# Are Life Insurers the New Shadow Banks?*

Nathan Foley-Fisher Nathan Heinrich Stéphane Verani †

First version: February 2020. This version: April 2023

**Abstract**

We show that large US life insurers increased lending to below investment grade firms starting in 2009 as banks refocused on commercial banking, against a backdrop of unconventional monetary policies and tighter bank regulations. These insurers have developed new businesses to profit from liquidity transformation by exploiting tax and capital arbitrage through complex on- and off-balance sheet arrangements. Using the COVID-19 pandemic as a natural experiment, we show that these insurers have become exponentially more vulnerable to an aggregate corporate sector shock. In addition, they benefited from the Federal Reserve's response to the pandemic.

JEL Codes: G23, G12, G18
Keywords: shadow banking, insurance companies, annuities, private equity, leveraged loans, collateralized loan obligations

*All authors are in the Research and Statistics Division of the Federal Reserve Board. A first draft of this paper circulated as "Capturing the Illiquidity Premium" from February 2020. For providing valuable comments, we would like to thank, without implication, Celso Brunetti, Francesca Carapella, Arthur Fliegelman, Gary Gorton, Anastasia Kartasheva, Ralf Meisenzahl, Borghan Narajabad, and seminar participants at the US Treasury Office of Financial Research and the Federal Reserve Board. We are also grateful to Andrew Melnyk and the American Council of Life Insurers for organizing a forum to discuss some of the issues raised in this paper with representatives of the life insurance industry. The views in this paper are solely the authors' and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

†nathan.c.foley-fisher@frb.gov; nathan.w.heinrich@frb.gov; stephane.h.verani@frb.gov (corresponding author) 202-912-7972, $20^{th}$ & C Street, NW, Washington, D.C. 20551.

# Are Life Insurers the New Shadow Banks?

**Abstract**

We show that large US life insurers increased lending to below investment grade firms starting in 2009 as banks refocused on commercial banking, against a backdrop of unconventional monetary policies and tighter bank regulations. These insurers have developed new businesses to profit from liquidity transformation by exploiting tax and capital arbitrage through complex on- and off-balance sheet arrangements. Using the COVID-19 pandemic as a natural experiment, we show that these insurers have become exponentially more vulnerable to an aggregate corporate sector shock. In addition, they benefited from the Federal Reserve's response to the pandemic.

JEL Codes: G23, G12, G18

Keywords: shadow banking, insurance companies, annuities, private equity, leveraged loans, collateralized loan obligations

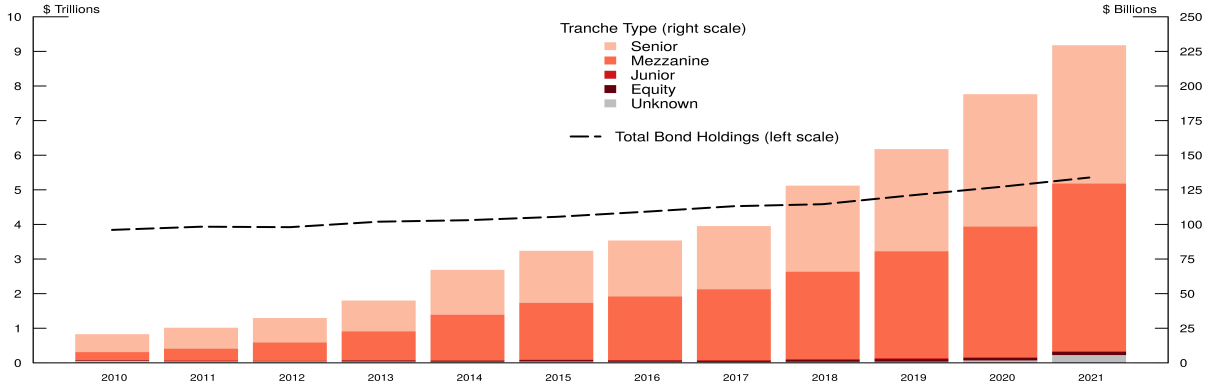
# 1 Introduction

From the 1970s, the US shadow banking system grew as private innovation and regulatory changes led to the decline of the traditional banking model (Gorton & Metrick 2010). The US financial system experienced a crisis during 2007-09, triggering a deep global recession, unprecedented monetary policy accommodation, and stricter banking regulations around the world. In the aftermath, yields on investment grade corporate bonds fell to historically low levels, and risky firms funded by junk bonds shifted to bank-originated leveraged loans. Banks shifted their activity away from investment banking financed by wholesale funding towards commercial banking financed by deposit funding, with striking increases in their holdings of safe assets (BIS 2018, Irani, Iyer, Meisenzahl & Peydró 2020). In the process, banks that previously held corporate loans on their balance sheet began selling them to a syndicate of investors, which include collateralized loan obligations (CLOs)—legal entities that use securitization to issue liabilities backed by a pool of below investment grade leveraged loans (Foley-Fisher, Gorton & Verani 2020).

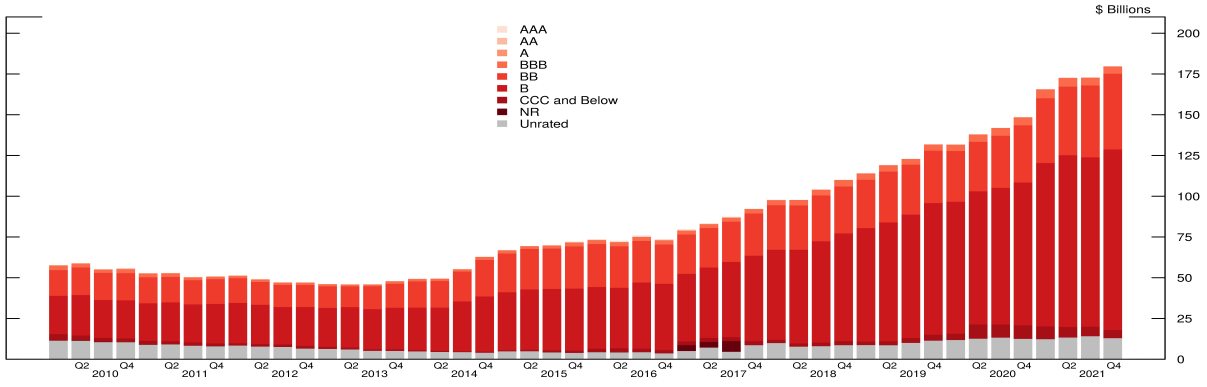
In this paper, we document in exhaustive detail the post-2009 development by some US life insurers of a new shadow banking business model that resembles investment banking in run up to the 2007-09 financial crisis. These life insurers profit by lending to highly-leveraged firms. In particular, they originate risky loans, hold them, and securitize them in CLOs. Their business leverages their expertise in assessing credit risk, their understanding of the preferences of other institutional investors, and arbitrage opportunities in the US insurance industry. As of year-end 2020, these life insurers manage about a quarter of all CLOs using vast amounts of fixed annuity liabilities to finance their CLO businesses. About a third of these life insurers are controlled by private equity firms.

**Figure 1: US insurers' exposure to CLOs after the 2007-09 financial crisis.** Panel A shows the total par value of CLO holdings by US life insurers in their general accounts. Panel B shows the total par value of leveraged loans in outstanding CLOs that were issued by asset managers affiliated with US life insurers. Panel C shows annual distributions of the percentage of each CLO issuance that was retained by US life insurers, with the central boxes show the interquartile range (IQR) of risk retention, bisected by the median as a horizontal line, and the whiskers show the distribution outside the IQR, up to ±1.5×IQR. Source: Authors' calculations based on data from the NAIC Annual Statutory Filings, Moody's Investor Services, Fitch Ratings, and Bloomberg Finance L.P.

**(a) US insurer general account investments in CLOs**




**(b) Leveraged loans in the CLOs of US insurer-affiliated asset managers**




**(c) Distribution of CLO deal risk retained by US insurers**

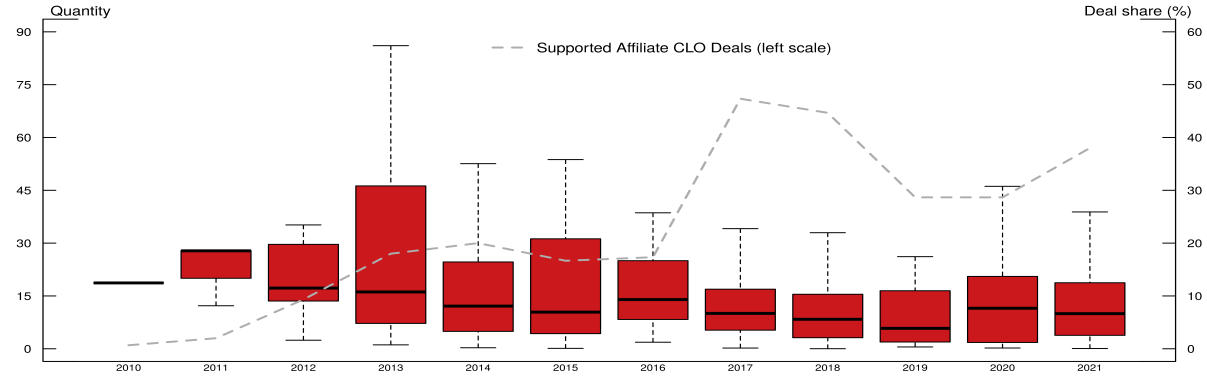


Figure 1 summarizes the growth of insurer shadow banking business in the period after the 2007-09 financial crisis. Figure 1(a) shows the exponential growth of insurers' general account investments in CLOs, reaching a record $235 billion at the end of 2021. By comparison the dashed line represents the total bond holdings of the US insurance industry, which only increased by about 20 percent over the same time period. Figure 1(b) shows the contemporaneous upsurge in US and European CLOs issued by US insurer-affiliated asset managers. The dashed line shows that the share of CLO new issuance by insurer affiliates doubled from about 20 percent in 2012 to about 35-40 percent in recent years. Figure 1(c) depicts the yearly distribution of the share of the affiliated CLO deal retained by insurers in their general accounts. Insurers consistently retain on average 5 percent of each CLO deal arranged by their affiliated asset managers.

Our results are important for two reasons. First, we shed light on the demand and supply drivers of shadow banking in the aftermath of the 2007-09 financial crisis. On the demand side, the insurance industry seeks relatively safe high-yielding debt securities.[1] On the supply side, leveraged loans offer a relatively low cost of funding for risky firms. Second, we identify new vulnerabilities associated with shadow banking. By definition, shadow banks replicate the maturity and liquidity transformation performed by banks, but without the corresponding regulation and supervision. We show that life insurers have filled a void left by banks in risky corporate loan markets. As large life insurers become shadow banks, they create and become vulnerable to run risk.

To grow their shadow banking businesses, the largest US life insurers developed a triangular organizational structure combining (i) one or more US-domiciled life insurance companies with (ii) one or more Bermuda-domiciled captive reinsurers and (iii) an asset

[1]CLO debt caters to the same demand as private-label mortgage-backed securities did before the collapse of the US housing market in 2007.

manager. First, the state-regulated insurance companies source relatively low-cost fixed rate insurance liabilities, such as fixed annuities and holds relatively risky debt securities at much less capital than other intermediaries in the US and Europe. Second, the Bermuda-domiciled captive reinsurers assume the mortality risk of the annuity liabilities. Annuity premiums are tax exempt in Bermuda and the corporate tax rate is about a third of what it is in the US. Third, the asset manager originates or purchases risky corporate loans. These assets are financed on- and off-balance sheet by the insurer's low-cost annuity liabilities. The combination of these three entities is the life insurers' new shadow banking business model.

We study detailed data—laboriously constructed from statutory filings—on these life insurers' new shadow banking business model. We carefully parse the organizational structure of more than 1,000 life insurers to identify the institutions that have restructured their businesses specifically to target lending to risky firms. We establish who holds the controlling stake of these insurance companies. We determine the asset manager and the captive reinsurers in their organizational structures. And we calculate the ownership shares of risk retention vehicles and loan warehouses facilitating off-balance-sheet investment in corporate loans, such as CLOs. We describe how these life insurers became new shadow banks by originating, warehousing, and securitizing loans to highly-leveraged corporations. By extending credit to these risky projects, insurers earn a sizeable spread over the cost of their fixed-annuity liabilities. We show that these life insurance companies hold some of the riskiest portions of the CLOs issued by their own affiliate asset managers against virtually no capital.

A major finding of this paper is that the liabilities of life insurers with shadow banking businesses resemble the liabilities of investment banks in run up to the 2007-09 financial

crisis. We show this by carefully measuring the liabilities issued by life insurers to finance their shadow banking businesses. These life insurers transform fixed annuity liabilities issued from their general account into a range of liabilities that resemble bank deposits, certificates of deposit, bonds, commercial paper, and repo. In essence, the shadow banking business of life insurers is similar to how banks prior to the 2007-09 financial crisis engaged in sub-prime mortgage securitization without risk transfer (Acharya, Schnabl & Suarez 2013).

We use this new dataset to show how life insurers structure CLO deals in a way that is optimized to the industry capital regulation. Our regression analysis reveals that their holdings of the riskiest CLO tranches issued by life insurers are about 25 percentage points higher than other insurers' holdings. In addition, they hold a disproportionately large amount of risky CLO tranches issued by their own affiliates. We describe in detail the institutional structures created by life insurers to fuel a boom in CLO issuance. Moreover, US life insurers finance the CLO deal risk of their affiliates keeping on average at least 5 percent of the deal in their general accounts.

The shadow banking business of life insurers exponentially increases the industry's vulnerability to aggregate corporate-sector shocks. We calculate that insurers' CLO exposures are comparable to their holdings of nonprime residential mortgage-backed securities (RMBS) just before the 2007-09 financial crisis. A widespread default or downgrade of risky corporate loans could force life insurers to assume balance sheet losses of their CLO-issuing affiliates, wiping out their equity. In a worst-case scenario, the perception of balance sheet weakness could incite liquidity-sensitive institutional investors to withdraw from those life insurers (Foley-Fisher, Narajabad & Verani 2019, 2020). As we saw during the 2007-09 financial crisis, US life insurers may require government

support to prevent shocks from being amplified and transmitted to the household sector. This vulnerability was a source of concern for investors when the COVID-19 pandemic was declared in the first quarter of 2020, before the massive intervention by the Federal Reserve.

We exploit the shock to corporate bond markets that occurred at the onset of the COVID-19 pandemic to show that investors were especially attuned to life insurers with shadow banking businesses. To do so, we use security-level data from statutory filings—particularly Schedules BA, DA, D, and Y—to precisely measure the on- and off-balance-sheet exposure of these life insurers to risky leveraged loans over and above the corporate bond holdings reported in Schedule D.

We use a difference-in-differences framework to test the hypothesis that investors distinguished among life insurers with shadow banking businesses during the COVID-19 pandemic. With stock price volatility as our dependent variable, we find a significant loading on a cross-sectional measure of life insurers' shadow bank businesses during the pandemic. The effect is not driven by daily changes in aggregate market fluctuations. In addition, we show that this effect largely subsided after May 12, 2021, when the Federal Reserve began purchasing corporate debt on secondary markets. Our results suggest that market participants were attuned to insurers' opaque shadow banking businesses at the beginning of the pandemic.

