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ABSTRACT

The near-failure on September 16, 2008, of American International Group (AIG) was an iconic moment in the financial crisis. Two large bets on real estate made with funding that was vulnerable to bank-run like behavior on the part of funders pushed AIG to the brink of bankruptcy. AIG used securities lending to transform insurance company assets into residential mortgage-backed securities and collateralized debt obligations, ultimately losing at least $21 billion and threatening the solvency of the life insurance companies. AIG also sold insurance on multi-sector collateralized debt obligations, backed by real estate assets, ultimately losing more than $30 billion. These activities were apparently motivated by a belief that AIG's real estate bets would not suffer defaults and were "money-good." We find that these securities have in fact suffered write-downs and that the stark "money-good" claim can be rejected. Ultimately, both liquidity and solvency were issues for AIG.

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1 Introduction

The near-failure on September 16, 2008 of American International Group (AIG) was an iconic moment of the financial crisis. AIG, a global insurance and financial company with $1 trillion in assets, lost $99.3 billion during 2008 (American International Group, Inc., 2008a, p. 194) and was rescued with the help of the Federal Reserve, the Federal Reserve Bank of New York, and the Treasury. The rescue played out over many months and involved the extension of loans, the creation of special purpose vehicles, and equity investments by the Treasury, with the government assistance available to AIG ultimately totaling $182.3 billion. The decision to rescue AIG was controversial at the time and remains so. AIG's fate also provided an important touchstone in discussions of financial reform. AIG motivated the enactment of new rules governing non-bank financial institutions, as well as rules about the treatment of financial derivatives.

In this paper, we begin with an overview of AIG's main corporate financial indicators from 2006-2009. However, most of the attention paid to AIG—and our focus—concerns the two main activities that caused the insurance company to be driven to the edge of bankruptcy by falling real estate prices and mortgage foreclosures: AIG's securities lending business and its credit default swap business. Although much of the discussion concerning AIG has centered on its credit default swap business, we will show that losses from its securities lending business were of a similar magnitude. On September 16, 2008, the cumulative losses from these two activities were on the order of $50 billion, and both appear to have played important roles in AIG's near-failure (as also emphasized by Peirce (2014) and Taibbi (2011, Chapter 3)).

We then turn to a description of the government rescue of AIG, including the special purpose vehicles that the New York Fed created to deal with the assets related to AIG's securities lending ("Maiden Lane II") and credit default swap operations ("Maiden Lane III"). In particular, we examine the write-downs on the assets in these portfolios from each asset's inception to October, 2014. AIG's real estate positions were apparently motivated by the belief that these investments would not default. The analysis sheds light on a claim often made by AIG executives that their mortgage-related investments might have suffered a decline in their market value in the short-term, but that they would pay off over time. This claim implicitly attributes any price decline in such securities to short-term illiquidity. The head of AIGFP, Joseph Cassano, often referred to the mortgage-related securities that AIG insured through credit default swaps as "money good" (for ex-

ample, see American International Group, Inc. (2007c)). Mark Hutchings, who ran AIG's securities lending business, made similar statements about the real-estate related investments financed by securities lending (Hutchings, 2010). However, this stark claim that assets were "money good" is not borne out: a number of AIG's mortgage-related investments suffered principal write-downs.

In our concluding section, we discuss the question of how to think about AIG as a financial firm.

It is important to be clear about what we do not do in this paper. We do not analyze AIG's regulatory oversight prior to the crisis. We discuss what happened in the AIG rescue, but we do not analyze alternative policies or capital structures for a rescue. We discuss the specific parties who benefited most from the rescue, but we do not address the broad question of what might have happened to the financial system had AIG failed. There was certainly reason for concern: In testimony about the AIG rescue, Federal Reserve Chairman Ben Bernanke (Bernanke, 2009) noted that AIG had $20 billion of commercial paper outstanding and $50 billion of exposure to other banks via loans, lines of credit and derivatives. Lehman Brothers had around $5.7 billion in commercial paper and its failure wreaked havoc on money market mutual funds (Federal Deposit Insurance Corporation, 2011). Policymakers and academics have written extensively about potential systemic consequences from the failure of a large, interconnected financial firm like AIG: for example, V. V. Acharya, Gale, and Yorulmazer (2011), Brunnermeier and Pedersen (2009), Kacperczyk and Schnabl (2010), Duarte and Eisenbach (2014), and Ellul et al. (2014), among many others.

2 AIG Financials: 2006-2009

AIG was an international insurance conglomerate with four main lines of business: 1) General Insurance, including property/casualty and commercial/industrial insurance; 2) Life Insurance and Retirement, including individual and group life insurance and annuities; 3) Asset Management, including private banking, brokerage, and investment advisory services; and 4) Financial Services, including a capital markets division, consumer finance, and aircraft leasing. Looking at that list of lines of business, it is not at all obvious why AIG had significant exposure to risks from falling real estate prices and default rates on subprime mortgages.

Each year, public firms must file with a 10K report with the Securities and Exchange Commission with an in-depth presentation of its financial

position. In its 2007 10K report, AIG listed $1.06 trillion in assets American International Group, Inc. (2007d, p. 130). Table 1 presents financial indicators for 2006–09, which help to put AIG's 2008 performance into perspective. The firm was showing some reasons for concern in 2007, including losses in the Financial Services division, and unrealized losses in its credit default swap business. But in 2008, AIG lost money in all of its main lines of business, with the largest losses in the Life Insurance and Financial Services divisions. In both cases, the losses stemmed from heavy bets on real-estate-related financial products. The Life Insurance division lost money primarily because of securities lending ($21 billion in losses), where life insurance company assets were loaned in exchange for cash that was used to invest in mortgage-related securities. In the case of financial services, AIG had written credit default swaps on mortgage-related bonds, losing $28.6 billion in 2008 American International Group, Inc. (2008a, p. 265). The securities lending business will be discussed in the next section; the credit default swap business will be discussed in the section after that. AIG's reported 2008 revenue of $11.1 billion incorporates the losses from securities lending, credit default swaps, and other sources.

3 AIG's Securities Lending Business

During 2008, AIG's life insurance subsidiaries lost approximately $21 billion from securities lending, in which the life insurance subsidiaries loaned out assets and invested the proceeds in risky assets, including assets backed by subprime residential mortgage loans. In this section, we discuss AIG's securities lending activity, which created unique problems because of its links to AIG's state-regulated life insurance subsidiaries. Recently, Peirce (2014) has examined the securities lending business in detail. We argue that it is impossible to evaluate the potential consequences of an AIG failure without understanding AIG's life insurance and securities lending activities.

3.1 What Is Securities Lending?

In a securities lending transaction, one party borrows a security from another and deposits collateral, typically cash, with the securities lender. The borrower may use the security as part of a short-selling strategy or to deliver a particular security to a customer. The securities lender invests the cash collateral and earns a yield from these investments, less a rebate paid to the securities borrower. Absent default, the lender remains the eco-

Table 1: AIG financial indicators by operating segment, 2006-2009, $ Billions

Item	2006	2007	2008	2009
Revenues	113.39	110.06	11.10	96.00
Earnings	14.05	6.20	-99.29	-12.31
Realized capital gains	0.11	-3.59	-55.48	-6.86
Unrealized CDS losses (AIGFP)	0	-11.47	-28.60	1.42
Operating Income:				
General Insurance	10.41	10.53	-5.75	0.17
Life Insurance & Retirement Services	10.12	8.19	-37.45	2.04
Financial Services	0.38	-9.52	-40.82	0.52
Asset Management	1.54	1.16	-9.19	NA
Assets				
General Insurance	167.00	181.71	165.95	154.73
Life Insurance & Retirement Services	550.96	613.16	489.65	553.49
Financial Services	202.49	193.98	167.06	132.82
Asset Management	78.28	77.27	46.85	NA

Source: American International Group, Inc. (2008a, p. 71, 194, and 225), and American International Group, Inc. (2009, p. 72, 195, and 230).

