1 Credit Risk and the Emergence of Credit Derivatives

Walter Wriston, the former Chief Executive Officer of the American bank Citibank, held that 'bankers are in the business of managing risk, pure and simple, that is the business of banking.'[1] Banks are distinct from other enterprises in that they seek risk,[2] which is the source of their profits and the basis of their business. However, these risks, deliberately taken, must be managed. In this respect, the 1990s emerged as a key period in financial practice, characterized by:

- Deregulation and growing internationalization of banking and financial activities.
- Considerable advances in information and communication technologies.
- Important conceptual advances resulting in better risk modeling (e.g. the *value-at-risk* concept for market risks).
- The phenomenal growth in derivatives (on organized and over-the-counter markets), now clearly the preferred instruments for managing financial risk.
- The widespread wish to optimize capital management,[3] the very essence of economic warfare, especially in the banking industry.

In this context, an examination of why credit derivatives have emerged is tantamount to considering credit risk as the main risk run by banking institutions. Indeed, it was the ever-more urgent necessity to manage credit risk that led to the development of the first credit derivatives, not least insofar as the traditional methods for managing credit risk were found to be unsatisfactory and sometimes ineffective.

In this first chapter we will give a definition of credit risk. Then we shall describe the particular context in which this risk is apprehended (including capital adequacy regulations applying to banking institutions, and the methods for analyzing and measuring this risk). Finally, we shall explain the context in which credit derivatives have been created, their nature, and their purpose. They provide financial market players with a new, relatively simple and direct, means of managing credit risk.

1.1 CREDIT RISK

In September 2003, the annual survey of the Center for the Study of Financial Innovation (CSFI), 'Banana Skins 2003, a CSFI Survey of the Risks Facing Banks,' baldly stated that 'credit derivatives top poll of risks facing banks.' Complex products and credit risk were cited as the main risks for the banking community in 2003, by the 231 financial professionals

[1] Quoted in Freeman (1993).

[2] In financial matters, risk may be defined overall as result volatility. In statistical terms, this is expressed by the standard deviation of these results around their mean.

[3] See Chapter 7.

Table 1.1 CSFI poll results (1996–2005)

1996	1998	2000	2002	2003
1. Poor management	1. Poor risk management	1. Equity market crash	1. Credit risk	1. Complex financial instruments
2. Bad lending	2. Y2K	2. E-commerce	2. Macro economy	2. Credit risk
3. Derivatives	3. Poor strategy	3. Asset quality	3. Equity markets	3. Macro economy
4. Rogue trader	4. EMU turbulence	4. Grasp of new technology	4. Complex financial instruments	4. Insurance
5. Excessive competition	5. Regulation	5. High dependence on technology	5. Business continuation	5. Business continuation

[a] Shading refers to those risks that are directly related to credit risk or credit derivatives/structured credit products (e.g. bad lending, asset quality, complex instruments, etc.).
Source: Reproduced by permission of CSFI.

surveyed by the think-tank.[4] It was the first time that complex financial instruments were quoted as the number one risk in the annual ranking since its creation in 1995. It should also be noted that credit risk in the wider sense (in its various forms) was consistently quoted in this survey as among the major risks between 1996 and 2003, as evinced by Table 1.1.

Naturally, this result should be seen in the light of the overall deterioration of the economic climate over 2000–2002. Oliver Wyman and Company, the consultancy, thus noted that the amount of outstanding debt in default had reached $130 bn worldwide in 2002, as against $110 bn in 2001 and $60 bn in 2000. This 2002 figure tops the historic 1992 record, an estimated $113 bn credit losses for the banking system worldwide.[5]

Furthermore, the many bankruptcies and scandals linked to dangerous loan policies underline the fact that credit risk is the greatest one run by banking institutions. In the last 20 years alone, for example, there have been the debt crises in developing countries in the early 1980s; then the débâcle of the savings and loans banks in the United States between 1984 and 1991,[6] too deeply mired in the junk bond market designed to finance highly leveraged hostile takeovers; or again, the banking crises in the United Kingdom, Norway, Sweden and France, among others, from 1990–1995.

Banks also have to face other types of risk: market risks, of course (volatility in financial asset prices, linked to interest and exchange rate movements, and share and commodity prices), liquidity risks (market demand and supply for this or that instrument), funding risks (capacity to meet financing needs), operating risks (inadequate control systems), legal risks (validity of derivatives contracts in particular), etc. Because of their role in the economic system (selecting borrowers, centralizing information, monitoring risk) and their balance sheet structure (asset/liability management and portfolio diversification strategies are not enough to eliminate risk), it is truly credit risk that must be seen as the most important one for banks.

In this section we shall endeavor to define credit risk, show its characteristics, and measure its effect on capital markets.

[4] The panel includes professionals from banks, regulatory authorities, bank clients (institutional investors), and observers and analysts of the capital markets.
[5] See Chassany (2002).
[6] The losses in the wake of this crisis were calculated as 4% of US GDP (Goldstein and Turner, 1996).

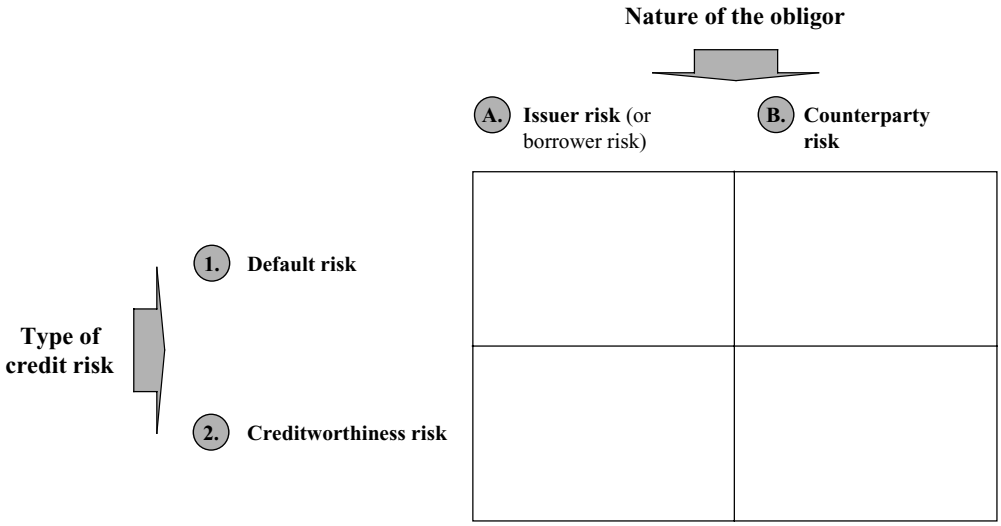

Figure 1.1 Typology of credit risk

1.1.1 Definition and Typology of Credit Risk

Credit risk may be defined overall as the risk of loss arising from nonpayment of installments due by a debtor to a creditor under a contract. The model in Figure 1.1 offers a typology of credit risk.