## 1.1 Literature

Our paper contributes to several strands of literature. First, our findings reveal important details about the trend in aftermath of the 2007-09 financial crisis of nonbanks replacing banks in the provision of credit to highly-leveraged corporations (Irani et al. 2020, Sarto

& Wang 2020). It took several years after the crisis to understand how the securitization of subprime mortgage-backed securities and incomplete risk transfer by banks lead to enormous stress in the banking sector (Acharya et al. 2013). We show a clear overlap between banks' securitization without risk transfer before the crisis and life insurers' risk retention of affiliated CLO deal risk. Second, our analysis informs the macro-finance literature studying the vulnerabilities associated with shadow banking (Gorton & Metrick 2010, Moreira & Savov 2017). We show that a combination of a retirement saving glut, low yields on safe assets, and tax arbitrage accelerated the development of shadow banking within the life insurance industry since 2010. As we saw during the financial crisis, US life insurers may require government support to prevent shocks from being amplified and transmitted to the household sector (Foley-Fisher, Narajabad & Verani 2020). Lastly, our analysis connects the literature on retirement and aging to shadow banking (Foley-Fisher, Gissler & Verani 2019, Foley-Fisher, Narajabad & Verani 2020, Ordoñez & Piguillem 2019). It is well known that the secular decrease in long-term yields that started in the 1980s is a challenge for pension funds and life insurers that fund illiquid long-term liabilities (Verani & Yu 2020). We show this challenge creates incentives for the life insurance industry to refocus its investment strategy towards relatively risky non-public assets.

The remainder of this paper contains six sections. In Section 2 we describe the new organizational structure that life insurers use to support their shadow banking businesses. In Section 3, we discuss the various regulatory arbitrages that lead to the emergence of this new organizational structure. In Sections 4 and 5 we document patterns in these new financial entities' liabilities and assets, respectively. Section 6 tests the life industry's vulnerability to corporate sector shocks. We offer some concluding remarks in Section 7.

# 2 Structure of life insurers' shadow banking business

Life insurers' shadow banking businesses combine three types of entities in a triangular organizational structure. The first type of entity is US-domiciled life insurance companies. Their predominant focus is on growing fixed-annuity liabilities to finance the shadow banking business. While selling new annuity contracts is one way to develop their business, it need not be originated from scratch. Rather, legacy blocks of annuities business—i.e., the general account assets and liabilities—can be acquired through the purchase of an insurance company, a reinsurance transaction, or a pension buy-out. While interest rates have remained low since the financial crisis, other insurers and private corporations have offered such blocks of business for sale at favorable prices in an effort to exit these interest-rate-sensitive business lines. Large life insurers with an investment-grade rating can also tap wholesale funding markets by issuing nontraditional insurance liabilities to institutional investors. These liabilities include funding agreement-backed securities (FABS) and Federal Home Loan Bank (FHLB) advances collateralized by funding agreements. We will describe these liabilities in more detail in Section 4.

The second type of entity is captive reinsurers located in Bermuda that assume the mortality and morbidity risk included in the annuity liabilities of the affiliated operating insurers domiciled in the US. Table 1 provides examples of life insurers that have established captive reinsurers in Bermuda. Every Bermuda reinsurer listed in Table 1 was formed after 2012, in part to take advantage of a tax arbitrage that we explain in the next section. The balance sheet of a captive reinsurer usually contains capital only to finance the US-domiciled insurer mortality risk. Because fixed annuities are savings instruments that contain little to no mortality risk, the balance sheet of the captive reinsurer usually contains relatively little capital.

**Table 1: Examples of triangular organizational structures designed for private debt business models.** Source: Bermuda Monetary Authority and NAIC Statutory Filings.

| (1.) US life insurer | (2.) Offshore captive reinsurer | (3.) Asset manager |
|---|---|---|
| AIG | AIG Life of Bermuda | AIG Asset Management |
| Allianz US | Allianz Re Bermuda Life | PIMCO |
| Athene | Athene Life Re (Bermuda) | Athene Asset Management |
| Genworth | Genworth Life and Annuity Ins. Co. (Bermuda) | AssetMark |
| Guggenheim Life | Delaware Life Ins. and Annuity Co. (Bermuda) | Guggenheim Partners |
| Global Atlantic | Global Atlantic (Bermuda) | Goldman Sachs Asset Management |
| Legal & General America | Legal and General Reinsurance Co. (Bermuda) | Legal & General Investment Management America |
| MetLife | MetLife Reassurance Company of Bermuda | MetLife Investment Management |
| Aegon US | Transamerica Life (Bermuda) | Aegon Asset Management |
| AXA US | XL Bermuda | AXA Investment Managers |
| Nassau Life | Nassau Re (Cayman Islands) | Nassau Corporate Credit, Nassau CorAmerica |

The third type of entity in the triangular organizational structure is an asset manager that originates, acquires, and manages corporate loans. The asset manager also manages all the assets in the US-domiciled life insurers. Partnerships between life insurers and asset managers have arisen in various ways. Some large incumbent US life insurers have developed in-house asset managers. Some other insurers acquired an existing asset manager. Lastly, some incumbent insurers both developed their own in-house asset manager and acquired an existing asset manager. For example, AIG developed AIG Asset Management in-house and acquired Covenant Credit Partners in 2018.

The new triangular organizational structure allows life insurers to expand their shadow banking business through complex activities both on- and off-balance sheet. By extending credit to risky firms and decreasing their tax base though captive reinsurance, these insurers earn a sizeable spread over their stable annuity funding. As many traditional life insurers exit the annuity business, life insurers with a shadow banking business typically promise their shareholders a return on equity above 15 percent.

Uncovering the triangular structure for each life insurer is complicated and time-consuming. We carefully parse the organizational structure of more than 1,000 life insurers to identify the institutions that have structured or restructured their businesses specifically to target corporate loan markets. We establish who holds the controlling stake of these insurance companies, determine the asset manager in their organizational structures, and calculate the ownership shares of risk retention vehicles facilitating off-balance-sheet investment in corporate loans, notably CLOs.

Table 2 shows summary statistics for insurance groups with and without shadow banking businesses for each year from 2010 onwards. We define an insurance group as having a shadow banking business if it includes a life insurer, offshore captive reinsurer,

and an asset manager, in a triangular organizational structure. Column 2 reveals strong growth in the number of insurance groups with shadow banking. Comparing the total general account assets for each category (Columns 3 and 7) reveals that since 2019 insurance groups with shadow banking businesses account for more than half of total industry assets. Columns 4 and 8 suggest that these insurance groups are more leveraged, on average, that insurance groups without shadow banking businesses.

**Table 2: Summary statistics for insurance groups with or without shadow banking businesses.** We define an insurance group as having a shadow banking business if it has a triangular organizational structure as described in the main text. Columns 2 and 6 report the number of insurer groups. Columns 3 and 7 report the aggregate general account assets ($bn) for insurers with and without shadow banking businesses. Our measure of leverage is the ratio of statutorially-defined general account liabilities to assets. Source: Authors' calculations based on data from NAIC Statutory Filings, Bloomberg LP, and Moody's Analytics, Inc.

| | Insurance groups with shadow banking businesses | | | | Insurance groups without shadow banking businesses | | | |
|---|---|---|---|---|---|---|---|---|
| Year | N | Assets ($bn) | Mean Leverage | St. Dev. Leverage | N | Assets ($bn) | Mean Leverage | St. Dev. Leverage |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 2010 | 5 | 44 | 10.6 | 5.9 | 782 | 3,376 | 5.0 | 52.5 |
| 2011 | 39 | 604 | 11.4 | 10.3 | 739 | 2,995 | 6.7 | 8.0 |
| 2012 | 47 | 845 | 12.7 | 12.2 | 708 | 2,813 | 7.9 | 33.4 |
| 2013 | 58 | 974 | 11.7 | 8.9 | 683 | 2,779 | 7.9 | 30.3 |
| 2014 | 71 | 1,358 | 9.9 | 8.2 | 656 | 2,548 | 6.4 | 7.1 |
| 2015 | 68 | 1,431 | 9.8 | 7.1 | 647 | 2,550 | 6.9 | 8.7 |
| 2016 | 75 | 1,584 | 9.8 | 7.1 | 628 | 2,601 | 6.9 | 8.5 |
| 2017 | 93 | 1,766 | 10.3 | 8.1 | 601 | 2,603 | 7.3 | 11.8 |
| 2018 | 103 | 2,211 | 9.6 | 7.0 | 583 | 2,220 | 7.0 | 8.8 |
| 2019 | 117 | 2,451 | 11.0 | 8.9 | 561 | 2,211 | 6.6 | 8.9 |
| 2020 | 104 | 2,615 | 12.1 | 11.4 | 563 | 2,384 | 6.9 | 9.4 |
| 2021 | 116 | 2,819 | 11.1 | 8.9 | 549 | 2,446 | 6.6 | 7.4 |

# 3 Why did the triangular structure emerge?

Shadow banking by-and-large is fueled by regulatory arbitrage opportunities that allow nonbank financial institutions to engage in bank-like activities without facing bank regulations. The emergence of the triangular structure described in the previous section is no exception. In this section, we explain the main tax and capital arbitrage opportunities driving the shadow banking activities of US life insurers in the period after the 2007-09 financial crisis. Together, these arbitrage opportunities mean that US life insurers can finance high-yield assets using wholesale funding while facing relatively low capital requirements. We end this section by discussing how these arbitrage opportunities, combined with cheap money and aggressive search for yield by institutional investors around the world, attracted private equity firms into the US life insurance industry.

## 3.1 Bermuda tax arbitrage

The first kind of arbitrage available to life insurers arises from the Bermuda captive reinsurers described in section 2. Bermuda captive reinsurance transactions allow insurers to dramatically decrease their cost of fixed-annuity funding. Annuities premiums are tax exempt in Bermuda and the corporate tax rate in Bermuda is about a third of that in the US. Moreover, the premiums paid by US operating companies to a Bermuda captive decrease the corporate tax rate faced by the US operating insurer, as it is a premium-related expense. Therefore, the premiums collected by the Bermuda captive from its affiliated US insurer are tax exempt and US insurers can claim the premiums paid to its Bermuda captive as an expense.

Unsurprisingly, given this arbitrage opportunity, the main source of funding for US life insurer shadow banking is fixed annuities, especially deferred fixed annuities. Deferred

fixed annuities are tax-deferred savings vehicles that individuals can use to accumulate wealth before retirement. At the end of the contract period for the deferred fixed annuity, and after reaching 59.5 years of age, contract holders have the option of receiving their accumulated wealth as a lump sum, a term annuity, or a life annuity. This is sometimes referred to as an annuity "payout phase."

Bermuda reinsurance transactions are structured in a way that the assets funded by the annuity liabilities remain on the balance sheet of the US-domiciled insurers. This is achieved using modified coinsurance (modco) transactions or coinsurance with funds withheld transactions with which the ceding insurer maintains the exclusive possession and control of the reinsured liabilities.[2] That said, the surge in Bermuda captive reinsurance from 2015 is not driven by the previously noted capital arbitrage. For instance, former NYDFS Superintendent Ben Lawsky coined the term "shadow insurance" in a 2013 NYDFS white paper to refer to captive reinsurance (Lawsky 2013). At the time, US life insurers used captive reinsurance to finance "excess capital"—that is, the difference between what the state regulators would like their insurers to hold as reserve and what the insurers thinks they should hold as reserve based on their own actuarial analysis (Koijen & Yogo 2016). This motive is largely absent with Bermuda today since it was approved by the NAIC as a "Qualified Jurisdiction" for reinsurance collateral reduction on January 1, 2015.[3]

[2]The Base Erosion and Anti-Abuse Tax (BEAT) was adopted as part of the 2017 tax reform bill and is a tax meant to prevent foreign and domestic corporations operating in the US from avoiding domestic tax liability by shifting profits offshore. The BEAT is applicable to base erosion payments paid or accrued in taxable years beginning after December 31, 2017. In principle, the BEAT would have greatly diminished the captive reinsurance tax benefit discussed above. However, a 2021 Private Letter Ruling from the IRS clarified that modco reinsurance transactions with an affiliated foreign re-insurer could be exempt from BEAT if they are structured in such a way that the US-domiciled insurer retroceded its insurance liabilities to the affiliated foreign re-insurer. For more details, see IRS PLR 202109001, which is available at `https://www.irs.gov/pub/irs-wd/202109001.pdf`.

[3]The NAIC invited the Bermuda Monetary Authority to participate in an "expedited review" in August 2013. During the expedited review process, the NAIC issued a public notice on its website requesting interested parties to submit public comments and received a single letter from the Association of Bermuda Insurers and Reinsurers (ABIR), which represents "the public policy interests of Bermuda's

## 3.2 Corporate debt risk-based capital arbitrage

Life insurers have a second arbitrage opportunity that fuels their shadow banking businesses, in addition to the Bermuda captive reinsurer tax arbitrage. US and Bermuda life (re)insurers face considerably lower risk-based capital charges when holding mezzanine CLO debt tranches (typically rated from AA to B) than their European counterparts as well as US and European banks. Table 3 summarizes the difference in capital charges between mezzanine CLO debt securities and similarly-rated public corporate bonds in the US and Europe. Compared to US and Bermuda insurers, US and European banks subject to Basel III and European insurers subject to Solvency II are highly discouraged from holding mezzanine CLO tranches. For example, the capital charge for a US insurer holding a BBB-rated CLO debt tranche is 2.5 percent, which is the same as a BBB-rated public corporate bond. An EU insurer operating under Solvency II would face a 98.5 percent capital charge when holding a BBB-rated CLO, which is 7.88 times larger than the corresponding charge on a BBB corporate bond (12.5 percent). The details for all the calculations in this sub-section are provided in Appendix B.

Risk-based capital charges for CLOs are considerably lower in the US because they are based solely on credit ratings. Other jurisdictions incorporate market-based measures of default risk, such as credit spreads. That is, US statutory accounting treats the default risk of mezzanine CLO tranches the same as an equivalently-rated public corporate bond. The ratio for US jurisdictions is close to one even though CLO debt securities have much larger credit spreads than equivalently-rated public corporate bonds. The last two columns of Table 3 shows that US and Bermuda insurers can earn about 3.6 times more spread for the same level of required capital by investing in a BBB-rated CLO

international insurers and reinsurers that protect consumers around the world." ABIR members include, among others, AIG and AXA, which appear in Table 1.

**Table 3: Comparing CLO capital charges in different regulatory jurisdictions.**

The table shows the ratio of capital required for CLO holdings to capital required for equivalently-rated public corporate bonds. In all cases, we assume the securities have a 5 year duration. The credit spreads reported in columns 6 and 7 are option-adjusted spreads. See Appendix C for full details. Source: Bloomberg LP, NAIC, Bermuda Monetary Authority, Basel III, and EU Solvency II regulations.

| Rating | NAIC RBC | Bermuda SCR | Basel III | EU Solvency II | Credit spreads (bps) | |
|---|---|---|---|---|---|---|
| | | | | | Corporate | CLO |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| A | 1 | 1.20 | 3.9 | 11.86 | 68.9 | 194.9 |
| BBB | 1 | 1.17 | 3.51 | 7.88 | 79.4 | 291.4 |
| BB | 1 | 1.25 | 7.72 | 18.22 | 202.6 | 710.6 |

debt tranche relative to a public corporate bond. Additional calculations, reported in Appendix C, show that US regulatory capital requirements increase in line with the rise in spreads for corporate bonds, shown in column 6.[4]

Bermuda offers an additional incentive to invest in mezzanine CLO by allowing life insurers to reduce their liabilities by the amount of excess spread on their investments, such as CLO debt securities (Devasabai 2022). Under US statutory accounting rules, excess spread must be held in reserve, rather than booked as an upfront profit, and cannot reduce liabilities. Although the Bermuda accounting practice is also allowed in Europe under Solvency II, the capital charge on CLOs in the US and Bermuda are considerably lower than in Europe because they are based on public corporate bond default experience.

Under US and Bermuda risk-based capital frameworks, life insurers can dramatically reduce their capital requirements by holding the entire debt stack of a CLO instead of the underlying pool of leveraged loans. For example, Table 4 shows that an insurer holding a

[4]For life insurers targeting 350 percent capital under NAIC C-1, the required capital for A-rated, BBB-rated, and BB-rated securities is 3 percent, 5 percent, and 16 percent, respectively.

portfolio of B-rated leveraged loans would face risk-based capital charges of 9.5 percent and 15 percent in the US and Bermuda, respectively. However, if this insurer packages the same portfolio of B-rated leverage loans into a CLO and purchases the entire CLO capital stack, it would face capital charges of 2.9 percent and 4.1 percent in the US and Bermuda, respectively. US and Bermuda insurers can cut their capital charges by more than two-thirds by holding a vertical slice of all CLO tranches instead of holding the loans in that CLO.

