

SECTION I

The Financial Crisis

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The 2007–2008 Financial Crisis

The crisis of 2007 and 2008 was a system-wide crisis whose amplitude is unprecedented in modern finance. It is systemic, in that it extends to the entire financial system. The sub-prime crisis should have been contained within the small segment of sub-prime mortgages. Financial risks of regulated firms are subject to strict regulations, whose purpose is precisely to avoid systemic, or “system-wide,” crisis. Instead, it extended to the entire financial system and triggered economic contagion. Why did regulations fail? What went wrong?

The crisis expanded through “traditional” contagions, the contaminations of other segments of the system by a local event, and through procyclical effects. Procyclicality refers to the magnification of the amplitude of cycles. Moreover contagion and procyclical effects interacted with each other, revealing unexpected and interconnected effects, as seen in the various papers and official documents¹ used as a starting point for defining reforms of the overall regulation system.

Contagion and procyclicality are joint effects, which make them difficult to segregate. Many contagion effects detailed hereafter contribute to procyclicality and the reverse is also true. In this introductory chapter on the crisis, they are sometimes isolated for convenience.

Accordingly, this chapter starts with a brief overview of the sub-prime market, the classical contagion mechanisms, the financial risks, and the basics of risk regulations and of accounting regulations. The next sections address new contagion effects that emerged from the crisis. Those include adverse effects of accounting standards, the dissemination of risks through securitization, the liquidity crunch and its mechanical contagion effect, the procyclicality resulting from regulations and financial firms’ behaviors, the role of lagged rating adjustments, the adverse effects of collateral-based leverage. Although the governance of banks is an issue in this context, we focus on the above effects.

¹ The Financial Stability Forum [28] focuses on procyclicality, and the White Paper of the White House [79] addresses other aspect of the crisis and proposes reforms. Both are reviewed in the concluding chapter, Chapter 60.

This preliminary chapter also provides an overview of the financial system and regulations, which are subsequently detailed throughout several dedicated chapters on risk, regulations, banks' practices and risk models.

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1.1 THE SUB-PRIME CRISIS

By mid-2007, housing prices in the US began to decline. In previous years, the mortgage industry was flourishing and the sub-prime market developed significantly. Sub-prime loans are simply loans that would not be granted to borrowers under normal standards. They are, as other mortgages, collateralized by real estate property, and rely on the expectation that house prices going up would make the collateral more valuable and transform a sub-prime loan in a prime mortgage. Collateralization is traditionally measured by the "Loan-to-Value" ratio, the ratio of the value of the collateral to the debt contracted, or "LTV." The LTV ratio is below one for mortgages. It was above standards for sub-prime loans.

In earlier years the capital markets performed well and all financial institutions were expanding profitably. Furthermore, the financial system was regulated. The so-called "Basel 2" regulations² for banking credit risk were enforced in 2008 in Europe. In the US, banks refrained from full compliance to the new rules, except international banks. But, in both regions, the market risk was under scrutiny by the supervisors.

However, many financial players were considering mid-2007 with some worries because the house market prices stopped inflating and because the interest rates on sub-prime loans, low at inception (teaser rates), were expected to increase after the initial grace period. A crisis in the sub-prime compartment of the market should have had a limited impact. The sub-prime market is a small segment of the huge mortgage US market. Even if some expected some difficulties in this special compartment, nobody expected that it would trigger a system-wide crisis.

In fact, an unprecedented crisis in modern times developed by the end of 2007 and peaked with the failure of Lehman Brothers in the US in September 2008. At that time, it became obvious that the entire financial system was locked into its first systemic crisis of modern times. Bank failures, considered as a "thing of the past," became numerous and spectacular. Northern Rock

² See Chapters 19 and 20 on regulations. Regulations guidelines are defined by the Bank of International Settlements (BIS) in Basel, Switzerland.

went under, an unprecedented event in the booming United Kingdom financial industry within the previous century. Failures extended to all players, funds, and insurance companies.

At first sight, this crisis looks like a puzzle. Indeed, it took some time to get a financial picture of what happened in a narrow time framework, to have a decent perception of the magnitude of expected losses by all financial players, to understand how drastic was the extent of the crisis, to realize that the financial landscape was undergoing an unprecedented shake up in modern times, and that the rules and the perceived “best practices” of governance and risk management proved inefficient.

How come the sub-prime market triggered such a contagion to all financial players and to all financial industries, triggering in turn an economic crisis? Why did regulations fail? How could the “systemic risk,” feared by all, actually materialize at a time when regulations – whose purpose is precisely to eliminate it – developed and culminated in the enforcement of the Basel 2 Accord for banks, and with the final stage of the Solvency 2 regulations for the insurance industry?

The sub-prime market size was estimated in 2007 at around \$600 billion of the \$3 trillion mortgage market. Sub-prime loans are loans which would normally not be granted to borrowers because they have sub-standard credit quality. Sub-prime borrowers originally pay 200–300 basis points (2–3%) above prime mortgage rates (“spread”) because they have higher credit risk and because they would not otherwise get a loan. Sub-prime borrowers often pay variable rates, with a grace period (2–3 years) before rates get higher. Such features make loans riskier if borrowers cannot sustain the hike of interest rates and/or if house values move down.