Notes: In 2009, results from asset management activities were included in the Life Insurance & Retirement Services category. Revenue is composed of premiums and other income, net investment income, realized capital gains (or losses), and unrealized CDS losses. Earnings are equal to net income (or losses) as reported on AIG's consolidated statement of income. Realized capital gains are primarily comprised of sales of securities and other investments, foreign exchange transactions, changes in the fair value of non AIGFP derivative instruments that do not qualify for hedge accounting treatment, and other-than-temporary impairments on securities. Unrealized CDS losses are the unrealized market valuation loss on AIGFP's super senior credit default swap portfolio. Operating income is equal to pre-tax income (or loss) for each business segment. Assets are equal to year-end identifiable assets for each business segment.

nomic owner of the security that is on loan, earning its return including any dividend or coupon payments. The cost to the security borrower is the difference between the return the borrower could have earned investing the cash collateral and the rebate fee, which is a market price determined by the scarcity of the security on loan. The term of a securities lending transaction may extend for various periods up to several months, but in many cases either party can terminate the transaction early. The borrower can end the transaction by returning the security to the lender, at which time the lender must also return the cash deposit to the borrower. A problem can arise if many borrowers simultaneously decide to end transactions and the securities lender does not have, or cannot raise, sufficient cash to meet these demands in a timely fashion.[1]

3.2 Characteristics of AIG's Securities Lending

AIG's securities lending activities were conducted "primarily for the benefit of certain AIG insurance companies" (AIG, 2007b, p. 108). These activities were centralized in a non-insurance subsidiary, AIG Global Securities Lending (GSL), which served as an agent for AIG's subsidiary life insurance companies. The life insurance companies provided securities, primarily corporate bonds, to GSL. These securities were loaned to banks and broker-dealers in return for cash collateral that was invested by GSL. The investment proceeds were used to fund the rebate to the security borrower, and the remainder was split 50-50 between GSL and the insurance companies. Nearly all of AIG's security loans had a one month term (Hutchings 2010).[2]

AIG expanded its securities lending rapidly in the run-up to 2008. At the end of 2003, the firm had less than $30 billion in securities lending outstanding. At the peak in 2007Q3, AIG had securities lending outstanding of $88.4 billion (American International Group, Inc., 2007e, p. 2). AIG had securities lending of $70 billion the second quarter of 2008, which then fell almost to zero by the fourth quarter of 2008.

AIG consistently lent more than 15 percent of its domestic life insurance assets: in 2007, for example, the figure was 19 percent. By comparison,

[1]Securities lending transactions are very similar to repurchase agreements, as discussed in Adrian et al. (2013). For additional background on securities lending, see Aggarwal, Saffi, and Sturgess (2012) and Bank of England (2010).

[2]Term arrangements can be fixed or indicative. If they are indicative, they can be terminated early without penalty (Bank of England, 2010). We do not have information about whether AIG's arrangements were fixed or indicative.

Metlife, another active insurance securities lender, never had more than 10 percent of its domestic life insurance assets on loan.

Typically, securities lending collateral is invested in short-term, highly liquid securities: A firm cannot easily lend its securities for cash collateral if possible borrowers of those securities fear that their cash collateral may not be secure. However, AIG invested a substantial portion of the cash collateral it received from securities borrowers in longer term, illiquid instruments, including securities dependent on the performance of subprime residential mortgages. At the end of 2007, 65 percent of AIG's securities lending collateral was invested in securities that were sensitive, either directly or indirectly to home prices and mortgage defaults. These securities included securities backed by residential and commercial mortgages as well as securities backed by credit card, auto and home equity loans. It also included collateralized debt obligations, which are structured financial instruments that are backed by a pool of financial assets, often the riskier tranches of mortgage-backed securities. Cash flows to collateralized debt obligations are divided into tranches ranked from junior to senior. Any losses are first allocated to the more junior tranches until their value is exhausted, a structure which offers protection to senior tranches.

Of the remainder of AIG's securities lending collateral, 19 percent was invested in corporate bonds; and 16 percent was in cash or other short-term investments American International Group, Inc. (2007d, p. 108). For comparison, a Risk Management Association Survey (Risk Management Association, 2007) of securities lenders shows that on average 33 percent of lending proceeds was invested in mortgage-backed securities, asset-backed securities (a broad category of securities backed by securities like credit card receivables and auto loans), and collateralized debt obligations; 42 percent in corporate bonds; and 25 percent in cash and short-term investments.

AIG's use of securities lending collateral to purchase residential mortgage-backed securities and collateralized debt obligations is similar to the broader phenomenon described in Krishnamurthy, Nagel, and Orlov (2014) of financial firms using short-term funding like repurchase agreements and securities lending to fund assets that had previously been funded through insured bank deposits. AIG's investments of securities lending collateral in real-estate-related instruments accelerated after 2005. On the other hand, AIGFP decided to stop increasing its exposure to real-estate-related risk near the end of 2005. It took some time to implement this decision, however, and deals that were in the pipeline were completed, and as a result AIGFP's real estate exposure continued to grow. In addition, some of the collateralized debt obligations that AIGFP insured

were "actively managed," which meant that the manager of the security could replace maturing, refinanced, and defaulting mortgages with new ones, including the particularly default-prone mortgages that were made in 2006 and 2007.

The AIG securities lending business was characterized by a large liquidity and maturity mismatch. Securities borrowers can demand the return of their cash collateral on short notice. However, AIG was investing this cash in long-term assets whose market values and liquidity could vary substantially in the short run. As long as AIG could make new security loans when existing ones came due, it could maintain its investments in long-run, illiquid assets. But an arrangement based on a liquidity and maturity mismatch, like this one, is clearly vulnerable to bank-run dynamics. The security borrowers have incentives that are similar to bank depositors who lack deposit insurance. Depositors will rush to withdraw cash when they are concerned about their bank's solvency. They want to make sure that they get their funds before the bank runs out of money. Similarly, security borrowers who are worried about the AIG's ability to return their cash on demand are likely to ask for it to be returned. And efforts to satisfy these demands will further erode AIG's liquidity and generate losses that will prompt other securities borrowers to demand the return of their cash collateral.

Indeed, before AIG was rescued on September 16, 2008, securities lending counterparties began to terminate these lending agreements. Standard and Poor's, Moody's and Fitch all lowered AIG's credit rating in May or June 2008. AIG announced large second-quarter losses on August 6, 2008. The possibility of further losses and still-lower credit ratings appears to have accelerated the counterparties' efforts to reduce their securities lending exposure to AIG. Because the combination of falling real estate prices and higher mortgage foreclosures had reduced the market price of securities tied to these underlying assets, and because it did not have access to other sources of liquidity, AIG was unable to generate sufficient funds to meet redemption requests and to return the cash collateral. Moreover, its losses on securities lending threatened the regulatory capital positions of AIG's life insurance subsidiaries, a point we discuss later and one that is also emphasized by Peirce (2014).

Like many episodes during the crisis, AIG's securities lending problems can be viewed through the lenses of both liquidity and solvency. AIG summed up its dilemma with respect to securities lending with considerable understatement in its 2008 10K report (American International Group, Inc., 2008a): "During September 2008, borrowers began in increasing numbers

to request a return of their cash collateral. Because of the illiquidity in the market for RMBS [residential mortgage-backed securities], AIG was unable to sell RMBS at acceptable prices and was forced to find alternative sources of cash to meet these requests." On Monday, September 15, 2008, alone, AIG experienced returns under its securities lending programs that led to cash payments of $5.2 billion (American International Group, Inc., 2008a, p. 4).

On September 16, 2008, AIG received "alternative sources of cash" from the Federal Reserve Bank of New York. The cash was initially in the form of loans. However, the New York Fed soon set up several limited liability companies as financial vehicles to handle its rescue of AIG. In December, 2008 Maiden Lane II purchased AIG's remaining portfolio of residential mortgage back securities in which it had invested securities lending collateral for $20.5 billion, a 48% discount relative to their par value of $39.3 billion. According to the Congressional Oversight Panel (2010, p. 45), AIG's securities lending counterparties demanded the return of $24 billion in cash collateral between September 12 and September 30, 2008. Ultimately, AIG reported losses from securities lending in excess of $20 billion in 2008.

3.3 Securities Lending and Bankruptcy

What would have happened to AIG's insurance companies and securities lending counterparties in the event of an AIG bankruptcy? Generally, if a securities lender seeks bankruptcy protection, the borrower simply takes ownership of the security that it borrowed; any additional claims associated with the transaction would be resolved in bankruptcy. The value of the security on loan is marked to market daily, and the collateral is adjusted accordingly, so any additional claims if a security lender goes bankrupt would typically be small. Because securities lending transactions are exempt from the "automatic stay" provisions of the bankruptcy code—that is, the rule that once bankruptcy has been declared, creditors cannot move to collect what they are owed—resolving these securities lending transactions should be fast and straightforward.

However, AIG's securities lending was conducted largely on behalf of its life insurance companies, which were regulated at the state level. If AIG had declared bankruptcy, the resolution of claims related to securities lending would likely have depended on the actions of state insurance regulators. When a life insurance company cannot meet its financial obligations, a state insurance commissioner will take control of the company's operations

and place it in receivership.[3] Federal bankruptcy law does not apply to insurance companies, although the actions taken under state receivership statutes are generally patterned after federal bankruptcy. However, certain important exceptions to this practice may have been material for AIG in 2008.

