%	2.6%
Life Insurers	21.0%	18.2%	16.3%	16.3%	16.7%
Corporate Equities	20,636,127	24,339,276	25,576,508	15,780,827	20,227,587
Commercial Banks	0.1%	0.1%	0.2%	0.0%	0.1%
Property-Casualty Insurers	1.0%	0.9%	0.9%	1.2%	1.1%
Life Insurers	5.6%	5.6%	5.7%	6.3%	6.2%
Multifamily Residential Mortgages	666,600	707,300	789,500	840,500	849,000
Commercial Banks	20.8%	22.3%	21.3%	25.6%	24.9%
Property-Casualty Insurers	0.0%	0.0%	0.0%	0.0%	0.0%
Life Insurers	6.4%	6.5%	6.6%	6.2%	5.7%
Commercial Mortgages	1,919,500	2,198,500	2,465,100	2,581,900	2,494,300
Commercial Banks	51.5%	51.1%	49.6%	51.5%	52.0%
Property-Casualty Insurers	0.1%	0.2%	0.2%	0.2%	0.2%
Life Insurers	11.7%	10.7%	10.2%	10.3%	10.3%

Note: Asset holdings are in millions of dollars.

Source: Federal Reserve Flow of Funds Accounts (Washington, DC: Board of Governors of the Federal Reserve System.

Table 4
2008 Balance Sheets for Property-Liability, Life-Health, and Commercial Banks

	Property-Liability Insurance		Life Insurance		Commercial Banks	
	Dollars	% Assets	Dollars	% Assets	Dollars	% Assets
Assets:						
Bonds	862.0	57.8%	2,146.4	46.8%	1,727.4	14.0%
Stocks	199.8	13.4%	168.6	3.7%	19.2	0.2%
Loans					3,173.1	25.8%
Mortgage Loans on Real Estat	5.0	0.3%	327.9	7.2%	3,665.5	29.8%
Real Estate	10.9	0.7%	20.1	0.4%	132.6	1.1%
Assets in Trading Accounts					965.1	7.8%
Cash and equivalents	103.2	6.9%	146.1	3.2%	1,041.8	8.5%
Other Invested Assets	65.5	4.4%	261.5	5.7%	688.1	5.6%
Total Invested Assets	1,246.4	83.5%	3,070.6	67.0%	9,685.4	78.7%
Reinsurance Recoverables	39.9	2.7%	26.7	0.6%		
Other Assets	205.7	13.8%	133.8	2.9%	2,625.5	21.3%
Separate Accounts			1,353.6	29.5%		
Total Assets	1,492.0		4,584.7		12,310.9	
Liabilities and Equity:						
Loss & Policy Reserves	815.0	54.6%	2,588.6	56.5%		
Deposits					8,082.2	65.7%
Federal Funds and Repos					803.9	6.5%
Other Borrowed Money	4.9	0.3%	22.3	0.5%	1,275.2	10.4%
All Other Liabilities	196.9	13.2%	315.8	6.9%	994.7	8.1%
Total Liabilities (non-SA)*			2,926.7	63.8%		
Separate Accounts			1,351.3	29.5%		
Total Liabilities	1,016.8	68.2%	4,278.0	93.3%	11,156.0	90.6%
Total Equity	475.2	31.8%	306.7	6.7%	1,154.9	9.4%
Total Liabilities and Equity	1,492.0		4,584.7		12,310.9	

*SA stands for separate accounts.

Note: Dollars in billions. Stocks include preferred stock. Loss & policy reserves includes loss adjustment expense reserves, unearned premium reserves and reinsurance payable for property-casualty insurance. For life insurers, loss & policy reserves includes reserves for life, annuity, accident and health, and policy claims. Real Estate includes premises of insurers and banks. Deposits include interest and non-interest bearing deposits.

Source: Life insurance data obtained from NAIC database of annual statements and property-casualty insurance data are from the 2009 edion of A. M. Best Co., Best's Aggregates & Averages (Oldwick, NJ). Commercial Bank data are obtained from Insurance Information Institute, *Financial Services Fact Book* (New York).