Defaults on loans don’t occur in the early stages of a loan, right after inception, nor at a later stage when the loan is almost paid back. Rather, the peak of defaults occurs in between, with historical statistics on non sub-prime loans showing a peak at around 50 to 60 months after origination, and depending on various factors, such as economic conditions prevailing or the nature of interest paid, fixed or adjustable. For lenders, loss in the event of default is mitigated by the real estate property backing the loan.

Default risk, measured by the likelihood of default event and the magnitude of such losses under default, increased progressively. Interest rates started to increase from mid-2004. House prices began to fall from 2005–6 in the US. Both factors reduced the solvency of borrowers and a surge in mortgage defaults showed up in 2007 and accelerated in subsequent months. The potential losses directly related to such defaults, at the date of this writing, remained difficult to evaluate, with estimates ranging initially from \$200 million to much bigger figures in 2008.

The specific features of sub-prime loans led to a concentration of reset dates to higher rates after the initial grace period with low rates for sub-prime borrowers. The peak of defaults was expected to occur more or less around the same period, in 2007–2008, given estimates on “normal seasoning,” or time profile of mortgage defaults. The home price downturn became visible as early as 2006 and accelerated subsequently. The three factors concurrently increased the default rates in 2007–2008.

Higher defaults in the segment were expected, perhaps not with the magnitude observed, but were also expected to remain within the segment. But they were not. Instead, the segment problems triggered unprecedented numerous “contagions” and adverse effects within the system.

Those adverse effects included a capital market downturn; a liquidity “crunch” or a contraction of liquidity of the funding and the cost of funding for all financial players; a “credit crunch,” or a drastic contraction of credit; and, finally, an adverse economic impact with the risk of a strong economic recession.

The summer 2007 crisis turned out to be a major financial crisis in 2008 with a series of bank failures, mergers, losses, and unprecedented intervention of financial authorities “injecting” liquidity in the system and up to nationalization of major institutions. When the crisis peaked, the US authorities set up a major, and unprecedented in modern finance, emergency plan in September 2008, intended to isolate so-called “toxic assets” from the balance sheets of banks and other financial players (insurance), and to avoid a global collapse of the financial system. In other countries, notably the UK, similar plans were implemented. At the same period, US authorities, faced with numerous failures of major institutions, supported some flamboyant Wall Street investment banks but let Lehman Brothers go under. The event seems to have considerably altered the trust in the financial system and brutally accelerated the plunge of the capital markets.

At this stage, it was clear to all that the financial system as a whole was on the verge of collapsing and that the financial landscape had drastically changed within weeks, with investment banks disappearing, through mergers and failures, inclusive of the biggest ones, and up to the failure of the biggest insurance company in the world, AIG.

After-the-fact, casual observation was enough to identify classical “contagion” mechanisms. More puzzling are other contagion mechanisms, which have become the focus of the new wave of regulations taking place today.

1.2 CLASSICAL CONTAGION MECHANISMS

A well-known contagion effect is the “domino effect.” The failure of a large financial institution triggers failure in many others who have large exposure, through lending for example, to the ailing institution. The domino effect played a role in the crisis since so many financial organizations failed. It is the foundation of the “too big to fail” principle, which suggests that no large institution can be allowed to fail for fear of contagion to many others. It is noticeable that the principle was not fully implemented when US authorities let Lehman Brothers go under, although they seem to have done whatever they could in other similar cases (Bear Stearns acquired by J.P. Morgan with a Federal Reserve credit line). The domino effect is the effect rather than the cause of the crisis. In this chapter, we try to examine some of the main contagion effects, other than the “domino effect” and some procyclical mechanisms that were seen as the explanation of the amplitude of the crisis.

The capital market downturn was triggered by several well-known factors, which developed with a much larger magnitude than in the recent crises. The usual “flight to quality” is triggered by the fear of investors of further losses from the on-going downturn of markets. Investors sell risky assets and buy Treasury bills and bonds. Such sales further accelerate the capital market downturn.

“Fire sales” of assets were triggered for all funds and leveraged financial firms, by the lower value of their collateralized securities. All leveraged funds, using extensively debt (“leverage”) for financing their assets, face a lower ratio of debt to the value of pledged assets. The gap between security values and debt is called the “haircut,” and is subject to minimum values below which either debt has to be reduced or additional collateral posted (“margin calls”). In other words, financial debt is over-collateralized, a standard practice for financial players, because the collateral is made of securities of which value varies with market movements. When values of market instruments fall, the ratio falls, triggering a deficiency, making debt unsustainable. In order to comply with lenders’ requirements, leveraged institutions have only one way out:

Fire sales of assets for reducing debt and bringing back asset value in line with LTV ratios, thereby adding to the market turmoil.

Banks' equity moved down because of huge markdowns of portfolios, due to the depreciated value of their assets, adding to fear of further losses and inadequate capital of banks. A bank's capital is the foundation of regulations. It is considered as the unique safety cushion capable of absorbing losses. Once capital is deteriorated by losses commensurate with capital size, the bank's solvency and credit standing strongly deteriorates.