Two main types of credit risk may be distinguished:

1. Default risk, which corresponds to the debtor's incapacity or refusal to meet his contractual financial undertakings towards his creditor, whether by payment of the interest or the principal of the loan contracted. Moody's Investors Service gives the following definition of default: 'Any failure or delay in paying the principal and/or the interest.'[7] In this case, creditors are likely to suffer a loss if they cannot recover the total amount due to them under the contract.[8]
2. Creditworthiness risk, which is defined as the risk that the perceived creditworthiness of the borrower or the counterparty might deteriorate, without default being a certainty. In practice, deteriorated creditworthiness in financial markets leads to an increase in the risk premium, also called credit spread[9] of the borrower. Moreover, where this borrower has a credit rating from a rating agency, it might be downgraded.[10] The risks of creditworthiness deterioration and default may be correlated insofar as creditworthiness deterioration may be the precursor of default.[11]

[7] De Bodard *et al*. (1994).

[8] Be it a 'financial' (bond, credit line, etc.) or a commercial debt.

[9] Credit spread corresponds to the gap between the yield demanded of a risky borrower by the market, and the risk-free rate. The latter may be defined as the yield from sovereign debt issued by governments (the United States, Germany, the United Kingdom, France, etc.) in their own currency. Credit spread is intended to reflect the borrower's credit risk as perceived by the market, and the value of the market's debt instruments is in reverse relation to the changes in this credit spread. For more on credit spread see Section 1.2.3.

[10] See Section 1.2.2 for rating agencies.

[11] Except in the case of a sudden default such as that of Baring Brothers.

As regards the 'type' of debtor, we shall use the following terminology:

(a) We shall speak of issuer (or borrower) risk where the credit risk (default or deteriorated creditworthiness) involves a funded ('cash') financial instrument such as a bond or a bank loan.
(b) However, we shall use the terminology specific to the derivatives markets (counterparty risk) for cases where the credit risk concerns the counterparty for an unfunded instrument such as a swap, an option or a guarantee.

Simply put, credit risk is assessed by the amount of the debt or the claims on the debtor ('exposure') multiplied by the probability of the debtor defaulting[12] before the end of the contract, with the product adjusted for the hope of recovering from assets after default:

$$\text{Credit risk} = \text{exposure} \times \text{probability of default} \times (1 - \text{recovery rate})$$

One last component of credit risk is therefore the uncertainty of the recovery rate possible on the claim after default. This second-ranking risk depends on several factors, not least:

- For borrower risk, the seniority of the debt instrument on which the creditor is exposed (in other words, its priority ranking in cash flows where the borrower is put into liquidation).
- The existence of collateral to guarantee the creditor's position.
- The nature of the debtor (recovery rates varying depending on the debtor's size, country of origin, sector of activity, etc.).

We shall return to the notion of recovery rates in Section 1.2.2.

1.1.2 Characteristics of Credit Risk

Credit risk has three main characteristics:

1. It is a 'systemic' risk, in other words, it is influenced by the general economic climate and is therefore highly cyclical.
2. It is a 'specific' risk, in that it changes depending on specific events affecting the borrowers (credit risk is then said to have an 'idiosyncratic' component).
3. Contrary to other market risks, it has an asymmetric profitability structure.

1.1.2.1 A Systemic Risk

Credit risk is strongly dependent on economic cycles: it tends to increase during depression and decrease during expansion. The cyclical nature of credit risk is illustrated by Figures 1.2 and 1.3, which show the business default rate in the world between 1987 and 2002, and in the United States since 1980.

It should be noted that in the years 2001–2002, the number of bankruptcies soared due to the sharp downturn in the economy, and that the amounts of defaults increased. Thus Moody's Investors Service noted that within the ranks of the rated issuers it handles, the amount of

[12] Case (2) of materialized risk due to creditworthiness deterioration is expressed theoretically by a higher probability of borrower or counterparty default.

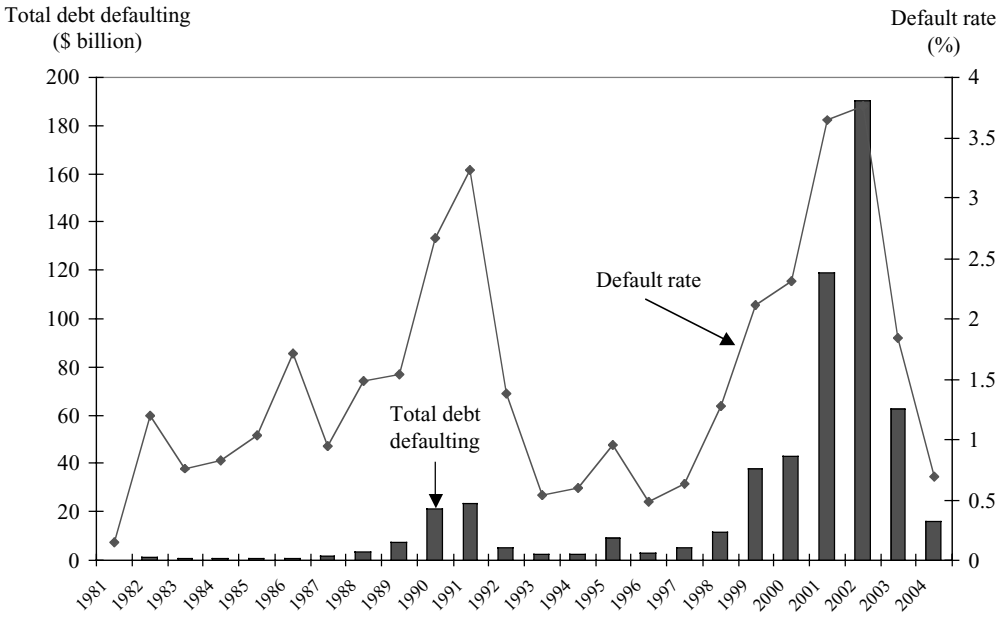

Figure 1.2 Bankruptcies in the world
Note: Borrowers rated by Standard & Poor's.
Sources: The Economist, Standard & Poor's, Commission Bancaire, authors' analysis.