If AIG had sought bankruptcy protection, state insurance commissioners would probably have seized AIG's insurance subsidiaries Dinallo (2010). In these circumstances, the status of securities lending transactions might have varied depending on where a particular AIG insurance subsidiary was located. As of 2008, of the ten states where AIG's life insurance subsidiaries were located, only Texas had passed a version of the Insurer Receivership Model Act (IRMA) written by the National Association of Insurance Commissioners (NAIC), which allows securities lending and other qualified financial contracts to receive the same exemption from the automatic stay provisions in an insurance resolution that would apply in bankruptcy.[4] Texas-domiciled companies supplied the securities for 58 percent of AIG's securities lending. However, the legal treatment of counterparties to the remaining 42 percent of the securities supplied by life insurers located in other states would have been uncertain in an insurance insolvency. AIG's 2007 10K points out that "the securities on loan as well as all of the assets of the participating companies are generally available to satisfy the liability for collateral received" (American International Group, Inc., 2007d, p. 108).

An additional protection for some securities borrowers would have arisen from a unique aspect of AIG's lending program. Rather than the typical practice of requiring collateral of 102 percent of the value of the security being lent, AIG began lending securities with less than 100 percent collateral, with the AIG parent company making up the difference to the insurance subsidiary (American International Group, Inc., 2008a, p. 3). AIG seems to have accelerated this practice as its liquidity issues grew more acute. For example, in an August 14, 2008, email, a Federal Reserve Bank of New York employee noted that "CSG (Credit Suisse Group) does not need the securities it borrows but instead AIG is using the deals to raise cash. As such CSG is looking to take a haircut on AIG's securities as opposed to posting cash to AIG in excess of the securities value which is the market

[3]The state receivership process has three stages: 1) conservation, 2) rehabilitation, and 3) liquidation. The receivership process can involve transfers of blocks of assets and liabilities to other companies. If the company cannot be rehabilitated or sold, it is declared insolvent and the commissioner liquidates the company and distributes assets or the proceeds from asset sales to approved claimants in the manner prescribed by the state's receivership laws.

[4]See Fitch Ratings (2006) and Law360 (2012).

standard" (Federal Reserve Bank of New York, 2008). By 2008, AIG had also boosted rebate fees paid to securities borrowers and was making losses on securities lending arrangements, but felt this was warranted in order to avoid a "run on the bank" scenario Hutchings (2010).

When the borrowing firm does not post enough cash to fund "substantially all of the cost of purchasing replacement assets," then from an accounting perspective, the transaction will be treated as a sale, rather than as a securities lending transaction. American International Group, Inc. (2008a, p. 166), reported losses of $2.4 billion on securities lending transactions that had to be reclassified as "sales" in 2008.

Overall, this analysis suggests that losses for AIG's securities lending counterparties would have been small had AIG sought bankruptcy protection and if the counterparties were able to take possession of the securities that they had borrowed. Securities borrowers who held securities worth more than the cash they were due from AIG would not have suffered losses in an AIG bankruptcy, barring uncertainties associated with state insurance law. Note that this conclusion only takes into account the potential for direct losses. Counterparties needing to unwind or liquidate positions quickly might have suffered indirect losses as well.

3.4 Impact of Securities Lending on AIG's Domestic Life Insurance Subsidiaries

The losses for life insurance companies engaged in securities lending can be attributed to two factors: losses on sales of assets incurred when those securities were sold for cash when borrowed securities were being returned, and unrealized mark-to-market losses on similar assets that had not yet been sold. Together, these losses put AIG's domestic life insurance companies under considerable regulatory pressure. Life insurance regulators establish minimum levels of capitals that take into account each company's asset risk, insurance risk, market risk, interest rate risk, and business risk (along with an adjustment to account for the fact that these risks are not perfectly correlated). When capital falls below a certain threshold, state insurance regulators are required to intervene to protect policyholders.

Looking at their official end-of-the-year balance sheets, AIG's life insurance subsidiaries appear to have made it through 2008 with a comfortable cushion of capital relative to regulatory minimums. However, these figures include over $19 billion in capital infusions in the third and fourth quarters of 2008 that were only possible because of the rescue of AIG. Table 2 shows the capital positions of the eleven AIG life insurance subsidiaries that had

more than $5 billion in assets at the end of 2007. For each company, the table shows 2007 assets and the share of those assets that were on loan through AIG's securities lending business, securities lending losses in 2008, and the company's regulatory capital as of the end of 2008, both with and without the capital infusions made possible by the rescue. Eight of these eleven companies would have had negative capital without the capital infusions. The rescue funds recapitalized the life insurance companies and kept them solvent, despite their securities lending losses. This ultimately benefited AIG's life insurance policy holders.

The urgency of the problems in AIG's life insurance subsidiaries is reflected in the rapidity with which they were recapitalized: By September 30, 2008, just 14 days after the initial loan to AIG, $13.3 billion of the loan proceeds from the Federal Reserve Bank of New York had already gone toward recapitalizing the life insurance subsidiaries (Congressional Oversight Panel, 2010, p. 84). Ultimately, at least $58 billion of the total government assistance to AIG went to addressing problems related to securities lending: $19 billion in capital infusions to the life insurance subsidiaries to address securities lending losses; $36.7 billion to repay collateral to securities lending counterparties ($19.5 billion from Maiden Lane II plus $17.2 billion from the revolving credit facility that the New York Fed established in the initial stages of the rescue) as well as an additional $3.1 billion from the revolving credit facility to repay securities obligations (Congressional Oversight Panel, 2010, p. 237).

4 AIG's Credit Default Swap Portfolio

We now turn to a discuss AIG's credit default swap business, with the goal of understanding the position in which AIG and its counterparties found themselves on September 16, 2008.

4.1 Credit Default Swaps

A credit default swap is a derivative financial instrument that behaves like an insurance contract on a bond or a similar financial security. The writer of the credit default swap, who is the insurance seller, promises to pay to the buyer of a credit default swap the difference between the market value and the par value of the insured bond if a "credit event" occurs. (For present purposes, setting aside the sometimes arcane details of these contracts, it is sufficient to think of a credit event as the failure of the bond to make a

Table 2: The role of the rescue in recapitalizing AIG's Life Insurance Subsidiaries, $ Million

		2007		2008			
Company	State	Assets ($)	Assets Loaned in Sec. Lending	Realized Sec. Lending Losses	Post-rescue Capital Infusions $	Regulatory Capital with rescue	Regulatory Capital without rescue
ALICO	DE	101,632	4.5%	470	967	4,332	3,365
VALIC	TX	63,999	15.1%	3,563	3,621	2,940	-681
AIG Annuity	TX	50,553	39.7%	7,109	6,048	3,242	-2,806
Am. General Life	TX	33,682	31.3%	3,790	3,084	2,844	-240
SunAmerica Life	AZ	39,455	27.1%	2,281	1,366	4,805	3,439
AIG SunAmerica Life	AZ	35,072	6.1%	425	281	1,317	1,036
AIG Life	DE	10,790	23.6%	870	679	465	-214
Am. Gen Life & Accident	TN	9,134	33.9%	977	786	594	-192
First SunAmerica	NY	6,479	30.3%	654	947	550	-397
Am. International	NY	7,093	35.1%	771	801	458	-343
United States Life	NY	5,315	25.1%	395	456	305	-151
Total: AIG Life		364,770	19.0%	21,305	19,036	22,393	3,357

Source: Authors' calculations from insurance regulatory filings accessed through SNL Financial and March 5, 2009 Hearing before the Senate Committee on Banking, Housing and Urban Affairs http://www.gpo.gov/fdsys/pkg/CHRG-111shrg51303/pdf/CHRG-111shrg51303.pdf (page 43). Table includes details for active securities lending participants with assets of at least $5 billion. The "Total: AIG Life" row includes all AIG life insurance subsidiaries. Capital is regulatory capital

promised payment, as in a default.) There are two ways that the writer of a credit default swap like AIG can suffer a loss. Obviously, a loss can occur if a credit event means that the bond or security no longer makes its promised payments. But in addition, a loss can occur when the probability of a future credit event rises, and so the price of buying a new credit default swap for protection against that loss also rises. In this case, the firm that originally sold the credit default swap at a lower price has suffered a loss on a mark-to-market basis, and that loss is incorporated in its accounting statements. The use of mark-to-market accounting was controversial during the financial crisis (Heaton, Lucas, and McDonald, 2010), but it is standard practice for most derivatives. Mark-to-market losses on AIG's credit default swap contracts were $28.6 billion in 2008 (American International Group, Inc., 2008a, p. 265).