The capital treatment of CLOs in US and Bermuda regulatory jurisdictions gave asset managers affiliated with US and Bermuda life insurers a comparative advantage in CLO issuance. The Federal Reserve and SEC's risk retention rules that were enacted under Dodd-Frank in late 2016 required all deal issuers to retain 5 percent of the deal risk. The 5 percent retention may be held as a vertical slice, a horizontal slice, or a combination of the two, creating an L-shaped slice. Holding a vertical slice amounts to holding the entire capital structure of a CLO, which means insurers in the US and Bermuda can retain an affiliated CLO deal's risk relatively cheaply. In addition to the US risk retention rules, several other jurisdictions have introduced similar "skin in the game" requirements since the financial crisis.[5] So, although the US risk retention rule was partly repealed in 2018, life insurers continue to invest in CLOs issued by their affiliated asset managers to meet foreign rules and as signal of quality to all investors.[6]

US insurers can finance the risk retention vehicle in a variety of ways that show up in different parts of their statutory filings. From 2010 to 2018, US life insurance

[5]Rules were introduced in 2010 in Europe and 2019 in Japan.

[6]"A year after rules requiring firms to hold a chunk of their own CLO deals were scrapped, evidence suggests they're increasingly opting to do so of their own accord. 'CLOs getting issued have required more equity support from the manager compared to last year,' said Jim Schaeffer, the deputy chief investment officer at Aegon Asset Management in Chicago. 'Managers are being asked to buy a portion of the equity to get deals done.' Schaeffer's own firm has retained a small part of one deal, though 'nowhere near a control piece,' he said." (Gutscher & Williams 2019)

**Table 4: Comparing capital charges on CLOs and the underlying pools of leveraged loans.** The table shows NAIC RBC and Bermuda SCR capital requirements on corporate loans and structured securities. All values in the table are percentages. The weighted average calculation for structured securities assumes a typical CLO capital structure that issues 63% AAA, 12% AA, 6% A, 6% BBB, 5% BB, and 8% equity. Source: Authors' calculations based on data from Moody's Investor Services, NAIC, and Bermuda regulations.

| | Corporate loans | | | Structured securities | |
|---|---|---|---|---|---|
| Rating | NAIC | Bermuda | | NAIC | Bermuda |
| AAA | 0.2 | 0.4 | | 0.2 | 0.5 |
| AA | 0.4 | 0.8 | | 0.4 | 1 |
| A | 0.8 | 1.5 | | 0.8 | 1.8 |
| BBB | 1.5 | 3 | | 1.5 | 3.5 |
| BB | 4.5 | 8 | | 4.5 | 10 |
| **B** | **9.5** | **15** | | | |
| CCC | 23.8 | 26.3 | | | |
| Equity | | | | 30 | 35 |
| | | | **Wgt. Avg.** | **2.9** | **4.1** |

companies reported those risk retention structures. They often used intermediate vehicles to meet risk retention rules and transferred the CLO deal risk onto their balance sheets. Table 5 shows the risk retention structures created for the 161 US CLO deals that life insurer affiliates issued during that period. Appendix D describes the details of majority-owned affiliates, capitalized majority-owned affiliates, and capitalized manager vehicles. In addition to the US CLO deals, there were 37 European CLOs that used different methods of risk retention. In total, 69 of the 198 CLO deals satisfied risk retention rules using a vertical slice of the deal. A further 54 CLO deals used a horizontal slice and 4 CLO deals used an L-shaped slice.

**Table 5: Types of risk retention used by US life insurers.** Note that each insurer may choose a different method to retain risk for each CLO it issues. Data in the table cover 158 US CLOs issued or refinanced from 2010 to 2017 by US life insurer affiliates as of 2019Q2. In addition, there are 36 European CLOs that use different methods of risk retention.Source: Authors' calculation based on data from NAIC Statutory Filings, Fitch Ratings, and Bloomberg LP.

| Type of risk retention | No. of insurers | No. of CLOs |
|---|---|---|
| Balance Sheet | 3 | 9 |
| Majority-owned affiliates | 8 | 45 |
| Capitalized majority-owned affiliates | 4 | 12 |
| Capitalized manager vehicles | 2 | 5 |
| Other | 1 | 2 |
| Unknown | 10 | 85 |
| Total | 28 | 158 |

# 4 Funding shadow banking with fixed annuities

In this section, we describe how life insurers' funding structures have changed since the 2007-09 financial crisis to accommodate the development of life insurers' shadow banking

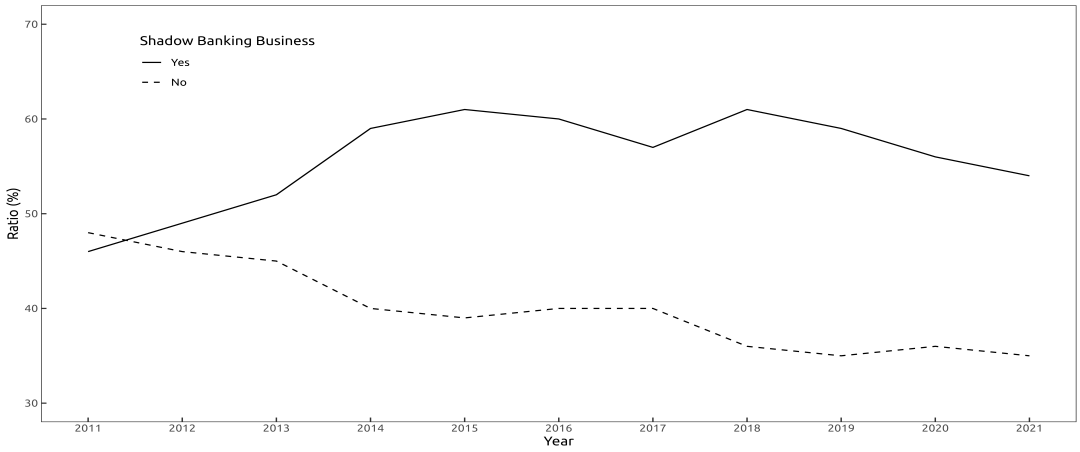
businesses. Figure 2 shows the striking shift of fixed annuities to life insurers with shadow banking businesses since 2010. The solid and dashed lines represent the share of fixed annuities for life insurers with and without a shadow banking business, respectively. The dollar value of these annuities is enormous. At the end of 2021, US life insurers had more than $3.3 trillion in fixed annuities, including both retail and institutional annuities and annuity-type contracts.[7] As we will explain, these contracts are the main source of funding for life insurers with shadow banking businesses. Because the vast majority of these insurance liabilities do not include mortality or morbidity risk, the insurance companies act exclusively as investment vehicles. In the rest of this section, we show that the liabilities of life insurers with shadow banking businesses resemble a mix of bank deposits, certificates of deposit, bonds, commercial paper, and repo, which is similar to the liability mix of investment banks in the years leading up to the 2007-09 financial crisis.

## 4.1 Deferred fixed annuities

By far the largest component of life insurance liabilities used to fund shadow banking businesses are individual deferred fixed annuities, reaching around $3 trillion in 2021. Deferred fixed annuities are strictly a tax-deferred saving vehicle that do not make life-contingent payments. Economically, deferred fixed annuities are very similar to banks' certificates of deposit from the perspective of investors, and the two are often considered

[7]Two broad types of deferred annuities are used by individuals in the US to save for retirement on a tax-deferred basis: Deferred fixed annuities and (deferred) variable annuities (VAs). Deferred fixed annuities are general account obligations of life insurers that offer a guaranteed rate of return over a set time period with tax deferrals. Deferred fixed annuities are the focus of this section and should not be confused with VAs. VAs, as their name suggests, have a rate of return that varies with the return on the stocks, bonds, and money market funds underlying the VA contracts and the assets backing the VAs remain the property of the VA account holders. The VA assets in life insurers' separate accounts are typically excluded from leverage calculations, etc.

**Figure 2: Growth in fixed annuities at life insurers with shadow banking businesses.** The lines in this chart show the percent of general account assets that is funded by deferred fixed and institutional annuities. The upward trend in the solid line relative to the dashed line shows the growth in these annuities at life insurers with shadow banking businesses. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, and Bloomberg LP.




substitutes by individuals close to retirement age.[8] Investors in deferred fixed annuities are severely restricted from withdrawing their funds for a fixed period of time. These withdrawal limits mean that deferred fixed annuities are a generally stable source of funding for life insurers. In exchange, the insurer guarantees the principal and, in some cases, the rate of return.

Life insurers with shadow banking businesses can develop their annuity liabilities in three ways. First, they can sell new deferred fixed annuity contracts. Sales of new deferred fixed annuity contracts has been steady at about 4 percent annually over the last decade—see Figure A.4(a) in Appendix A. The holders of these annuities can accumulate wealth on a tax-deferred basis until their retirement.

The second way for life insurers to develop their annuity liabilities is to purchase

[8]Variable annuities are a type of deferred annuity but are not an appropriate source of funding for life insurers' shadow banking businesses because those contract holders have full discretion and ownership over the asset portfolio funded by their consideration.

existing deferred fixed annuity blocks of business through reinsurance. In the period following the 2007-09 financial crisis, the market for blocks of annuities business became dislocated as interest rates remained low. Insurer guarantees on these products render them interest rate sensitive and less profitable in the low-interest-rate environment. As a consequence, sellers struggled to find willing buyers for their strained businesses and prices plummeted. The dislocation in the market helped to fuel the rapid expansion of private equity firms in the life insurance industry starting in 2010 that we explained in Section 2. These relatively low-cost blocks of business became natural targets for private equity firms developing their corporate lending businesses. PE-backed insurers acquire blocks of annuity business through third-party reinsurance and outright purchases of life insurance companies.

The third and final way for life insurers to develop their annuity liabilities is to engage in pension buyout transactions. Corporations with employee defined benefit (DB) pension plans have also sought to sell their obligations to avoid costly payouts amid low interest rates. These plans are generally big and require large balance sheet capacity. Although large incumbent life insurers such as Prudential have been the main buyer of DB liabilities, newer PE-backed life insurers have entered the market in recent years. Figure A.5 in Appendix A shows the large pension buyouts since 2012 that involved assets of $1 billion or more. All except two of these buyouts went to US life insurers with shadow banking businesses.

A pension buyout creates a large group annuity liability for the life insurer. The pension fund trustees of a corporation buy a large group annuity contract from a life insurer by paying a single up-front consideration that covers all of the pension fund's commitments to its members. After a transitional period of typically two years or less,

the initial annuity contract is broken into a collection of individual annuity contracts issued to each of the pension fund members. Once the individual contracts have been issued to the fund members, the trustees no longer have the obligation to pay pension benefits and can wind down the fund and the pension fund sponsor can remove the pension liability from its balance sheet.

Another type of group annuity liability is general account stable value products. Stable value products are guaranteed insurance accounts marketed by life insurers as an alternative to money market mutual funds in employer-provided defined contribution (DC) plans, such as 401(k), 457, and 403(b) plans. Guaranteed insurance accounts are provided to DC plan managers via a group annuity issued using the general account insurance company. Stable value products offer investors the same degree of liquidity as money market mutual fund shares. Although it is not possible to separately identify stable value products within group annuities using regulatory filings, the Stable Value Investment Association estimates that general account stable value products amount to about $375 billion at the end of 2020.

## 4.2 Institutional annuities

Larger life insurers with an investment-grade credit rating are able to expand their insurance liabilities beyond individual and group fixed deferred annuities with institutional annuities (Figure A.4(b) in Appendix A). Institutional annuities are primarily funding agreements, which are deposit-type contracts with discretionary terms. Funding agreements are general account liabilities that pay a fixed or floating interest rate for a set period of time. Only life insurers with a sufficiently large balance sheet and a sufficiently high credit rating can issue funding agreements at favorable rates. This is

one reason for keeping control of the insurer asset and liabilities in the US.

As with deferred fixed annuity liabilities that do not make payments conditional on the survival of the contract holders, institutional funding agreements have neither mortality nor morbidity contingencies. They can be privately placed, used to obtain advances from FHLBs, structured as guaranteed interest contracts, or securitized into FABS (Foley-Fisher, Narajabad & Verani 2020). Because they are backed by general account assets, funding agreements are insurance obligations that are senior to debt and, therefore, allow the insurer to borrow at lower cost than by issuing debt or equity (Foley-Fisher, Narajabad & Verani 2020). Life insurers with shadow banking businesses have issued about $425 billion in funding agreements that include little to no mortality risk that are not legally debt contracts and thus do not enter traditional measures of leverage. In addition, they are largely tax exempt in Bermuda—see Figure A.3 in Appendix A.

By tailoring their funding agreements to obtain the cheapest source of funding, life insurers can maximize the spread they earn over the cost of funding. For example, life insurers use FABS to convert funding agreements into short-term structured products that grant access to lower-cost wholesale funding markets. Funding agreement-backed commercial paper is attractive to short-term institutional investors, such as money market funds and private cash pools. These types of contracts give the owner the option to reclaim their funding from insurers on relatively short notice. FABS allow life insurers to transform an insurance liability issued from their general account into corporate debt.

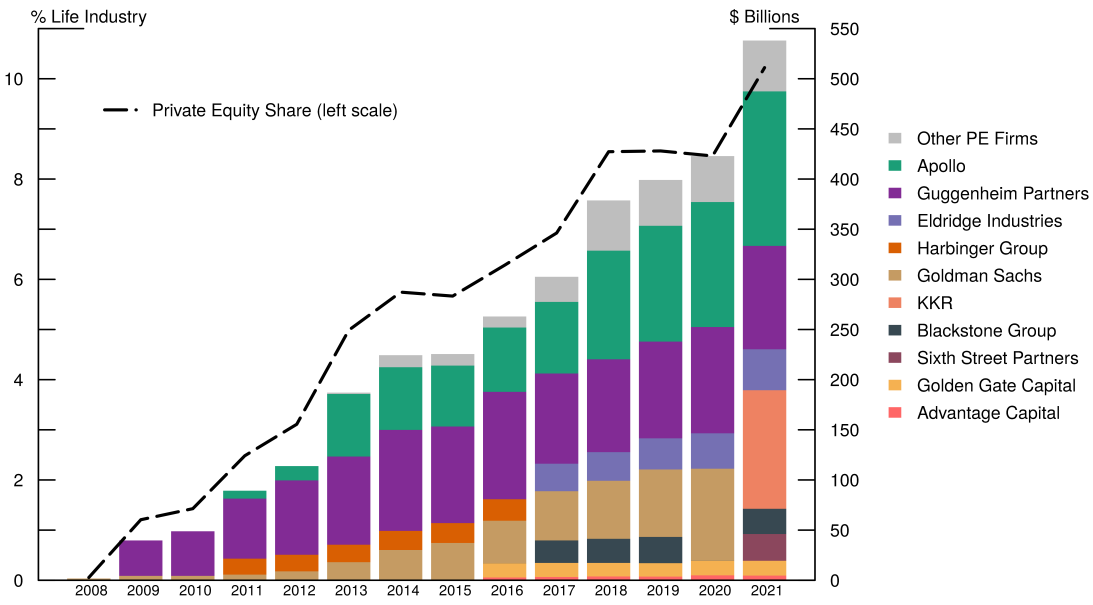
These wholesale funding activities render a life insurer vulnerable to runs. An early sign of the impending financial crisis of 2007-09 was when short-term institutional investors ran on certain short-term funding markets. These investors are sensitive to any repricing of risk because they are themselves vulnerable to runs (Kacperczyk & Schnabl

2013). Short-term institutional investors ran on short-term FABS issued by several other large life insurers (Foley-Fisher, Narajabad & Verani 2020). Runs on life insurers are like large unexpected adverse shocks to cash flows (Foley-Fisher, Narajabad & Verani 2019). During the financial crisis, runs on insurers forced them to scramble for liquidity from other sources, including FHLBs. In some cases, insurers required substantial government assistance to prevent spillovers to households and to the rest of the financial system.

