Critical Review

ISSN: 0891-3811 (Print) 1933-8007 (Online) Journal homepage: https://www.tandfonline.com/loi/rcri20

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To cite this article: Viral V. Acharya & Matthew Richardson (2009) CAUSES OF THE FINANCIAL CRISIS, Critical Review, 21:2-3, 195-210, DOI: 10.1080/08913810902952903

To link to this article: https://doi.org/10.1080/08913810902952903

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CAUSES OF THE FINANCIAL CRISIS

ABSTRACT: *Why did the popping of the housing bubble bring the financial system—rather than just the housing sector of the economy—to its knees? The answer lies in two methods by which banks had evaded regulatory capital requirements. First, they had temporarily placed assets—such as securitized mortgages—in off-balance-sheet entities, so that they did not have to hold significant capital buffers against them. Second, the capital regulations also allowed banks to reduce the amount of capital they held against assets that remained on their balance sheets—if those assets took the form of AAA-rated tranches of securitized mortgages. Thus, by repackaging mortgages into mortgage-backed securities, whether held on or off their balance sheets, banks reduced the amount of capital required against their loans, increasing their ability to make loans many-fold. The principal effect of this regulatory arbitrage, however, was to concentrate the risk of mortgage defaults in the banks and render them insolvent when the housing bubble popped.*

There is almost universal agreement that the fundamental cause of the crisis was the combination of a credit boom and a housing bubble.

In the five-year period covering 2002–2007, the ratio of debt to national income increased from 3.75:1 to 4.75:1. It had taken the prior full decade to accomplish an increase in debt of this magnitude, and it had taken fifteen

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Critical Review 21(2–3): 195–210
ISSN 0891-3811 print, 1933-8007 online

DOI: 10.1080/08913810902952903

years to do the same thing prior to that. Moreover, from 2002 to 2007, house prices grew at an unprecedented rate of 11 percent per year.

When the "bubble" burst, a severe economic crisis was bound to come. The median family, whose house was highly leveraged and whose equity represented 35 percent of its wealth, would not be able to continue to consume as much as it did through 2007. The economy was going to feel the brunt of it.

It is much less clear, however, why this combination of events led to such a severe financial crisis: that is, why we had widespread failures of financial institutions and the freezing up of capital markets. The systemic crisis that ensued reduced the supply of capital to creditworthy institutions and individuals, amplifying the effects on the real economy.

There is no shortage of proximate causes of the financial crisis. There were mortgages granted to people with little ability to pay them back, and mortgages designed to systemically default or refinance in just a few years, depending on the path of house prices. There was the securitization of these mortgages, which allowed credit markets to grow rapidly, but at the cost of some lenders having little "skin in the game"—contributing to the deterioration in loan quality (Berndt and Gupta 2008; Dell'Ariccia, Igan, and Laeven 2008; Keys, Mukherjee, Seru, and Vig 2008; Mian and Sufi 2008). Finally, opaquely structured securitized mortgages were rubber-stamped as "AAA" by rating agencies due to modeling failures and, possibly, conflicts of interest, as the rating agencies may have been more interested in generating fees than doing careful risk assessment.

Somewhat surprisingly, however, these are not the ultimate reasons for the collapse of the financial system. If bad mortgages sold to investors hoodwinked by AAA ratings were all there was to it, those investors would have absorbed their losses and the financial system would have moved forward. The crash would have been no different, in principle, than the bursting of the tech bubble in 2000.

In our view, what made the current crisis so much worse than the crash of 2000 was the behavior of many of the large, complex financial institutions (LCFIs)—the universal banks, investment banks, insurance companies, and (in rare cases) even hedge funds—that dominate the financial industry. These LCFIs ignored their own business model of securitization and chose *not* to transfer the credit risk to other investors.