All such mechanisms are usually triggered by a downturn of financial conditions. But their effect is usually of limited magnitude and never ended up in systemic risk. Moreover, the recent history of continuous growth of economies fueled by easy financing, have symmetric effects. In the expansive phase, the risk appetite for financially risky assets grows. The value of assets also increases and generates capital gains, rather than capital losses, which allows leveraged institutions to further increase their leverage. Banks' equity is up, fueled by profits. Combining favorable economic conditions with regulations supposed to limit the magnitude of adverse effect tends to make the financial industry more "resilient," as evidence was provided by several crises, which were all feared, such as the downturn in 2002, but ended up with a limited magnitude.

Wealth effects usually follow adverse financial conditions. Faced with reduced wealth, due to the decline of real estate property or of the value of financial assets, spending declines. A financial crisis has always an adverse economical impact, beyond the financial sphere. Consumer spending cannot rely anymore on refinancing mortgages, which is feasible when home values go up making it possible to get another loan extension within acceptable limits for lenders, secured by an increasing home value. Agents with less wealth, become reluctant to spend. Wealth effect further slows down consumption and, consequently, investment. Consumption and revenue fall; saving rate becomes negative. Doubt on growth becomes stronger and expectations adjust accordingly. Expected recession materializes in lower growth. All economic entities, financial firms and non-financial firms, face lower growth prospects.

1.3 FINANCIAL RISKS

All classical adverse mechanisms are supposed to have limited magnitude because of risk regulations. Risk regulations address the main risks faced by financial players. Risk is defined as a combination of uncertainty and potential losses resulting from adverse scenarios. Major risks are subject to quantification imposed by Basel regulations.

Credit risk is the risk of losses due to borrowers' defaults or deterioration of credit standing. Market risk is the risk of losses due to adverse movements of the value of financial instruments (stocks, bonds, etc.) because of market movements for an horizon that depends on the required time to liquidate them, thereby avoiding further losses. Both risks are regulated in banks. Credit risk is now subject to Basel 2 rules. Market risk has been measured since the 1996–1997 Basel amendments for market risk either by capital charges allocated to each exposure, or the now common "value-at-risk" calculation³. Other risks are well defined and supervised, even though they do not require a capital charge.

Interest rate risk is the risk of losses due to adverse movements of interest rates, notably when cost of debt increases. Liquidity risk, or funding risk, refers to the availability of funds when

3 See related Chapters 19 and 20 on market risk regulations.

needed. It is the risk of not being able to raise funds at a reasonable cost, and it culminates when a financial entity cannot raise additional funds, with the ultimate stage being bank failure.

Both risks are related to mismatch risk. Mismatch risk results from the maturity of assets being often longer than maturity of financing. Lending or investing long and borrowing short is a common practice because it allows financial institutions to tap the lower rates of the highly liquid short-term market and to benefit from longer rates when lending (when the term structure of interest rates is upward sloping). Maturity mismatch creates liquidity risk when financial players roll over their short-term debts. It creates as well interest rate risk since the rollover of short-term debts is at prevailing rates, which might increase. Mismatch risk is a common practice even in depository institutions, which benefits from short-term funds and lends for longer maturities. Since mismatch risk was the source of the failure of the saving and loans institutions in the US, when short-term interest rates jumped up when the Chairman of the Federal Reserve in the US, Paul Volcker, decided to increase interest rates to double digit levels for fighting inflation in 1979, it is still surprising that mismatch risk is left to direct control by banks, and entails no capital charge.

Obviously, financial players are aware of such risks and they prepare themselves for market disruptions. A common way of isolating a bank from market disruptions is to hold very liquid assets. Liquid assets are the easiest to sell without risk of significant losses. Short maturity risk-free assets are less exposed to value variations when interest rates increase. High credit quality assets are always in demand at time of uncertainty, when “flights to quality” occur. Assets meeting those two basic requirements are Treasury bills. Holding such assets allows one to rely on sales of such assets to obtain liquidity when market conditions deteriorate. Banks hold a varying fraction of their total assets in highly liquid assets. How much depends on the bank’s exposure to such market disruptions and the bank’s policies. Regulations do not provide minimum amounts although regulators normally monitor the situations of banks. The drawback for banks is the low return of such liquid assets, which creates a trade-off between the cushion against market disruptions and profitability.

Market liquidity risk is a price risk and refers to the capability of selling traded instruments at a “fair price.” Market liquidity is directly related to the volume of trading in capital markets. As long as trading exists with some volume, selling assets without disrupting price remains relatively easy. The recent period demonstrated that market liquidity can dry up just as funding liquidity did.

The absence of stringent regulations on liquidity risk is the “liquidity hole” in regulations, as well as it is in the theory of finance. It proved to be a major weakness that turned a downturn of capital markets into a major liquidity crisis for both the markets and the financial system.

A review of financial reports of banks in various countries, referring to the end of 2006, showed that banks were apparently prepared for such risks. They disclosed the volumes of liquid assets; the mismatch between assets and liability maturities; the measures of regulatory capital; the excess capital buffer over minimum requirement; how they performed their value-at-risk calculations for market risk; and up to the assessment of “economic capital” for credit risk, based on economic assessment rather than regulatory rules. Such disclosures testify of the prevailing confidence in their risk management practices before the crisis.

