

SURF Spotlight
How Mortgage Losses Became the Primary Catalyst for the Financial Crisis¹
2019 Q4

While it is widely understood that mortgage losses in the U.S. suffered by overleveraged firms was a primary catalyst for the financial crisis (Duffie, 2019), there is still not a complete understanding of how these mortgage losses were transmitted through the financial system. In this *SURF Spotlight*, I summarize the findings of “The Role of CDOs in the Financial Crisis,” by Larry Cordell, Greg Feldberg, and Danielle Sass, hereafter “CFS (2019).” This paper details the mechanism through which mortgage losses were concentrated in mortgage-derivative products (MDPs), namely the AAA and “super-senior” securities² of asset-backed security collateralized debt obligations (ABS CDOs) and credit default swaps (CDS). Since large, overleveraged financial firms were the primary investors in these MDPs, these losses imperiled their solvency, placing them at the center of the crisis.

These findings help clear up misperceptions that the crisis came primarily from a vast, *disproportionate* expansion of mortgage credit to low-income, subprime areas of the market (Mian and Sufi, 2018). With better microdata, Adelino, Schoar, and Severino (2016) and Foote, Loewenstein, and Willen (2016) show that there was not a disproportionate shift in the stock of mortgage debt toward low-income or low-credit-score households.

What CFS (2019) shows is that mortgage losses ultimately were concentrated in the AAA and super-senior securities of ABS CDOs from three different sources that became the dominant assets in these CDOs:

- 1) ABS CDOs were the primary, even exclusive, investor for lower-rated private-label mortgage-backed securities (PLMBS), which is where subprime and Alt-A PLMBS losses ultimately were concentrated.
- 2) Some \$200 billion CDS referencing these lower-rated PLMBS were placed into these CDOs, further concentrating and multiplying subprime mortgage losses. These CDS placed into the CDOs became the “long” for what Michael Lewis (2010) famously dubbed “The Big Short.”
- 3) Most lower-rated CDO bonds were not sold into the market, but rather cross-sold into other CDOs, effectively eliminating credit support and concentrating some \$325 billion of losses in the AAA and super-senior securities of ABS CDOs and the CDS referencing them.

What turned these \$325 billion of ABS CDOs losses into a financial crisis is that the primary investors in these MDPs were large, overleveraged firms at the center of the financial crisis (i.e., AIG, Citigroup, Merrill Lynch, UBS, Bear Stearns, and several other large financial firms). Precrisis capital rules were minimal or nonexistent on these MDPs, leading to the government bailouts in 2008.

¹ This commentary was written by Larry Cordell of the Supervision, Regulation, and Credit Department of the Federal Reserve Bank of Philadelphia. The opinions expressed here are those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

² “Super-senior” securities are most often CDS contracts referencing senior AAA CDO securities. While not rated, they are senior to AAA bonds in a deal. Since rating agencies do not have a rating above AAA, we classify them alongside AAA in the analysis.

Nonprime Mortgage Losses Transmitted Through PLMBS

Mortgage losses transmitted through PLMBS were concentrated in lower-rated PLMBS bonds. Losses on loans placed into PLMBS are historically very large, with around 90 percent concentrated in 2005-07 originations. Losses on subprime loans placed in PLMBS will ultimately total close to \$400 billion; losses on Alt-A mortgages — to borrowers with strong credit scores but other risky characteristics — in MBS are expected to be about \$250 billion (Exhibit 1).³

Given the magnitude of the housing crisis and the losses suffered, the PLMBS securitization process will ultimately generate surprisingly small writedowns⁴ for the AAA PLMBS, especially for subprime. While AAA subprime security prices fell sharply during the crisis with many downgrades, by one recent estimate, losses on AAA subprime bonds originated between 1987 and 2007 averaged less than 1 percent (Ospina and Uhlig, 2018; Exhibit 2). The main reason losses on AAA MBS were relatively modest was the loss-absorbing capacity of the lower-rated securities, which provides credit support for the AAA subprime bonds up to 23 percent on average. Losses on lower-rated securities were indeed catastrophic — averaging 51 percent for those subprime MBS originally rated BBB-AA, 57 percent for Alt-A, and 34 percent for prime. What was unprecedented about the securitization process in the 2000s was that the primary, if not the only, investor for these lower-rated MBS was not market investors, but rather ABS CDOs, which we examine next.