The legitimate and worthy purpose of securitization is to spread risk. It does so by removing large concentrations of risk from the balance

sheets of financial institutions, and placing small concentrations into the hands of large numbers of investors. But especially from 2003 to 2007, the main purpose of securitization was not to share risks with investors, but to make an end run around capital-adequacy regulations. The net result was to keep the risk concentrated in the financial institutions—and, indeed, to keep the risk at a greatly magnified level, because of the over-leveraging that it allowed.

Banking 101

The simple theory of banking is that banks act as financial intermediaries between depositors and borrowers (Diamond 1984). Depositors provide funds to make loans, and banks provide expertise in assessing the credit-worthiness of borrowers. Historically, then, the asset side of a bank's balance sheet would consist of loans funded by deposits (as well as loans funded by non-deposit debt and equity).

A bank's loans are considered assets because they are owed back to the bank. Deposits are considered liabilities because, upon demand, they must be returned by the bank to the depositors. In the meantime, however, most deposits have been lent out to borrowers; the interest on these loans is the main source of the bank's profits. Most deposits, therefore, are unavailable at any given time to be reclaimed by the depositors.

To avoid the possibility that all the depositors will demand the return of their deposits at the same time—as occurred during the several panics between 1850 and 1914 and during the Great Depression—deposits are generally insured up to a certain amount by the government. In return for this guarantee and an insurance fee, and to ensure that banks have a stake in the process, banks are required to hold a minimum amount of "capital" as a buffer against losses. (While there are other complementary explanations of bank-capital regulation, this simple one suffices for exposition of our main point.) For these purposes, "capital" must be defined by regulators. In the run-up to the crisis, the regulations in most Western countries equated capital with funds obtained either by raising equity (selling stock or certain forms of "hybrid" debt that has equity-like features); or by retaining earnings. We argue below that banks' efforts to circumvent these capital-adequacy requirements caused the financial crisis.

In a world without deposit insurance, capital-adequacy regulations might be unnecessary. The creditors of financial institutions (depositors,

uninsured bondholders, and other counterparties) might curb excessive risk taking. Uninsured bondholders and other counterparties could do so by charging higher interest rates to banks that took what seemed to be excessive risks. Similarly, depositors could demand higher interest rates on their deposits in exchange for the higher risk involved in using these banks; and if unanticipated risks seemed to arise, they would participate in bank runs (akin to the run of unsecured creditors on banks during the ongoing crisis). But the creation of deposit insurance carried with it a risk of moral hazard for traditional banks, and implicit government bailout guarantees for institutions that are considered too big to fail did the same for today's LCFIs.

The bank-capital regulations of most Western countries follow the terms recommended by the Bank for International Settlements' Basel Committee on Banking Supervision (located in Basel, Switzerland). Under the Basel accords, banks must maintain at least an 8 percent capital buffer against a risk-adjusted measure of their assets. In the United States, the F.D.I.C. has interpreted "at least" 8 percent to mean 10 percent, if a bank is to be designated "well capitalized" (a designation that brings certain privileges, such as a lower deposit-insurance premium). Maintaining this capital buffer is inherently costly. For one thing, it cannot be lent out at interest. For another, the two main forms of "capital," according to the Basel rules, are equity and retained earnings. If a bank's capital must be boosted through issuing equity shares, it generally signals to investors the adverse news that retained earnings are unlikely to be enough to meet capital needs (Myers and Majluf 1984), and the new equity injections will dilute the value of existing shares (Myers 1977).

Securitization, however, allowed banks to avoid holding costly capital by essentially turning them into underwriters that still originate loans, but then sell them off to others. Once loans are removed from a bank's balance sheet in this way, the 8- or 10-percent capital reserve need not be held.

Securitization explains the fact that there are far fewer deposits in the modern financial system than there are loans. The U.S. banking system currently holds approximately $7 trillion in deposits, but the credit market includes $2.7 trillion in bank and leveraged loans, $3.3 trillion of commercial mortgages, $1.3 trillion of subprime mortgages, $5.8 trillion of non-agency (i.e., non-Fannie Mae or -Freddie Mac) prime residential mortgages, and $2.6 trillion of consumer loans, among others. The riskier credit, such as high-yield corporate loans, nonprime mortgages, commercial mortgages, and consumer credit, is generally securitized.