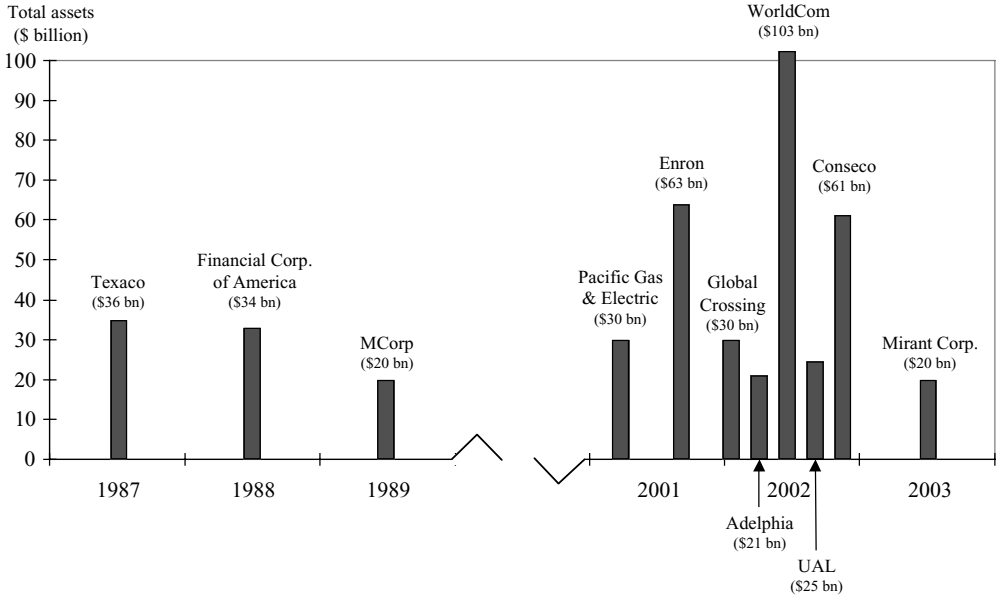

Figure 1.3 Largest bankruptcies in the USA (total asset value in excess of $20 bn)
Source: BankruptcyData.com. Reproduced by permission of New Generation Research, Inc.

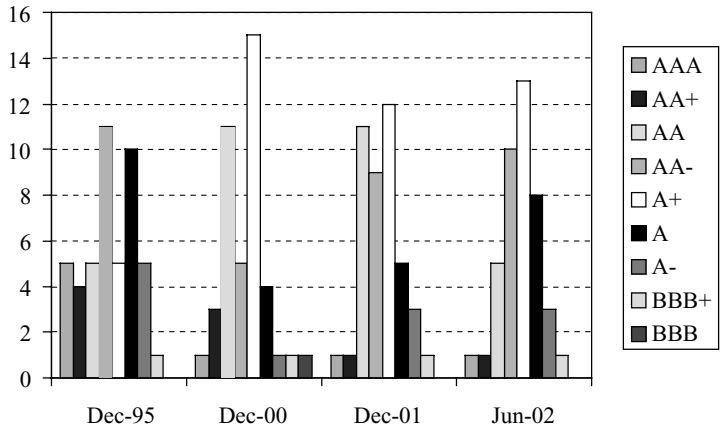

Figure 1.4 Top 50 European banks – rating trends
Note: Excluding German Landesbanken. AAA-rated banks have the best credit standing (see Section 1.2.2).
Source: Standard & Poor's. Graph titled "Top 50 European Banks – Rating Trends (excl. Landesbanks)" published in Bondholders Versus Shareholders – The Pressure of Managing Conflicted Expectations and the Implications for Ratings, Walter Pompliano, 2002, reproduced with permission of Standard & Poor's, a division of the McGraw-Hill companies, Inc.

defaults for the year 2002 (€43 bn) was greater than the total amount of defaults between 1985 and 2001 (€22 bn).[13] Furthermore, eight of the greatest bankruptcies in United States history took place between 2001 and 2003, as indicated by Figure 1.3.

This figure also illustrates the systemic nature of credit risk: four of the seven greatest bankruptcies of 2001–2002 were of companies in the telecommunications sector. This is not only dependent on overall macro-economic conditions, but also on the state of health in the telecom sector itself.

Naturally, this cyclical aspect has a direct impact on the health of banking institutions, as Figure 1.4 shows. It also has considerable impact on:

- The funding of the economy and growth, which shows pro-cyclical tendencies. In other words, banks are ready to fund the economy when everything is running smoothly, but they withdraw from the market when the first signs of cyclical downturn appear, and this behavior contributes to the creation of a 'credit crunch' (see Figure 1.5).[14]
- Financial instability, which appears to be inherent to a globalized, liberalized financial system which is itself characterized, among other things, by the absence of adjustment via prices. Too great an offer of credit does not lead to lowering prices or profits, but on the contrary, contributes to them increasing (credit growth sustains activity and increases the price of assets, thus favoring the perceived soundness of borrowers, and so on).[15]

[13] See *L'Agefi* (2003).
[14] Further analysis available in the 2002 annual report of the BIS and Chavagneux (2002).
[15] See the 2001 annual report of the BIS and Wolf (2001).

