Outbreak:

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Any of the myriad problems in the U.S. mortgage market could have been contained, but together they caused a crisis that spread across the globe

THE causes of the crisis in subprime mortgages have become clear. They started with poor underwriting practices, which became legion. But damage was propagated at each stage of the complicated process in which a risky home loan was originated, then became an asset-backed security that then formed part of a collateralized debt obligation (CDO) that was rated and sold to investors.

What is not so clear, though, is how these losses could spread to other parts of the global financial system. Like an epidemic in which an invisible virus infects many people and communities, the financial crisis spread when losses to intermediaries in one nontransparent market raised concerns about liquidity and solvency elsewhere. Just as diseases are passed on by close human contact, pests, and contaminated food, so this financial crisis has been transmitted through connected markets and institutions while leaving others largely untouched.

We examine the origins of the subprime crisis and the various places, some of them surprising, where the effects of the crisis have been found—such as markets in which banks make loans to one another, short-term commercial paper, and even municipal bonds.

The U.S. subprime loan virus

There is nothing inherently wrong or reckless about lending to borrowers with lower incomes and lower credit scores. But prudence dictates that in making subprime loans, lenders must control the risks by more closely evaluating the borrower, setting higher standards for collateral, and charging rates commensurate with the greater risks.

Too often, however, standards were steadily loosened in recent subprime and "Alt-A" (whose risks are between prime and subprime) lending. Instead, many subprime mortgages were "ninja" loans—standing for no income, no job, and no assets. To make matters worse, many of these mortgages

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were issued with initially low "teaser" interest rates or with other terms, such as interest-only or negative amortization payment options, to make them seem more affordable to borrowers. This allowed borrowers to get larger mortgages, but created greater future payments for households when the teaser rate expired or principal repayments began.

The rationale for such risky lending was that house prices were appreciating rapidly and had not fallen nationally in the United States since the 1930s. Therefore, any potential repayment problems would be substantially mitigated, if not eliminated, by higher market prices for the underlying collateral. If the borrower failed to repay on schedule, the home's increase in value would facilitate a refinancing or, in the event of foreclosure, would cover the loan and accrued interest and penalties. Under the assumption that house prices would continue increasing and loan-to-value ratios would always be falling, little could go wrong.

The process of transforming home loans into securities (in which the income and principal payments are passed, through a trust, to investors) added problems. Whereas all pass-through, mortgage-backed-securities (MBSs) issued by the U.S. government–sponsored enterprises (GSEs)—Fannie Mae and Freddie Mac—have common underwriting standards, the MBSs issued by the major Wall Street firms had varying loan standards. This made the costs of understanding disclosed information, and the premium on maintaining confidence, much higher. Due diligence from investors did not increase enough to compensate for this greater information burden.

Instead, investors increased their reliance on the assessments of credit rating agencies. Although these agencies have a long and well-known track record rating bonds, subprime residential MBSs and CDOs were new and more complex. CDOs are structured credit securities backed by pools of securities, loans, or credit derivatives whose cash flows are divided into segments, called tranches, with different repayment and return characteristics.

Because subprime mortgages were new, there was limited information on their past performance, a shortcoming that was especially important when trying to determine how these mortgages—individually and as a group—would perform during economic stress. Optimism about how subprime mortgages would perform led to more than 90 percent of securitized subprime loans being turned into securities with the top rating of AAA (IMF, 2008).

Market incentives for loan originators, securitizers, and even credit rating agencies did not encourage skepticism of these hard-to-understand securities. Rather, the incentives increased the volume of transactions and encouraged disregard of issues such as credit quality and prudence because all players were getting paid to get deals done and because someone else—the end investors—would ultimately hold the risk.