4.2 AIG's Credit Default Swaps

As of December 31, 2007, AIG had written credit default swaps with a notional value of $527 billion. These swaps were written on corporate loans ($230 billion), prime residential mortgages ($149 billion), corporate debt/-collateralized loan obligations ($70 billion) and multi-sector collateralized debt obligations ($78 billion) (American International Group, Inc., 2007d, p. 122). (AIG also had an additional $1.5 trillion of other derivative exposures, including over $1 trillion in interest rate swaps.) The credit default swaps written on multi-sector collateralized debt obligations proved the most troublesome. Again, a collateralized debt obligation is a financial security backed by an underlying stream of debt payments, which can be from mortgages, home equity loans, credit card loans, auto loans, and other sources. The payments on this security are then divided into tranches, so that junior tranches will bear losses before senior tranches do—allowing the senior tranches to receive a higher credit rating. It is even possible to create a collateralized debt obligation by combining tranches of other collateralized debt obligations, a so-called CDO-squared. AIG insured collateralized debt obligations backed by a variety of assets, but including a substantial share backed by mortgages, including both residential and commercial, as well as prime, subprime and Alt-A (which fall between prime and subprime on the risk spectrum) (American International Group, Inc., 2008a, p. 139).[5] It is important to realize that AIG's credit default swap exposure resulted in

[5]Details of one of AIG's multi-sector credit collateralized debt obligation are summarized in Appendix A. Source documents for many CDOs are available online at http://fcic.law.stanford.edu/resource/staff-data-projects/cdo-Library.

a "one-way" bet on real estate: that is, a decline in real estate prices and a rise in foreclosures would impose costs on AIG, but a rise in real estate prices or a fall in foreclosures would not benefit AIG. In contrast, market-making financial firms (like a stockbroker-dealer) typically seek to hedge any significant directional exposure, so that they make profits regardless of whether the price of the underlying asset (say, the price of a stock) rises or falls.

American International Group, Inc. (2007d, p. 122) characterized $379 billion of its credit default swaps (out of $527 billion), those on corporate loans and prime residential mortgages, as used for "regulatory capital relief rather than risk mitigation," primarily by European banks. These do not appear to have been especially risky; in its 2008 10-K (American International Group, Inc., 2008a, p. 118), AIG reported a mark-to-market loss of $379 million on this portfolio, 0.1 percent of the notional value. Moreover, AIG expected that the swaps would be terminated by the counterparties once they were operating under the Basel II capital rules (American International Group, Inc., 2007d, p. 122). This suggests that the counterparty banks considered themselves compliant with Basel II, although they were not yet regulated under those rules.

AIG began originating multi-sector credit default swaps in 2003, at a time when the firm was rated AAA. Over half of AIG's cumulative issuances of credit default swaps, however, occurred after the firm's credit rating was downgraded twice in 2005. AIGFP reportedly decided to stop originating credit default swaps in December 2005, at which point they still had $80 billion of commitments (Polakoff, 2009, p. 5).[6]

4.3 Collateral and Variation Margin

AIG's credit default swap contracts were traded over-the-counter—that is, directly with counterparties—as opposed to being traded on an exchange and cleared through a clearinghouse. The standard master agreement for over-the-counter derivatives is provided by the International Swaps and Derivatives Association and includes a credit support annex, which specifies how counterparty credit risk will be addressed. Both the master agreement and annex can be customized when negotiating a deal.

By construction, many derivatives contracts have zero market value at inception; this is generally true for futures, swaps, and credit default swaps.

[6]The AIG portfolio of credit default swaps does not directly show up on its balance sheet, due to accounting conventions.

When a position has zero market value, the two parties to a contract can, by mutual consent, exit the contract without any obligation for either to make any further payment to the other. Note that one or both parties may be using the contract to hedge a position, in which case exiting would leave at least one party with unhedged risk to consider.

As time passes and prices move, a contract initiated with zero market value will generally not remain at zero market value: Fair value will be positive for one counterparty and negative by an exactly offsetting amount for the other. In such cases, it is common for the negative value party to make a compensating payment to the positive value counterparty. Such a payment is referred to as *margin* or *collateral*; the two terms mean the same thing.[7] Collateral can flow back and forth as market values change. It is important to note that this transfer of funds based on a market value change is classified as a change in collateral and not as a payment. The reason is that the contract is still active, so collateral is held by one party against the *prospect* of a loss at the future date when the contract matures or makes payment on a loss. If the contract ultimately does not generate the loss implied by the market value change, the collateral is returned. The accounting treatment of collateral recognizes this description, and the reporting of collateral on the balance sheet depends upon the existence of a master netting agreement. When full variation margin is regularly exchanged, the value of the contract is in effect regularly reset to zero, meaning that the counterparties can agree to exit the contract without any further payments.

4.4 AIG's Collateral Practices

The post-crisis investigation shed light on AIG's collateral arrangements with various counterparties. Most of the credit default swap contracts written by AIG did not call for full exchange of variation margin. Rather, they carried a wide range of collateral provisions (details are summarized in American International Group, Inc. (2007a) and American International Group, Inc. (2007b) and standard collateral practices are discussed in ISDA (2010)). Some contracts made no provision for any exchange of collateral. Most often, AIG would make collateral payments only if the decline in value of the insured assets exceeded some predefined threshold. These thresholds

[7] Technically, payments due to market value changes are *variation margin*. Another use of collateral is to protect against possible future market value changes. This kind of collateral, called "initial margin" or the "independent amount," was typically not used in OTC markets in dealer-to-dealer transactions prior to the crisis and is not relevant for discussing AIG.

often depended on AIG's credit rating, which meant that a corporate ratings downgrade could lead to a large required collateral payment.

Selected examples from December 2007 (American International Group, Inc., 2007b) illustrate agreements ranging from full mark-to-market to an 8 percent threshold with various credit rating triggers for AIG and in some cases for the underlying collateral. Here are three examples. Goldman Sachs had 44 transactions with AIG, with a total notional value of $17.09 billion. The threshold (level of market value change required to trigger a collateral payment) was "4% as long as AIGFP is rated in the AA/Aa category" (American International Group, Inc., 2007b, p. 4). Societe Generale had 38 transactions with AIG, with a total notional value of $18.64 billion. The threshold was "8% as long as AIGFP is rated AA/Aa2 and Reference Obligation is rated at least in the AA/Aa category; the Threshold is reduced based on a matrix that takes into account lower ratings of AIGFP and/or the Reference Obligation" (American International Group, Inc., 2007b, p. 6). Finally, RBS had four transactions with AIG, with a total notional value of $1.35 billion. AIG had to make variation payments for any market value change; the threshold for these was zero (American International Group, Inc., 2007b, p. 6).

The assets underlying the multi-sector collateralized debt obligations were not easily traded. As a consequence, there were running disagreements between AIG and its counterparties, later documented by the Federal Crisis Inquiry Commission, about their mark-to-market value at any given time and hence the amount of collateral that AIG owed counterparties.

Because many of the AIG credit default swap agreements did not include full payment of mark-to-market variation margin, AIG could and did accumulate unpaid losses. An unpaid variation amount is economically equivalent to a loan from the counterparty to AIG. If AIG has $1 billion in unpaid variation margin, it is as if AIG borrowed $1 billion from the counterparty. In addition, a party accumulating unpaid losses may be unwilling to exit a derivatives contract, because doing so would force it to make full collateral payments. Presumably this is why the credit support annex of swap agreements will often contain provisions that allow the purchaser of a credit default swap to terminate the agreement if the issuer of the swap experiences a credit downgrade.

AIG had first reported a loss on its written credit default swaps in 2007, losing $11.5 billion on all such swaps for the year—$11.1 billion in the fourth quarter alone—with 98 percent of the total coming from credit default swaps on multi-sector collateralized debt obligations (American

Table 3: Evolution of collateral calls and collateral posted for AIG's CDS on Multi-Sector CDOs, $ Millions

	Goldman Sachs		Societe Generale		All Counterparties		Total
Date	Call	Posted	Call	Posted	Call	Posted	Shortfall
6/30/2008	7,493	5,913	1,937	1,937	15,780	13,241	2,539
9/12/2008	8,979	7,596	4,280	4,008	23,441	18,922	4,519
9/15/2008*	10,072	7,596	9,833	4,320	32,013	19,573	12,440
9/16/2008	10,065	7,596	9,818	5,582	33,879	22,445	11,434

Source: AIG/Goldman Sachs Collateral Call Timeline, FCIC. http://fcic.law.stanford.edu/documents/view/2172

*AIG was downgraded on September 15, 2008, as a result of which many multi-sector CDS counterparties were contractually entitled to additional collateral.

International Group, Inc., 2007d, p. 83).[8] Losses continued in 2008. Table 3 depicts the evolution of collateral calls between June and September 2008 for Goldman Sachs and Societe Generale (AIG's two largest credit default swap counterparties), as well as for all counterparties combined. As of June 30, 2008, counterparties had called $15.78 billion and AIG had posted $13.24 billion. The totals climbed gradually until on September 12, total calls amounted to $23.44 billion, with AIG having posted $18.92 billion. Thus, prior to the rescue, AIG had already provided almost $20 billion to counterparties.