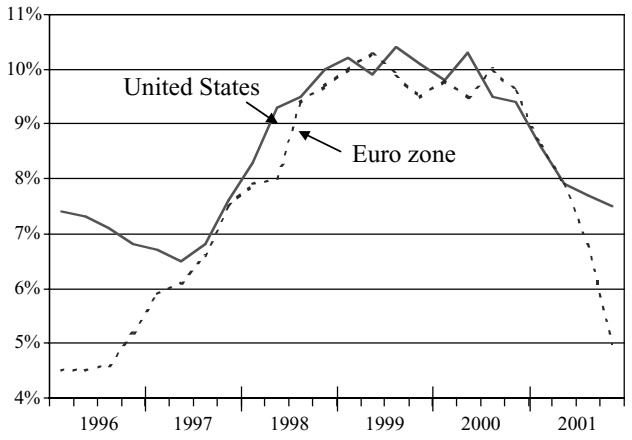

Figure 1.5 Credit cycles: annual variations of internal credit to the private sector (%)
Source: Bank of International Settlements.

1.1.2.2 A Specific Risk

The second characteristic of credit risk is its specific nature, that is to say, the fact that the credit risk linked to a borrower or counterparty is directly influenced by its characteristics: size,[16] corporate strategy, events affecting it, changes in its direct economic environment, etc. One example of this is the resounding bankruptcy of the Asian merchant bank Peregrine Securities in November 1997, which typifies the materialization of a 'specific' credit risk. It was obliged to close down after the Indonesian company Steady Safe had defaulted on a US$235 m bridge loan. It amounted to a quarter of the bank's capital![17]

1.1.2.3 A Risk with Asymmetrical Profitability Profile

One last characteristic of credit risk is its peculiar profitability structure. It is different from other market risks (share prices, interest rates, etc.) in that it is closely linked to the individual performance and capital structure of the borrower.

When the pattern of their associated profitability rates is examined, it becomes clear that market and credit risks differ:

- The structure of profitability linked to market risk is symmetrical and may, in statistical terms, be close to normal 'bell curve' patterns.
- On the contrary, profitability linked to credit risk is asymmetrical and shows a 'fat tail' structure.

The differences between profitability structures linked to market or credit risks are shown in Figure 1.6.

[16] In France, the chances of a company surviving are closely linked to its size. While the average liquidation rate is 88.8% for bankrupt companies overall, it is only 38.8% for companies with a turnover of more than €7.62 m. (*Source:* Deloitte & Touche Corporate Finance; see Fouquet, 2001.)

[17] Guyot (1998). Peregrine offered Thai and Indonesian companies high-yield bond issues in dollars, which it then placed with Korean and Japanese investors. Peregrine guaranteed its clients' issues and advanced the corresponding cash in the form of bridge loans. When the Indonesian rupee lost almost 75% of its value against the dollar between September and December 1997, PT Steady Safe was never able to pay back the bridge loans.

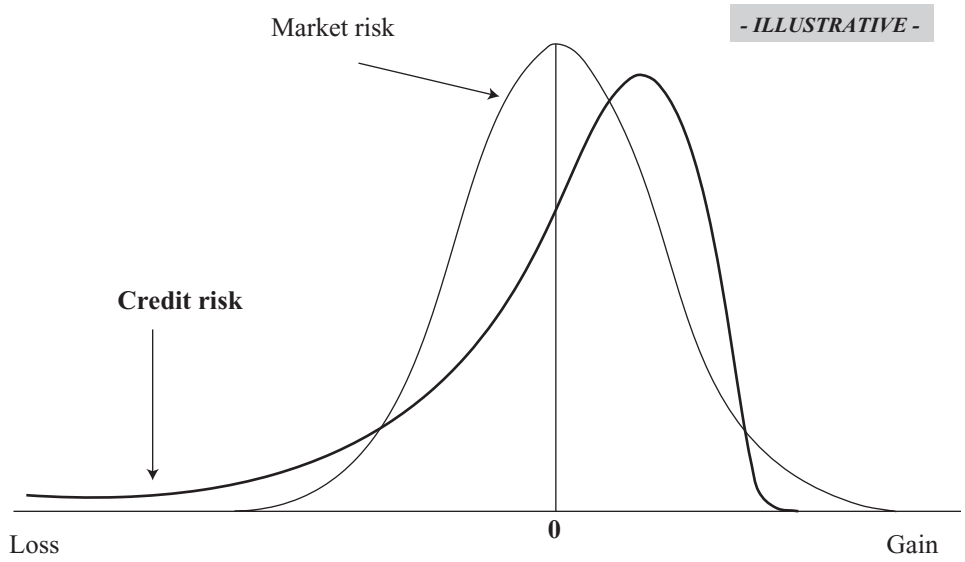

Figure 1.6 Profitability structure of credit and market risks

The profitability curve for credit risk can be interpreted thus: the creditor has a strong probability of making a relatively modest profit on the interest of the debt, and a small chance of losing a large part of the initial outlay (when the credit risk materializes). This observation has far-reaching implications for credit risk modeling techniques and for models of credit derivative pricing.[18]

1.1.3 The Importance of Credit Risk in Capital Markets

Credit risk is most certainly the largest class of risk in the world, if we keep the definition of credit markets as being those for bonds and banking debt, counterparty risk exposures arising from derivatives transactions, and credit risk arising from commercial activity. All commercial transactions incorporate a credit element, unless they are 100% paid for in cash immediately.

Leaving aside the special category of trade receivables and examining only financial instruments, it is possible to link the various derivatives to the underlying class of instrument. Thus, the spectrum of financial risk in Figure 1.7 shows that exposure to credit risk can come in different shapes, depending on the underlying asset.

Derivatives were traditionally developed at the two ends of the spectrum, in other words, in the equity and interest rate markets (based on domestic government debt issues) via organized markets such as Euronext, Liffe, Deutsche Börse–Eurex, Chicago Mercantile Exchange, Chicago Board of Trade, etc. As regards OTC derivatives, that is, those negotiated directly between operators not using an organized, regulated market, credit derivatives were the market segment with the strongest growth since 1999, although they represent under 2% of total outstanding contracts in notional amount according to BIS statistics.