How the Securitization Process Concentrated and Magnified Mortgage Losses in AAA ABS CDOs

Cordell, Huang, and Williams (2011) provided the first comprehensive picture of the ABS CDO market.⁵ Exhibit 3 shows the full securitization process from mortgage loans to PLMBS to ABS CDOs, through CDO²s, which are CDOs that contain tranches of other CDOs. (The average subordination, or support, level of each class of securities is in parentheses.) The investment grade securities of nonprime PLMBS became the primary collateral for CDOs. BBB-rated MBS securities were concentrated in so-called mezzanine CDOs; A-rated securities were concentrated in “high-grade” CDOs. However, unlike mortgages, the CDO collateral was not backed by houses with substantial recovery values, but rather by bonds much more prone to catastrophic loss. For example, BBB subprime bonds on average covered losses starting at 4 percent and became worthless when MBS losses reached 8 percent.⁶ On average, A-rated subprime bonds became worthless when losses reached 13 percent. Subprime losses would often far exceed these levels.

³ We do not consider the \$30 billion of Prime PLMBS losses here or losses by Freddie Mac, Fannie Mae, or Ginnie Mae because they were a very small share of securities placed in CDOs.

⁴ Here, we distinguish actual writedowns on these PLMBS from “mark-to-market” (MTM) losses booked as a requirement of fair value accounting. MTM losses were actually very large, exasperating actual credit losses suffered.

⁵ Intex classified ABS CDOs as CDOs that included residential mortgages or other securities that required “active” management allowing for reinvestments because of prepay options on mortgages.

⁶ In Lewis (2010) and the accompanying movie, they referred to “Armageddon” as occurring when subprime MBS losses reach 8 percent, which happened to be the average “detachment point” in which the BBB bonds became worthless, as happened very often for 2005–07 nonprime MBS. This made even the AAA securities of CDOs worthless.

Over time, these subprime bonds came to dominate ABS CDOs.⁷ This was the first group of assets that generated catastrophic losses for the CDOs, as we showed previously.

The second major group of assets that contributed to CDO losses was that CDO investors increasingly held long positions in CDS that referenced subprime MBS. CDS are “side bets” between two parties. “Protection buyers” want to hedge their mortgage risk or speculate on a downturn. “Protection sellers” insure against loss or purchase long exposure to mortgage risk. While the exact size of the CDS market is unknown, ABS CDOs likely became the largest single market for protection sellers on subprime MBS: All told, \$201 billion of CDS were placed into CDOs. These protection buyers (i.e., short sellers), like John Paulson and Michael Burry, became what Michael Lewis (2010) famously dubbed “The Big Short.”

The third major asset of ABS CDOs that caused heavy losses came from the fact that, unlike PLMBS, most of the lower-rated tranches of CDOs were never sold to third-party investors, but rather were simply cross-sold into other CDOs. By our measure, 75 percent of the BBB- to AA-rated tranches of CDOs were sold or referenced into other CDOs or CDO²s. Recall that for PLMBS investors, the lower-rated tranches of PLMBS securities protected the AAA bonds against loss. But with CDOs, most lower-rated CDO bonds never left the ABS CDO market, effectively eliminating the loss-absorbing capacity of these lower-rated securities.

The sum total of the securitization process meant that mortgage losses were going to be heavily concentrated in the AAA and super-senior securities of these ABS CDOs, unlike the AAA PLMBS bonds.⁸ As we show in Exhibit 4, of the \$410 billion of expected ABS CDO losses, \$325 billion, nearly 80 percent, are expected to be realized by the AAA and super-senior CDO bonds. Any loss on a AAA bond is problematic. Losses of this magnitude are what compelled Goodman et al. (2008) to label the ABS CDO business “the greatest ratings and risk management failure ever.”

How ABS CDO Losses Were Transmitted Through the Financial System

Importantly, \$325 billion of losses would not in and of itself cause a financial crisis. What made these losses the primary catalyst for the financial crisis was that virtually no capital was held against these securities, and the firms holding them were massively overleveraged, partly because of risk-based and Basel II capital requirements.