The effect of ratings triggers is evident in a comparison of collateral calls for September 12, 2008, and those for September 15, 2008, the day on which all three ratings agencies downgraded AIG below AA-. Total collateral calls increased by $8.6 billion, to $32 billion. AIG's collateral shortfall rose from $4.5 billion to $12.4 billion. Societe Generale's call on that day rose by 5.5

[8] AIG's credit default swap business was barely disclosed prior to 2007. The phrase "super senior" referring to tranches of collateralized debt obligations appears four times in the 2006 annual report and 114 times in 2007; "multi-sector" does not appear in 2006, but appears 23 times in 2007; "CDO" (for collateralized debt obligation) appears twice in 2006 and 93 times in 2007. AIG's 2006 annual report discloses that it had written $483.6 billion in credit default swaps, but provides no details, whereas the 2007 report reports notional values of credit default swap by category. AIG's first public disclosure of credit default swaps written on the multi-sector collateralized debt obligations came on August 9, 2007, during a second-quarter earnings call (Financial Crisis Inquiry Commission, 2011, p. 268). The lack of disclosure is surprising given that the credit default transactions increased the size of AIG's balance sheet by 50 percent in economic terms.

billion.

4.5 What Would Have Happened to Credit Default Swap Counterparties if AIG Had Declared Bankruptcy?

If AIG had declared bankruptcy on September 16, 2008, what would have been the direct effect on credit default swap counterparties? It is of course impossible to answer this question definitively, but some straightforward observations are possible.

AIG had 21 counterparties for its multi-sector credit default swaps. Of those, nine had collateral calls exceeding $500 million, and six of those—Goldman Sachs, Societe Generale, Merrill, UBS, DZ Bank, and Rabobank—had a difference greater than $500 million between the collateral they had requested and the amount AIG had posted. Table 4 shows these collateral shortfalls for the six largest counterparties to AIG's multi-sector credit default swaps as of September 16, 2008 and also shows the shortfall relative to shareholder equity for each counterparty. Of the $11.4 billion that AIG owed to counterparties on its credit default swaps on September 16, 2008, these six banks accounted for $10 billion.

If AIG had defaulted, the counterparty banks to the credit default swaps on the multi-sector collateralized debt obligation would have likely faced three direct consequences. First, the banks would have kept the collateral already posted by AIG. This is a result of the rule mentioned earlier that derivatives are exempted from the automatic stay in bankruptcy (for discussion, see Edwards and Morrison (2005) and Bolton and Oehmke (forthcoming)). Second, the banks would have been treated as general creditors for any collateral that had been requested but AIG had not yet posted. Third, the banks would have retained the asset or position that had been hedged by the defaulted credit default swap.

Assuming that assets were valued correctly and that the September 15, 2008 downgrade of AIG to an A rating eliminated remaining any remaining thresholds that might have further increased collateral calls, the economic cost of an AIG default for its counterparties would be equal to the collateral shortfall: that is, the difference between called and posted collateral. How significant would this shortfall have been for the counterparty banks? As can be seen in Table 4, even for the six banks that were individually owed more than $500 million, in no case did the shortfall exceed 10 percent of their equity capital.

However, comparing the actual loss with counterparty equity may be too sanguine, because it assumes that counterparties would simply absorb

Table 4: AIG's counterparties for CDS on multi sector CDOs: Collateral Shortfall relative to equity and Asset Sales necessary to maintain pre-shortfall equity to asset ratio $B

	Total Assets **[1]**	Shareholder Equity **[2]**	Collateral Shortfall 9/16/2008 **[3]**	Shortfall/ Equity ([3]/[2]) **[4]**	Implied Asset Sales ([4]×[1]) **[5]**
Goldman Sachs	1,081.8	45.6	2.5	5.41%	58.5
Societe Generale	1,694.4	56.0	4.2	7.56%	128.1
Merrill Lynch	875.8	38.4	1.0	2.70%	23.6
UBS	1,784.5	41.5	1.0	2.41%	43.0
DZ Bank	677.0	10.6	0.7	7.00%	47.4
Rabobank	894.0	45.0	0.6	1.31%	11.7
Total asset sales to return to pre AIG shortfall equity to assets					312.4

Source: Financial Crisis Inquiry Commission (2010) and author calculations using 2008 Q2 and Q3 financials. Goldman Sachs, Merrill Lynch, and UBS assets, shareholders equity, and tier 1 capital come from 2008-Q3 financial statements. Societe Generale, DZ Bank, and Rabobank values come from 2008-Q2 financial statements. Column [5] is equal to column [4] multiplied by column [1] and represents the assets sales that would be necessary if the AIG collateral shortfall from column [3] was realized and the firm in question chose to preserve its original equity to asset ratio.

the loss. This assumption faces at least three potential problems. First, Brunnermeier and Pedersen (2009) and Duarte and Eisenbach (2014), among others, emphasize the possibility of fire-sale spillovers. Institutions might respond to the loss in capital by selling assets in order to return to their pre-loss leverage ratios. This could lower asset prices and lead to mark-to-market losses at other firms who might in turn sell assets to get back to target leverage ratios. Our back of the envelope calculations presented in Table 4 suggest that if these six banks had chosen to respond by selling assets to get back to their pre-AIG default debt to equity ratios, they would have needed to sell $312 billion in assets. Second, the cancellation of the credit default swaps would leave many of the counterparties with unhedged exposure to real estate risk. Retaining this risk could reduce the capacity for risk-taking. Third, even if one concludes that counterparties could have absorbed losses due to an AIG failure, other market participants would not have known at the time who was exposed and in what amount. For this reason, the failure of any large financial firm can be stressful for the financial system—a conclusion that is not particular to credit default swaps or AIG.

Another consequence of AIG's failure would have been cancellation of the $387 billion of other credit default swaps mainly held by European banks. Collateral calls related to these positions totaled just $500 million on September 16, 2008 (Congressional Oversight Panel, 2010, p. 42), and as noted above, the institutions were apparently anticipating the swaps to expire when they adopted Basel II capital rules. The cancellation of these swaps would have created a capital deficiency, but it is not clear that this would have been economically important. In any event, European financial regulators would have had the option to forebear for a time with enforcing the capital rules, thus allowing a period for adjustment.

Overall, how much did the rescue of AIG benefit its multi-sector credit default counterparties? Some media reports suggest that $62 billion in taxpayer funds were paid to AIG's multi-sector credit default swap counterparties (for example, Orol (2010)). In fact, the direct counterparty benefit from the rescue is smaller. We can divide the payments to AIG's credit default swap counterparties into three categories.

First, there are collateral payments AIG made prior to the rescue. These payments would have been retained by counterparties in a bankruptcy and therefore cannot be attributed to the rescue. These payments totaled $22.4 billion with $18.5 billion associated with multi-sector collateralized debt obligations that became part of the Maiden Lane III Fed-created special purpose vehicle (see also Congressional Oversight Panel (2010, p. 93)). Second, there are collateral payments made by AIG after the rescue. These

payments could only be made because of the rescue and clearly offset losses that counterparties would have sustained in the absence of a rescue. This amount provides a lower bound on the assistance received by counterparties to the credit default swaps due to the rescue. AIG's 2008 10-K reports total collateral payments for credit default swaps of $40.1 billion for 2007 and 2008, suggesting that $17.7 billion was paid after the rescue. (As confirmation of this amount, the Congressional Oversight Panel (2010, p. 93) found that collateral payments of $16.5 billion were made after the rescue for the assets that became part of Maiden Lane III.) Finally, Maiden Lane III made cash payments of $26.8 billion in exchange for the assets that AIG had insured These payments were equal to the estimated fair market value of the assets at the time (SIGTARP, 2009). While there may not have been many buyers for these assets, even at 47% of face value in the fall of 2008, it is inappropriate to consider the entire amount of the price that Maiden Lane III paid for the credit default swap as a direct benefit to the counterparties. Indeed, as we discuss in the next section, this portfolio of assets appreciated and was later sold for a modest gain.

5 Performance of Maiden Lane Assets

The Federal Reserve Bank of New York created several special purpose vehicles as part of the rescue of AIG. Among them, Maiden Lane II purchased the remaining securities lending invested collateral from AIG, and Maiden Lane III acquired from AIGFP's counterparties the collateralized debt obligations that AIG had insured. This acquisition terminated the associated credit default swaps. Maiden Lane II was funded by a $19.5 billion loan from the New York Fed and $1 billion from AIG that would absorb the first $1 billion in losses. Maiden Lane III was funded by a loan from the New York Fed of $24.3 billion and $5 billion in equity from AIG (Congressional Oversight Panel, 2010, p. 87, 91). The New York Fed has thoroughly documented the resulting cash flows at http://www.newyorkfed.org/markets/maidenlane.html. These data, in combination with information from various other sources, allow us to examine how the value of these securities evolved both while they were held in the Maiden Lane vehicles and afterward.