[18] See Chapter 6.

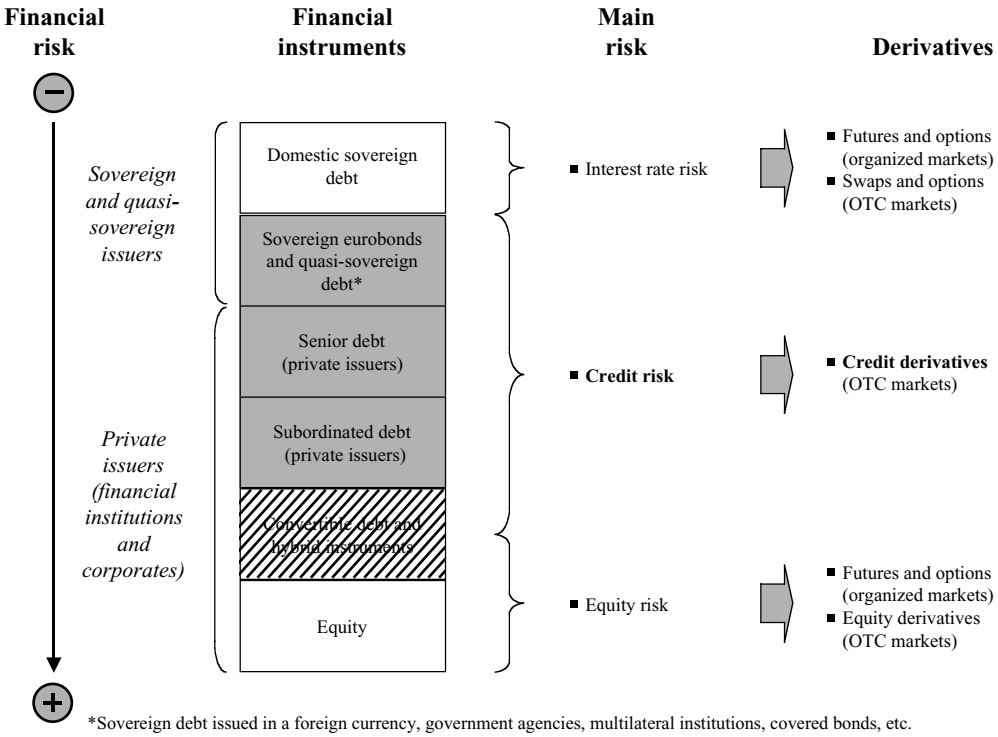

Figure 1.7 The spectrum of financial risk and derivatives

Moreover, it should be noted that once they are linked to the vast range of underlying financial instruments, credit derivatives have a considerable scope of action. In recent years, the relative proportion of debt instruments for funding financial institutions and corporates has risen considerably in financial markets against that of shares. This is due more particularly to the excess offer of liquidity in credit markets, historically low interest rates, and lower equity volumes (see Figure 1.8).

The latter trend is due among others to a sharp fall in initial public offerings (IPOs), especially since the Internet bubble burst in 2000–2001, a relatively active takeover market (mergers and acquisitions) up to 2001, and vast share buyback plans set in train by companies to increase the return on their capital.

While the omnipresence of credit risk is a crucial issue for economic agents in the commercial and financing markets, it is also present in the derivatives markets. Traders in these markets are also exposed to credit risk, most often referred to as counterparty risk. We shall return to this in a special paragraph because it is measured and managed differently from that for the classic credit markets (cash) presented in the foregoing. It goes without saying that credit derivatives may also be used for management of counterparty risk in the derivatives markets.

Counterparty risk is practically non-existent on organized derivatives markets, as will be shown below;[19] however, it remains present in OTC markets. Here, credit risk assessment

[19] See Section 1.3.

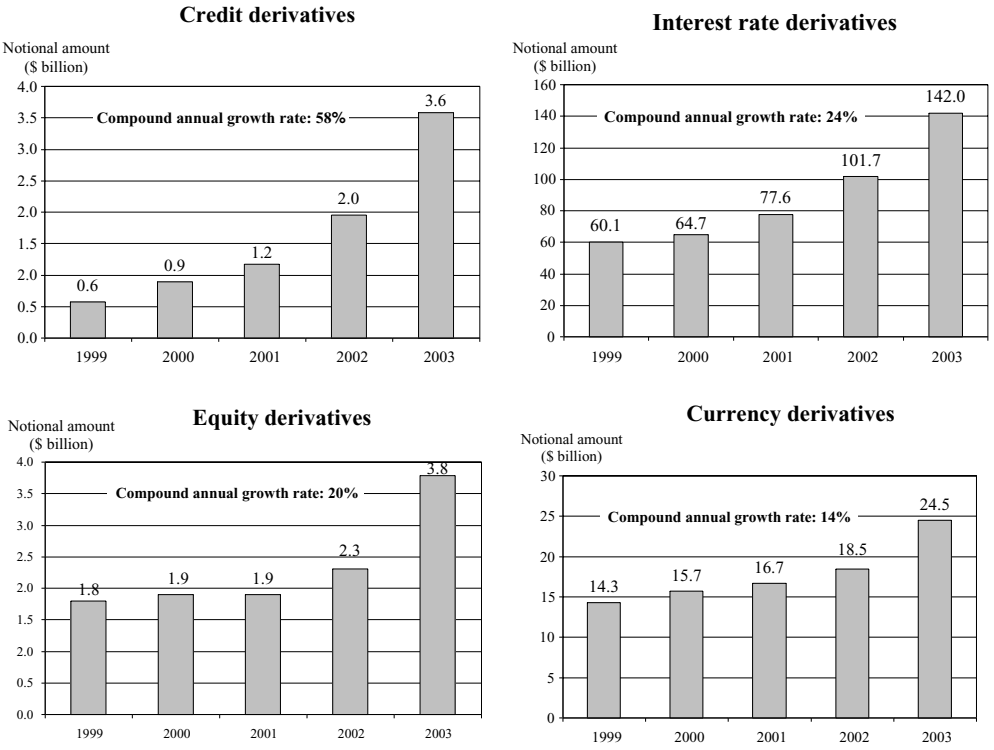

Figure 1.8 Size and growth of OTC derivatives markets (notional amounts)
Sources: Bank of International Settlements, BBA, authors' analysis.

follows a different logic from that applied in the classic credit markets, especially as regards measurement of exposure.