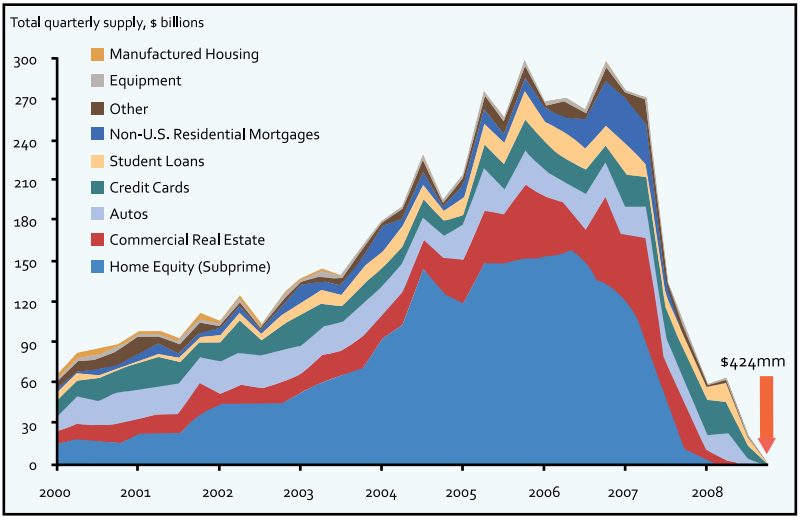
Securitization alters the original idea of banking: banks are now intermediaries between *investors* (rather than just depositors) and borrowers. To understand how this works, consider the successful model of securitizing prime mortgages. This involved pooling prime mortgages into mortgage-backed securities (MBSs) that pay their owners fractional streams of the interest and principal payments collectively made by the mortgage holders. The principal and interest of these mortgages were guaranteed by Fannie Mae and Freddie Mac. The U.S. residential mortgage market is worth more than $10 trillion. Over 55 percent of it is securitized, and 64 percent of these securities are backed by Fannie and Freddie.

In the period beginning around the end of 2002, as credit markets began to recover from the preceding recession, banks extended the prime-mortgage securitization model to other, riskier asset classes. This allowed banks to transfer these risks from their balance sheets to the broader capital market, including pension funds, hedge funds, mutual funds, insurance companies, and foreign-based institutions.

The new asset-backed securities were "structured," meaning that they divided (for example) mortgage pools into "tranches" according to the predicted riskiness of the loans. Holders of shares in the riskier tranches received higher premium payments, but in exchange, they were subject to losses before the holders of shares in the less-risky tranches. Thus, the holders of the least-risky tranches, as determined by the three rating agencies—Moody's, Standard and Poor's, and Fitch—got a lower risk payment, but they would feel any effect of nonperformance in the structured security only after its "subordinated tranches" had stopped performing (through delinquency or default). The relatively low-risk level of an AAA-rated tranche, however, did not necessarily mean that it was backed by prime loans. It might only mean that, of the thousands of nonprime loans in a given mortgage-backed security, this tranche was designated as the one that would continue to yield income from performing debts throughout the entire security until all the other tranches had been wiped out.

The growth in structured securities across Wall Street from 2002 to 2007 was staggering. While residential mortgage-related securities were certainly a large component, so, too, were securities backed by such assets as commercial mortgages, leveraged loans, corporate bonds, and student loans. Figure 1 graphs the new issuance of various asset-backed securities during this period. Note that there is an almost threefold increase in new

Figure 1. Asset-Backed Security Issuance, 2000–2008



Source: J. P. Morgan Securities Inc. Data as of 10/31/2008.

issuance from 2002 to 2007. In the aggregate, securitization worldwide went from $767 billion at the end of 2001 to $1.4 trillion in 2004 to $2.7 trillion at the peak of the "bubble," in December of 2006. By late October, 2008, the market had effectively collapsed.