First, favorable capital rules on AAA-rated securities created strong incentives for firms to buy and hold AAA-rated securities. The Basel Committee on Banking Supervision had set a basic 8 percent capital standard relative to “risk-weighted assets,” with weights assigned under Basel I and II regulations. Securities rated AA or AAA carried a 20 percent risk weight, for a capital charge of just 1.6 percent, a leverage ratio of 62.5 to 1. With Basel II, international regulators in 2004 further eased standards for AAA-rated securities. For “granular pools” like those of private-label MBS and CDOs, capital on super-senior securities was set at 0.56 percent — a leverage ratio of 179 to 1.

⁷ Exhibit 5 in CFS (2019) shows that in 2006–07 almost 80 percent of ABS CDO assets were of PLMBS, primarily subprime.

⁸ Even the equity tranches of ABS CDOs were often hedged away through “correlation trades,” where investors like John Paulson purchased the equity tranche of some synthetic ABS CDOs, only to short more highly rated bonds.

Even worse, capital requirements on CDS referencing super-senior CDOs escaped capital regulation altogether because over-the-counter (OTC) derivatives markets were banned from regulation by federal and state regulators by the Commodity Futures Modernization Act of 2000.⁹ Thus, the CDS held by AIG referencing super-senior ABS CDO securities had no capital, margin, mark-to-market, or liquidity requirements.

The second major problem was that Basel II and risk-based capital requirements left the firms dangerously undercapitalized. As a primary example, Citigroup had \$2.2 trillion of total book assets in June 2007, but only \$1.3 trillion of risk-weighted assets, driven partly by low risk weightings on its mortgage holdings. So while its leverage ratio (measured by total *book* assets to capital) went from 15 to 1 in 1999, to 25 to 1 by 2007, Citigroup's regulatory capital ratio was 8 percent to 9 percent of risk-weighted assets clear through the financial crisis, which made it well capitalized by regulatory capital standards (Exhibit 5). Losses on their CDO holdings would total \$34 billion, ultimately leading to their government rescue.

Citigroup was a microcosm for how ABS CDO losses reverberated through the financial system in 2007 and 2008. AIG suffered \$33 billion of writedowns on its CDOs; several other monoline insurers suffered catastrophic losses that led to their bankruptcies. Super-senior CDOs were also retained on balance sheet at UBS, Merrill Lynch, and Morgan Stanley. CDO writedowns were recorded at 16 of the 18 CDO issuers, many of which received government support in various forms or were merged out of existence. As shown in Exhibit 6, among the world's major financial firms, \$220 billion of ABS CDO losses were recorded, 42 percent of all writedowns recorded between July 2007 and January 2009, making them the primary catalyst for the financial crisis and the primary vehicle for transmitting mortgage losses through the financial system.

Conclusion and Lessons Learned

In this *SURF Spotlight*, I describe how the securitization process concentrated some \$325 billion of losses in ABS CDO AAA and super-senior securities, placing them at the center of the financial crisis. But while ABS CDOs were the primary catalyst for the financial crisis, the primary *cause* of the financial crisis remains the enormous leverage built up in the precrisis financial system (Duffie, 2019).

Have lessons been learned? Regulators have supplemented the Basel II regime with bank stress tests. This is a clear improvement from a supervisory perspective.

The new capital rules have increased capital requirements and, so far, the largest banks are significantly less leveraged. (Citigroup's leverage has been as low as 10 to 1 in recent years.) Risk-weighted assets remain central to capital adequacy requirements, but they are imperfect. It remains essential to retain nonrisk-weighted leverage ratio standards as a crucial backstop to prevent a recurrence of the overleveraged firms in the run-up to the financial crisis. These issues are being debated now among the regulatory community at the time of this writing.¹⁰

⁹ See *The Financial Crisis Inquiry Report*, Financial Crisis Inquiry Commission (FCIC, 2011), p. xxiv.

¹⁰ See Randal Quarles, "A New Chapter in Stress Testing," speech at the Brookings Institution, November 9, 2018, at <https://www.federalreserve.gov/newsevents/speech/quarles20181109a.htm>.