1.4 REGULATIONS

There are two set of regulations that that apply to financial firms. Risk regulations are designed to prevent failure of individual financial firms by imposing minimum standards to the capital

base that are risk driven. Accounting standards affect the value assessment of financial assets and liabilities, and have a direct influence on capital base and the bottom line of the income statement.

1.4.1 Risk Regulations

Financial risks are precisely defined because they are regulated. Regulations impose a quantification of potential losses stemming from risks, and such potential losses are the foundation for determining the capital base of financial institutions. The regulations of the financial system are reviewed in Chapters 19 and 20 of this text. Only the basic principles are summarized here. The core concept of risk regulations is the “capital adequacy” principle, which imposes a capital base commensurate with risks to which each bank is exposed. The principle is sound and makes a lot of sense. Instead of “dos and don’ts,” banks simply need to have enough capital to make their risks sustainable⁴.

The rationale of the principle is that lenders can always absorb “statistical losses,” such as those that are measurable in retail banking where there are millions of commitments, through adequate provisions. Risk provisioning can go beyond with provisions for general factors, should banks feel that they are exposed to such factors in their portfolios. But what would happen for the first Euro or Dollar of loss beyond the provisions? In the absence of capital, there would be no further buffer for such “average” losses. The rationale of the capital buffer is that banks should have a capital capable of sustaining much higher than average losses. It sounds natural, for ensuring bank solvency, to impose a capital base in line with such unexpected losses. Of course unexpected losses are future and potential losses. They are not supposed to materialize in other than unexpected ways. And they depend on current risks taken by the bank. The challenge of regulators and of banks as well, is in measuring potential losses in line with current risks.

The capital adequacy principle was the starting point of the strong emergence of modern risk management because it requires translating risks, which appear, at first sight, as intangibles, into Euro or Dollar values. Risk quantification and modeling made tremendous advances under the impulse of capital regulations.

Guidelines are defined by a regulators meeting in Basel at the Bank of International Settlement (BIS), hence the name of “Basel” Accords. The sequence of Accords in Basel started 20 years ago with the Accord for credit risk, or Basel 1, which relied on the very simple Cooke ratio. The Cooke ratio stipulated that the capital charge for lending or credit risk in general should be 8% of risk-weighted assets. Risk-weighted assets are the amount at risk, subject to loss, weighted by a coefficient between 0% and 100%. Such values were supposed to match rough proxies of the likelihood of unexpected credit losses, after considering the diversification effect of lending portfolios. Since they were very few weights, the first capital accord was very easy to implement, which was the purpose of its simplicity.

The 1996–1997 amendments targeted market risk, and allowed to use a standard approach using risk weights and, for the first time, the internal model approach, or the value-at-risk model for market risk. The challenge for measuring potential losses is to turn intangible risks into quantified measures in monetary value. The conceptual solution to that challenge is the

4 Among others, important documents on risk regulations by the Basel Committee for Banking Supervision (BCBS) are for credit risk in sources [7] and [10] and [8] for market risk, supplemented by publications available on the Bank of International Settlements (BIS) website.

“value-at-risk” concept, which synthesizes risks into a Dollar or Euro value through risk models. Value-at-risk gained popularity because it measures in a single figure the potential losses, a measure imposed by the bank’s supervisors. Value-at-risk is the potential loss that is not supposed to be exceeded in more than a very small fraction of all feasible scenarios. It has now a track record of around 10 years and is implemented in most banks as the basis for the calculation of the capital charge against market risk.

In January 2007, the Basel 2 Accord for credit risk was enforced in European countries and for major international banks. The Basel 2 Accord essentially differentiates the capital charge according to the credit risk of the borrowers, using as an intermediate step internal credit ratings assigned by banks to all borrowers (in approaches other than the simpler Standard approach).

Ratings are measures of the “credit standing” as a rank along a scale. For bonds, rating agency scales are widely used. Those are letter grades such as, in the simplified Moody’s scale: Aaa, Aa, A, Baa, Ba, B. Detailed scales are also extensively used. Under Basel 2, any borrower from a bank (corporations, banks), should be assigned an internal credit rating, which drives the capital charge. For individuals, in retail banking, the large volume of data allows using statistical measures, or “scores,” for measuring credit standing, already used by many banks. Some are nationwide such as the famous FICO (Fair Isaac Corporation) score in the US. Others are proprietary to banks, such as in Europe.

Regulations were stringent, but regulations “holes” remained. Mismatch risk is a case in point, since it is left mainly to the self-discipline of market players, and without any capital charge. In addition, the scope of regulations does not extend to the entire industry. Another case in point is that of hedge funds. Hedge funds use proprietary trading techniques for enhancing their return, providing alternate sources of returns to straight investments in securities. For doing so, they use various techniques, such as betting on convergence of market parameters of different regions, or stock prices, or using event-driven strategies, betting on the outcome of mergers or even elections for example. Creativity has no bounds. Regulations would make proprietary strategies more public than they are, removing the added value of hedge funds policies, as some argue. Hedge fund management was left to self-discipline as well, contrasting with standard mutual funds subject to stringent restrictions. Moreover, funds can be highly leveraged (using debt financing), posting as collateral the assets held. A well-known effect of debt financing is that, under favorable conditions, it enhances the returns to investors (and to the fund managers as well). This could be fine, except that funds rely a lot on market liquidity and on mismatch risk for enhancing return. As explained subsequently, hedge funds participated to the aggravation of the crisis because of rules applying to collateral-based financing and mismatch risk.