The greatest demand for these products was due to the creation of the AAA-rated tranches, which appealed to a host of potential investors. Since the AAA ratings indicated to investors that these tranches of "asset-backed" investments—collateralized debt obligations (CDOs) and collateralized loan obligations (CLOs)—were as safe as the safest corporate bonds, the role of the rating agencies in this process was important (White 2009).

Nevertheless, we believe that the rating agencies' role *in marketing asset-backed securities to investors* can be overestimated as a factor in the crisis, because, in fact, investors were not the chief purchasers of these securities: banks themselves were. Instead of acting as intermediaries between borrowers and investors by transferring the risk from mortgage lenders to the capital market, the banks became primary investors. Since—unlike a typical pension fund, fixed-income mutual fund, or sovereign-wealth fund—banks are highly leveraged, this investment strategy was very risky. The goal, however, was logical: namely, to avoid minimum-capital regulations.

One of the two primary means for this "regulatory arbitrage" was the creation of off-balance-sheet entities (OBSEs), which held onto many of the asset-backed securities. These vehicles were generically called "conduits." Structured investment vehicles (SIVs), which have received the most public attention, were one type of conduit.

With loans placed in conduits rather than on a bank's balance sheet, the bank did not need to maintain capital against them. However, the conduits funded the asset-backed securities through asset-backed commercial paper (ABCP)—bonds sold in the short-term capital markets. To be able to sell the ABCP, a bank would have to provide the buyers, i.e., the banks' "counterparties," with *guarantees* of the underlying credit—essentially bringing the risk back onto itself, even if it was not shown on its balance sheet.

These guarantees had two important effects, however.

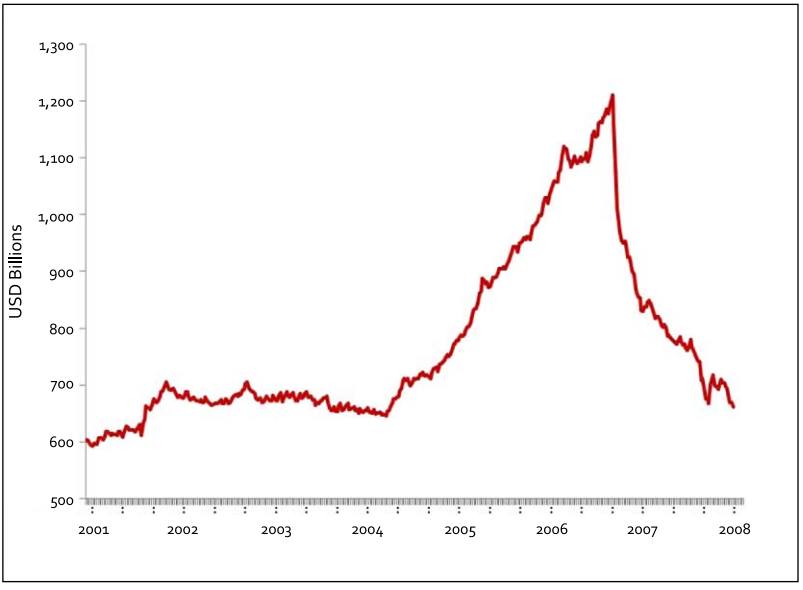
First, guaranteeing the risk to banks' counterparties was essential to moving these assets off the banks' balance sheets. Designing the guarantees as "liquidity enhancements" of less than one year maturity (to be rolled over each year) allowed banks to exploit a loophole in Basel capital requirements. The design effectively eliminated the "capital charge" and thus banks achieved a tenfold increase in leverage for a given pool of loans.

Second, the guarantees ensured the highest ratings for the vehicles from the rating agencies. AAA-equivalent ratings made it possible for banks to sell ABCP to money-market funds, which are required by law to invest mainly in the highest-rated securities. This allowed banks to fund the ABCP at low interest rates, similar to that paid on deposit accounts.