## 4.3 Private equity firms entry into the US life insurance industry

The combination of cheap money, private credit expertise, arbitrage opportunities, and search for yield by worldwide pension and retirement fund managers attracted private equity firms into the US life insurance industry. Partnering with life insurers is especially attractive to private equity firms, as a way to scale up their corporate lending businesses (Kirti & Sarin 2020). Figure 3 shows the rapid growth of life insurers controlled by private equity firms. Starting from virtually nothing in 2008, as of 2021Q2 private equity firms control roughly 10 percent of US life insurance industry general account assets, equivalent to nearly $500 billion. That said, Figure 3 shows that private equity-backed insurers are only part of a trend in the life industry to grow shadow banking businesses. For instance, we find that both incumbent life insurers and private equity-backed life insurers have developed the shadow banking business we described in this section. We conclude that the growth of shadow banking in the life insurance industry is a consequence of the post-2009 environment rather than the arrival of private equity firms in the life insurance industry.

**Figure 3: US life insurer general account assets controlled by private equity firms.** The bars in this chart show the dollar value of life insurers' general account assets that are controlled by the private equity firms listed on the right of the chart. The dashed line shows the total amount of these assets as a percentage of the entire life insurance industry's general account assets. Source: Authors' calculations based on NAIC Statutory Filings.




Source: Staff estimates based on data from the NAIC Annual Statutory Filings.

# 5 Lending to below-investment grade firms

In this section, we show how life insurers' shadow banking businesses use the fixed annuity liabilities and arbitrage opportunities described in the previous sections to lend to below investment-grade firms. Our analysis of life insurers' risky corporate investments uses a broad range of detailed data reported in insurers' statutory filings. In addition to the equity and fixed-income investments reported in Schedule D, we parse the information contained in Schedules DA, BA, and Y. Schedule DA reports life insurers' short-term investments, in which we identified a number of warehouses for CLOs financed by life insurers' general accounts. Schedule BA reports other long-term investments, such as fund holdings and affiliate equity investments, also on a case-by-case basis, in which we identified funding to CLO risk retention vehicles. Schedule Y, which we laboriously used earlier to identify the triangular organization of insurers with a shadow banking business, provides important details about the ownership shares of the various investment vehicles, such as off-balance-sheet leveraged loan warehouses and risk-retention vehicles.

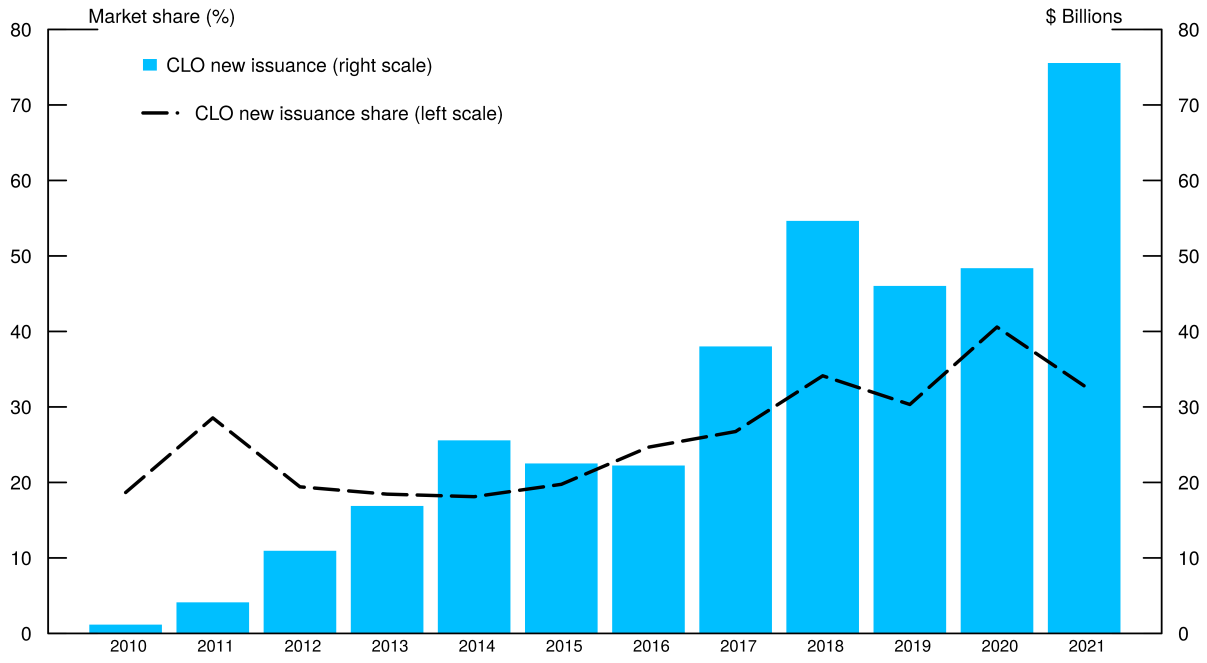
## 5.1 Securitization without risk transfer

We begin by describing the surge in CLO originations by US life insurers. We then explain the institutional structures that were used to support the boom. CLOs are securitization vehicles to shift risk in the underlying pool of leveraged loans to different investors. We show how these vehicles are designed to retain significant amounts of risk obscurely on the balance sheet of the life insurers that originated the CLOs.

The dashed line in Figure 4 shows that the share of CLO new issuance volume attributable to US life insurer affiliates doubled from about 20 percent in 2012 to about 40 percent in 2020. CLO gross issuance by US life insurers reached a record $60 billion

in 2018. The figure shows new issuance of both US dollar-denominated "US" CLOs and euro-denominated "Euro" CLOs. Both these types of CLOs may contain leveraged loans to US firms.

**Figure 4: CLO new issuance volume by US life insurer affiliates (includes Euro and US CLOs).** The dashed line in the figure shows US life insurers volume as a share of total CLO new issuance. Last reported observation is annualized new issuance volume for 2021:Q1. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, Fitch Ratings, and Bloomberg LP.




CLO market growth of US life insurers means they are increasingly important to the leveraged loan market, as shown in Figure 1(b). The most recent data indicate that life insurers' CLOs contain just over 25 percent of all leveraged loans in CLO vehicles, or just under $200 billion in loans.

Figure 1(c) and Table 6 summarize the distribution of the deal risk that was retained on the balance sheet of insurers for affiliate CLO deals at the end of the year of issuance. We constructed these data by combining exposures recorded in Schedules D, DA, and BA.

**Table 6: Distribution of affiliated CLO deal risk retained by US life insurers.**

Each row reports the distribution across CLOs of the holdings of US life insurers in the CLOs that they issued in that year. Holdings are calculated as the sum of fixed income investments reported in Schedule D and other investments reported in Schedule BA, including equity tranches and holdings of risk retention vehicles. We assume that an insurer's holdings of an affiliate risk retention vehicle are shared equally between the CLOs that are supported by that vehicle. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, Fitch Ratings, and Bloomberg LP.

| Year | Mean | p25 | Median | p75 | # of CLOs |
|---|---|---|---|---|---|
| 2010 | 12.5 | 12.5 | 12.5 | 12.5 | 1 |
| 2011 | 15.1 | 13.3 | 18.5 | 18.6 | 3 |
| 2012 | 13.9 | 9.1 | 11.5 | 18.4 | 14 |
| 2013 | 17.8 | 4.9 | 10.8 | 30.1 | 27 |
| 2014 | 14.7 | 3.4 | 8.1 | 16.4 | 30 |
| 2015 | 18.3 | 3.1 | 6.9 | 18.8 | 25 |
| 2016 | 17.7 | 5.6 | 9.3 | 15.5 | 26 |
| 2017 | 10 | 3.6 | 6.7 | 11.2 | 71 |
| 2018 | 8 | 2.1 | 5.6 | 10.1 | 67 |
| 2019 | 9 | 1.3 | 3.9 | 11 | 43 |
| 2020 | 11.2 | 1.3 | 7.7 | 13.4 | 43 |
| 2021 | 8.9 | 2.6 | 6.7 | 12.3 | 57 |
| Total | 11.6 | 2.9 | 6.8 | 13.3 | 407 |

For each deal, we first calculate fixed-income investments in each deal as reported on Schedule D. We then add the exposure to each deal reported on Schedules DA and BA, including equity tranches and holdings of risk-retention vehicles. We assume that an insurer's holdings of an affiliate risk-retention vehicle are divided among the CLOs proportionate to the size of each deal supported by that vehicle.

The table reports the distribution of risk retained across CLOs issued in each year. Across the sample as a whole, US life insurers retain, on average, about 7 percent of the deals they support for their affiliated asset managers. The mean of the distribution is consistently above the median as insurers retain more risk for some deals.

This form of risk retention is remarkably similar to securitization without risk transfer. The goal of the CLO structure is to offload to different investors the risk of holding a portfolio of leveraged loans. The risk retention structure is intended to align the incentives of the CLO manager and investors. However, life insurers with shadow banking businesses are financing this deal risk with annuity liabilities. The exposure may create a vulnerability for life insurers with shadow banking businesses, as we describe in the next section.

## 5.2 What kind of CLO tranches do insurers buy?

Focusing closely on US insurers' total holdings of CLOs, Figure 1a shows striking growth. CLO holdings have increased exponentially, reaching about $194 billion by the end of 2020. In comparison, the dashed line in the figure shows that total bond holdings in the US insurance industry increased only by about 20 percent over the same time period. Most of these holdings are by life insurers or by P&C insurers that are part of large life insurance groups.

Life insurers' attraction to CLOs developed for several reasons. First, many CLOs offer floating interest rates, which allowed insurers to avoid locking themselves into long-term fixed-income investments during the post-crisis period of low interest rates. In addition, the supply of other collateralized securities has contracted since the crisis, particularly the supply of non-agency residential mortgage-backed securities (RMBS). Moreover, as discussed in Section 3, CLOs offer life insurers an attractive return relative to similarly-rated public corporate bonds. Lastly, until recently, crisis-response statutory accounting principles could be exploited to adjust a CLO's credit rating and lower its capital charge (see Appendix C for details).

We next investigate how CLO holdings evolved *within* the life insurance industry. The top-left and top-right panels of Figure 5 plot CLO holdings separately for life insurers without and with shadow banking businesses, respectively. The color indicates the type of CLO tranches with the senior tranche being typically rated AAA. These panels show that life insurers without shadow banking businesses lagged those with shadow banking businesses in term of CLO investment, especially the mezzanine tranches.

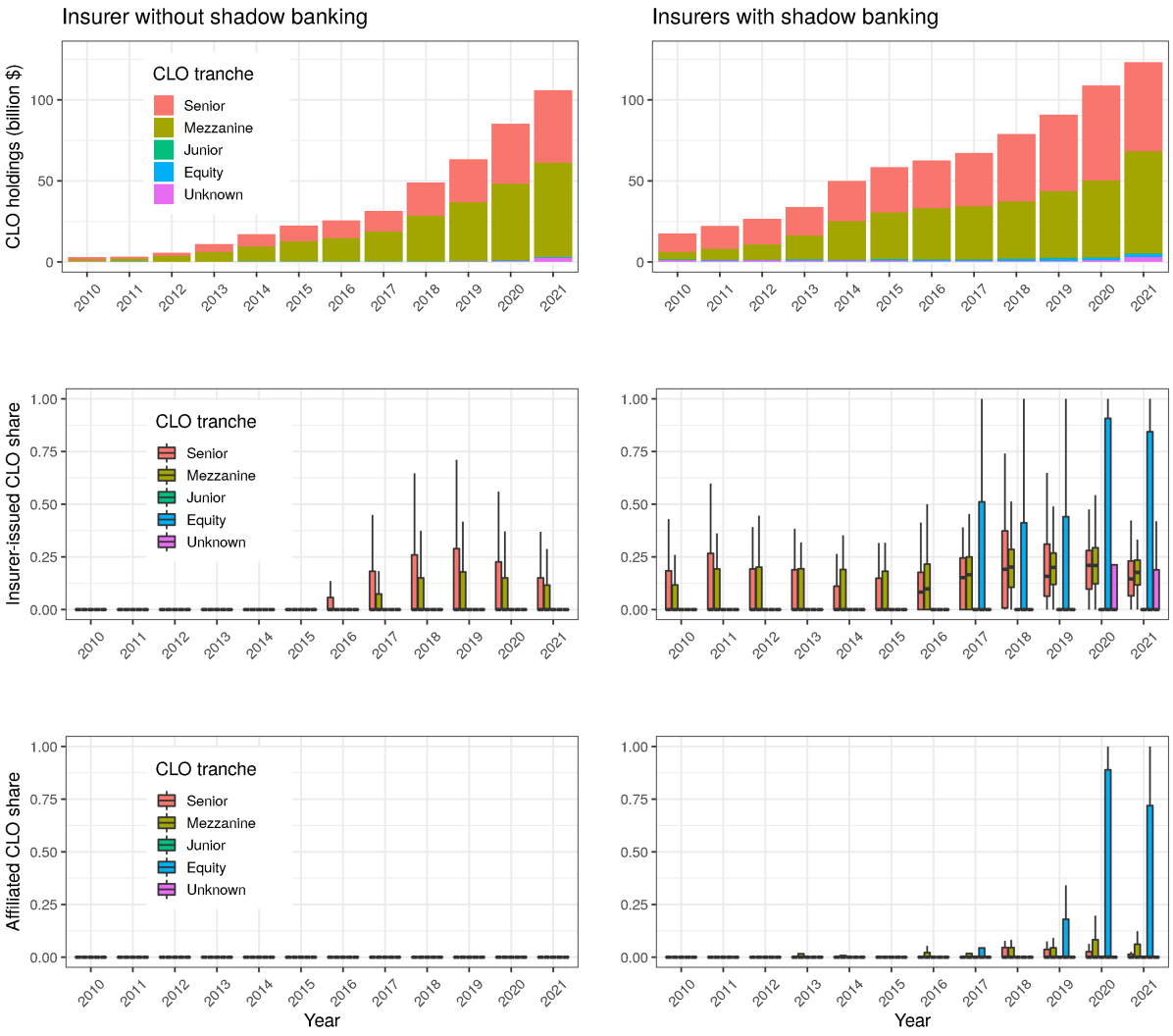
The boxplots in the middle panels of Figure 5 plot the distribution across insurer groups of the total amount of insurer-originated CLO holdings, expressed as a fraction of an insurer's total CLO holdings. That is, let $m_{ijkt}$ denote the dollar amount of class category $k$ of CLO $j$ held by insurer $i$ at the end of year $t$ and let $p_j \in \{0,\ 1\}$ be an indicator variable that takes the value 1 if CLO $j$ was originated by any insurer and 0 otherwise. The boxplots in the panels are the distributions across insurers of

$$\text{CLO\_holding\_share}_{ikt} = \frac{\Sigma_j m_{ijkt} \times p_j}{\Sigma_j m_{ijkt}}.$$

The unit of observation in a boxplot is the share of an insurer's CLO holdings in a given

class category that was originated by any insurer. We report separate boxplots for each CLO class category $k$ and year $t$.

**Figure 5: US insurers' CLO holdings by CLO origin.** Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, Fitch Ratings, and Bloomberg LP.




The figure suggests that insurers with shadow banking businesses hold significantly higher shares of CLOs originated by insurers. Indeed, insurers without shadow banking businesses do not buy *any* CLOs originated by insurer affiliates prior to 2014. In addition, insurers with shadow banking businesses tend to hold more tranches of CLOs issued by

insurers than the insurer market share in CLO issuance would suggest.