Other entities are supposed to follow a “code of conduct” enforced by the market. The case in point is that of rating agencies. The business model of rating agencies is assigning credit ratings which serve the investors. Since they help issuers of bonds to raise financing, they are paid by issuers. Self-discipline can be powerful enough to impose self-regulation because the reputation of agencies depends on how well they do. At least, this was the prevailing view, since no one regulated rating agencies. Once the role of rating agencies in monitoring risk was heavily criticized, it became a common perception that self-regulation was not enough, and that the “issuer paid” model might raise conflicts of interest for agencies rating issues.

The debate on regulations before the crisis was how to weight self-regulation, or self-discipline, versus rule-based regulations enforced over financial firms. Since the crisis, it became official that regulation could not depend any more on self-discipline or “codes of conduct.” Rather, all official documents point to the deficiency of existing regulations, and universally

recommend that existing regulations should be more consistent and reinforced⁵. The contrast is striking. Extending the scope of regulation and how stringent regulations should be, have become hot issues.

1.4.2 Accounting Standards

“Fair value accounting,” under the new accounting standards, focuses on the price at which an asset can be sold⁶. For market products, stocks, bonds, and derivatives, prices are usually liquidation values unless they are loans and receivables or held until maturity assets. For assets valued at fair values, valuation depends on whether markets are active or not. Active markets are such that the volume of transactions allows defining clear prices. For other instruments, prices can be derived from other traded instruments in active markets. For instruments for which prices cannot be derived from active markets, valuation is model based. The classification in accounting categories is based on management intent.

A main drawback of fair value, as it used to be discussed, was to make the net income more volatile because it was directly related to market movements, thereby blurring the profitability picture. This drawback was addressed by making a distinction between assets held for trading purpose, for which capital gains and losses of traded instruments are transferred to net income, and those for which capital gains and losses are transferred to the capital rather than to the bottom line.

When markets went down, fair value rules triggered markdowns of portfolios, even if there was no intention to sell them, which translated into losses that eroded the capital base of banks.

1.5 CONTAGION THROUGH SECURITIZATIONS

Banks progressively shifted from the “originate and hold” business model to the “originate and distribute” business model. Traditional lending consists of lending and keeping the loans in the “banking portfolio” until maturity. The drawback of such classical practice is that loans withheld in the balance sheet freezes the capital required by regulators, thereby excluding origination of new loans if the bank has capital constraints. The securitizations allowed bank to turnaround the constraint and to keep developing their loan business⁷. The mechanism facilitated the financing of growing economies.

Banks originate new loans but, instead of keeping them in their balance sheets, they sold them into the capital markets, thereby off-loading massive amounts of credit risk in the capital markets. The principle consists of creating a Special Purpose Entity (SPE), a legal entity, alike a fund, which is bankruptcy remote from sponsors (banks or other financial players). The SPE buys the assets and issues “bonds” in the market for financing the acquisition. Loan cash flows serve for compensating investors in such asset-backed securities issued by “SPEs.” As a result, banks distributed credit risk to a variety of investors, which was seen as a wider diversification of risks.

⁵ See the concluding chapter, Chapter 61.

⁶ See Chapter 21 on accounting standards.

⁷ See Chapter 5 on financial products, for definitions of securitizations, and Chapter 58 detailing the securitization economics.

Banks' original motivation for selling assets, under the "originate and distribute" business models is to free capital, which allows them to expand their lending activities again. Investors look for credit spread of issued bonds (spread of bond yields above risk-free yield) and base their investment decisions on the ratings assigned by rating agencies to such loan-backed bonds. Investors care only about the credit quality of bonds, measured by credit ratings, rather than the composition of the pool of loans, over which they have no direct information, making the role of rating agencies critical in the process. They also had an additional benefit when investing in SPE securities. The credit spreads of notes issued by securitization vehicles have been more attractive than those of comparable corporate bonds with the same rating.

Whatever the risk of the assets securitized, the funding of the SPE can be achieved through the "structuring" of loan-backed bond issues⁸. A series of notes of different seniorities, from AAA to high yield bonds, are issued. Seniority refers to the relative priority of different debt claims on the SPE. The subordinated notes bear the risk of securitized assets, thereby providing insurance against losses for more senior notes. Senior notes can be hit by losses only once the subordinated notes absorbed the first losses. The mechanism allows assigning high ratings to senior notes. It also allows customization of the risks of bonds issued by a single securitization to the differentiated risk appetites of a wide array of investors from conservative pension funds, buying senior bonds, to investors looking for the high spreads of subordinated bonds, at the cost of additional risk.

Securitizations became widely spread. Whatever the risk of the underlying assets, whether they are mortgages or risky loans, they can be securitized. All that securitization arrangers have to do for securitizing riskier assets is to increase the size of subordinated bonds for increasing the safety cushion protecting the senior bonds. With such mechanisms, financing speculative grade debt (high-risk debt) is feasible partially with AAA bonds, the rest of the bonds issued guaranteeing the seniority levels of the high-grade bonds.