Table 5

Aggregate Insurer Financial Statement Information for 2008

(Dollar amonts in billions)

			Life			Property-Casualty
Balance Sheet, Income Statement, and Cash Flow						
Assets (excluding Separate Accounts)			3,231.1			1,492.0
Bonds (excluding Separate Accounts)			2,146.4			862.2
Stocks (excluding Separate Accounts)			168.8			199.8
Liabilities (excluding Separate Accounts)			2,926.7			1,016.8
Surplus			306.7			475.2
Total Premiums and Considerations			631.5			448.0
Total Insurance in Force (gross of reins.)			36,811.0			NA
Benefit and Loss Payments			536.8			270.0
	Amount	%Benefits	%Surplus	Amount	%Benefits	%Surplus
Net Cash from Operations	141	26.3%	46.1%	40	15.0%	8.5%
Key Investments						
Bonds						
Mortgage Backed Securities	Amount	%Bonds	%Surplus	Amount	%Bonds	%Surplus
Pass through	122.6	5.7%	40.0%	64.7	7.5%	13.6%
CMOs and REMICs	390.1	18.2%	127.2%	99.5	11.5%	20.9%
Placement type						
Private Placement	525.9	24.5%	171.5%	34.3	4.0%	7.2%
Public	1,620.5	75.5%	528.4%	827.9	96.0%	174.2%
	Amount	%Stock	%Surplus	Amount	%Stock	%Surplus
Stock of Banks, Trusts, and Insurers	30.5	18.1%	9.9%	21.1	10.6%	4.4%
Reinsurance	Amount	% Surplus	%DPW*	Amount	% Surplus	%DPW*
Premiums ceded:						
To Nonaffiliates	46.8	15.3%	6.8%	67.0	14.1%	13.6%
To Affiliates	75.9	24.7%	11.1%	345.5	72.7%	70.1%
Recoverables & Funds Held by Reinsurer**	26.7	8.7%		39.9	8.4%	
Reinsurance Recoverable - Nonaffiliates	11.1	3.6%		7.6	1.6%	
Reinsurance Recoverable - Affiliates	5.7	1.9%		15.4	3.2%	
Reserve Credit Taken (Amount Recoverable)***						
From Nonaffiliates	174.8	57.0%		154.5	32.5%	
From Affiliates	220.2	71.8%		612.6	128.9%	
Reins. Ceded Surplus Relief						
From Nonaffiliates	1.8	0.6%		NA	NA	
From Affiliates	7.8	2.5%		NA	NA	
		% Total			% Total	
	Amount	In Force		Amount	In Force	
Reinsurance Ceded In Force -- Nonaffiliated	10,498	28.5%		NA	NA	
Reinsurance Ceded In Force -- Affiliated	7,506	20.4%		NA	NA	

*DPW = direct premiums written.

**Funds held by reinsurers are not broken out separately for affiliates and nonaffiliates in the annual statement.

***For property-casualty insurers this amount is the net amount recoverable from reinsurers from Schedule F.
For life insurers, it is the reserve credit taken from Schedule S.

Note: Amounts are in billions of dollars. Reinsurance Recoverable from nonaffiliates and affiliates does not add up to Reinsurance Recoverables/Funds Held by Reinsurer because it excludes Funds Held by Reinsurer. Benefit and Loss Payments are from the Cash Flow statement item, "Benefit and loss related payments." For property-casualty, Reserve Credit Taken - Reins. Ceded Nonaffiliates (Affiliates) obtained from Schedule F part 3, column 17, "Net Amount Recoverable from Reinsurers," net of unearned premiums in column 13.

Sources: NAIC Annual Statement databases, Best's Aggregates & Averages, Property/Casualty Edition, 2009.