The complexity of these structured investments—which slice a security into several tranches, each with a different level of risk and sold separately—posed additional challenges for the rating process. The models used by the rating agencies, like other investors, proved to be inadequate at anticipating not only the level of individual defaults but also how defaults would occur simultaneously across housing markets in the United States. These shortcomings made it difficult to correctly quantify and differentiate credit risk tranche by tranche. Highly rated senior tranches were assumed to have little correlation with riskier, lower-rated tranches. However, as the poor quality of the loans became more apparent and securities were downgraded, tranches soon began to fall in value together.

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More problems occurred when the securities were distributed and traded. The vulnerability of leveraged, or thinly capitalized, investment positions and the illiquidity of many structured credit markets were exposed when trading was disrupted in a host of other markets—subprime-linked MBSs, CDOs, asset-backed commercial paper (ABCP), and credit derivatives (Dodd, 2007). High degrees of leverage, in which investors borrowed heavily or used derivatives to increase returns to capital, made investment strategies vulnerable to large market price movements. Mortgage originators, broker-dealers, hedge funds, and the structured investment vehicles (SIVs) banks maintained off their balance sheets were highly leveraged. The principal risk management strategy was to plan to trade rapidly out of a loss-making position. But such a strategy, which relies on markets remaining liquid, failed when markets rapidly became illiquid.

It is a challenge to any financial market when trading becomes one-sided—with everyone trying to sell or to buy. But some markets have proved to be more reliably liquid than others. U.S. stock exchanges remained liquid even during the crash of 1987 and the bear market that followed the dot-com boom earlier this decade. This proved not to be the case with over-the-counter markets for mortgage-related securities and credit derivatives. These markets do not have dealers who are obli-

gated or otherwise committed to supporting market liquidity by maintaining binding bid and ask quotes throughout the trading day. During periods of stress, they can withdraw from market making, and the absence of trading eliminates an independent way of marking-to-market portfolio positions (see "Over-the-Counter Markets: What Are They?" on page 34). As volatility in MBSs and credit markets increased, the riskiness of making markets and maintaining an inventory of the securities also rose. That reduced the willingness of dealers to offer market liquidity to those seeking to trade.

The virus spreads

Any of these problems alone would have posed a difficult but possibly self-correctable situation and been confined to the subprime market. Outright losses from subprime mortgages themselves have been relatively small, equivalent to a 2–3 percent fall in U.S. stock prices. But the problems coalesced and spread to many other key sectors of the financial system and economy. Overall, the IMF, in its April 2008 *Global Financial Stability Report,* estimated that global losses could reach $945 billion once other losses, such as in commercial real estate, were included. The speed and breadth of the spread was surprising, and analysts were confounded by many of the following 10 developments that spilled over from the subprime crisis.

The dismal quality of subprime and Alt-A lending standards in 2006–07. As delinquencies and foreclosures mount, the poor quality of loans made in 2006–07 continues to shock analysts. Given the absence of a recession to prompt such losses, two things have become clear. First, many borrowers could afford their mortgage only if house prices continued to rise, allowing them to refinance before their teaser rates ended. With house prices now falling in many regions, loan delinquencies and foreclosures have risen sharply because borrowers are unable to refinance. Second, a large number of borrowers, brokers, and appraisers inflated house prices and borrowers' incomes on loan applications. Without continuing house price appreciation, many of these mortgages were unaffordable in any case. Although rate resets on subprime adjustable rate mortgages are exacerbating the delinquency problem, these were *not* the initial cause.

The extent and speed of rating downgrades of asset-backed securities. Investors have learned to their cost that the credit ratings of structured credit securities are more likely to suffer rapid and severe downgrades than are corporate bonds (see chart). Not only have downgrades occurred more frequently to subprime securities, they have often been reduced several notches at once because of the sensitivity of such securities' ratings to increases in assumed credit losses. As a result, investors' faith in rating agency opinions has been shaken—credit spreads on AAA-rated U.S. residential MBSs have been priced at about the same level as BBB-rated corporate bonds since August 2007.