Table 5: Summary statistics for assets in Maiden Lane 2 and Maiden Lane 3 portfolios

	Maiden Lane 2 Assets			Maiden Lane 3 Assets		
	Min.	Median	Max.	Min.	Median	Max.
Notional (mm$)	0.02	31.00	266.00	0.04	201.00	5400.00
Purchase percentage	0.01	0.56	0.99	0.10	0.48	0.94
Sale percentage	0.00	0.58	1.02	0.03	0.49	0.96
Gain (mm$)	-70.50	1.53	76.40	-172.00	36.80	779.00
Return ($\frac{\text{Gain}}{\text{Purchase Price}} - 1$)	-0.95	0.13	4.06	-0.85	0.35	1.24
Benchmark return	-0.15	0.22	0.23	0.03	0.21	0.23
Return less Benchmark return	-1.18	-0.07	3.84	-0.91	0.14	1.02

Source: Authors' calculations using data from the Federal Reserve Bank of New York and Markit. Notes: "Purchase percentage" is the ratio of the price paid for each asset to its notional value. "Sale percentage" is the ratio of the price received for each asset to its notional value. All dollar values are in millions. For Maiden Lane II, the benchmark is ABX.HE.AAA.06-1, while for Maiden Lane 3, the benchmark is 70% ABX.HE.AAA.06-1 plus 30% CMBX.NA.AAA.1-1, an index of commercial mortgage backed obligations.

5.1 Maiden Lane II and III Performance

The New York Fed managed the Maiden Lane vehicles and assets with the goal of selling the assets once markets stabilized. Both Maiden Lane vehicles were ultimately liquidated for a total gain of $9.5 billion. While held in the Maiden Lane vehicles, the underlying securities paid interest and also repaid principal and experienced writedowns, both of which reduced their face value. They were ultimately sold by auction. The Maiden Lane II assets were bought in December 2008 for $20.5 billion (53% of par value), returned $8.9 billion in interest and principal while held, and the residual claims were sold for $15.1 billion (51% of par) for a non-annualized return of 16.9%. The securities were sold principally in 2011 and 2012. Table 5 summarizes the size, purchase and sale discount, and returns of the individual Maiden Lane II and III securities. There is significant variation in the size and discounts of securities.

It is not obvious whether the overall return of 16.9% is "good" given the risk of the assets. We can ask, however, whether the Maiden Lane securities performed especially well or poorly compared to a broader universe of residential real estate. To perform this comparison while controlling for different liquidation dates, we use as a benchmark an index of AAA securitized subprime mortgage loans originated in the last six months of 2005,

the ABX.HE.AAA.06-1 index. The median security in Maiden Lane II had a 13% return and underperformed the ABX by 7%. It is worth noting that AIG had begun to sell its securities lending collateral prior to the creation of Maiden Lane II, and the securities acquired by the special purpose vehicle were likely the poorest assets.

The securities in Maiden Lane III—primarily the multisector collateralized debt obligation that AIG had insured through its credit default swaps—were bought in November and December 2008 for $29.3 billion (47.4% of par), returned $17.1 billion in interest and principal, and were sold for $22.6 billion (49.8% of par), for a non-annualized return of 35.1%. The securities were sold primarily in 2012. The median security in Maiden Lane III returned 35%, exceeding the benchmark return by 14%. Returns on the Maiden Lane III securities were greater than those on Maiden Lane II, even after adjusting for the return benchmark. (The benchmark for Maiden Lane III was 70% ABX.HE.AAA.06-1 and 30% CMBX.NA.AAA.1-1, an index of commercial mortgage backed obligations. We obtained almost identical results using this benchmark and using ABX alone.)

5.2 Post-Maiden-Lane Performance

Table 6 shows the performance of the securities lending invested collateral portfolio that eventually became part of Maiden Lane II and the super senior tranches of the collateralized debt obligations that were insured by AIGFP and eventually became part of Maiden Lane III.[9] The table provides information at four points: when the securities were originated (various dates), when the Maiden Lane vehicles were created, when the securities were sold from the Maiden Lane vehicles (various dates), and as of October 2014 (or the most recent prior date for which information is available). Thirty-six percent of the Maiden Lane II securities and fifty-nine percent of the Maiden Lane III securities in the table have experienced write-downs. A sizeable share of write-downs have occurred during the post-Maiden Lane period. As explained earlier, senior tranches will be the last to experience actual losses, and for this reason, actual losses in these tranches will appear later and will likely increase over time. With approximately one-third of principal still outstanding, future substantial writedowns for the assets in both Maiden Lanes II and III remain possible.

[9] Figures reported in Table 6 reflect the full outstanding amount for any security that was included in Maiden Lane II or III and not the share of the security purchased by those vehicles. Please see the notes to Table 6 for additional details.

Table 6: Aggregate Performance of Maiden Lane Assets: Origination through October 31, 2014

	Date			
	Origination	Maiden Lane		Most
		Purchase	Sale	Recent
ML2 Notional ($ billions)	137.7	85.9	62.6	43.2
ML2 Amortization ($ billions)	0.00	51.8	72.6	87.4
ML2 Write-down ($ billions)	0.00	0.05	2.5	7.0
ML2 Write-down Since Start (%)	0.00	0.04	1.8	5.1
ML2 securities with Write-downs (%)	0.00	0.5	17.5	36.0
ML3 Notional ($ billions)	82.5	68.8	45.8	29.5
ML3 Amortization ($ billions)	0.00	13.7	31.0	43.1
ML3 Write-down ($ billions)	0.00	0.00	5.7	9.9
ML3 Write-down Since Start (%)	0.00	0.00	6.9	12.0
ML3 securities with Write-downs (%)	0.00	0.00	47.2	59.0

Source: Authors' calculations based on data from the Federal Reserve Bank of New York and from summaries derived from Intex data. Analysis using the Intex data was performed by Larry Cordell and Yilin Huang of the Federal Reserve Bank of Philadelphia.

Notes: Data were available for each of the 855 securities in Maiden Lane II and 146 of the 155 securities in Maiden Lane III, accounting for 97 percent of the original Maiden Lane III face amount. Omitted securities were either not present in the Intex data (7 securities) or had partially missing data (2 securities).

"Origination" is the date the security was created, "Beginning of Maiden Lane" is the approximate time at which the asset was purchased by a Maiden Lane, "Maiden Lane Sale" is the approximate time at which the asset was a sold by a Maiden Lane, and "Most Recent" refers to information as of October 31, 2014 or the most recent prior data available. (Some assets matured or were written down completely prior to October 31, 2014. Once a security has been paid off or written down completely, no additional data are reported for it.) Figures reflect the full outstanding amount for any security that was included in Maiden Lane II or III and not the share of the security purchased by those vehicles. For example, Maiden Lane II might have owned 10% of a particular security and 100% of the outstanding amount of the security is used to compute the figures in the table.

Reported write-downs to date are 5.1 percent of the original face value of the securities that ended up in Maiden Lane II and 12 percent for Maiden Lane III. These estimates were calculated from information provided by Larry Cordell and Yilin Huang from the Federal Reserve Bank of Philadelphia, following the methodology in Cordell, Huang, and Williams (2012). The Maiden Lane III assets are harder to assess because issuers of collateralized debt obligations do not report writedowns prior to maturity. It is thus necessary to look for writedowns on the individual instruments constituting the collateralized debt obligation. The fact that the Maiden Lane II and III assets have suffered write-downs means that we can reject the stark claim that they were "money-good".

6 Was AIG Special?

Given the drama surrounding AIG, it is natural to ask how AIG compared to other financial firms at the time. Was AIG unusual in its risk-taking or was it just unlucky? It turns out that AIG resembled some large banks in important respects: its real estate holdings were comparable to those of Citigroup and Bank of America, banks which also received considerable official support in 2008 and 2009. In addition, AIG's financing of its real estate positions was fragile and prone to runs in times of financial difficulty. Making a comparison with other firms requires first that we assess AIG's position prior to the rescue, especially its exposure to housing. A notable feature of AIG was its large position in written credit default swaps and we need to take these into account when comparing firms.

6.1 A Comparison of AIG with Other Financial Firms

Issuing a credit default swap is economically equivalent to borrowing in order to finance the purchase of the same risky bond that the credit default swap would insure. To see this, suppose that you have excellent credit, that you borrow \$50, at a 5% rate of interest, and that you use the proceeds to buy \$50 in one-year bonds that might default, and which consequently pay a 15% rate of interest. If the bonds pay in full, you have a \$57.50 asset ($\$50 \times 1.15$) offset by a \$52.50 liability ($\$50 \times 1.05$), and you will have earned the 10% interest differential (\$5). However, if the bonds lose \$20, for example, you have a \$30 asset and a \$52.50 liability – you have a loss of \$22.50. This pattern of gains and losses is precisely that faced by the seller of a credit default swap on the bonds. If the bonds pay in full, the

seller earns the credit default swap premium ($5), and if the bonds default, the credit default swap seller bears the loss ($22.50) which is paid to the bondholder.[10]

To relate this to AIG, consider the simplified example of a firm with $100 in assets and $90 of debt and therefore $10 of equity. The firm has an asset-to-equity ratio of 10:1 (that is, $100/$10). This firm now sells a credit default swap on $50 of mortgage-backed securities. In the contract, the buyer of the credit default swap agrees to make an annual payment of $5, and the seller bears the loss if the mortgage-backed securities fail. The economic result is the same as if the firm had $150 in assets ($100 plus the $50 in mortgage-backed securities insured by the credit default swap), financed with $140 in debt, $50 of which is implicit in the credit default swap. The issuance of a credit default swap implicitly changes assets and debt, but not equity.