Figure 2 graphs the growth and collapse of the ABCP market over the years 2001 to 2009. The issuance peaked from 2004 until the second quarter of 2007. When the collapse occurred in the next quarter, the ABCP could not be rolled over, and the banks had to return the loans to their balance sheets. Acharya and Schnabl 2009 show that when the crisis hit, of the $1.25 trillion in asset-backed securitized vehicles, a loss of only 4.3 percent was structured to remain with investors. The remaining loss wiped out significant bank capital and threatened banks' solvency.

Not all banks used off-balance-sheet assets financed by ABCP. Some chose an alternative route that had a similar effect. A bank would still make loans and move them off its balance sheet by securitizing them. But the bank then turned around and reinvested in AAA-rated tranches of the very securitized products that they (or other banks) had created. Because of their AAA ratings, these securities had a significantly lower capital

Figure 2. The Rise and Fall of Asset-Backed Commercial Paper, 2001-2008



Source: Federal Reserve Board. Data do not include European ABCP.

requirement. For commercial banks, the Basel accord weighted the risk of AAA-rated securities at less than half the risk of ordinary commercial or mortgage loans, and thus required a proportionately lower capital reserve for them. In 2004, the Securities Exchange Commission granted stand-alone American investment banks the ability to employ internal models to assess credit risk and corresponding capital charges. This allowed investment banks to use even higher leverage than commercial banks.

As Table 1 shows, banks, GSEs (Fannie and Freddie), and broker/dealers held $789 billion worth of the AAA-rated CDO tranches that were backed by nonprime loans, or approximately 50 percent of the market. Moreover, the majority of the subordinated tranches of the CDOs was also held by banks, broker/dealers, and monoline insurers (which insure only one type of bonds—e.g., municipal bonds), which collectively owned $320 billion of the $476 billion total.

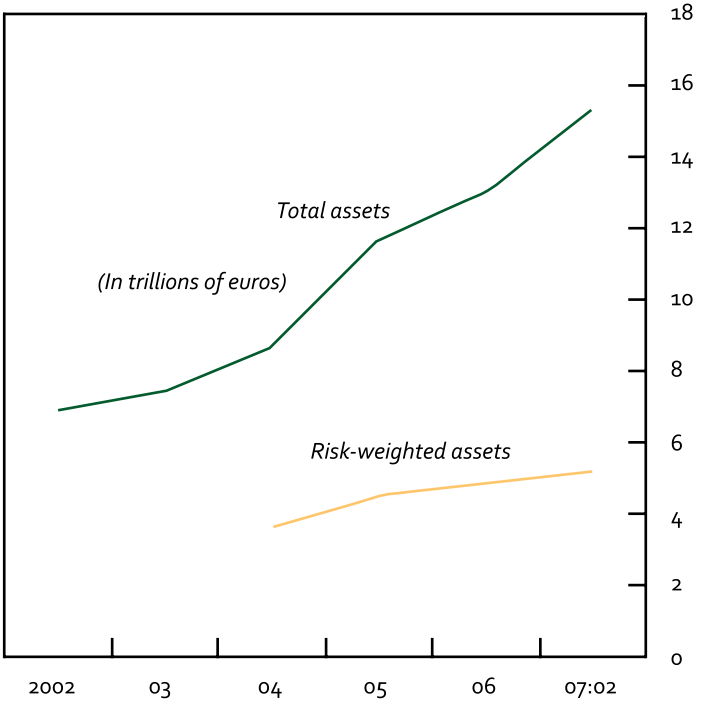
Thus, while the assets on banks' balance sheets doubled between 2004 and the middle of 2007, the regulatory assessment of the risk of these

Table 1. Dollar Value of Mortgage Debt, 2008

	Non-securitized mortgages	HELOC*	Fannie, Freddie, & Ginnie** MBS	Privately issued AAA tranches	Privately issued subordinate tranches	Other	Total	
Banks & Thrifts	2,020	869	852	383	90		4,212	39%
GSEs & FHLB***	444		741	308			1,493	14%
Brokers/dealers			49	100	130	24	303	3%
Financial Guarantors		62			100		162	2%
Insurance Companies			856	125	65	24	1,070	10%
Overseas			689	413	45	24	1,172	11%
Other	461	185	1,175	307	46	49	2,268	21%
Total	2,925	1,116	4,362	1,636	476	121	10,680	
	27%	10%	41%	15%	4%	1%		

* home equity line of credit
** Fannie Mae, Freddie Mac, and Ginnie Mae
*** Federal Home Loan Bank
Source: Krishnamurthy 2008.