Table 6
Insurer Insolvencies: Primary Triggering Events
Life Insurers (1976-2009) and Property-Casualty Insurers (1969-2009)

	Life-Health	Property-Casualty
Inadequate pricing/Deficient loss reserves	27.5%	40.0%
Affiliate problems	18.6%	7.8%
Invest problems (overstated assets)	15.4%	7.1%
Rapid growth	14.5%	13.6%
Alleged fraud	9.1%	7.8%
Miscellaneous	8.3%	8.8%
Catastrophe Losses	NA	7.2%
Significant business change	4.7%	4.0%
Reinsurance failure	2.0%	3.6%
Average number of failures per year	18.6	25.7

Note: Data are only on companies where the cause of impairment was identified.
Source: A.M. Best Company (2010c and 2010d).

Table 7
Solvency Record and Guaranty Fund Assessments: 1988-2008

	Life-Health				Property-Casualty			
Year	No. of Failures	Failure Rate	Assessments ($ millions)	Assessments % of Premiums	No. of Failures	Failure Rate	Assessments ($ millions)	Assessments % of Premuims
1988	27	1.15%	$80	0.0351%	50	1.52%	$465	0.2298%
1989	54	2.38%	$135	0.0552%	48	1.45%	$714	0.3418%
1990	46	2.10%	$248	0.0939%	55	1.66%	$434	0.1988%
1991	81	3.92%	$885	0.3355%	60	1.77%	$435	0.1948%
1992	38	1.95%	$760	0.2696%	58	1.69%	$384	0.1685%
1993	24	1.30%	$725	0.2270%	41	1.18%	$520	0.2152%
1994	12	0.56%	$854	0.2525%	29	0.83%	$498	0.1985%
1995	11	0.53%	$876	0.2495%	16	0.46%	$67	0.0256%
1996	19	1.13%	$611	0.1615%	12	0.35%	$95	0.0355%
1997	18	1.11%	$419	0.1035%	31	0.89%	$236	0.0854%
1998	12	0.77%	$201	0.0453%	18	0.56%	$239	0.0843%
1999	26	1.77%	$126	0.0257%	19	0.60%	$179	0.0620%
2000	11	0.87%	$101	0.0187%	49	1.56%	$306	0.1012%
2001	8	0.60%	$113	0.0236%	50	1.62%	$713	0.2168%
2002	8	0.62%	$69	0.0135%	47	1.54%	$1,184	0.3125%
2003	4	0.33%	$18	0.0034%	35	1.14%	$874	0.2106%
2004	5	0.42%	$96	0.0178%	18	0.59%	$953	0.2182%
2005	10	0.89%	$71	0.0133%	14	0.46%	$836	0.1910%
2006	3	0.28%	$19	0.0032%	15	0.50%	$1,344	0.2966%
2007	9	0.89%	$81	0.0133%	5	0.17%	$943	0.2085%
2008	9	0.59%	$60	0.0094%	16	0.53%	$385	0.0867%
Totals	426		$6,491		670		$11,361	
Average	21.3	1.18%	$325	0.0981%	33.5	1.03%	$571	0.1798%

Sources: A. M. Best Co. (2010c and 2010d), National Conference of Insurance Guaranty Funds, National Organization of Life-Health Guaranty Funds, American Council of Life Insurers, *Life Insurance Fact Book* (2009).

Note: The failure rate is the number of insolvencies divided by the total number of insurers. Assessments % of premiums is guaranty fund assessments divided by total insurance premiums for life and property-casualty insurers, respectively.