- On a classic financial instrument, credit risk exposure is equal to the creditor's obligation on the debtor (the amount used – outstanding – by the borrower on his credit line) to which accrued interest is added.
- On derivatives, exposure to credit risk depends on the mark-to-market. This is not equal to the notional amount of the transaction, but corresponds to the cost of replacing the contract in the market conditions prevailing at the time of the assessment.[20]

The example in Table 1.2 shows the off-balance-sheet market structure of JP Morgan Chase, one of the world's largest traders in the derivatives markets.

At end 2003, the replacement value of the contracts (that is, the counterparty risk the bank was exposed to) was only 0.25% of the total notional value of the contracts it had concluded, as against 0.32% at end 2002 and 0.33% at end 2001.

Credit risk is the main risk banking institutions are exposed to, both in their traditional loan activities and in their role as intermediaries in the financial markets. Let us see now the various

[20] Capital adequacy regulations of banking institutions determine the 'credit risk equivalent' on a derivatives position by adding to this mark-to-market value an amount corresponding to the notional of the contract multiplied by an add-on, which represents the potential risk of drift of the mark-to-market, depending on the evolution of the various market parameters.

Table 1.2 Derivatives exposure of JP Morgan Chase

USD billion	Notional amounts			Counterparty risks		
Class of risk	2003	2002	2001	2003	2002	2001
Interest rate	31 252	23 591	19 085	60	55	41
Foreign exchange	1 582	1 505	1 636	10	7	10
Equity	328	307	284	9	13	12
Credit	578	366	262	3	6	3
Commodities	24	36	36	2	2	5
Total	33 764	25 805	21 303	84	83	71

Source: JP Morgan Chase annual reports (2003, 2002 and 2001).

approaches enabling this risk to be assessed, and then what traditional instruments can be used to manage it.

1.2 ASSESSMENT AND MEASUREMENTS OF CREDIT RISK

There are three main ways to assess credit risk:

- The regulatory standards applying to banking institutions in this field.
- The analysis performed by rating agencies, the traditional function of which is to measure the credit risk associated with a bond issue.
- The assessment of credit risk in capital markets via the issuer's credit spread.

These approaches are presented below.

1.2.1 Bank Capital Adequacy Standards (Basel I)

Because credit risk and the role of banking institutions are so important for the financial system, strict rules have been drawn up by the international banking supervisory authorities.[21] The first regulations on bank credit activity were made by the Basel Committee [22] in 1988, under the aegis of the BIS, and then spread to other countries via the appropriate supervisory authorities.

1.2.1.1 The Context

Banking activities have always been regulated. This is due to the particular role played by financial institutions in the economy. There are two main reasons for the need to control banking activities:

1. Systemic risk, that is, the risk that the failure of one bank might cause others to fail by contagion due to the close links between them, not least the settlement system, and thus threaten the stability of the entire financial system.

[21] Only the measures pertaining to credit risk regulation in commercial banks are presented here. For more detailed information on the various capital adequacy regulations, see, for example, Bessis (1995), especially chapter 3.

[22] The Basel Committee membership includes the central bank representatives from 13 countries: Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Spain, Sweden and Switzerland, the United Kingdom, the United States.

2. Insurance of bank deposits by the public authorities, which therefore means they will closely scrutinize banking activities. Bank deposits are inherently volatile and runs on banks where customers suddenly doubt the safety of their deposit could jeopardize the financial system.

The logic on which the 1988 international regulations were based was that banks' capital should be adequate for the risks they run, not least credit risk. The supervisory authorities in each country wished to come to an agreement, under the aegis of the BIS, to avoid diverging national regulations and create a 'level playing field' for all banks. The first proposals for capital adequacy were made by the Bank of England and the main American regulators,[23] along the lines of the preliminary work of the Basel Committee.

1.2.1.2 The Basel I Regulations

On 15 July 1988, the Basel Committee published the International Convergence of Capital Measurement and Capital Standards. This agreement, called the 'Basel I' Accord, the principles of which were to be applied by all banks in the countries party to the agreement before 1 January 1993, concerns only credit risk. It had two goals:

1. Strengthen the soundness and stability of the international banking system by encouraging international banks to raise their capital amount.
2. Establish a uniform regulatory framework (applicable to all the banking institutions of the countries signing the agreement) for the purpose of reducing an existing source of competitive inequality among international banks, previously caused by heterogeneous national regulations.

The main measures provided by the agreement are as follows:

- Each asset held by a bank is classified in one of the four categories defined by the regulations. Each category carries a corresponding risk weight of 0%, 20%, 50% or 100%,[24] which is applied to the amount of assets held in the category in order to determine the amount of the bank's risk-weighted assets (RWA).
- Bank capital is divided into core capital (basic equity) or tier 1, and supplementary capital or tier 2. The core capital is mainly capital in the accounting sense (shareholders' paid-up capital and common stock, disclosed reserves), while the supplementary capital mainly consists of hybrid debt capital and subordinated term debt. The target standard ratio of capital to risk-weighted assets must be at least 8%, whilst core capital must be equal to at least 4% of the bank's risk-weighted assets.[25]
- The bank's off-balance-sheet activities are taken into account in these ratios by converting exposure into a 'credit risk equivalent' by using a 'credit conversion factor' (CCF).
- Finally, the regulations provide for restrictions in respect of large risks. These are defined as positions higher than 10% of bank capital, and declaration thereof to the supervisory

[23] The Federal Reserve (Fed), which supervises bank holdings, the Federal Deposit Insurance Corporation (FDIC), which regulates the other banks, and the Office of the Comptroller of the Currency (OCC), which is responsible for supervising US banks.