This has been a particular problem for banks that retained the "superior senior" AAA-rated tranches of CDOs that they sponsored. A number of banks did not have the expertise to analyze the risks of these asset-backed exposures and effectively relied on rating agency analysis for due diligence. Consequently, when these AAA-rated securities began to be downgraded starting in July 2007, these banks incurred significant mark-to-market losses.

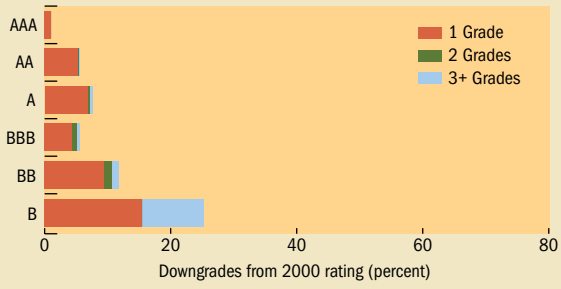
The panic in money market funds in August 2007. The first jolt to the wider markets came in July, when there was a significant round of subprime MBS rating downgrades (because of rising delinquencies) and two hedge funds sponsored by the Wall Street firm Bear Stearns tried to liquidate large positions in those securities. But it was not until the French bank BNP Paribas announced in August that it was suspending withdrawals from some money market funds that wider interbank market turmoil began. Fearing strong customer demand for cash withdrawals, money market funds defensively shifted their portfolios from medium- and long-term bank deposits and commercial paper (essentially corporate IOUs) to overnight and ultrashort maturities. This provoked strong demand for short-term liquidity and a collapse in the market for ABCP, the short-term paper that was being used to fund off-balance-sheet investments in long-term assets. That made it difficult for banks in Europe and North America to borrow for much longer than overnight. Even though there were few bank solvency concerns at this stage, the rewards for lending at longer maturities were insufficient to compensate for the risk of lending to a counterparty that might be in trouble.

The "hidden" banking system. The collapse in demand for ABCP cast light on the SIVs that a number of banks had sponsored directly or to whom they had given significant

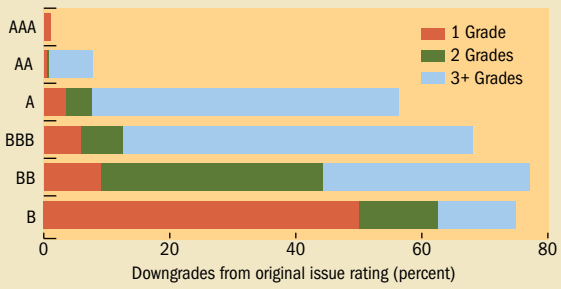
Speeding down

AAA corporate securities infrequently decline more than one ratings notch at a time . . .

(corporate securities, rating downgrades, 2001)



. . . but many subprime securities took dramatic rating declines.



Source: Standard & Poor's.

backup loan commitments. Essentially, these off-balance-sheet entities engaged in liquidity transformation—taking the short-run proceeds of ABCP sales and buying longer-term assets, akin to what banks traditionally do on balance sheet by taking in deposits and making loans. But because they were off balance sheet, they did not need as much capital to meet bank regulatory requirements. When the ABCP market collapsed, banks had to lend to these entities and soon had to decide whether to bring them officially onto their balance sheets. Some banks did, expanding their balance sheets and the amount of capital they required; some did not, triggering asset sales and forcing investors to incur losses. Although rating agencies and regulators knew about these entities, their size (more than $1 trillion in assets) and their contribution to the demand for risky assets were not widely appreciated before August 2007.

The extent of banks' liquidity commitments. As banks' ability to fund themselves in the wholesale markets came under stress, they began to "hoard" liquidity by holding more cash-like assets and reducing the periods at which they would lend to other banks. Banks grew more concerned about how many lending commitments they had made to each other, to hedge funds, and to corporate entities. Simultaneously, because banks found it more difficult to raise funds by selling loans into securities markets, they had to keep more loans on their books. Banks were confronted with liquidity strains at both ends of the loan production line: they had to keep loans that they had planned on selling and had to honor loan commitments that they would rather not have. This coincided with banks' increasing reluctance to lend to one another. The result was unprecedented illiquidity in the interbank markets.