We can confirm the visual inspection of the middle panels of Figure 5 in a more formal regression setting:

$$\begin{aligned}\text{CLO\_holding\_share}_{ikt} =& \alpha_i^1 + \alpha_t^2 + \gamma \text{High\_yield\_CLO}_k + \\ & \beta \text{High\_yield\_CLO}_k \times \text{Shadow\_bank}_i + \epsilon_{ikt} \ ,\end{aligned} \tag{1}$$

where the dependent variable $\text{CLO\_holding\_share}_{ikt}$ is the variable defined above. The variables on the right-hand side of the specification are all indicator variables. $\text{High\_yield\_CLO}_k \in \{0,\ 1\}$ takes the value 1 if the tranche $k$ is not senior. $\text{Shadow\_bank}_i \in \{0,\ 1\}$ takes the value 1 if insurer $i$ has shadow banking business. The specification includes insurer fixed effects ($\alpha_i^1$) and year fixed effects ($\alpha_t^1$). The coefficient ($\beta$) on the interaction term ($\text{High\_yield\_CLO}_k \times \text{Shadow\_bank}_i$) tests the hypothesis that the shares held by life insurers with shadow banking businesses are different from insurers without shadow banking businesses.

Table 7 shows the results from estimating equation 1. Column 1 reports the within-insurer partial correlation between $\text{CLO\_holding\_share}_{ikt}$ and $\text{High\_yield\_CLO}_k$, suggesting that insurers hold relatively more insurer-originated subordinated CLO tranches. The coefficient of interest on the interaction term in Column 2 is statistically and economically significant, confirming that the effect comes from insurers with shadow banking businesses. The coefficient estimates in Column 2 suggest that insurers with shadow banking businesses, on average, hold a 4.6 percentage point (or 19.2 percent) larger share of the insurer-originated subordinated CLO tranches relative to insurer-originated senior tranches. For comparison, $\text{CLO\_holding\_share}_{ikt}$ is about 26 percent,

on average, for insurer-originated senior tranches. Column 3 shows that this relationship is robust to controlling for aggregate shocks with year fixed effects and allowing for error correlation across insurers and across years.

**Table 7: Insurers with shadow banking businesses hold a disproportionately large amount of the risky tranches of CLOs issued by insurers.** The dependent variable in all specifications (CLO_holding_share$_{ikt}$) is the fraction of all class $k$ CLO tranches held by insurer $i$ at the end of year $t$ that were issued by any insurer. The independent variables are all indicator variables. High_yield_CLO$_k \in \{0,\ 1\}$ takes the value 1 if the tranche $k$ is not senior. Shadow_bank$_i \in \{0,\ 1\}$ takes the value 1 if insurer $i$ has shadow banking business. PE-owned$_{it} \in \{0,\ 1\}$ takes the value 1 if insurer $i$ is owned by private equity at the end of year $t$. See Table E.1 for summary statistics of all variables. Note: $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

| *Dependent variable:* | CLO_holding_share$_{ikt}$ | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| High_yield_CLO$_k$ | 0.036*** | 0.014 | 0.014 | 0.033* |
| | (0.013) | (0.013) | (0.016) | (0.016) |
| High_yield_CLO$_k$ × Shadow_bank$_i$ | | 0.101*** | 0.099** | |
| | | (0.038) | (0.038) | |
| PE-owned$_{it}$ | | | | 0.093 |
| | | | | (0.078) |
| High_yield_CLO$_k$ × PE-owned$_{it}$ | | | | 0.073 |
| | | | | (0.053) |
| SE clustering | Firm | Firm | Firm year | Firm year |
| Fixed effects | Firm | Firm | Firm year | Firm year |
| Observations | 4,815 | 4,815 | 4,815 | 4,905 |
| Adjusted $R^2$ | 0.213 | 0.219 | 0.229 | 0.227 |

Lastly, Column 4 shows that the results are *not* driven by PE-owned insurers, who may be taking on more risk than the average insurer (Kirti & Sarin 2020). We construct an indicator variable PE-owned$_{it} \in \{0,\ 1\}$ that takes the value 1 if insurer $i$ has private equity ownership at the end of year $t$. In Column 4, we replace Shadow_bank$_i$ with PE-owned$_{it}$.

The coefficient estimate on the interaction term is not statistically different from zero. This finding suggests that it is the shadow banking businesses of life insurers and not private equity ownership that drives the disproportionate holdings of subordinated CLOs originated by insurers affiliates.

There are two potential explanations for this pattern. The first explanation is risk retention, as previously discussed.[9] The boxplots in the bottom panels of Figure 5 visually confirm that insurers with shadow banking businesses invest in the CLOs that they themselves originate, especially the equity tranche. Indeed, insurers with shadow banking businesses began holding the riskiest tranches of their own CLOs from about 2016, which corresponds to the arrival of the risk-retention rule discussed in detail in the next section.

The second potential explanation is reach for yield. The debt securities issued by insurer-affiliated CLOs may offer a higher yield per rating than non-insurer CLOs. Table 8 uses data from Moody's Analytics on the universe of CLO debt tranches to test this hypothesis. Our CLO tranche-level dataset allows us to compare the spread on similarly rated CLO tranches issued in the same year by insurer affiliated and unaffiliated CLO managers.

The dependent variable ($\text{Spread}_{ijk}$) in Column 1 of Table 8 is the spread on debt tranche $i$ of CLO deal $j$ issued by CLO manager $k$. The main independent variable ( $\text{Insurer\_CLO}_{jk}$) takes the value one if the CLO is managed by an insurer affiliate and zero otherwise. Column 1 estimates the average difference in spread for CLO debt securities issued by insurer affiliates and non-affiliates. This specification controls for the tranche's maturity at issuance, the deal's AAA tranche attachment point, the deal's equity tranche

[9] A closely-related explanation that is not directly testable is investor preferences. Those insurers engaging in CLO risk retention with their own CLOs may prefer purchasing CLO tranches from other managers that have "skin in the game" by engaging in CLO risk retention. This could explain insurers' preference for mezzanine and junior CLO tranches issued by third party insurer affiliates.

**Table 8: CLOs issued by insurer affiliates do not offer higher yields.** Our sample includes all debt tranches issued by US CLOs from 2010 to 2021. We restrict our sample to tranches whose spreads are based on 3-month LIBOR. The dependent variable ($\text{Spread}_{ijk}$) in all specifications is the spread on debt tranche $i$ of CLO deal $j$ issued by CLO manager $k$. The independent variable $\text{Insurer\_CLO}_{jk}$ takes the value one if the CLO is managed by an insurer affiliate and zero otherwise. Tranche maturity ($\text{Tranche\_maturity}_{ijk}$) is measured at the point of issuance. All specifications include the deal's AAA tranche attachment point and the size of its equity tranche as control variables. The regressions are weighted by tranche size measured as the tranche amount at issuance. We report robust standard errors clustered by CLO manager. See Table E.2 for summary statistics of all variables. Note: $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

| *Dependent variable:* | $\text{Spread}_{ijk}$ | | | |
|---|---|---|---|---|
| *Credit rating of data sample:* | AAA to B | AAA to B | AAA only | AA to B |
| | (1) | (2) | (3) | (4) |
| $\text{Insurer\_CLO}_{jk}$ | $-0.025^{*}$ | 0.008 | $-0.007$ | $0.070^{*}$ |
| | (0.013) | (0.020) | (0.016) | (0.036) |
| $\text{Tranche\_maturity}_{ijk}$ | $0.054^{***}$ | $0.073^{***}$ | $0.070^{***}$ | $0.093^{***}$ |
| | (0.004) | (0.003) | (0.003) | (0.007) |
| CLO deal senior tranche attachment $\text{point}_{jk}$ | $0.537^{***}$ | 0.253 | $-0.014$ | 0.812 |
| | (0.194) | (0.229) | (0.115) | (0.539) |
| CLO deal equity $\text{fraction}_{jk}$ | $1.381^{***}$ | $0.772^{**}$ | $0.948^{***}$ | $-0.581$ |
| | (0.263) | (0.326) | (0.278) | (0.844) |
| Tranche rating FE | Y | Y | - | Y |
| Tranche issue year FE | Y | N | N | N |
| Tranche issue year × CLO manager FE | N | Y | Y | Y |
| Observations | 10,708 | 10,708 | 3,900 | 6,808 |
| Adjusted $R^2$ | 0.926 | 0.935 | 0.432 | 0.921 |

size. Fixed effects for the year of issuance and credit rating are included. The regression is weighted by tranche size. Robust standard errors clustered by CLO managers are reported.

The adjusted $R^2$ reported in column 1 shows that this specification can account for almost 93 percent of the variation in CLO tranche spreads. The coefficient estimate on Insurer_CLO$_{jk}$ in Column 1 is statistically insignificantly different from zero, suggesting that, on average, CLO tranches offered by insurer affiliates do not offer a higher yield than unaffiliated insurers. That said, a potential issue with this interpretation is that some CLO managers are choosing to acquire insurers to issue CLOs and/or retain risk. This type of selection could create unobserved heterogeneity across managers that biases the coefficient Insurer_CLO$_{jk}$ in column 1 toward zero. To control for CLO manager selection, Column 2 replaces the CLO year of issue fixed effect with a CLO year of issue interacted with CLO manager fixed effect. Column 2 shows that the null result survives controlling for this selection effect. Columns 3 and 4 further investigate this issue by splitting the sample by senior tranches rated Aaa by Moody's and subordinated tranches rated Aa to B by Moody's, respectively. Comparing the coefficient estimates on Insurer_CLO$_{jk}$ across columns 3 and 4 reveals that there are no differences across senior and subordinated tranches originated by insurer and non-insurer affiliates. Therefore, our results suggest that insurers do not purchase CLO tranches from insurer affiliates to reach for yield.

# 6 Vulnerabilities to aggregate corporate-sector shocks

In this section, we gauge the potential CLO-related losses for insurers with shadow banking businesses. We find that their exposures are comparable to their holdings of

nonprime RMBS just prior to the 2007-09 financial crisis. As we learned from that crisis, even relatively small exposures may create a vulnerability for life insurers. We describe how life insurers' shadow banking businesses render them vulnerable to runs by institutional investors. Lastly, we use the pandemic as a natural experiment to show that investors are attuned to life insurers' shadow banking businesses.

Panel A of Table 9 shows our estimates of potential CLO-related losses for insurers with shadow banking businesses. The first line is our estimates of exposure to CLOs issued by each insurer's own affiliates. Deal risk retention—described in the previous section—appears in the third column of this row. The second row of the table shows exposure to CLOs issued by affiliates of other insurers. And the third row shows exposure to CLOs issued by non-insurers. In terms of dollar amounts, insurers' largest exposure is to CLOs that were issued by managers who were unaffiliated with insurers. That said, insurers hold a disproportionately large amount of their own-affiliates' deal risk: More than 20 percent of their exposure to affiliate-issued CLOs is in junior tranches, compared to only about 7 percent for non-insurer CLOs and less than 1 percent for other insurers' CLOs.

To be sure, the dollar amounts of these exposures are small compared to the size of insurers' balance sheets. That said, they are comparable to the industry's exposure to nonprime RMBS just before the 2007-09 financial crisis. In 2008:Q2, the insurance industry held about $138 billion of nonprime RMBS on their balance sheets (Chernenko, Hanson & Sunderam 2014). A tranche-level breakdown of RMBS holdings for the subset of insurers with shadow banking businesses is not available. For comparison, the entire insurance industry's exposure to mezzanine and junior CLO debt—shown in Panel B—was $130 billion in 2021.

**Table 9: Estimating potential CLO losses.** All amounts are in billions of US dollars, estimated at the end of 2021. The senior/mezzanine/junior designation per tranche is determined by a combination of Moody's and Bloomberg tranche descriptions and credit ratings from Moody's, Standard & Poor, and Fitch credit rating agencies. We identify the highest credit rating across all initial/earliest ratings for each tranche. Tranches rated AAA are senior, AA - BB are mezzanine, and B and below that are junior. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, Fitch Ratings, and Bloomberg LP.

*Panel A: Life insurers with shadow banking businesses*

| | Senior | Mezzanine | Junior | Total |
|---|---|---|---|---|
| Affiliated CLO | 0.8 | 4.0 | 1.2 | 6.0 |
| Other-insurer CLO | 4.9 | 7.3 | 0.3 | 12.4 |
| Non-insurer CLO | 30.1 | 39.7 | 3.1 | 73.0 |
| Total | 35.8 | 51.0 | 4.6 | 91.4 |

*Panel B: All insurers*

| | Senior | Mezzanine | Junior | Total |
|---|---|---|---|---|
| Affiliated CLO | 0.8 | 4.5 | 1.4 | 6.8 |
| Other-insurer CLO | 17.9 | 20.6 | 0.6 | 39.1 |
| Non-insurer CLO | 85.3 | 97.7 | 6.2 | 189.1 |
| Total | 104.0 | 122.2 | 8.1 | 235.0 |

A comparison to subprime exposures just before the 2007-09 financial crisis is warranted because insurers experienced runs during that crisis (Foley-Fisher, Narajabad & Verani 2020). An early sign of the impending financial crisis of 2007-09 was when short-term institutional investors ran on certain securities. These investors are sensitive to any repricing of risk because they are themselves vulnerable to runs (Kacperczyk & Schnabl 2013). Short-term institutional investors ran on securities lending programs—notably AIG—and ran on short-term FABS issued by several other large life insurers (McDonald & Paulson 2015, Foley-Fisher, Gissler & Verani 2019). Runs on life insurers are like large unexpected adverse shocks to cash flows (Foley-Fisher, Narajabad & Verani 2019). During the financial crisis, runs on insurers forced them to scramble for liquidity from other sources, including FHLBs. In some cases, insurers required substantial government assistance to prevent spillovers to households and to the rest of the financial system.

For insurers with shadow banking businesses, a widespread decline in the value of the loans backing the CLOs could directly wipe out the CLO deal risk they hold. This might trigger further pressure as liquidity-sensitive institutional investors—such as FABS investors or FHLBs—increase the cost of funding or withdraw it entirely. The combination of eroding equity and rapid institutional investor withdrawals could create a severe liquidity crisis for the life insurance industry. We next show that investors are attuned to these kinds of risks for life insurers with shadow banking businesses.

## 6.1 Investors are attuned to insurers' shadow banking businesses

By their nature, life insurers' shadow banking businesses are difficult to analyze. Therefore, we expect more disagreement among stock traders about how the pandemic might affect life insurers with a shadow banking business, before massive interventions

by the Federal Reserve and the US Treasury. Adopting a difference-in-differences with variable treatment approach, we test the hypothesis that insurers with larger shadow banking businesses at the beginning of 2020 experienced relatively higher stock price volatility during the COVID-19 pandemic. We measure each insurance group's exposure to shadow banking using the laboriously constructed data discussed previously. For each life insurance group, we calculate the variable Aff. CLO exp.$_i$/TAC$_i$, which is the ratio of the amount of insurer $i$'s general account holdings of insurer $i$'s affiliated CLOs to this insurance group total adjusted capital. In the main specification, the variable treatment is an insurer's exposure to shadow banking measured by Aff. CLO exp.$_i$/TAC$_i$. The second difference in our empirical approach is before and after the March 11, 2020 pandemic announcement date. A loading of stock price volatility on insurers' shadow banking variable would suggest that market participants try to learn more about these insurers as the shock propagates and disproportionately affects the US corporate sector.

We implement our baseline test in a linear regression framework. The unit of observation is a life insurer-trading day. The sample of observation extends from January 2, 2020 to June 23, 2020. The coefficient $\beta$ on the interaction between pandemic$_t$ and Aff. CLO exp.$_i$/TAC$_i$ in the following linear model allows us to trace the difference-in-differences effect of the increase in shadow banking activities on insurer stock price volatility during the COVID-19 pandemic:

$$\text{Stock Volatility}_{it} = \alpha_i + \gamma \text{pandemic}_t + \beta \text{pandemic}_t \times \frac{\text{Aff. CLO exp.}_i}{\text{TAC}_i} + \epsilon_{it} \ , \qquad (2)$$

where pandemic$_t$ is a dummy that takes the value 1 after March 11, 2020. Our specification (2) includes insurer fixed effects $\alpha_i$ to absorb the effects of potentially unobserved fixed insurer characteristics—e.g., difference in state regulations and insurer

rating and business focus—that may directly affect life insurers' stock price volatility. The coefficient of interest is $\beta$, which represents the differential effect of the size of an insurer's shadow banking business on its stock price volatility during the pandemic. We report insurer clustered robust standard errors as our baseline.