This was approximately AIG's situation: the firm as a whole had $1.06 trillion of assets and about $964 billion in liabilities at the end of 2007, so it had equity of $96 billion. It issued $527 billion in credit default swaps. It was therefore economically equivalent to a firm with $1.59 trillion in assets and $96 billion in equity. Taking into account the credit default swaps, AIG's ratio of assets to equity was 16:1 rather than 11:1.

AIG was not the only financial firm with off-balance sheet real estate holdings. Citigroup, Bank of America, and JPMorgan Chase all had off-balance-sheet asset-backed commercial paper conduits used to fund real estate holdings (V. Acharya, Schnabl, and Suarez, 2013). The effective asset to equity ratio for these banks was also higher than reported.

Table 7 compares AIG's total real estate exposure with Citigroup, Bank of America, and JPMorgan Chase, and with that of another large insurance company, Metlife. After adjusting the balance sheets as discussed above, we find that AIG's real estate exposure was 24% of assets, comparable to that of Bank of America (32%) and Citigroup (21%). AIG's effective real estate holdings were almost four times its book equity.

6.2 Was AIG A Bank?

Banks typically employ short-term financing to fund holdings of long-term illiquid assets. AIG did have some explicit short-term financing, in particular $20 billion of commercial paper. But AIG's illiquid real estate positions

[10] In economic terms, a credit default swap is economically equivalent to a purchase of the insured asset financed by issuing floating rate debt (Duffie, 1999). For a general discussion of credit default swaps, see McDonald (2013, Chapter 27).

Table 7: Real Estate Exposure and Leverage for AIG, MetLife, Citigroup, Bank of America, and JPMorgan Chase, year-end 2007, $B

	AIG	MetLife	Citigroup	BofA	JPM
Real Estate, on balance sheet	153.3	117.5	377.5	514.9	138.6
Off-balance sheet ABCP			97.5	54.2	63.4
CDS on Residential Mortgage	149.0				
CDS on Multi-Sector CDOs	78.0				
Total real estate exposure	380.3	117.5	475.0	569.1	202.0
Reported Assets	1060.5	558.6	2187.6	1715.7	1562.1
Adjusted Assets	1587.5	558.6	2285.2	1770.0	1625.6
Equity	95.8	35.2	113.6	146.8	123.2
Reported Assets/Equity	11.1	15.9	19.3	11.7	12.7
Adjusted Assets/Equity	16.6	15.9	20.1	12.1	13.2
Real estate as % of Adjusted Assets	24%	21%	21%	32%	12%
Real estate as % of Equity	397%	334%	418%	388%	164%

Sources: MBS and real estate values for MetLife, Citigroup, Bank of America, and JPMorgan Chase are from 2007-Q4 bank holding company data accessed via the Federal Reserve Bank of Chicago website: http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm. Values for off-balance sheet ABCP come from Philipp Schnabl's website: http://pages.stern.nyu.edu/~sternfin/pschnabl/. All other values are from 2007 10K filings and authors' calculations.

Notes: AIG's real estate exposure includes investment of securities lending collateral in real estate related assets. CDS on residential mortgage and multi-sector CDOs are the notional value of AIG's credit default swap portfolio (by asset class). Equity is equal to total shareholders' equity as reported in the companies' 2007 10K filings on their consolidated balance sheets. Reported assets are equal to total assets as reported on the companies' consolidated balance sheets. Adjusted assets are equal to reported assets plus off-balance sheet ABCP and in AIG's case, their credit default swap portfolio. Please note that in addition to the CDS on residential mortgages and multi sector CDOs listed above, this also includes CDS on corporate loans ($230 billion) and CDS on corporate debt/corporate CLOs ($70 billion). Reported leverage is equal to reported assets divided by equity. Adjusted leverage is equal to adjusted assets divided by equity.

were also financed in a way that was not as transparently fragile as demand deposits, but which could create large liquidity needs if AIG suffered losses.

As discussed earlier, AIG's securities lending agreements had a relatively short maturity and could be subject to early termination. As AIG suffered downgrades and as the real estate investments made with securities lending proceeds suffered losses, securities lending counterparties became increasingly likely to terminate these agreements, culminating in a $5.2 billion redemption request on September 15, 2008. This desire by counterparties to unwind their exposure to AIG resembled a bank run, as counterparties sought to unwind the positions rather than be left with collateral and possibly involved in lawsuits. AIG effectively used collateralized short-term financing to buy real estate assets.

Although the mechanism was different, AIG's multi sector credit default swap positions also suffered from something akin to a bank run. AIG's CDS counterparties could not unilaterally terminate credit default swap agreements, but they were entitled to collect collateral as the values of insured assets declined and these counterparty rights could sometimes be accelerated if AIG's credit rating was lowered. When AIG was downgraded on September 15, 2008, collateral calls on AIG's multi sector credit default swaps increased by $8.6 billion as a result.

While AIG was not literally a bank, it undeniably had bank-like characteristics as it employed financing (both explicit and implicit) that was subject to termination and cash demands when asset values fell.

7 Conclusions

Insurance companies are traditionally less vulnerable to financial crises than banks, in large part because they have relatively low-risk assets and do not rely heavily on short-term funding. However, AIG made itself vulnerable in a number of ways. Notably, AIG's near-failure was a result of two outsized bets on real estate, both of which generated large needs for liquidity. First, AIG used securities lending to transform insurance company assets into residential mortgage-backed securities and collateralized debt obligations, ultimately losing $21 billion and threatening the solvency of its life insurance subsidiaries. On one day in 2008, AIG was required to pay $5.2 billion in cash to satisfy redemption requests. Second, AIG issued credit default swaps on real-estate-backed multi-sector collateralized debt obligations, ultimately losing more than $30 billion and facing a one-day $8.6 billion collateral demand due to a downgrade its credit rating. Secu-

rities lending and writing credit default swaps were both "carry trades:" that is, bets that long-term assets would earn a higher return than the short-term cost of funding. AIG's use of financial markets to transform itself from a traditional insurance company to a bank-like firm ultimately proved disastrous.

The rescue of AIG had many beneficiaries. The broader financial system was spared the unpredictable consequences of a large and complicated firm failing at a time when financial markets were very fragile. Direct beneficiaries of the rescue included the life insurance subsidiaries that received $20 billion in capital infusions, protecting their policy holders. The counterparties to the credit fault swaps AIG had sold on multi-sector credit default obligations were also beneficiaries, although their direct benefit was the $17.7 billion in collateral payments made after the rescue, rather than much larger figures that have sometimes have been emphasized. In addition to addressing problems with securities lending and the multi-sector credit default swap portfolio, rescue funds provided to AIG directly benefited numerous other counterparties including AIG's employees, holders of AIG's commercial paper and other AIG debt holders and repo counterparties, states and municipalities who had AIG sponsored Guaranteed Investment Agreements, as well as defined contribution pension plans holding stable value wraps issued by AIG.

AIG's near failure is often described as a liquidity event: that is, it found itself in 2008 holding a number of mortgage-based securities that were impossible to sell—except perhaps at unreasonably low "fire sale" prices. But AIG sustained a loss of $99 billion in 2008, exceeding the firm's end of 2007 equity of $96 billion (AIG 2008b, p. 36), raising the question of whether it experienced a liquidity problem, a solvency problem or both. Despite its reliance on fragile sources of funding, AIG had no specialized liquidity risk committee until 2007 (AIG 2007b, p. 99). It is tempting to attribute this to the company's insurance origins together with senior managements' belief that the real estate related investments were "money good". Our examination of the performance of AIG's underlying real estate securities indicates that AIG's problems were not purely about liquidity. While we cannot say whether prices in 2008 were "correct", the assets represented in both Maiden Lane vehicles have experienced substantial write-downs, with the possibility of more in the future. With hindsight, it may seem obvious that AIG's real estate assets were not "money good" and would suffer real losses. However, the belief that they would not suffer losses, and that liquidity would not be a problem, was an important factor in their creation and purchase by AIG and others.

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Appendices

A Example of a Collateralized Debt Obligation: Adirondack 2005-1

Adirondack was a $1.5 billion multi-sector CDO created by Goldman Sachs in 2005, and the AAA-rated tranches were insured by AIG. The Adirondack 2005-1 Pitchbook is available at http://fcic.law.stanford.edu/documents/view/2306 and the Offering Circular at http://fcic.law.stanford.edu/documents/view/2284.The Adirondack prospectus stated that a AAA rating for the senior tranches was a precondition for issuance and that the proceeds from issuance would be used to purchase RMBS (78.7%), CMBS (9.2%), CDOs (8.1%), ABS (1%), REITs (3%), and Synthetics (12.1%, of which 29.4% are RMBS, 21.7% are CMBS, and 48.9% are CDOs). See p. 25 of the Offering Circular.