[24] The main categories of risk weightings are the following: exposure to sovereign OECD member borrowers is weighted 0%, that to OECD banking institutions and local authorities 20%, mortgages are weighted 50%, and all the other debts (of which all corporate debt) are weighted the maximum 100%.

[25] Since 1966, the European Union has allowed a third type of capital (tier 3). This is a subordinated debt instrument with a minimum maturity of two years. This category of capital can be set against activities related only to the bank's trading book and not its banking book.

authorities is compulsory. Positions over 25% of the bank's capital are forbidden. Furthermore, the total amount of large risk must not exceed 800% of capital.

- The European Capital Adequacy Directive (CAD), published on 15 March 1993 and applying to banks and brokerage houses acting in the European Union, repeats most of the Basel Committee proposals set forth in 1988 and subsequently.

1.2.1.3 Criticism of the Basel I Regulations

The Basel Committee regulations have often been criticized. One particular criticism is that the static, arbitrary weightings of assets do not properly reflect the credit risks run by banking institutions and cause discrepancy between bank return on capital in the economic context, once it has been adjusted for risk (RAROC), and bank return on capital in the regulatory context. The most frequently expressed criticisms are that:

- The Basel I constraint is too high for large companies and too low for small businesses, on average more likely to default.
- By applying a single weighting for all types of credit, many unsophisticated banks have confused capital adequacy and loan pricing, whatever the counterparty's credit quality. Nothing could have been further from the initial intentions of the Basel Committee. Similarly, because many financial institutions have not developed internal rating systems, they are tempted to lend only to the highest-risk borrowers, since the capital allocation is similar to that required for a loan with a better-quality counterparty and the yield is higher.
- The difference in arbitrary weightings of sovereign borrowers, banks and private companies is not satisfactory. Let us take, for example, a three-year bond issued by Novartis, a borrower rated Aaa/AAA by Moody's Investors Service and Standard & Poor's. A bank investor must weight this asset 100% if it is held on his balance sheet. Its allocation in regulatory capital will be higher than that on a ten-year bond issued by an A-rated OECD bank (thus of poorer quality), weighted 20%. Yet the probability of default of the latter within ten years is far greater than that of Novartis within three years.
- The Basel I regulation does not take account of the term structure of the credit risk, because the treatment is uniform whatever the maturity.
- The rule of weighting by type of underlying asset does not take account of the effects of over-concentration. The capital to be set against a risk is directly proportional to the amount of exposure to this risk. This means that the marginal regulatory cost of a new operation is constant, while financial theory shows that the marginal economic cost is an increasing function of the size of the commitment.
- Finally, under Basel I regulations it is impossible either to take account of the overall risk of a loan portfolio (since the correlations between the various components of a portfolio may significantly modify the institution's overall risk profile), or to net exposures if the bank is both creditor and debtor of a counterparty.

This Basel I Accord has been amended several times since its implementation. The biggest change was the introduction of a separation between the trading book and the banking book[26] by the European Capital Adequacy Directive (CAD) of 1996, applied worldwide by the Basel

[26] Generally, assets, financial instruments and debt securities held for the purpose of short-term sale (within six months) or to take advantage of short-term price movements, can be handled in the trading book. It is imperative that assets in the trading book be valued marked-to-market. All assets not eligible to go into the trading book automatically go into the banking book.

Committee for Banking Supervision. This Directive created new rules for the allocation of capital for market risks.[27] Thus, treatment of credit exposures eligible for the trading book is more favorable in terms of capital requirement than that in force for those in the banking book: the weightings applied for the former are lower than those for the latter (the treatment methods for which remain those of the Basel I rules).

The many criticisms leveled at the 1988 agreement and the changes in regulations (not least the use of internal models for calculating the capital requirements for market risks) have led the supervisory authorities to review their approach. Other important factors have contributed to this evolution, more especially the emergence of credit derivatives, which have enabled:

- More sophisticated credit management by financial institutions, exposing the limits of the 1988 agreement.
- More commonly used practices of 'regulatory arbitrage.'[28]

These efforts resulted in the publication of a Revised Framework of the International Convergence of Capital Measurements and Capital Standards in 2001–2004, also known as the Basel II Accord. After many negotiations and adjustments between banking institutions, national supervisory authorities and the Basel Committee, this Accord should be implemented, by various methods, by the banks in the main countries by 2007. We shall return to the Basel II agreements, and their 'symbiotic' relationships with credit derivatives, in Chapter 7.

1.2.2 Credit Risk Analyzed by Rating Agencies

The second characteristic of credit risk is that, in addition to the ongoing scrutiny of the banking supervisory authorities, it has given rise to a dedicated system of analysis and measurement that has taken on growing significance over the past ten years: that of the rating agencies.

1.2.2.1 Presentation of Rating Agencies

Rating agencies arose in the American market at the beginning of the 20th century, with the creation of the first agency, Moody's Investors Service, by John Moody in 1909.[29] Their initial purpose was to serve as intermediary between the issuers in the emerging, rapidly growing bond market in the USA, and investors, by supplying the latter with an independent assessment of the creditworthiness of the issues.

In economic theory, the role of rating agencies is clearly established. Acting as intermediaries, they enable the information asymmetry between issuers and investors during a bond issue to be reduced, by providing an independent assessment of the issue. Thus the rating agencies enable investors to build up portfolios more cheaply than if they themselves had had to collect the information needed to make a full assessment of the issuers' creditworthiness.

The three largest rating agencies in the world are Moody's Investors Service, Standard & Poor's and Fitch Ratings. Between them they share 95% of the world financial rating market. They are present in all the largest financial centers in the world and hold the highly coveted

[27] Interest and exchange rate risks, settlement–delivery risks, and large risks.

[28] Regulatory arbitrage, a practice where banking institutions reduce their level of regulatory capital while maintaining an equivalent economic ('real') risk, was one of the main factors for growth in the credit derivatives market in the late 1990s, not least the more sophisticated ones such as collateralized debt obligations (CDOs – see Chapter 4).

[29] This was soon followed by Fitch Investors Service in 1922, and by Standard & Poor's Corp. (S&P) in 1923. The other main rating agencies were created from the 1970s on, some having since disappeared due to mergers: Thomson Bankwatch (1974), Japan Bond Research Institute (1975), IBCA (1978), Duff & Phelps (1980).