Table 10 reports the results.[10] Column 1 shows that insurers with larger shadow banking businesses experienced disproportionately higher stock price volatility during the pandemic. The coefficient on the interaction term suggests that a one standard deviation increase in Aff. CLO exp.$_i$/TAC$_i$ is associated with a 0.074 increase in stock price volatility during the pandemic. This effect is economically large. For reference, the mean stock price volatility is 0.026 in the pre-pandemic sample. Columns 2 and 3 control for the effect of daily variation in aggregate market conditions by including the VIX and trading day fixed effects, respectively, and show that our baseline difference-in-difference estimate is robust. Column 4 relaxes the specification of Column 2 by allowing the effect of VIX to vary before and after March 11, 2020, with no effect on our coefficient of interest. Lastly, Column 5 reports the same difference-in-difference specification as in Column 1 using life insurance groups' total adjusted capital instead of Aff. CLO exp.$_i$/TAC$_i$ and shows that our baseline estimated effect is not driven by life insurers' size.

Lastly, we investigate the effect of the Federal Reserve's historic intervention in US corporate debt markets on May 12, 2021 on insurers with shadow banking businesses. Column 6 decomposes the pandemic into two periods. The first period (NoFed$_t$) covers March 11, 2021, through May 11, 2021. The second period (Fed$_t$) covers May 12, 2021, to the end of our sample. The union of these two variables is the variable pandemic$_t$. The coefficients on each of the interactions between these two variables and Aff. CLO exp.$_i$/TAC$_i$ allow us to trace the difference-in-difference effects of the

[10]Table E.3 reports the summary statistics for the variables used in Table 10.

**Table 10: Investors' perception of the vulnerability of life insurers' shadow banking businesses to corporate sector shocks.** The dependent variable in all specifications (Stock Volatility$_{it}$) is the realized intra-day stock price volatility of insurer $i$ on day $t$. The main independent variables are an indicator variable (pandemic$_t$) that takes the value 1 after March 11, 2020 and the ratio of the amount of insurer $i$'s general account exposed to insurer $i$'s affiliated CLOs to this insurance group total adjusted capital (Aff. CLO exp.$_i$/TAC$_i$). The indicator variable NoFed$_t$ takes the value 1 from March 11, 2021 to May 11, 2021, and zero otherwise. The indicator variable Fed$_t$ takes the value 1 from May 12, 2021 to the end of our sample, and zero otherwise. See Table E.3 for summary statistics of all variables. Note: $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

| *Dependent variable:* | Stock Volatility$_{it}$ | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| pandemic$_t \times \frac{\text{Aff. CLO exp.}_i}{\text{TAC}_i}$ | 0.042*** | 0.043*** | 0.043*** | 0.043*** | | |
| | (0.011) | (0.011) | (0.011) | (0.011) | | |
| pandemic$_t$ | 0.031*** | -0.006*** | | -0.020*** | 0.030*** | |
| | (0.001) | (0.001) | | (0.003) | (0.001) | |
| VIX$_t$ | | 0.002*** | | 0.001*** | | |
| | | (0.0001) | | (0.0001) | | |
| pandemic$_t$×VIX$_t$ | | | | 0.001*** | | |
| | | | | (0.0001) | | |
| pandemic$_t$×TAC$_i$ | | | | | 0.0003 | |
| | | | | | (0.0002) | |
| NoFed$_t$ | | | | | | 0.042*** |
| | | | | | | (0.002) |
| Fed$_t$ | | | | | | 0.014*** |
| | | | | | | (0.001) |
| NoFed$_t \times \frac{\text{Aff. CLO exp.}_i}{\text{TAC}_i}$ | | | | | | 0.056*** |
| | | | | | | (0.012) |
| Fed$_t \times \frac{\text{Aff. CLO exp.}_i}{\text{TAC}_i}$ | | | | | | 0.022** |
| | | | | | | (0.009) |
| Fixed effects | Firm | Firm | Firm & Day | Firm | Firm | Firm |
| SE clustering | Firm | Firm | Firm-Day | Firm | Firm | Firm |
| Observations | 7,069 | 7,069 | 7,069 | 7,069 | 7,069 | 7,069 |
| Adjusted $R^2$ | 0.232 | 0.600 | 0.681 | 0.606 | 0.231 | 0.311 |

increase in shadow banking activities on insurer stock price volatility before and after the Federal Reserve began purchasing corporate debt on the secondary market. The coefficient estimates confirm that most of the effect we identify can be attributed to the period *before* the Federal Reserve intervened in corporate debt secondary markets. These results suggest that the Federal Reserve's intervention was effective at decreasing investor incentives to produce information.

# 7 Concluding remarks

In this paper, we show how US life insurers have developed shadow banking businesses that resemble investment banking in the period before the 2007-09 financial crisis. These businesses fill the vacuum created by banks retreating from opaque corporate lending following that crisis. Life insurers are one point in a triangular organization structure, together with offshore captive reinsurers and asset managers. Exploiting a dislocation in annuity markets, these new shadow banks use funding from relatively stable annuity liabilities to originate, warehouse, and securitize loans to risky corporations. These new shadow banking businesses exponentially increase the industry's vulnerability to aggregate corporate sector shocks.

Our findings have immediate policy implications. First, the opacity of these insurers' new bank-like businesses is a challenge for capital adequacy assessments based on publicly-available credit ratings (Moody's 2021). Assessing the credit and liquidity risks of corporate loans will greatly add to regulators' burden. Second, the connections we measure between life insurers, captive reinsurers, and asset managers provide a framework for testing the resilience of the insurance industry—and the financial system more broadly—to direct and indirect shocks to the corporate sector. Importantly, our tests

focus on tail risks and complement the insurance regulators' capital adequacy assessments based on moderately adverse conditions (AAA 2014). And third, although we cannot identify a causal effect of regulation, we note that the design of life insurers' shadow banking businesses allows them to operate at the precise intersection of regulatory boundaries—at the limits of oversight by the Federal Reserve, state insurance regulators, the Security and Exchange Commission, and the Financial Stability Oversight Council.

## References


AAA (2014), 'Asset Adequacy Analysis', *American Academy of Actuaries* .

Acharya, V. V., Schnabl, P. & Suarez, G. (2013), 'Securitization Without Risk Transfer', *Journal of Financial Economics* **107**(3), 515–536.

BIS (2018), *Structural changes in banking after the crisis*, number 60 *in* 'CGFS Papers', Bank for International Settlements.

Chernenko, S., Hanson, S. G. & Sunderam, A. (2014), 'The rise and fall of demand for securitizations', *NBER Working Paper #20777* .

Devasabai, K. (2022), 'Private equity's insurance innovation needs a risk check'. Risk.net article published online March 16, 2022. URL: `https://www.risk.net/our-take/7939371/private-equitys-insurance-innovation-needs-a-risk-check`.

Foley-Fisher, N., Gissler, S. & Verani, S. (2019), 'Over-the-Counter Market Liquidity and Securities Lending', *Review of Economic Dynamics* **33**, 272–294.

Foley-Fisher, N., Gorton, G. & Verani, S. (2020), 'The Dynamics of Adverse Selection in Privately-Produced Safe Debt Markets', *NBER Working Paper #28016* .

Foley-Fisher, N., Narajabad, B. & Verani, S. (2019), 'Assessing the size of the risks posed by life insurers' nontraditional liabilities', *FEDS Notes. Washington: Board of Governors of the Federal Reserve System* **May 21, 2019**.

Foley-Fisher, N., Narajabad, B. & Verani, S. (2020), 'Self-fulfilling Runs: Evidence from the U.S. Life Insurance Industry', *Journal of Political Economy* **128**(9), 3520–3569.

Global Legal (2017), *The International Comparative Legal Guide to Securitization (10th Edition)*, Global Legal Group.

Gorton, G. & Metrick, A. (2010), 'Regulating the shadow banking system', *Brookings Papers on Economic Activity* pp. 261–312.

Gutscher, C. & Williams, C. (2019), 'Locked out of credit party, clos flash cash to do deals'. Bloomberg article published online May 7, 2019. URL: `https://www.bloomberg.com/news/articles/2019-05-07/locked-out-of-credit-party-clos-flash-cash-to-get-deals-done#xj4y7vzkg`.

Irani, R., Iyer, R., Meisenzahl, R. & Peydró, J.-L. (2020), 'The Rise of Shadow Banking: Evidence from Capital Regulation', *The Review of Financial Studies* **34**(5), 2181–2235.

Kacperczyk, M. & Schnabl, P. (2013), 'How safe are money market funds?', *The Quarterly Journal of Economics* **128**(3), 1073–1122.

Kirti, D. & Sarin, N. (2020), 'What Private Equity Does Differently: Evidence from Life Insurance', *U of Penn, Inst for Law & Econ Research Paper #2154* .

Koijen, R. S. & Yogo, M. (2016), 'Shadow insurance', *Econometrica* **84**(3), 1265–1287.

Lawsky, B. (2013), 'Shining a Light on Shadow Insurance', *New York State Department of Financial Services* .

McDonald, R. & Paulson, A. (2015), 'AIG in Hindsight', *Journal of Economic Perspectives* **29**(2), 81–105.

Moody's (2021), 'Revisions to the RBC C1 Bond Factors prepared for the NAIC and the ACLI'.

Moreira, A. & Savov, A. (2017), 'The Macroeconomics of Shadow Banking', *The Journal of Finance* **72**(6), 2381–2432.

Ordoñez, G. & Piguillem, F. (2019), 'Retirement in the Shadow (Banking)', *NBER Working Paper #26337* .

Sarto, A. & Wang, O. (2020), 'The Secular Decline in Interest Rates and the Rise of Shadow Banks', *Available at SSRN: https://ssrn.com/abstract=4248374* .

Verani, S. & Yu, P. C. (2020), 'What's Wrong with Annuity Markets?'.

# Online appendices

## A How fixed individual and group annuities work

Fixed individual and group annuities provide their holders with a stream of future income guaranteed by the general account of the life insurer. Participation in group annuities is limited to the employees of a company that wants to create the retirement benefit. The holders of these annuities receive a predetermined rate of return. In the case of fixed-indexed annuities, the yields on contributions are tied to the performance of a prespecified index, typically with limits on both the downside and the upside. In contrast to fixed annuities, the return on contributions to variable annuities depends on the performance of a predefined portfolio of assets (although the insurer again typically limits the upside and downside). Annuities also differ in the length of time of their obligations: Life annuities pay until the death of the holder; term annuities pay for a set period of time.

Figure A.2 shows the annual sales volume of fixed annuities by type of life insurer for the 20 largest retailers of fixed annuities, while Figure A.1 shows the annual sales volume of group annuities by type of life insurer, which includes the pension buyout transaction depicted in Figure A.5. The 2012 spike in Figure A.1 includes the Prudential and General Motors $25 billion pension risk transfer transaction, which is the largest to date. Over time, life insurers with private debt businesses have increased their share of sales and, as of 2018, account for more than half of the fixed annuity market. This growth reflects, in part, the entry of firms with private debt businesses.

Figure A.4 shows the striking reallocation of annuity liabilities from traditional life insurers to life insurers with shadow banking businesses since 2010. Figure A.4(a) plots the total amount of general account deferred fixed-annuity liabilities using data from life

insurers' statutory filings. This includes individual and group deferred fixed-annuity balances acquired through direct sale, third-party reinsurance, and pension buyouts, as well as stable value liabilities offered in employer-provided pension plans. The life insurance industry's total deferred fixed annuity liabilities grew 4 percent per annum on average, from 2010 to 2021, reaching $3 trillion. Figure A.4(b) plots the total amount of general account institutional annuity liabilities, which include privately placed funding agreements, funding agreements issued to FHLBs, and funding agreements-backed securities. The same pattern is evident in this panel. In total, life insurers with shadow banking businesses have issued about $375 billion in funding agreements that include little to no mortality risk, do not enter traditional measures of leverage, and are largely tax exempt (in Bermuda).

**Figure A.1: Group annuities sales (flow).** The bars show the total annual amount of new group fixed annuities by type of life insurer. These data include sales of new group annuities and pension buyouts that become group annuities of the acquiring life insurer. Source: Authors' calculations based on data from the NAIC Annual Statutory Filings and Bloomberg LP.

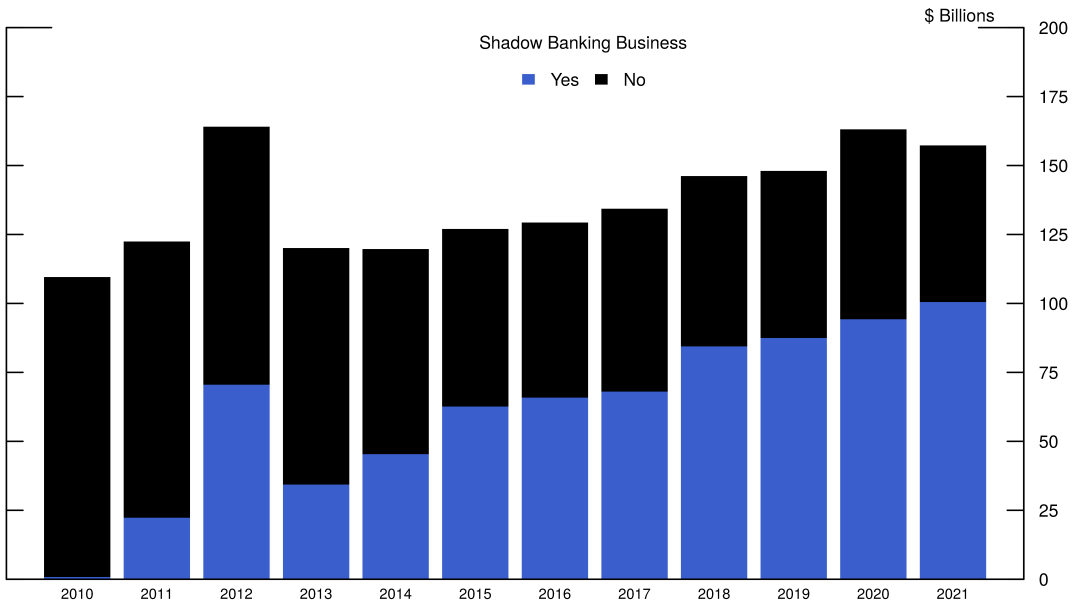


**Figure A.2: Individual fixed annuities sales (flow).** The bars show the total annual amount of new individual fixed annuities by type of life insurer. Source: Authors' calculations based on data from LIMRA Research, NAIC Annual Statutory Filings, and Bloomberg LP.