Table 8
Property-Casualty Reinsurance Premiums and Receivables To Non-Affiliated Counterparties

Section 1: Reinsurance Premiums Ceded

	RPC Top Reinsurer %	RPC Top 4 Reinsurers %	RPC Top 10 Reinsurers %	Herfindahl Index RPC	RPC Top Re/DPWA	RPC Top 4 Re/DPWA	RPC Top 10 Re/DPWA	RPC All Re/DPWA
Average	52.0%	80.4%	92.6%	4,168	10.1%	15.6%	17.8%	19.5%
Max	100.0%	100.0%	100.0%	10,000	95.2%	95.2%	95.2%	95.3%
99th	100.0%	100.0%	100.0%	10,000	67.3%	77.4%	80.0%	82.2%
95th	100.0%	100.0%	100.0%	10,000	39.3%	55.3%	60.1%	62.2%
75th	78.9%	100.0%	100.0%	6,476	12.5%	21.5%	26.0%	28.8%
median	43.6%	87.6%	100.0%	2,917	4.9%	9.1%	10.9%	13.1%
25th	26.0%	64.1%	89.3%	1,418	1.5%	3.1%	3.8%	4.7%
5th	14.1%	40.3%	64.7%	653	0.2%	0.3%	0.3%	0.5%
1st	8.1%	25.7%	48.6%	346	0.0%	0.0%	0.0%	0.0%
Min	4.1%	12.9%	23.7%	126	0.0%	0.0%	0.0%	0.0%

Section 2: Reinsurance Receivables

	RR Top Re % of Total	RR Top 4 Re % of Total	RR Top 10 Re % of Total	Herfindahl Index RR	RR Top Re/PHS	RR Top 4 Re/PHS	RR Top 10 Re/PHS	RR All Re/PHS
Average	53.8%	82.3%	93.5%	4,350	21.0%	32.6%	37.2%	41.1%
Max	100.0%	100.0%	100.0%	10,000	277.3%	278.3%	288.2%	288.5%
99th	100.0%	100.0%	100.0%	10,000	179.2%	224.6%	236.6%	249.6%
95th	100.0%	100.0%	100.0%	10,000	85.7%	129.6%	143.8%	160.8%
75th	82.0%	100.0%	100.0%	6,907	24.1%	40.5%	46.7%	52.2%
median	47.4%	90.5%	100.0%	3,248	8.4%	15.5%	18.4%	21.0%
25th	28.1%	68.0%	91.9%	1,578	2.5%	4.7%	6.1%	6.7%
5th	14.5%	41.9%	69.2%	677	0.3%	0.5%	0.6%	0.6%
1st	8.6%	26.5%	49.8%	367	0.0%	0.1%	0.1%	0.0%
Min	4.1%	12.4%	22.9%	124	0.0%	0.0%	0.0%	0.0%

Source: National Association of Insurance Commissioners property-casualty annual statement cd-roms and ScheduleF.com.
Note: RPC = reinsurance premiums ceded, DPWA = direct premiums written plus reinsurance premiums assumed, RR = reinsurance receivables, PHS = policyholders surplus. RPC Top x Reinsurer % = RPC to top x reinsurers as % of total RPC, RPC Top x Re/DPWA = RPC to top x reinsurers as % of total DPWA, RR Top x Re % of Total = RR from top x reinsurers as % of total RR, RR Top x Re/PHS = RR from top x reinsurers as % of PHS. Herfindahl indices are based on percentages of premiums ceded and receivables across counterparties.

Table 9: Life Reinsurance Premiums and Receivables Life Insurance, Annuity To Non-Affiliated Counterparties

Section 1: Reinsurance Premiums Ceded

	RPC Top Reinsurer %	RPC Top 4 Reinsurers %	RPC Top 10 Reinsurers %	Herfindahl Index RPC	RPC Top Re/DAP	RPC Top 4 Re/DAP	RPC Top 10 Re/DAP	RPC All Re/DAP
Average	57.1%	88.0%	97.8%	4,580	13.5%	19.4%	21.3%	21.9%
Max	100.0%	100.0%	100.0%	10,000	100.0%	100.0%	100.0%	100.0%
99th	100.0%	100.0%	100.0%	10,000	99.6%	100.0%	100.0%	100.0%
95th	100.0%	100.0%	100.0%	10,000	59.3%	75.2%	79.6%	83.9%
75th	78.9%	100.0%	100.0%	6,400	16.3%	25.4%	27.8%	29.5%
median	53.0%	93.5%	100.0%	3,943	4.9%	9.5%	10.9%	11.3%
25th	34.7%	79.6%	98.6%	2,130	1.5%	2.6%	3.0%	3.2%
5th	20.1%	57.2%	85.6%	1,115	0.2%	0.4%	0.4%	0.4%
1st	14.4%	43.7%	75.3%	769	0.0%	0.0%	0.0%	0.0%
Min	11.0%	29.7%	55.9%	447	0.0%	0.0%	0.0%	0.0%