The speed of bank liquidity runs. When counterparty credit concerns are high and liquid assets are being hoarded, even solvent banks can find it difficult to remain funded. The U.K.'s Northern Rock required emergency funding from the Bank of England because it could not securitize or otherwise sell the mortgages on its books, could not raise cash from other banks, and had insufficient liquid assets to survive for more than a few weeks. Similarly, Bear Stearns suffered a wholesale market "run" despite supervisory assurances that the firm exceeded regulatory capital requirements. Bear Stearns exhausted its $17 billion liquidity reserve in three days, even as the New York Fed and JPMorgan Chase negotiated a rescue. Northern Rock and Bear Stearns are but two examples of the fragility of trust in wholesale markets and of how quickly a firm can run out of cash when its reputation is tarnished and markets are illiquid.

Fear of a tarnished reputation helps explain why banks have been reluctant to use the backup lines of credit they maintain with one another. They worry about generating rumors that they are becoming illiquid. For similar reasons, banks have been reluctant to use emergency liquidity support from central banks. As a result, the Fed developed a version of its discount window facility to allow a wider range of banks to bid for liquidity anonymously. Other central banks are seeking to ensure that use of their facilities does not generate market rumors.

The concentration of subprime credit risk in bond insurers. Some bond insurers, who had previously specialized in providing credit protection for municipal and infrastructure bonds (the "monoline" insurance companies), began in 2003 to insure asset-backed securities and CDOs to reinforce the AAA ratings of the most secure tranches. Rising mortgage delinquencies and foreclosures sent the value of these securities tumbling and increased the liabilities to the insurers, and led to their being downgraded or put under ratings watch by the credit rating agencies. The two largest, Ambac and MBIA, were estimated to have lost $23 billion and were required to raise additional capital.

The collapse of the municipal bond and student loan markets. The severe problems at monoline insurance companies sent a shock through the markets for municipal bonds and securities backed by student loans. More than one-half of the $2.6 trillion in outstanding U.S. municipal bonds are guaranteed by monoline insurers so that the bonds can receive AAA credit ratings. The guarantees have the effect of homogenizing many of the more than two million different bond issues outstanding into similarly rated AAA securities.

In recent years, the market has been moving away from conventional fixed-coupon bonds and toward other innovative instruments, such as auction rate securities (ARSs). Although ARSs are usually long term in maturity from the point of view of the borrowers, lenders consider them short-term securities because their interest rate is reset frequently in a Dutch auction arrangement, when holders also have the option of selling the security. Under normal circumstances, the interest costs are lower to the issuer, and the investment is more liquid to institutional and corporate money managers. But problems with the insurers raised doubts about the credit ratings of the ARSs and, whereas broker-dealers traditionally provided clearing bids to ensure an orderly market, they ceased making such bids when they found themselves acquiring too many securities. As a result, auction after auction failed, and many municipalities have had to pay much higher interest rates.

Many firms specializing in student loans used the ARS technique and, after auction failures, were forced to shut down their business or curtail making new loans.

The dependence of the U.S. mortgage market on state-sponsored entities in the crisis. The U.S. authorities have been unusually active in using federal agencies and government-sponsored enterprises to support the mortgage market. This has taken the form of refinancing mortgages (the Federal Housing Administration), dramatically increasing lending to mortgage banks in need of liquidity and buying more MBSs

(the Federal Home Loan Banks), buying more mortgages and issuing and buying more MBSs (the GSEs), and extending liquidity against a wider range of mortgage-related collateral from a wider range of counterparties (Federal Reserve). In short, the U.S. authorities have pulled almost every lever at their disposal to keep mortgage lending going.