The growth of securitization of mortgages has been sustained since the mechanism started to be implemented by banks. For mortgage backed securities, ("MBS"), the early phase was 40 years ago in the US. Securitizations of other assets are more recent, such as consumer loans, or corporate loans. There was an accelerated growth of securitizations of bonds and debts throughout 1996–2002, slowing down in 2002, and breaking down at crisis time.

Securitizations by banks or mortgage institutions are attractive because they save the capital, and because investors benefit from higher spreads for same ratings with loan-backed bonds. As a result of this "win-win" game, both banks and investors gain.

But, as a result of risk distribution through securitizations, no one knows any more who bears the credit risk of the riskier assets, such as sub-prime loans. By disseminating risk across investors, securitizations create a potential for triggering a "contagion" of risks to all investors in those bonds. If securitized pools of assets are perceived as riskier, investors might fear that the risk is much higher than expected. So called "toxic assets," such as sub-prime loans, found their ways into securitized portfolios and became "poison pills" triggering doubt about the securitized portfolios, even though they might represent a small, although unknown, fraction of them.

As a result, securitizations disseminated the risks of toxic assets to the entire industry, and to players who do not know exactly how much risk they were carrying "indirectly." The theory is that credit ratings of rating agencies should provide reliable information about this risk. The practice is that rating agencies might not be well equipped to quantify such risks and that, although they claim to monitor risks when time passes, they might not have the human

⁸ This is the dominant mechanism of securitization. See Chapter 58 for alternate schemes.

resources for doing so. Once it became obvious to all that the risk was higher than expected, it was too late. All that rating agencies could do was accelerating downgrades, for catching up on unexpected risks, which confirmed the fears of investors and created a high risk aversion for the perceived risk of these products.

It is not surprising that all blame securitizations today for having spread credit risk all over the financial system and not providing any way of assessing such risk. Securitizations disseminated risks that should have been contained to some specific segments of the markets. The consequence is that they disappeared when the crisis expanded.

Securitizations were a major source of financing for banks, not only a way of saving capital. Their virtual disappearance dried a major source of funds in the brilliant years of securitizations. It left them with the pressure of capital constraints. This is enough to trigger a credit crunch, no bank being able to extend further credit for lack of financing through securitizations,

Still, the securitization mechanism relies on sound economics. As long as assets provide enough return for compensating investors in line with the risk that they take, SPEs remain sound vehicles. When the asset returns fall below such threshold, when the perceived risk changes drastically, when trust with respect to the assets backing the risk of investors disappears, the mechanism collapses, after having spread distrust everywhere. As a consequence, securitizations virtually stopped since the crisis.

The process was aggravated by the lack of short-term liquidity which also serves in the financing of the pools of assets securitized. In absence of liquidity, some SPEs had to unwind their holding of assets, liquidating them in adverse conditions to pay investors. As an alternate option, banks who originated assets held by the SPEs took them back in their balance sheets to avoid reputation risk, thereby reversing the effect on capital required, which increased again.

1.6 LIQUIDITY CONTAGION

The crisis turned almost instantly into a liquidity crisis. The \$1.2 trillion commercial paper market, the most liquid market in the US in 2007, dried up very quickly after the first phases of the crises. Liquidity froze, making funding shrink and turning financing into a major issue for all borrowers.

The first mechanism of this liquidity gridlock appears to be risk aversion of lenders, and this impression was later confirmed when major institutions collapsed. The “who is going to be next to lose” issue made potential lenders reduce their exposures to others, for fear that would suffer of unexpected losses of equally unexpected magnitudes. Mismatch risk, or more simply, relying on short-term funds, exacerbates the effect of a liquidity crunch in the short-term liquidity markets. Banks and other financial firms relying on short-term debt chased liquidity that evaporated suddenly, triggering a liquidity crisis.

In normal periods, the short end of the money market is very liquid. Mismatch risk is of no consequence. But, if rolling over short-term debt becomes difficult because of market disruption, the funding is disrupted. Still, mismatch is common. A bank’s so-called “structural position” consists of lending long and borrowing short. Mismatch increases the profitability because the term structure of interest rates, the set of rates applicable to various maturities from the short-term horizon up to the very long-term, is usually upward sloping. This upward sloping curve implies that long-term rates are higher than short-term rates under normal conditions, which indeed prevailed for a long time before the crisis. Mismatches allow capturing the spread between long-term and short-term rates.

Many securitization vehicles rely on “liquidity conduits.” Liquidity conduits, attached to SPEs, serve for tapping liquidity in the short end of the market because it is cheaper. The arrangers of such conduits need to make sure that the mismatch risk will not translate into a disruption for the vehicle being financed. The standard manner of doing so is to attach to the conduit “back-up liquidity lines” by so-called “liquidity providers.” A liquidity provider, commonly a bank, contracts to provide liquidity up to a maximum amount in the event of market disruption. The contract is subject to various conditions, such as a minimum rating of the portfolio of assets being financed. The length of market disruptions is supposed to be “short,” not to last for months.

Once liquidity dried up, all liquidity commitments were triggered. This implies that mismatch risk translated in a lot of “involuntary lending” by banks. Not only did they have to lend to comply with their commitments, but also they faced simultaneously the issue of having insufficient liquidity for themselves. Liquidity did not dry up only because of the “who is next to lose how much” issue. It also dried because of such involuntary lending commitments by lenders. Involuntary lending made liquidity even scarcer.