Figure 3. The Increasing Leverage Produced by Risk-Weighted Assets



Source: International Monetary Fund Global Financial Stability Report, April 2008.

assets grew at a far more sluggish pace. Regulators deemed banks to be relatively safely invested, because the assets were rated AAA. This enabled banks to double their leverage, and thus the quantity of profitable loans they could make. Figure 3 shows this trend succinctly: In the top ten publicly traded banks, the magnitude of total assets rose relative to the size of their *risk-weighted* assets.

Why Subprime Mortgages?

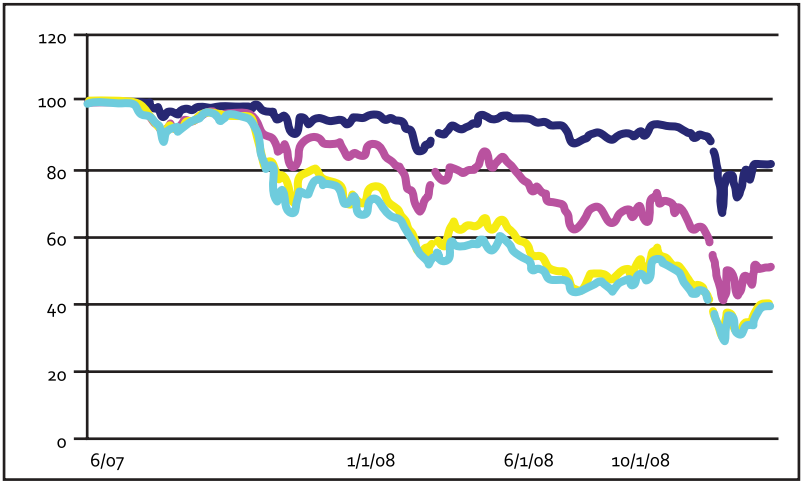
Why did the banks create and then retain the risks of assets such as subprime mortgages?

Take the AAA-rated tranches of subprime CDOs. True, they were risky. But banks that held these tranches had it both ways: On the up side, they reduced their capital requirements, and they (or other

investors) earned the higher premium commanded by the risky nature of subprime assets. For example, at the peak of the housing bubble, in June 2006, even the relatively low-paying AAA-rated tranches of subprime CDOs offered twice the premium of the typical AAA credit-default swap of a corporation. On the down side, they would incur losses only in the rare event that a large number of subprime mortgages defaulted at once, such that even the AAA tranche of a CDO got hit. Such a scenario, however, would almost surely result from an economic catastrophe—a systemic shock that would affect all markets.[1] The banks were betting that this would not happen—or perhaps the bank decision makers' time horizons were too short for them to care if it did happen. But, of course, it did.

To see how hard the systemic shock hit the AAA tranches, Figure 4 graphs various AAA-rated ABX index series from their initiation until the end of 2008. ABX creates indices of 20 representative CDOs of subprime mortgages. These indices are initially priced at par, and one

Figure 4. Prices of Subprime AAA Tranches, 2007-2008



The top line represents the prices of the ABX index of AAA-rated tranches of subprime mortage–backed securities (MBS) issued in the first half of 2006. The second line represents prices for AAA MBS tranches issued in the second half of 2006. The third line represents price of AAA MBS tranches issued in the first half of 2007. The bottom line represents prices for AAA MBS tranches issued in the second half of 2007. The period shown is 1 June 2007 – 31 December 2008. The ABX index reflects the prices of twenty representative tranches.
Source: Markit.

can see that the 2006 series stayed around that level until late July 2007, when the crisis started. Depending on the series, the AAA tranches are, as of March 2009, selling from 40 cents to 80 cents on the dollar. Putting aside issues specific to the pricing of the ABX, at the current prices in Figure 4 and given the aforementioned $789 billion worth of loans, losses to the financial sector range from $158 to $473 billion on their holdings of the AAA-tranches of mortgage-backed securities alone.