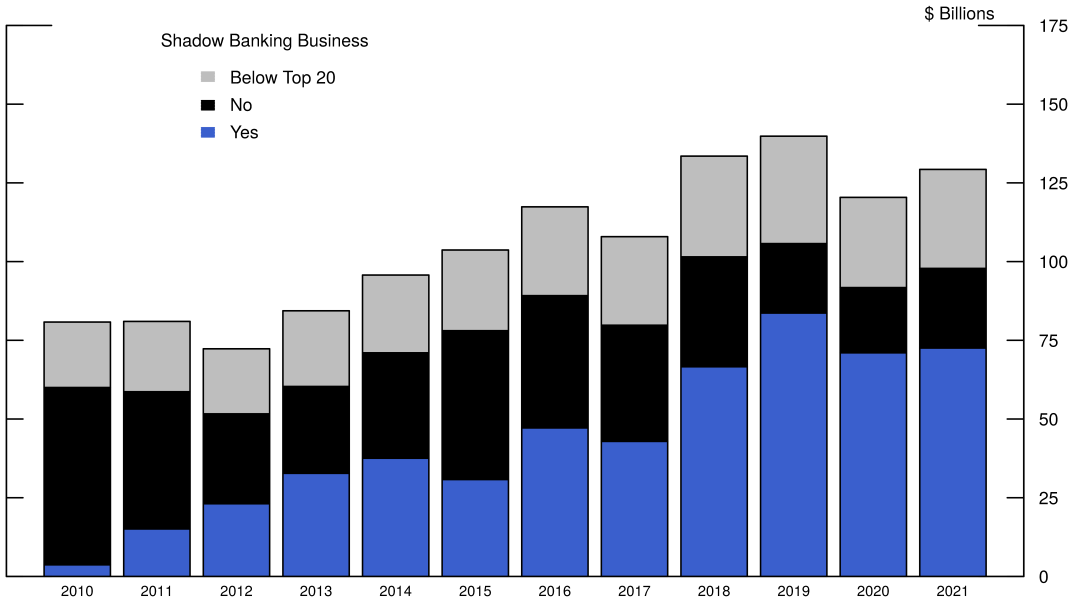


**Figure A.3: Institutional annuity capital from funding agreements.** The bars show the quarterly stock of institutional funding agreements outstanding by type of life insurer. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, and Bloomberg LP.

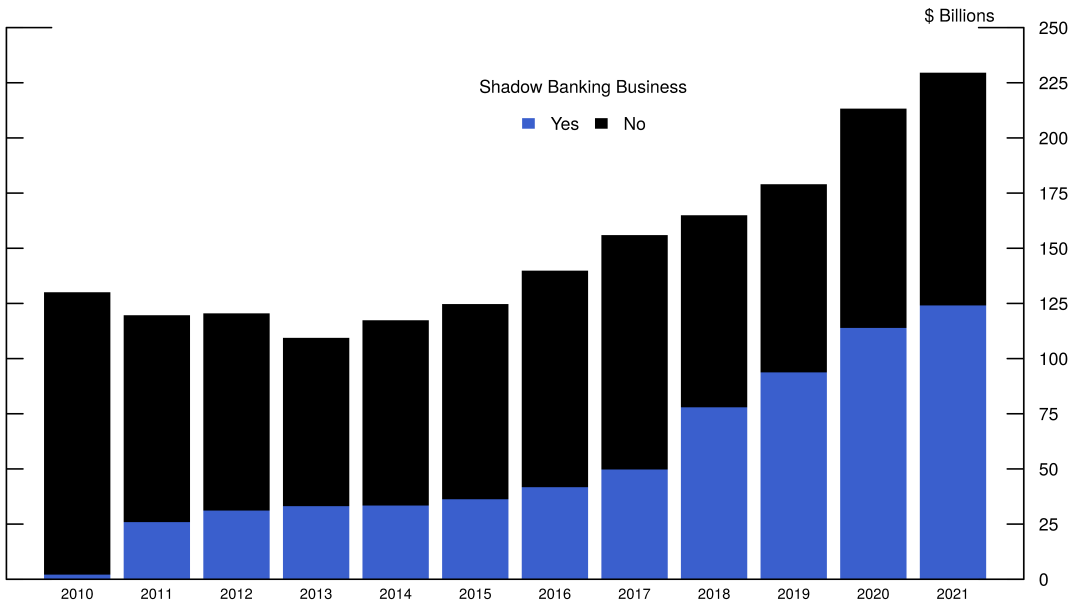
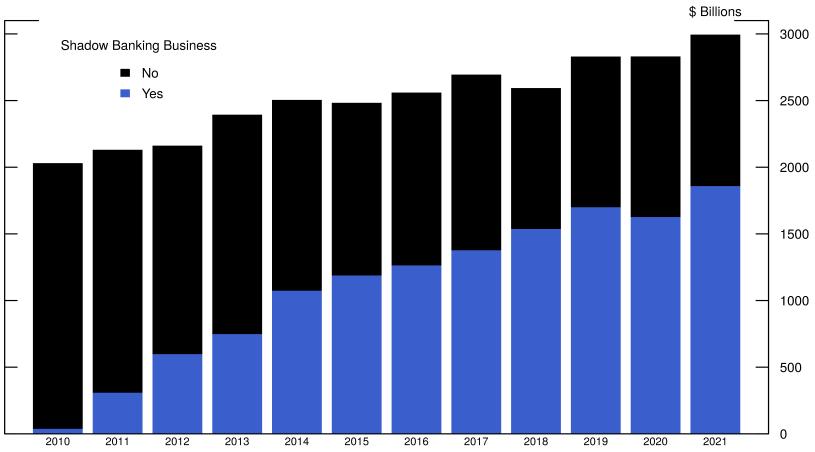


**Figure A.4: Reallocation of annuity liabilities in the life insurance industry.** The bars show the annual account balances for individual and group deferred fixed annuities (top panel) and institutional annuities (bottom panel) by type of life insurer. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, and Bloomberg LP.

**(a)** Individual and group deferred fixed annuities




**(b)** Institutional annuities

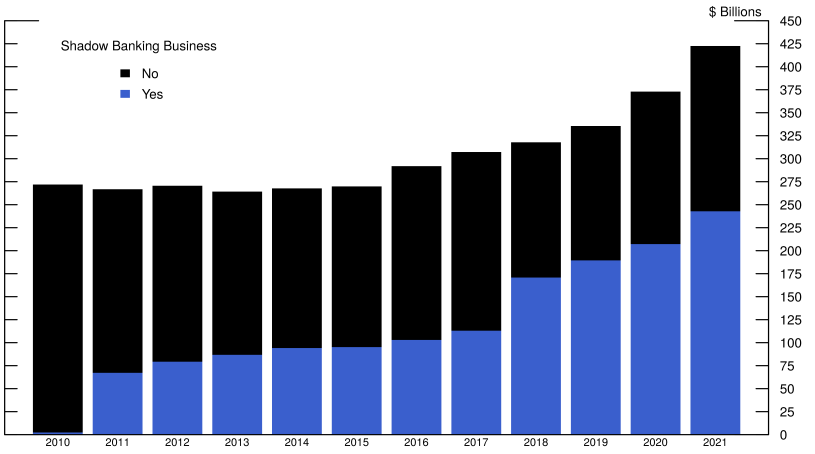
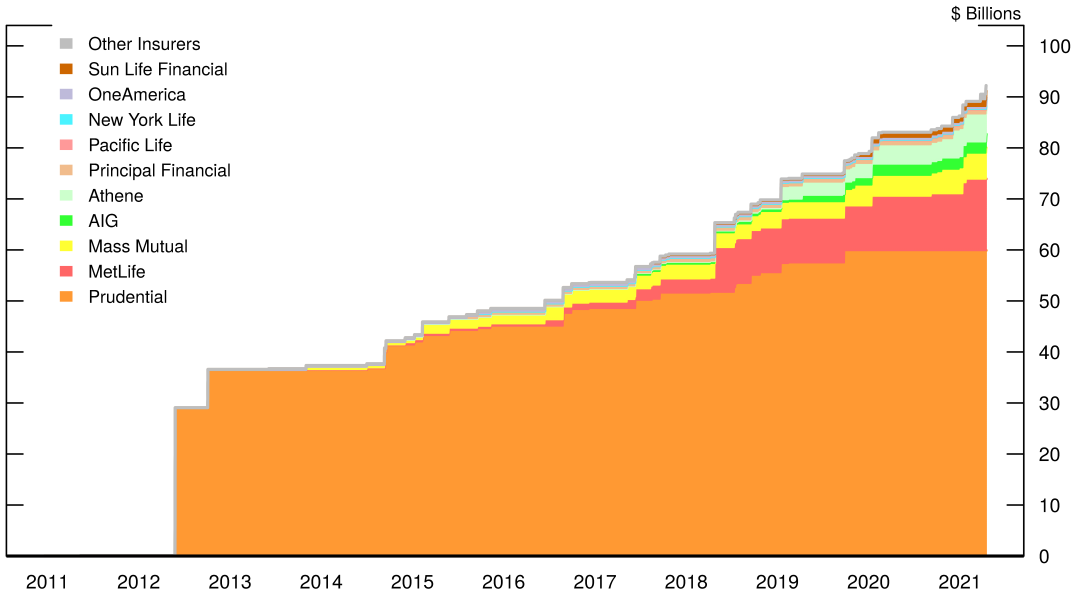


**Figure A.5: Pension risk transfers by US life insurance companies.** The bars show the stock of private corporations pension liabilities acquired by life insurers as of each year end since 2011. Source: Authors' calculations based on data from the Pension & Investments (P&I) data.



# B Regulatory arbitrage

The calculations for risk-based capital for CLOs and corporate bonds are provided in Table B.1. In all of the columns, we take the mid-rating (e.g., A instead of averaging A+, A, and A-) and assume a 5-year duration. After taking the ratio of the capital charge per CLO to similarly rated corporate bond per regulatory regime, we arrive at Table 3 in the main text. The grouped bars in Figure B.1 provide a graphical representation of Table 3, while the line plots the difference in credit spreads on similarly rated corporate bonds and CLOs from Table 3.

**Table B.1:** CLO and corporate bond capital charges under different regulatory regimes.

| | NAIC RBC[a] (1) | Bermuda SCR[b] (2) | Basel III[c] (3) | EU Solvency II[d] (4) |
|---|---|---|---|---|
| **CLOs** | | | | |
| A | 0.82 | 1.8 | 191.5 | 83 |
| BBB | 1.52 | 3.5 | 326.3 | 98.5 |
| BB | 4.54 | 10 | 826.1 | 100 |
| **Corporate Bonds** | | | | |
| A | 0.82 | 1.5 | 50 | 7 |
| BBB | 1.52 | 3 | 100 | 12.5 |
| BB | 4.54 | 8 | 100 | 22.5 |

[a] Source: Revisions to the RBC C1 Bond Factors and NAIC Memorandum: Interpretation of the 2021 Life Risk-Based Capital (RBC) Results in Light of the 2021 Bond Factor Changes.

[b] BSCR Ratings 3, 4, and 5 correspond to A, BBB, and BB, respectively. The capital charge factors are listed above. Source: Bermuda Insurance (Prudential Standards) (Class 3A Solvency Capital Requirement) Rules 2011.

[c] We calculate the Basel III CLO capital charges by taking the 5-year duration non-senior tranche risk weights for each rating. We multiply this by $\frac{1}{1-\text{tranche thickness}}$. Tranche thickness refers to the detachment point minus the attachment point; for our calculations, we assume a tranche thickness of 6% for AAA, 5% for BBB, and 8% for BB. Source: Basel III Revisions to the Securitization Framework (July 2016) and High-Level Summary of Basel III Reforms (December 2017).

[d] Under the EU Solvency II regulations, prior to 2019, CLOs were considered Type 2 securities for the solvency capital requirements (SRC). In 2019, the EU Solvency II regulations for securitizations changed and began treating CLOs as non-simple, transparent, and standardized (non-STS) securities; however, the SRC on non-STS and Type 2 securities remained the same. EU Solvency II capital charges for both CLOs and corporate bonds are calculated as follows. Credit quality steps 3, 4, and 5 correspond to ratings A, BBB, and BB, respectively. Assuming a 5-year duration, the SCR is equal to

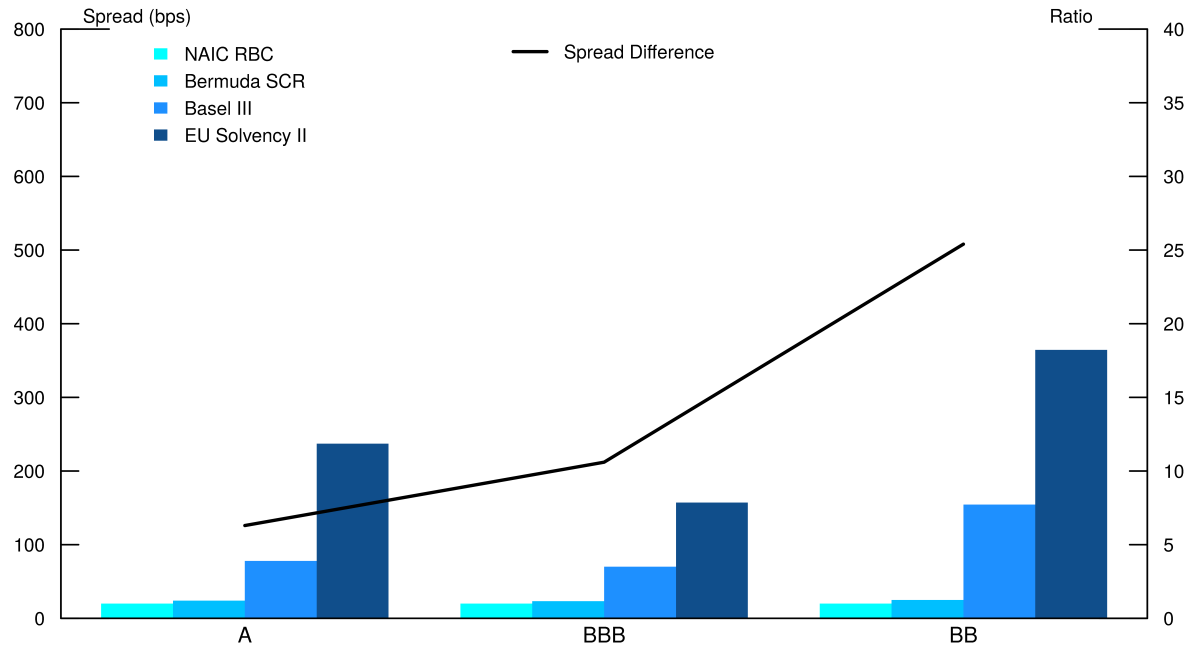
$\min(b_i \cdot \text{duration}; 1)$ where $b_i$ is a credit quality factor depending on the credit quality step ($b_i$ is the convention used in the Solvency II regulation). Source: Commission Delegated Regulation (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) and Commission Delegated Regulation (EU) of 1.6.2018 amending Delegated Regulation (EU) 2015/35.

**Table B.2:** Ratio of CLO to public corporate bond risk-based capital charges.

| Rating | NAIC RBC | Bermuda SCR | Basel III | EU Solvency II |
|---|---|---|---|---|
| A | 1 | 1.2 | 3.83 | 11.86 |
| BBB | 1 | 1.17 | 3.26 | 7.88 |
| BB | 1 | 1.25 | 8.26 | 4.44 |

**Figure B.1: CLO and corporate bond regulatory capital and credit spreads.**

The bars shows the ratio of capital charges, and the line the difference in credit spreads for similarly rated corporate bonds and CLOs. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, and Bloomberg LP.

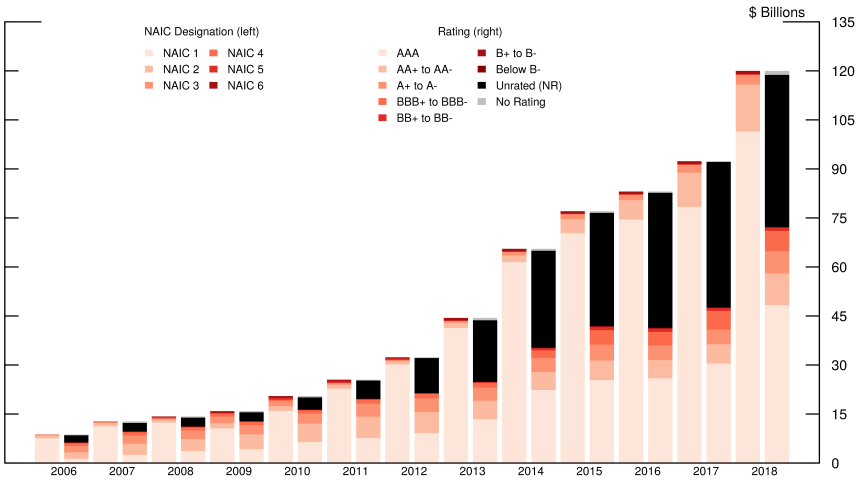


# C Further regulatory capital charges for CLO holdings

Until recently, CLOs offered life insurers an attractive return relative to similarly-rated investments because crisis-response statutory accounting principles could be exploited to adjust a CLO's credit rating and lower its capital charge. As shown in Figure C.1(a) and C.1(b), almost $75 billion of life insurers' CLO holdings have a 0.3 percent capital charge as indicated by NAIC Designation 1 even though less than $50 billion of their holdings are rated by Moody's at A3 and above. This treatment arises from changes to the statutory accounting principles that were introduced during the financial crisis to save insurers from their exposure to RMBS whose capital charges rose from 0.3 percent (NAIC Designation 1) to up to 19.5 percent (NAIC Designation 6) when the securities were downgraded. The rating adjustment methodology reduces the capital charge for certain loan-backed and structured securities that have low book value relative to par value. The reduction in capital charges is a boon for insurance companies that invest aggressively including, for example, those tied to private equity companies such as Apollo and Guggenheim.