Liquidity appears to have dried up even after massive injection of liquidity by central banks. Presumably, banks and financial firms were “hoarding liquidity” for fear of a lack of liquidity if they started using it for extending credit. Involuntary lending and liquidity hoarding are effects rather than causes. The cause seems to have been the risk aversion and uncertainty about who was next to lose, an effect to be traced back not only to “toxic assets,” which could not explain the magnitude of losses if considered in isolation, but also to fair value accounting standards.

1.7 CONTAGION AND PROCYCLICALITY THROUGH FAIR VALUE RULES

Even though the principle of fair value has a sound basis, it became a contagion factor in exceptionally adverse conditions. The contagion effect results from uncertainty with respect to “who is going to be the next to lose.” Most of the losses of financial entities resulted from the markdowns of their portfolios, resulting from the downturn of the market aggravated by extensive fire sales of assets. But losses are also tied to the nature of portfolios held by financial institutions⁹.

Many firms held securitizations assets, subject to suspicion because of the house price downturn and because of dissemination of “toxic assets” through securitizations. Finding out which assets are embedded in portfolios, directly or indirectly, and whether they qualify as toxic assets, are no trivial tasks. Bank systems were not designed for the purpose of tracing back underlying assets in securitization notes. Rather they record transactions and valuations, as required for trading and lending.

Many assets, easy to value in active markets, lost perceived value in inactive and illiquid markets. The category of assets subject to model valuation, extended to assets which, otherwise, would have been valued on prices considered as reliable when active markets became inactive. Model prices were themselves subject to a negative perception, since many assets, which were

⁹ The *Financial Times* provided useful articles on the causes of the crisis in the late months of 2008, following the Lehman Brothers collapses in September 2008 and in early 2009. The document of the FSF [28] provides various views on procyclicality.

supposedly properly priced, lost perceived value because confidence in models collapsed in stressed conditions. Fair values failed to provide the actual values of assets, whatever they were. Rather, the perceived values substituted to actual values.

The combined result of dissemination of toxic assets and fair value rules implemented in severe conditions made losses unavoidable. It became impractical to find out what the actual solvency of banks was. Some might see that mechanism as a deterioration of banks' solvency only, which it is. But the substitution of perceived values and credit standing of financial firms to "actual" values and related solvency issues seems to have had a joint effect on liquidity and credit crunches.

Under stressed conditions, solvency and liquidity are intertwined. Solvency uncertainty triggers lack of funding and illiquidity. The reverse is also true. Leveraged firms rely on collateral-based financing, subject to over-collateralization ratios. Should the market move down, whatever the reason, leveraged entities have no other option for complying with the over-collateralization ratio than reducing their debt through "fire sales" of assets under adverse conditions. Fire sales trigger losses that adversely affect solvency. This mechanism was not expected to have so much adverse effect and is further detailed in section 1.9. Whether illiquidity or solvency is the initial cause does not matter. Once the mechanism triggered it operates both ways.

The mechanism makes risk aversion increase. Risk aversion in inter-bank lending and borrowing can be measured by the spread between inter-bank lending and borrowing, which jumped to unprecedented peaks, as high as 10 times the usual spread prevailing in other times.

Without fair value effects in adverse conditions, risk aversion would presumably be lower because the unique issue would have been isolating the toxic assets. Fair values were a contagion factor in that they exposed simultaneously all players to losses that become unpredictable.

Fair value rules are also procyclical. In a downturn of the markets, they trigger markdowns, which trigger losses, which trigger a lower capital base, a lower credit standing and solvency, and a higher cost of financing or a lack of collateral based financing due to lower values of collateral. The mechanisms are reversed in expansion. Fair value triggers markups, gains, a stronger capital base, a higher credit standing and a better solvency, and ends up in easy financing.

The mechanism is procyclical because a first downside move in the market triggers all above effects, resulting in downgrades of credit standing and values, and triggers another downside of markets, which accelerates the initial downside. All effects tend to be cumulative over time. This mechanism is procyclical to the extent that it magnifies the amplitude of movements. Adverse affects, in stressed conditions, magnify the market movements and the industry deterioration. Such effects could be inverted in a favorable environment, and, indeed, they did contribute to the expansion preceding the crisis.

The symmetry can be seen as a good point. After all, when everything goes well, it is normal for the financial system to get stronger and vice versa. The point is valid, but, unfortunately, it cannot be segregated from procyclicality, and procyclicality can end up in major crisis, which is a major drawback. No wonder why fair value rules are under attack today, after having been seen as favorable by many players in the expansion phase.

1.8 CONTAGION THROUGH RATING DOWNGRADES

There were waves of downgrades by rating agencies of banks and other issuers, which accompanied the deterioration of solvency of banks, resulting both from defaults of borrowers and

from fair value rules¹⁰. Credit ratings measure the credit standing and solvency of borrowers. Downgrades correspond to a higher credit risk, commanding a higher cost of funds, and a higher return required by lenders and investors in instruments issued by downgraded entities. Accordingly, downgrades trigger higher cost of funding and lower prices of instruments issued by those who are downgraded, adding to their difficulties. Finally, late or not, downgrades confirm the fears of investors and lenders.