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Exhibit 1

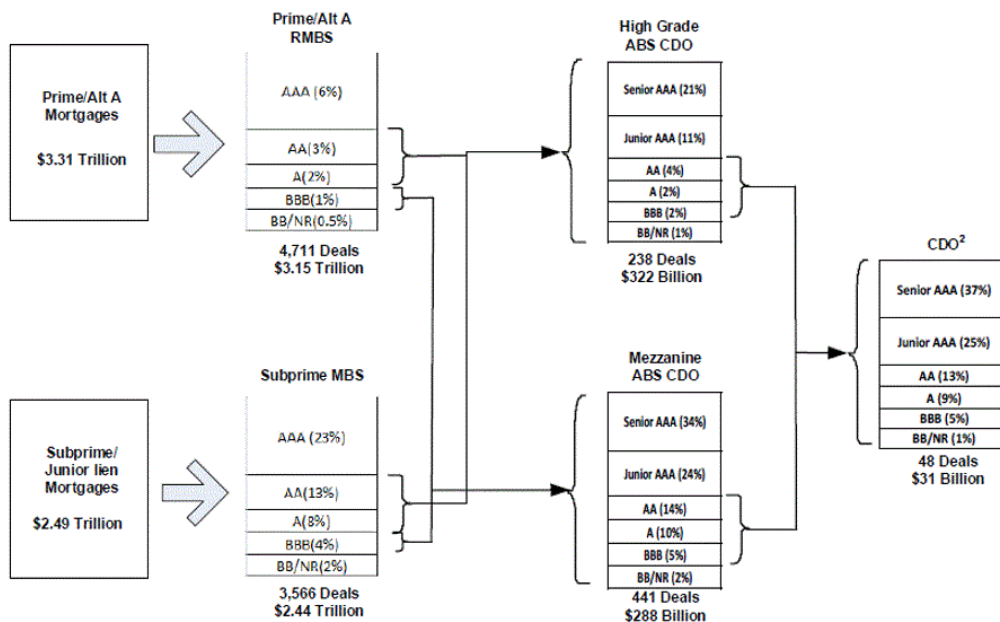
Subprime and Alt-A Losses in PLMBS Cumulative by Vintage Through October 2018 (\$ Billions)		
Vintage	Subprime Losses	Alt-A Losses
2002 & Prior	16.9	1.4
2003	9.0	1.4
2004	27.8	10.9
2005	112.6	63.7
2006	180.6	122.3
2007	38.8	49.4
Totals	385.7	249.0
Losses 2005– 2007	332.0	235.4
% 2005–2007	86%	95%
Source: CoreLogic Solutions		

Exhibit 2

MBS Losses as of December 2013 by Credit Rating and Mortgage Type (\$ Billions)			
Mortgage Type	Principal Amounts	Losses	% Losses
Prime	1,238.7	37.5	3.0
Alt-A	1,327.3	145.2	10.9
Subprime	1,196.0	119.1	10.0
AAA-Rated Securities			
Prime	1,172.7	14.8	1.3
Alt-A	1,210.0	78.9	6.5
Subprime	979.5	4.3	0.4
Investment Grade Securities, Excluding AAA			
Prime	54.0	18.4	34.0
Alt-A	96.5	55.3	57.3
Subprime	203.9	104.8	51.4
Non-Investment Grade Securities			
Prime	12.0	4.3	36.2
Alt-A	20.8	10.9	52.7
Subprime	12.7	10.0	78.7
Note: Figures taken from Ospina and Uhlig (2017, Table 5)			