Similarly, the financial firms that used off-balance-sheet entities had, through the guarantees they issued on the ABCP, written huge quantities of insurance against a systemic decline in the overall economy, especially in the housing market. With both conduits and, especially, with AAA tranches, the guarantees were often provided by third-party insurers such as monolines and the infamous A.I.G., which also had it both ways: they collected insurance premia when times were good, and would have to honor their promises only when there was a systemic decline of markets and the economy. The problem with writing huge amounts of such insurance, however, is that it guaranteed that the very problem being insured against—a systemic decline—would prevent the underwriters of the insurance from making good when the problem materialized. Hence, the financial crisis.

Why Did the Banks Bet the House on Housing?

The reason banks took this highly leveraged bet can be found in the risk-taking incentives of employees within financial firms.

In the period leading up to the crisis, bankers were increasingly paid through short-term cash bonuses based on volume and on marked-to-market profits, rather than on the long-term profitability of their "bets."[2] Thus, they had no incentive to discount for the liquidity risk of asset-backed securities if their bets were wrong and nobody wanted to buy these securities. Nor was there an incentive to discount for the "maturity mismatch" inherent in structured investment vehicles—which funded long-term assets through short-term debt that had to be rolled over frequently, generally overnight. Nor, apparently, did their managers assess the true skills of those who were generating these large "profits." Thus, regulatory arbitrage became the primary business of the financial sector because of the short-term profits it was generating.

A case in point.[3] In the summer of 2005, UBS, the Swiss-based LCFI, became a major player in subprime mortgage CDOs. It would purchase pools of subprime mortgages from mortgage originators and slice and dice them, so that the "super senior" tranches would receive the highest designation from the rating agencies. The resulting AAA securities would then be sold off to investors. UBS was paid handsomely for structuring these deals. This business usually worked as intended: The credit risk that would normally be held by UBS or other banks or mortgage lenders was transferred to the better-capitalized investment community.

Starting in 2006, however, the CDO group at UBS noticed that their risk-management systems treated the AAA securities as essentially riskless, even though they yielded a risk premium: the proverbial free lunch. So they decided to hold onto them rather than sell them. They held less than $5 billion of these securities in February 2006, but by September 2007 the CDO desk was holding a staggering $50 billion of them. Incredibly, this happened even though the housing market had turned south in June 2006; even though subprime lenders had begun to go belly-up in December 2006; and even though UBS itself shut down its in-house hedge fund, Dillon Read Capital Management, in May 2007—due to subprime investment losses. None of this mattered to the UBS CDO group. For every $1 of super-senior securities held, it booked the premium as immediate profit; and for every dollar of current "profit" booked, the members of the CDO group received correspondingly higher bonuses. The members of the group had every incentive to increase the quantity of CDOs on the balance sheet as much as possible, since their own bonuses were tied to instant profits with no recognition of any risk. In similar fashion, by the late summer of 2007, Citigroup had accumulated over $55 billion of AAA-rated CDOs.

The Crisis Spreads

The collapse of the ABCP market in the third quarter of 2007 forced commercial banks to bring the assets held in their conduits back onto their balance sheets. This affected Citigroup adversely, and consumed the Royal Bank of Scotland (which inherited ABN AMRO's OBSEs in January 2009), to take just two examples. Investment banks, which are not subject to the same capital requirements as commercial banks, held their CDOs on their books, but since investment banks, too, are typically

funded overnight, they suffered the same maturity mismatch as did commercial banks' off-balance-sheet entities. By September 2008, investment-banking operations that had loaded up on AAA tranches of subprime mortgages had effectively brought down UBS, Bear Stearns, and Lehman Brothers.