Since the frequency of downgrades increased abruptly, rating agencies seemed not to have anticipated the difficulties and tried to catch up with bad news. Lagged downgrades tend to be concentrated in time, instead of gradually measuring the actual credit standing of issues. Because rating downgrades seemed to have lagged way beyond timely adjustments, such waves of downgrades generated doubts about the value of credit ratings, resulting in lower perceived ratings than gradually adjusted ratings.

Rating downgrades have other indirect effects. Many lenders and investors require a minimum rating for lending and investing. Notably, they trigger additional collateral calls, which requires posting additional collateral. If no additional collateral can be posted, the only open choice is to reduce debt by selling assets under adverse conditions.

Entities hit by rating downgrades were those more exposed to mortgage loan risk. Among those are insurance companies, or monolines, called “credit enhancers.” As the name suggests, by providing insurance against loss for certain instruments, they enhance their credit quality. But the “wrapped” instrument quality is as good as the quality of the insurer. Because “monolines” extended so many guarantees to assets, they were highly exposed to the risk which erupted in a short period of time. It was not long before credit enhancers were downgraded.

Downgrades of credit enhancers have a leverage effect: Any instrument “wrapped” in a guarantee by credit enhancers is also downgraded. The scope of downgrades and deterioration of credit quality increased drastically when the value of the guarantee provided by credit enhancers went down.

Procyclicality for credit ratings result from the lag between ratings and actual deteriorations of the credit standing of products and issuers. Credit ratings are well known to be “sticky.” Agencies claim that ratings are long-term and that there is no point in adjusting them frequently. Perhaps, but sticky ratings create lags. When some issues are upgraded and other downgraded, the net effect on the system is negligible. When there is a strong cycle, lags amplify the cycle. And monolines downgrades magnified the waves of downgrades by extension to all “wrapped” assets by insurers.

1.9 CONTAGION AND PROCYCLICALITY IN A LEVERAGED INDUSTRY

Most financial firms rely on collateralized debt, subject to an over-collateralization ratio. When the collateral values go down, the only way to comply with the constraint is reducing debt through sales of assets for repaying a fraction of the debt contracted. Fire sales of assets

¹⁰ The ratings assigned by agencies were relatively stable, and downgrades increased abruptly in the last months of 2007 and throughout the first semester of 2008 when the crisis amplified.

contribute to the contagion to the capital markets. In fact, the de-leveraging process is gradual and continuous when asset values keep declining. To that extent, collateral-based financing has contributed to the downturn of the market, and because it is gradual, it presumably maintained a pressure on the market for several months¹¹.

The mechanism is strongly procyclical. If asset values move down, sales of assets amplify the downturn. If asset values are up, funds and others can afford to borrow more because the collateral value increases as well. Furthermore, the process is cumulative. A downturn triggers fire sales of assets and fire sales accelerate the downturn, which triggers another round of fire sales and so on. The reverse happens in up-cycles, for the benefit of financial players, but perhaps not for the benefit of the financial system. Asset values go up, allowing additional collateral-based leverage, and additional debt finances and additional assets, which allows more financing and so on. The expansion is easier, but its drawback appears when the cycle reverses, notably when the entire system becomes highly leveraged – as it seems to have been the case.

A leveraged expansion is not necessarily beneficial to the system to the extent that it increases the systemic risk. In an adverse situation, the risks materialize and are cumulative. Although these principles are supposed to be well known, the adverse effect of de-leveraging in stressed conditions has been underestimated, even though it is mechanical.

Procyclicality is exacerbated by investors. Investors are happy when leveraged returns get higher, but when the situation reverses, they contribute to magnify the adverse cycle because of the redemption of shares in funds, which aggravates further the need for liquidity and the necessity of fire sales.

Note that the key point is not leverage. The key point is collateral-based leverage. Debt exists because assets are pledged, otherwise raising debt would not be feasible. In the end, it is the combination of fair value rules, collateral-based leverage, and the associated debt to value ratio that are procyclical.

1.10 SOME IMPLICATIONS

It is still too early to foresee all implications of the crisis. Regulations holes will be filled up with new regulations. Disclosure requirements on banks' portfolios will get more stringent. Fair value rules will be relaxed, at least to a certain extent, trying to strike a balance between faithful image and meaningless values when markets dry up. Liquidity and mismatch risks will be supervised again, as they were at certain periods. Governance and short-term horizon for compensations will evolve.

As the history of regulations shows, there will be a new wave of more comprehensive and stringent regulations, which might be followed by more flexibility. At a time when a drastic crisis requires immediate actions, long-term analysis and views are more necessary than ever. There is a lot of work on financial research, on such hot topics as liquidity and how to define a "better regulation," the regulation that everyone would agree to be required. The reforms are still in the process of being gradually defined. Finance researchers now have a lot of issues

¹¹ Although various documents address the procyclicality of accounting standards and of risk regulations, they do not mention the specific mechanism stemming from collateral-based debt, which is the core of this section.

to explore, perhaps not the same areas than before this major crisis. Many mechanisms of the crisis described in this chapter are under scrutiny, at the time of this writing, as the concluding chapter of this text illustrates.

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