Exhibit 3

Transformation of Mortgage Loans to CDO²s 1998 – 2007



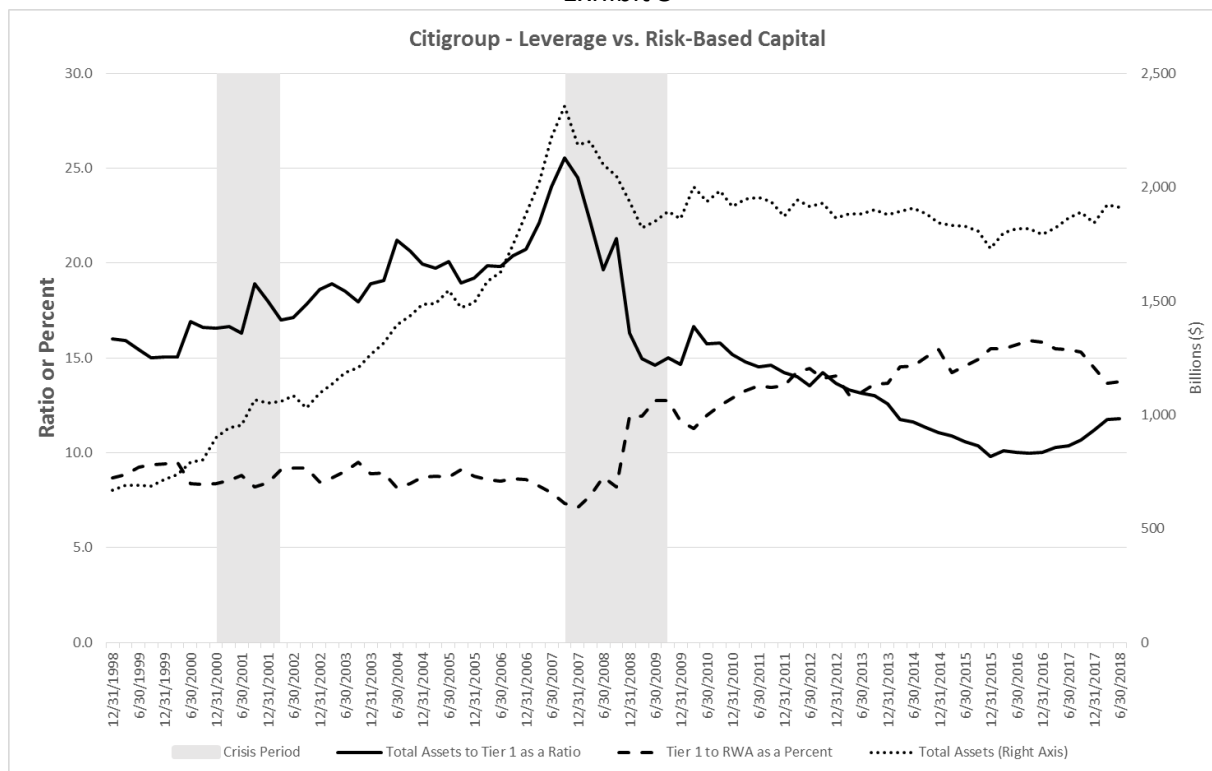
Note: Figure taken from Cordell, Huang and Williams (2011). This figure shows the total dollar amounts and counts for the various sources of mortgages, mortgage-backed securities, CDOs and CDO²s that made up the mortgage market from 1998 - 2007. CDO = Collateralized Debt Obligation; RMBS = Residential Mortgage-Backed Securities; ABS = Asset-Backed Securities. Subordination levels are in parentheses.

Exhibit 4

Summary Expected Losses for ABS CDOs by Issuance Year and Original Rating					
	Tranche Loss (\$ Million)				
	1999 - 2005H1	2005H2	2006	2007	Grand Total
AAA/Super-Senior	32,872	30,143	135,633	125,934	324,582
BBB-AA	14,786	7,424	24,805	20,533	67,549
BB/B/NR	4,876	2,203	6,607	4,733	18,419
Grand Total	52,534	39,771	167,045	151,200	410,549
	Loss %*				
AAA/Super-Senior	25	46	70	84	60
BBB-AA	75	101	99	102	93
BB/B/NR	94	96	101	99	98
Grand Total	33	53	74	86	65

*Note: Super-senior are securities often not rated but senior to AAA in their trusts. Since rating agencies do not have ratings above AAA, they are combined with AAA. Losses include unpaid original principal plus \$2.9 billion of unpaid capitalized portions of accumulated interest shortfalls, so losses can exceed 100 percent. Sources: Intex for valuations, Bloomberg and IDC for fair values on ABS, and MBS collateral bonds.

Exhibit 5



Source: Federal Reserve’s Regulatory Y-9C reports.

Exhibit 6

Crisis-Related Writedowns Through January 26, 2009 \$ Millions					
Firm Type	ABS CDOs	Corporate Credit	RMBS Exposure	Other or Undefined	All Writedowns
Insurers/asset managers	61,074	6,320	31,691	17,067	116,152
North American banks	86,114	23,702	44,750	55,103	209,669
European banks	63,990	18,579	26,425	62,834	171,828
Asia/emerging market banks	9,248	4,724	5,728	3,743	23,443
Totals	220,426	53,325	108,594	138,747	521,092
% Total	42%	10%	21%	27%	