Table 8 shows the various tranches of the CDO, the interest they would pay, and the maturity date of each tranche. The CP notes (in the last row of the table) contained a put agreement, under which Societe Generale was obligated to buy additional A-1 LT-a notes at par, with the proceeds used to repay the notes. AIG wrote CDS on the two senior most tranches, the A-1 LT-a Floating Rate tranche, which paid 32 basis points above LIBOR, and the CP Notes, which were intended to pay LIBOR.

Tranche Description	Amount ($b)	Interest (LIBOR +)	Due
A-1 LT-a Floating Rate	267.5	0.32%, 0.34% after July 2008	2040
A-2 Floating rate	60.8	0.40%	2040
B Floating rate	57.7	0.58%	2040
C Floating rate	30.4	1.40%	2040
D Floating rate	24.3	2.75%	2040
E Floating rate (optional)	5.0	>=2.75%	2040
CP Notes	1070.1	0	2040
A-1 LT-b Floating rate	?	0.32%, 0.34% after July 2008	2040
Total	1515.8		

Table 8: Details of Adirondack 2005-1 offering. Source: Adirondack 2005-1 CDO Offering Circular, FCIC.

B Notes on Data

Important data sources include

- the Maiden Lane documentation available from the New York Fed, including spreadsheets reporting prices and dates for the Maiden Lane transactions
- Annual (10-K) and quarterly (10-Q) reports for AIG and other financial institutions
- numerous documents available via the FCIC website
- Proprietary data from Intex, which provides "the source data for the universe of publicly issued private-label mortgage-backed securities (MBS) as well as as publicly traded structured-finance ABS CDOs." (Cordell, Huang, and Williams, 2012, p. 3). Actual calculations with the Intex data were performed by Larry Cordell and Yilin Huang of the Federal Reserve Bank of Philadelphia. Numbers in this paper are based on results of their calculations.
- Proprietary data from Markit, which provides CDS price quotes, specifically the ABX and CMBX series used in Table 5.
- Proprietary data from SNL Financial which provides access to the regulatory filings of US domiciled insurance operating companies, used in constructing Table 2.
- Proprietary data from Bloomberg which provides historical ratings for AIG (Table 9), and for the Maiden Lane II and III securities (Figure 1).

C Notes on the Maiden Lane Securities

C.1 Information from the New York Fed

The New York Fed data related to the Maiden Lane transactions and vehicles are publicly available at http://www.newyorkfed.org/markets/maidenlane.html. For each security held in a Maiden Lane, the New York Fed supplies spreadsheets that report:

- Security description
- Date when acquired (settlement date)
- Date when sold (settlement date)
- The face value of the security and purchase price, both when acquired and sold
- Net cash flow received while the security was held in a Maiden Lane
- The identity of the counterparties

Important characteristics of the securities, however, can only be inferred using proprietary commercial data.

The Maiden Lane data reports the price at which securities were bought and sold and the total cashflow earned from holding the security. It is thus possible to compute the return earned while the securities were held by the Maiden Lanes, and the NY Fed spreadsheets do this. Unfortunately, it is not possible to compute actual writedowns while the securities were held in the Maiden Lanes, and the NY Fed spreadsheets do not report performance after the securities are sold.

Given additional data, such as that available from Intex, we can decompose the reported return into four components: interest, principal repayments, capital gains, and writedowns. We can also track subsequent performance. To understand what the New York Fed data does and does not allow us to infer, let F_t be the face value of a security at time t, with F_0 denoting the face value at origination. The face value can change either because there have been cumulative principal repayments, R_t, or cumulative writedowns, W_t. There are also cumulative interest payments, I_t.

Suppose that a CDO or an RMBS with face value F_t on date t is purchased for x_1F_1 on date 1, and sold at date 2 for x_2F_2, with x_t representing the percent of face value at which the security trades. Total net cash flows between time 1 and 2, C_2, are due to interest and principal repayments: $C_2 = \Delta I_2 + \Delta R_2$,

where Δ denotes the change between time 1 and time 2.[11] Over time, the face value changes as a result of cumulative principal repayments, R_t, and cumulative writedowns, W_t. By definition, principal changes are due to repayments and writedowns:

$$F_2 = F_1 - \Delta R_2 - \Delta W_2 \tag{1}$$

The return on the security is

$$\text{Return} = x_2 F_2 + \Delta R_2 + \Delta I_2 - x_1 F_1 \tag{2}$$

The Maiden Lane data reports this return. To interpret this number, we can rewrite equation (2) as

$$\begin{aligned}\text{Return} &= x_1(F_2 - F_1) + \Delta R_2 + \Delta I_2 + (x_2 - x_1)F_2 \\ &= x_1(-\Delta R_2 - \Delta W_2) + \Delta R_2 + \Delta I_2 + (x_2 - x_1)F_2 \\ &= -x_1 \Delta W_2 + \Delta R_2(1 - x_1) + \Delta I_2 + (x_2 - x_1)F_2\end{aligned}$$

To interpret this expression:

$-x_1 \Delta W_2$ Writedowns are a loss, but only a loss against the price paid for the security (x_1). We report cumulative writedowns, W_t, and cumulative principal repayments ("amortization") in Table 6.

$\Delta R_2(1 - x_1)$ Principal is repaid at \$1, which is a gain relative to the discounted purchase price of x_1

ΔI_2 Interest is worth \$1 for each dollar paid

$(x_2 - x_1)F_2$ There can be a capital gain or loss on the remaining principal. (Principal that is not remaining has been written down for a loss or paid off at a gain.)

If we know either writedowns or principal repayments for the Maiden Lane securities, the other can be inferred.

C.2 Other information

There are also numerous formerly confidential documents published by the FCIC and otherwise, relating to the Maiden Lane securities. These notably include American International Group, Inc. (2010) and American

[11] For simplicity, we incorporate interest on principal repayments into I_t.

International Group, Inc. (2008b). American International Group, Inc. (2010) tells us the origination dates for the multi-sector CDOs that AIG insured, and it reveals that most of them had at least some subprime mortgage exposure. American International Group, Inc. (2008b) reports losses on a security-level basis for securities in Maiden Lane III, at the time the securities were purchased for the vehicle.

C.3 Credit Rating History for Maiden Lane Securities

Credit ratings for the individual RMBS and CDOs held in the Maiden Lane vehicles are plotted in Figure 1. This figure complements Table 6, showing that ratings declines accompanied the writedowns.

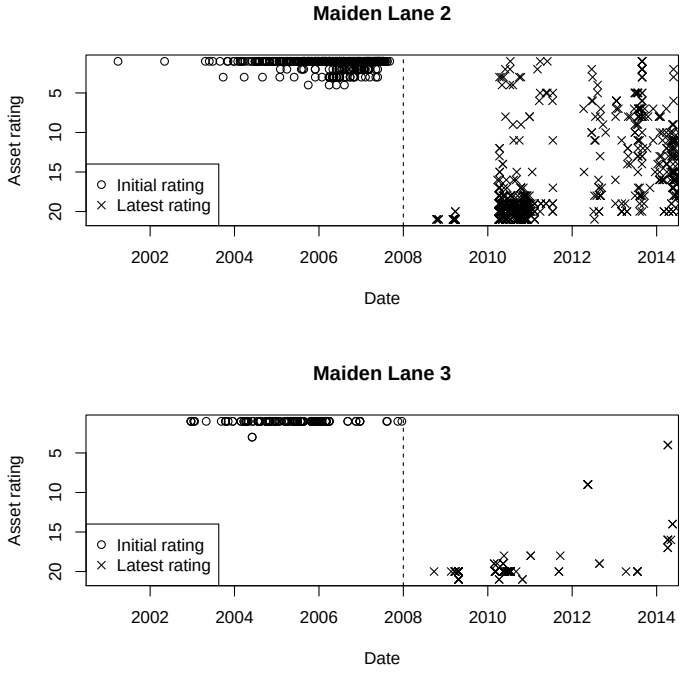

Figure 1: Credit ratings for the assets in Maiden Lanes II and III, at origination and latest available. Low numbers correspond to high ratings: a "1" is AAA, and 22 is the lowest rating. Source: Bloomberg

D AIG's Credit Rating History

AIG's rating history is in Table 9.

Date	Rating Firm	Rating
3/30/2005	S&P	AA+
6/03/2005	S&P	AA
5/08/2008	S&P	AA-
9/15/2008	S&P	A-
3/31/2005	Moodys	Aa1
5/02/2005	Moodys	Aa2
5/22/2008	Moodys	Aa3
9/15/2008	Moodys	A2
3/15/2005	Fitch	AA+
5/02/2005	Fitch	AA
5/08/2008	Fitch	AA-
9/15/2008	Fitch	A

Table 9: History of Fitch, Moody's, and S&P credit ratings for AIG, 2005 - 2008. Prior to March 2005, AIG was rated AAA by all three rating agencies. Source: Bloomberg