Section 2: Reinsurance Ceded, Reserve Credit Taken

	RCT Top Re % of Total	RCT top 4 Re of % of Total	RCT top 10 Re % of Total	Herfindahl Index, RCT	RCT top Re/PHS	RCT Top 4/PHS	RCT Top 10 Re/PHS	RCT All Re/PHS
Average	62.3%	90.8%	98.4%	5,250	64.1%	84.9%	91.4%	93.2%
Max	100.0%	100.0%	100.0%	10,000	500.0%	500.0%	500.0%	500.0%
99th	100.0%	100.0%	100.0%	10,000	500.0%	500.0%	500.0%	500.0%
95th	100.0%	100.0%	100.0%	10,000	381.5%	454.2%	457.3%	471.0%
75th	90.6%	100.0%	100.0%	8,250	58.2%	110.3%	122.5%	123.0%
median	61.5%	97.6%	100.0%	4,644	11.7%	20.9%	23.8%	24.5%
25th	38.0%	85.8%	99.6%	2,580	2.8%	5.4%	6.0%	6.0%
5th	20.6%	61.8%	89.9%	1,240	0.1%	0.1%	0.1%	0.1%
1st	13.6%	39.7%	77.7%	650	0.0%	0.0%	0.0%	0.0%
Min	9.0%	28.3%	51.7%	87	0.0%	0.0%	0.0%	0.0%

Source: National Association of Insurance Commissioners life annual statement cd-roms.

Note: RPC=reinsurance premiums ceded, DAP = direct premiums written + reinsurance assumed, RCT = reserve credit taken, PHS = policyholders surplus. RPC Top x Reinsurer % = RPC to top x reinsurers as % of total RPC, RPC Top x Re/DAP = RPC to top x reinsurers as % of total Dap, RCT Top x Re % of Total = RCT from top x reinsurers as % of total RCT, RCT Top x Re/PHS = RCT from top x reinsurers as % of PHS. Herfindahl indices are based on percentages of premiums ceded and receivables across counterparties.

Table 10
Credit Default Swaps: Total Amounts Outstanding by Counterparty Type
(US$ millions)

	2005-H2	2006-H1	2006-H2	2007-H1	2007-H2
All Counterparties	13,908,285	20,352,307	28,650,265	42,580,546	58,243,721
Reporting Dealers *	6,937,821	10,608,598	16,292,457	23,315,544	32,276,030
Other financial institutions	6,334,885	9,017,148	11,266,863	18,383,446	25,241,239
Banks and security firms	3,541,269	5,024,785	5,322,178	9,592,045	13,971,129
Insurers and Monolines	235,020	296,749	306,096	331,459	492,381
SPVs, Hedge funds, & Other	2,558,596	3,695,612	5,638,591	8,459,943	10,777,727
Non-financial institutions	635,575	726,561	1,090,942	881,554	726,455

	2008-H1	2008-H2	2009-H1	2009-H2
All Counterparties	57,402,759	41,882,685	36,046,236	32,692,694
Reporting Dealers *	33,161,494	25,034,592	19,184,088	17,717,180
Other financial institutions	23,296,814	16,353,286	15,346,611	13,400,068
Banks and security firms	13,683,278	11,346,448	11,072,963	9,949,608
Insurers and Monolines	397,980	399,082	385,810	331,294
SPVs, Hedge funds, & Other	9,215,558	4,607,757	3,887,838	3,119,169
Non-financial institutions	944,449	494,802	1,515,533	1,575,443

Source: Bank for International Settlements, http://www.bis.org/statistics/derdetailed.htm.