While the post-Lehman phase has been the most difficult period of the crisis so far, the first signs of the impending crisis can now be traced back to nearly two years earlier, with the bankruptcy of Ownit Solutions, a nonbank specialist in subprime and Alt-A (not-quite-prime) mortgages. From then on, there was a slow run on other non-bank non-prime mortgage lenders. Most of their loans were hybrid "2/28" or "3/27" adjustable-rate mortgages. These loans offered a fixed "teaser" rate for the first two or three years, and then adjustable rates for the remaining twenty-eight or twenty-seven years, respectively. After the first two or three years, the adjustment of rates would be substantial enough as to be unaffordable for the subprime borrowers; thus, the mortgages were designed to be refinanced. But for the most part, this would be possible for subprime borrowers only if the collateral on the loan (i.e., the price of the house) had increased in value. Otherwise, they would default.

Because these mortgages were all originated around the same time, mortgage lenders had inadvertently created an environment that could lead to a systemic wave of defaults if the price of housing had declined two or three years later, when the mortgages reset (Ashcraft and Schuermann 2008; Gorton 2008). Once the failure of lenders like Ownit Solutions signaled that this had begun to happen, the short-term finance available to nonprime lenders dried up, and hundreds of such specialists failed. The next wave of the crisis began on August 9, 2007, when three investment funds that were part of the French LCFI, BNP Paribas, could not assess the mark-to-market values of their securitized investments backed by subprime mortgages. This led to a suspension of redemptions by Paribas, which, in turn, caused the asset-backed commercial paper market for OBSEs to "freeze": Purchasers of ABCP suddenly realized that assets backing the conduits were of such dubious quality that they might have little to no resale value, especially if they were all hit at once with delinquencies and defaults (cf. Acharya, Gale, and Yorulmazer 2008).

A year later, most of the assets funded by banks through securitized markets were subjected to the same doubts, which brought down the investment banks that repackaged subprime and other mortgages—as well as corporate, auto, and other loans—into structured securities. The

failure of the likes of Fannie Mae, Freddie Mac, and Lehman Brothers, which invested in the securities created out of these mortgages, led to severe counterparty risk concerns that paralyzed capital markets and thus caused the worldwide recession.

Standing behind the collapse of the investment banks and the GSEs was the systemic failure of the securitization market, which had been triggered by the popping of the overall housing bubble, which in turn had been fueled by the ability of these firms, as well as commercial banks, to finance so many mortgages in the first place. The severity of the resulting recession and its worldwide scope has been magnified by the huge decline in lending by commercial banks, including not just BNP Paribas, Citibank, Royal Bank of Scotland, and UBS, but Bank of America, J. P. Morgan Chase, and others, such as Wachovia, that no longer exist. These banks had been huge buyers of subprime mortgages.

The genesis of it all was the desire of employees at highly leveraged LCFIs to take even higher risks, generating even higher short-term "profits." They managed to do so by getting around the capital requirements imposed by regulators—who, in turn, were hoping to diminish the chance that deposit insurance, and the doctrine of "too big to fail," might cause LCFIs to take just such risks.

NOTES

1. Coval, Jurek, and Stafford 2009, therefore, calls these kinds of tranche products "economic catastrophe bonds."
2. See Rajan 2008 for an early hint of this problem with bankers' pay. Acharya and Volpin 2009 provides a model explaining why pay may have risen in the banking industry, and why at the same time risk-management (governance) quality deteriorated, due to greater mobility of risk-takers across financial institutions. Acharya and Richardson 2009 provides a detailed account of such governance failures (see, especially, chs. 7 and 8).
3. The following account is taken from UBS's "Shareholder Report on UBS's Write Downs," prepared for the Swiss Federal Banking Commission, 18 April 2008.

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