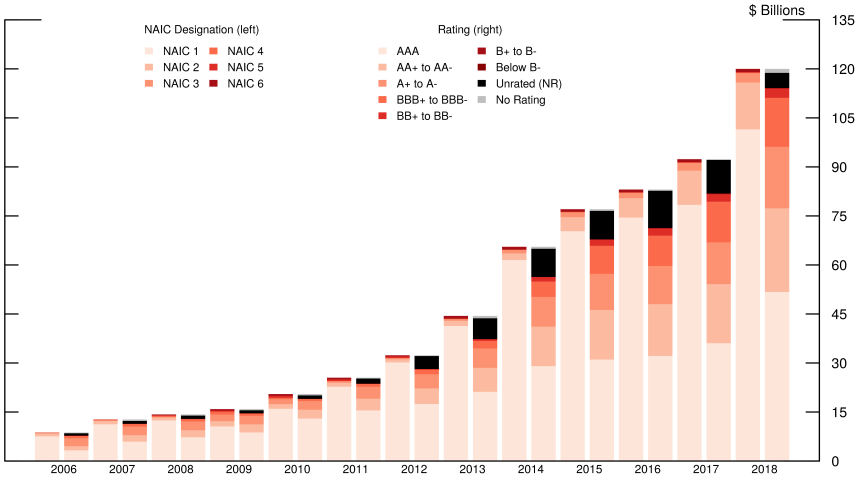
**Figure C.1: Ratings and capital charges associated with US insurer holding of CLOs.** There are two columns for each year. The left-hand column in a given year shows the capital charge broken down by NAIC designation. The right-hand column in a given year shows the capital charge broken down by credit rating. Panels (a) and (b) use the minimum and maximum, respectively, credit ratings across the three major rating agencies. Source: Authors' calculations based on data from NAIC Statutory Filings, Moody's Investor Services, Fitch Ratings, and Bloomberg LP.

**(a) Minimum rating**




Source: Staff estimates based on data from Bloomberg Finance LP, Moody's Investors Service, and NAIC Quarterly and Annual Statutory Filings. Data are current as of 2018Q4.

**(b) Maximum rating**




Source: Staff estimates based on data from Bloomberg Finance LP, Moody's Investors Service, and NAIC Quarterly and Annual Statutory Filings. Data are current as of 2018Q4.

# D US risk retention structures

There are three main arrangements to satisfy risk retention rules: MOAs, CMOAs, and CMVs. Figures D.1, D.2, and D.3 are stylized diagrams of the three arrangements.

CMVs retain the CLO deal risk via a separate management company. The company invests in the risk retention securities and, potentially, manages the CLOs. Unlike the MOA alternative arrangement for satisfying risk retention rules, there is no accounting requirement that the legacy manager make a minimum capital contribution to a CMV (or own a majority of its equity) or that it have "control" over major economic decisions by the CMV (Global Legal 2017).

In Creditflux CLO Yearbook 2017 (pg. 26), the market analysts noted: "There are two other options to achieve risk retention compliance for managers that are not keen on raising capital for MOAs, CMOAs and CMVs. Managers taking a vertical, rather than horizontal, strip in the CLO can finance that vertical strip in various ways. Insurance companies have emerged as the key financiers in this market, although some arrangers are also understood to offer financing solutions. The latest approach to hit the market is a syndicated vertical strip, developed by RBC." `http://creditflux.com/asset/documents/ef3551c03a43b479d5b9a17a3495d603.pdf`

**Figure D.1: Stylized diagram of majority-owned affiliate.** Source: Creditflux CLO Yearbook 2017.

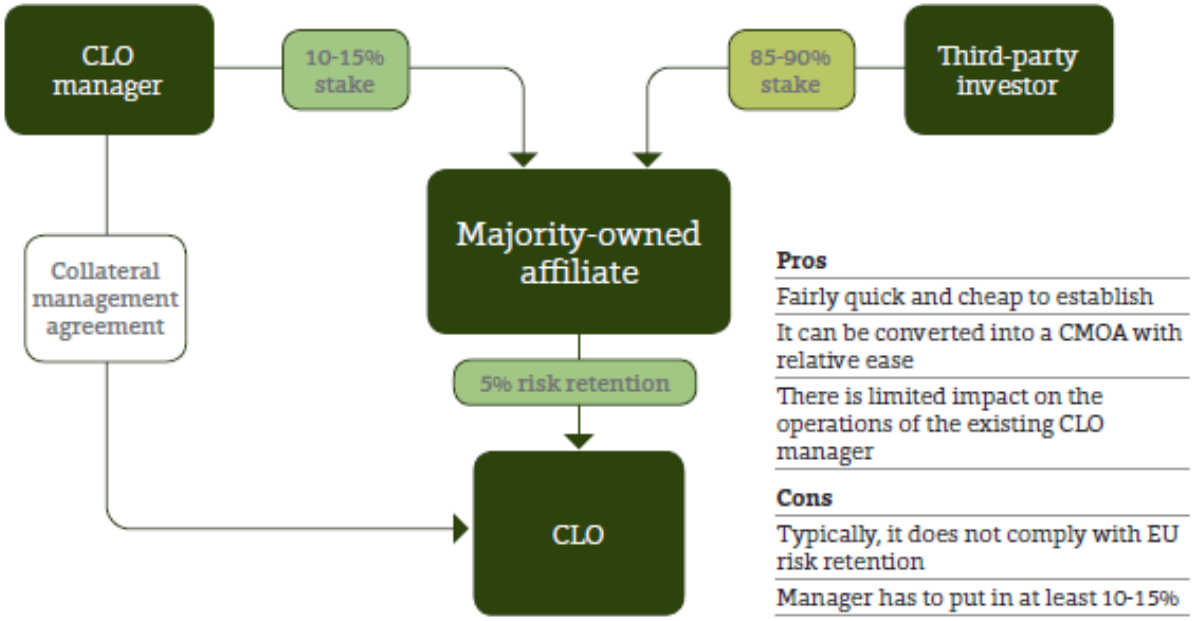



**Figure D.2: Stylized diagram of capitalized majority-owned affiliate.** Source: Creditflux CLO Yearbook 2017.

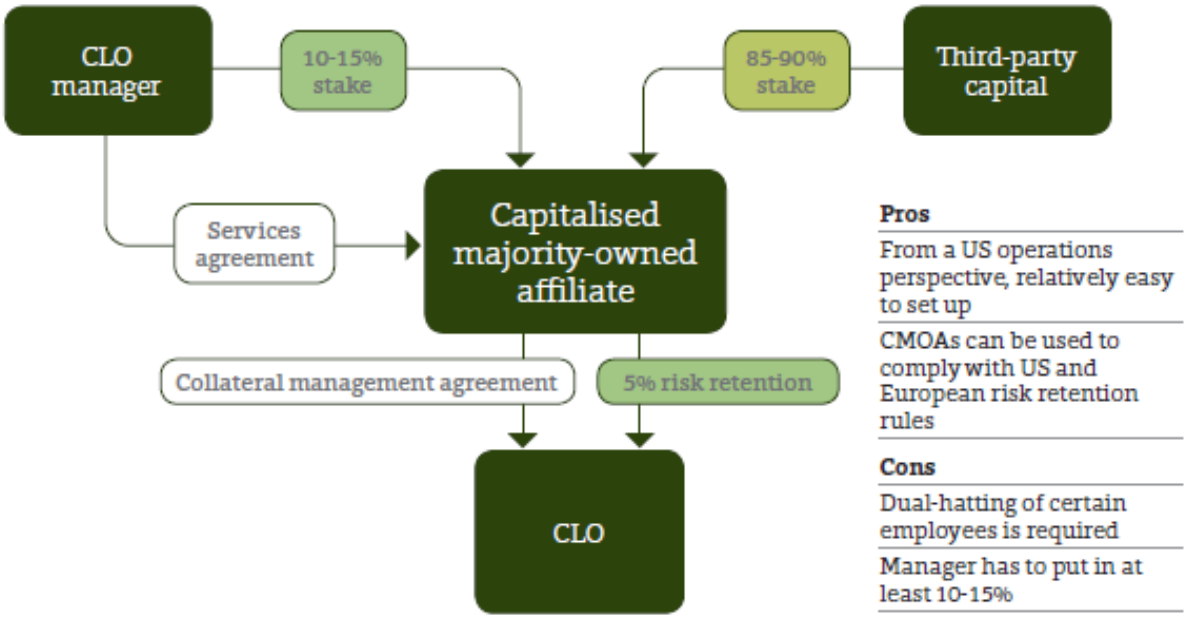
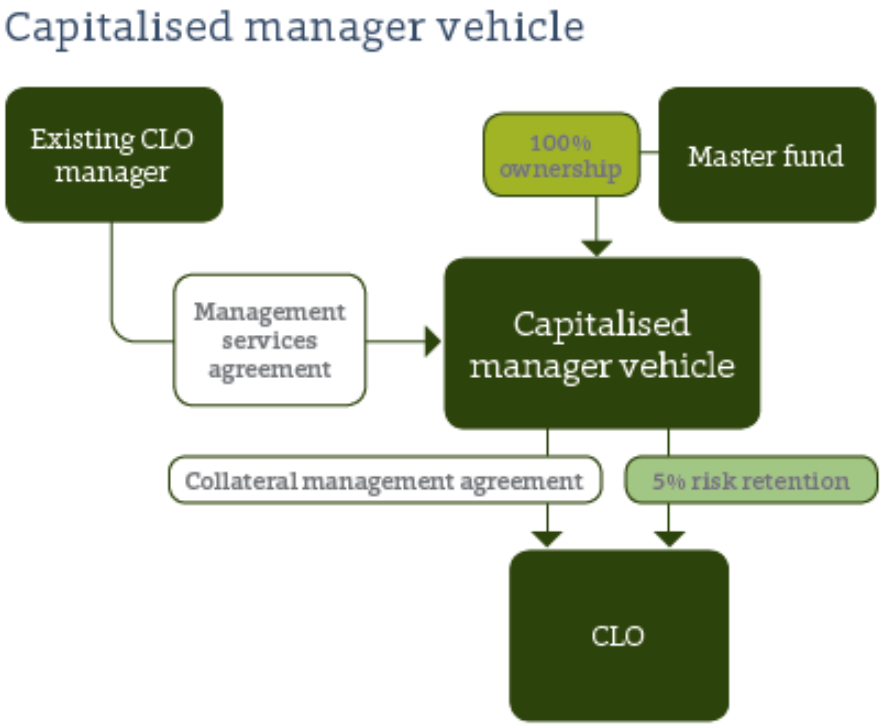


**Figure D.3: Stylized diagram of capitalized manager vehicle.** Source: Creditflux CLO Yearbook 2017.



# E Additional summary statistics

**Table E.1: Summary statistics for Table 7.** The variable CLO_holding_share$_{ikt}$ is the fraction of class $k$ CLO tranches issued by an insurer and held by insurer $i$ at the end of year $t$; High_yield_CLO$_k \in \{0,\ 1\}$ takes the value 1 if the tranche $k$ is not senior; Shadow_bank$_i \in \{0,\ 1\}$ takes the value 1 if insurer $i$ has shadow banking business; PE-owned$_{it} \in \{0,\ 1\}$ takes the value 1 if insurer $i$ has private equity ownership at the end of year $t$. Source: Authors' calculations based on data from NAIC Annual Statutory Filings, Bloomberg Finance LP, and Moody's Analytics, Inc.

| Variables | Obs. | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| CLO_holding_share$_{ikt}$ | 4,915 | 0.241 | 0.266 | 0 | 0 | 0.3 | 1 |
| High_yield_CLO$_k$ | 4,915 | 0.544 | 0.498 | 0 | 0 | 1 | 1 |
| Shadow_bank$_i$ | 4,915 | 0.224 | 0.417 | 0 | 0 | 0 | 1 |
| PE-owned$_i t$ | 4,915 | 0.064 | 0.245 | 0 | 0 | 0 | 1 |

**Table E.2: Summary statistics for Table 8.** The variable CLO_holding_share$_{ikt}$ is the fraction of class $k$ CLO tranches issued by an insurer and held by insurer $i$ at the end of year $t$; High_yield_CLO$_k \in \{0,\ 1\}$ takes the value 1 if the tranche $k$ is not senior; Shadow_bank$_i \in \{0,\ 1\}$ takes the value 1 if insurer $i$ has shadow banking business; PE-owned$_{it} \in \{0,\ 1\}$ takes the value 1 if insurer $i$ has private equity ownership at the end of year $t$. Source: Authors' calculations based on data from NAIC Annual Statutory Filings, Bloomberg Finance LP, and Moody's Analytics, Inc.

| Variables | Obs. | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| Spread$_{ijk}$ | 10,716 | 2.771 | 1.945 | 0.000 | 1.388 | 3.5 | 10 |
| Insurer_CLO$_{jk}$ | 10,716 | 0.236 | 0.425 | 0 | 0 | 0 | 1 |
| Original_balance$_{ijk}$ ($mn) | 10,716 | 97.533 | 126.440 | 0 | 21.5 | 120.25 | 998.4 |
| CLO deal senior fraction$_{jk}$ | 10,716 | 0.651 | 0.065 | 0.000 | 0.631 | 0.680 | 0.845 |
| CLO deal equity fraction$_{jk}$ | 10,716 | 0.061 | 0.036 | 0.000 | 0.039 | 0.077 | 0.758 |

>

**Table E.3: Summary statistics for Table 10.** The variable Stock Volatility$_{it}$ is the realized intra-day stock price volatility of insurer $i$ on day $t$; pandemic$_t$ takes the value 1 after March 11, 2020; Aff. CLO exp.$_i$/TAC$_i$ is the ratio of the amount of insurer $i$'s general account exposed to insurer $i$'s affiliated CLOs to this insurance group total adjusted capital; NoFed$_t$ takes the value 1 from March 11, 2021 to May 11, 2021, and zero otherwise; Fed$_t$ takes the value 1 from May 12, 2021 to the end of our sample, and zero otherwise. Source: Authors' calculations based on data from NAIC Annual Statutory Filings, Bloomberg Finance LP, and Moody's Analytics, Inc.

| Variables | Obs. | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| Stock Volatility$_{it}$ | 7,069 | 0.046 | 0.039 | 0.000 | 0.021 | 0.058 | 0.494 |
| pandemic$_t$ | 7,069 | 0.610 | 0.488 | 0 | 0 | 1 | 1 |
| NoFed$_t$ | 7,069 | 0.366 | 0.482 | 0 | 0 | 1 | 1 |
| Fed$_t$ | 7,069 | 0.244 | 0.430 | 0 | 0 | 0 | 1 |
| VIX$_t$ | 7,069 | 32.940 | 16.656 | 12.100 | 16.390 | 41.170 | 82.690 |
| TAC$_i$ | 7,069 | 4.253 | 5.802 | 0.008 | 0.239 | 5.576 | 25.778 |
| Aff. CLO exp.$_i$ / TAC$_i$ | 7,069 | 0.019 | 0.068 | 0 | 0 | 0 | 0 |