Note: Amounts shown are notional amounts outstanding for all currencies and maturities. Amounts are semiannual totals, e.g., 2009-H2 gives figures as of December 31, 2009.

*Reporting dealers are mainly large commercial and investment banks that participate in the inter-dealer market and/or have an active business with large customers. See BIS (2007).

Table 11
Insurer Activity in Single Name Credit Default Swaps: Aggregated Transaction Data
(June 20, 2009 through March 19, 2010)

Reference Entity	Region	Average Daily Notional (US$)	Average No. Trades/Day	% of Total
AMERICAN INTERNATIONAL GROUP	Americas	125,000,000	16	0.3%
ALLIANZ	Europe	100,000,000	9	0.6%
AXA	Europe	100,000,000	10	0.8%
HANNOVER RE	Europe	100,000,000	9	1.1%
SWISS RE	Europe	100,000,000	10	1.4%
PMI GROUP	Americas	100,000,000	11	1.6%
AEGON	Europe	75,000,000	7	1.8%
ASSICURAZIONI GENERALI	Europe	75,000,000	8	2.0%
AVIVA	Europe	75,000,000	8	2.2%
METLIFE	Americas	75,000,000	9	2.4%
MUNICH RE	Europe	75,000,000	7	2.6%
AETNA	Americas	50,000,000	5	2.7%
BERKSHIRE HATHAWAY	Americas	50,000,000	7	2.8%
GENWORTH FINANCIAL	Americas	50,000,000	5	3.0%
MARSH & MCLENNAN	Americas	50,000,000	6	3.1%
ALLSTATE	Americas	50,000,000	4	3.2%
HARTFORD FINANCIAL SERVICES	Americas	50,000,000	7	3.4%
XL CAPITAL	Americas	50,000,000	7	3.5%
ZURICH	Europe	50,000,000	5	3.6%
ACE	Americas	25,000,000	3	3.7%
CIGNA	Americas	22,500,000	4	3.7%
PRUDENTIAL FINANCIAL	Americas	22,500,000	4	3.8%
AON	Americas	20,000,000	3	3.8%
CHUBB	Americas	20,000,000	3	3.9%
LIBERTY MUTUAL	Americas	17,500,000	3	3.9%
LINCOLN NATIONAL	Americas	17,500,000	3	4.0%
CNA FINANCIAL	Americas	15,000,000	3	4.0%
ROYAL & SUN ALLIANCE	Europe	15,000,000	2	4.1%
STANDARD LIFE ASSURANCE	Europe	15,000,000	2	4.1%
LIBERTY MUTUAL GROUP	Americas	12,500,000	2	4.1%
UNISYS	Americas	12,500,000	3	4.2%
UNUM GROUP	Americas	12,500,000	2	4.2%
ODYSSEY RE HOLDINGS	Americas	10,000,000	2	4.2%
SCOR	Europe	10,000,000	1	4.2%
TRAVELERS	Americas	10,000,000	2	4.3%
FAIRFAX FINANCIAL	Americas	7,500,000	1	4.3%
HUMANA	Americas	7,500,000	2	4.3%
LEGAL & GENERAL GROUP	Europe	7,500,000	1	4.3%
QBE INSURANCE GROUP	Australia	7,500,000	1	4.4%
EVEREST REINSURANCE	Americas	5,000,000	1	4.4%
FORTIS	Europe	5,000,000	1	4.4%
ING	Europe	5,000,000	1	4.4%
IRISH LIFE	Europe	5,000,000	1	4.4%
TOKIO MARINE & NICHIDO FIRE	Japan	5,000,000	1	4.4%
MITSUI SUMITOMO INSURANCE	Japan	2,500,000	0	4.4%
SOMPO JAPAN INSURANCE	Japan	2,500,000	0	4.4%

Source: Depository Trust and Clearing Corporation (DTCC).