The scale of banks' forced deleveraging. Banks have suffered losses, absorbed assets from failed SIVs and hedge funds onto their balance sheets, and been forced to honor loan commitments. As a result, they have had to ration capital more strictly. With capital impaired and difficult, or very expensive, to raise externally, banks have sought to reduce voluntary loans and tighten the terms of the credit they already extend—whether on home equity loans to consumers or on loans to hedge funds. Commercial banks are naturally leveraged—holding capital that is a small fraction of total assets—and so a relatively small decline in capital can result in a much larger decline in total lending. One estimate is that the $400 billion of U.S. banking system losses from the current crisis would result in a $2 trillion decline in total lending and a 1.2 percent reduction in U.S. GDP (Greenlaw and others, 2008; IMF, 2008).

Resistance: Not all surprises were bad

Despite the many unexpected adverse developments during the spread of the subprime financial crisis, there were a few welcome surprises.

First, ***the spread of the problems to emerging market economies has been limited thus far, and both global growth and demand for commodities have remained strong.*** Emerging markets have not been totally immune. Some countries, such as Kazakhstan and Iceland, have experienced banking sector strains, emerging market bond spreads have risen, and some emerging market equity markets have fallen sharply (after rising rapidly in the prior few years). But so far no major crisis has occurred, nor has there been a massive destabilizing flight of capital. Real economies have not contracted so far.

Second, the ***willingness of sovereign wealth funds to supply capital to stressed commercial and investment banks has been a sign of the positive role that such long-horizon investment institutions could play in contributing to global financial stability.*** As of March 2008, such funds had contributed $45 billion in capital to banks and insurers, although continuing market losses make further capital injections less likely in the near term.

Some possible cures

Although policy measures are still being crafted, several key objectives need to be taken into account, both to correct current problems and to deter their recurrence:

- ***Moderating leverage.*** Key parts of modern financial markets involve so much leverage that they are vulnerable to large price movements and market illiquidity. As we are seeing, unwinding that leverage exacerbates credit tightness, and distressed trading generates excessive price movements. Policymakers should tighten prudential restraints on leverage, perhaps through higher capital or collateralization requirements.
- ***Improving liquidity management.*** Some major institutions have proved less resilient than expected to shocks in funding. Key market participants need to better provide for their operating liquidity.
- ***Fostering market liquidity.*** Liquidity, and in turn the price discovery process, in over-the-counter markets has proved fragile. Steps are needed to bolster the dependability of liquidity in these markets—for instance, through formalizing dealers' quote obligations (as in the U.S. treasury market).
- ***Promoting due diligence.*** Investors demonstrated a lack of due diligence and an overreliance on credit ratings in investing in structured securities. Institutional investors especially need to adopt investment guidelines that require greater due diligence as their fund managers move into new asset classes. To improve scrutiny, structured credit products need to become simpler and easier for investors to value independently.
- ***Increasing transparency.*** The lack of market price transparency in structured credit instruments has exacerbated the accounting and valuation challenges created by—and contributing to—this crisis. Improvements in the public availability of price and trading information would aid in price discovery and market price valuation. In addition, banks need to be given appropriate regulatory incentives to consolidate off-balance-sheet entities when they are likely, in practice, to stand behind them.

A stubborn strain

What have we learned from this contagion? First, securitization has moved some credit risks from the banking system, but not as much as anticipated and at the expense of transparency. It is taking a long time to discover where the losses have accumulated. Second, over-the-counter markets are not necessarily liquid when under stress. The disruption to interbank markets has been more profound and long lasting than anyone anticipated before August 2007, meaning that institutions must be able to survive considerable periods on their own resources. Third, risk management at individual banks has focused on protecting the institution while largely ignoring systemic risks. As a result, individually rational actions to ensure survival have resulted in collectively irrational outcomes. And, finally, crisis resolution has become extremely complex in a world of dispersed risks and derivatives. Central banks have been required to innovate rapidly to contain the outbreak, and yet the crisis has persisted. Fighting this epidemic has proved far harder than the doctors imagined. ■

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