Nationally Recognized Statistical Ratings Organizations (NRSRO) stamp of approval from the American regulatory authorities (Securities and Exchange Commission, SEC). By a series of mergers and acquisitions,[30] the three 'majors' have now gained a virtual oligopoly over the world rating market, with the exception of insurance and reinsurance companies where the specialized American agency A.M. Best & Co. holds a strong position.

Even though the American market is relatively mature, activity in the past few years has been spurred by the phenomenal growth in the European ratings market in the wake of the unification of the bond market in continental Europe when the euro was introduced at the end of 1999. Moody's rates over 4000 companies worldwide, of which almost 50% are outside the United States, as against 700 and 100 respectively in the early 1950s (and 3000 and 200 in 1920!).

Moreover, while initially, most of their income came from corporate bond issues, the rating agencies have found attractive growth opportunities in new structured transactions (securitizations, CDOs). Thus, Paul Mazataud, head of structured financing at Moody's, points out 'There is often a confusion between the agencies' activities and just corporate ratings. Some 40% of our income comes from rating of securitization operations'.[31] We shall return to this fundamental change in the role of the rating agencies in the bond market, which, from simple assessment of a borrower's capacity (corporate or sovereign) to meet his undertakings, has evolved into the assessment of the performance of ever-more complex structured products.

1.2.2.2 Assessment of Credit Risk

The traditional approach of the rating agencies to assessment of credit risk is to give a rating summing up their opinion of a borrower's creditworthiness and his capacity to meet his undertakings. Therefore, a rating expresses their opinion both of the probability of default and the loss severity were that default to occur.

The rating is made after a process of fundamental analysis combining quantitative (such as study of financial statements) and qualitative methodologies (strategic analyses, interviews with the issuing company's management, etc.). Moody's defines ratings thus: they are 'opinions of future relative creditworthiness, derived by fundamental credit analysis and expressed through the familiar Aaa to C symbol system. Fundamental credit analysis incorporates an evaluation of franchise value, financial statement analysis and management quality. It seeks to predict the credit performance of bonds, other financial instruments, or firms across a range of plausible economic scenarios, some of which will include credit stress. Credit ratings provide simple, objective and consistent measurements of creditworthiness.'

All credit rating agencies use a scale of ratings, usually symbolized by letters, measuring the risk of default and potential losses arising from the default. The scales used by the main agencies are shown in Figure 1.9.

There are generally two rating levels:

- Investment grade for the best issues (from AAA/Aaa to BBB/Baa3).
- Speculative grade (from BB+/Ba1 to default, D).

[30] Fitch Ratings thus merged with IBCA and then took over Duff & Phelps and Thomson Bankwatch, to form a third body capable of rivaling Moody's and S&P. In 2002, Moody's took over KMV Corp.

[31] Quoted by Raulot (2003a).

Deteriorating credit quality

	S&P	Moody's	Fitch	Interpretation
Investment Grade	AAA	Aaa	AAA	Highest quality, minimal credit risk
	AA+ AA AA-	Aa1 Aa2 Aa3	AA+ AA AA-	High quality, subject to very low credit risk
	A+ A A-	A1 A2 A3	A+ A A-	Upper medium grade, subject to low credit risk
	BBB+ BBB BBB-	Baa1 Baa2 Baa3	BBB+ BBB BBB-	Medium grade, subject to moderate credit risk and may possess speculative characteristics
Speculative Grade	BB+ BB BB-	Ba1 Ba2 Ba3	BB+ BB BB-	Include speculative elements and subject to substantial credit risk
	B+ B B-	B1 B2 B3	B+ B B-	Speculative obligations, subject to high credit risk
	CCC+ CCC CCC-	Caa	CCC CC	Obligations of poor standing, subject to very high credit risk
	C	Ca	C	Highly speculative, likely to default
	D	C	DDD, DD, D	Obligations in default

Figure 1.9 S&P, Moody's and Fitch rating scales

This categorization is also clearly shown in the statistics published by the rating agencies on default rates and cumulative default rates (Tables 1.3 and 1.4).

Moreover, the rating agencies are precious sources of information for credit market practitioners as regards post-default recovery rates.[32]

The recovery rate depends directly on the seniority of the underlying debt, as shown in Figure 1.10.

As a rule, the recovery rate is higher for bank loans than for bonds, since the former are often collateralized[33] and rank *pari passu*[34] with the issuer's senior bond debt. This explains why, where there is an equal risk of default (due to cross-default provisions for the various classes of instruments), bank debts often have a better rating than bonds issued by the same borrower. Furthermore, it should be noted that the level of the recovery rate on a debt also depends on the borrower's sector of activity (in this regard, see the results of the Altman and Kishore survey, published in 1996). Finally, one last characteristic of recovery rates is their variability over time. Table 1.5. shows measurements of the historical volatility of recovery rates.

One final indicator of credit risk that is provided by rating agencies is transition matrices. These enable calculation of the probability of a borrower keeping his rating over a given period, moving up to a better rating, or being downgraded from the initial rating. As for the probabilities of default and recovery rates, these data are aggregated from historical series (see Tables 1.6 and 1.7).

[32] Recovery rates are most often estimated by the price at which the post-default debt is traded in the secondary market. In practice, this value may be determined by a survey of the various market-makers for the debt in question. In an efficient market, this price should equal the net present value of all future cash flows generated by the distressed security.

[33] The nature of this collateral influences the hope of recovery of a defaulted bank loan. The survey by Carty *et al*. (1998) shows that lenders holding collateral in the form of the borrower's short-term assets (cash flow, client receivables, inventory) recovered 90% of their commitment on average, as compared to 85% for claims secured by long-term assets (lands, buildings, plant) and 74% for those secured by stakes in subsidiaries' equity capital.

[34] Of equal rank in the case of default and asset liquidation.

Table 1.3 Cumulative default rates by rating categories on corporate bonds and loans 1983 to 2001 (%)

	Time horizon					
Rating	Y1	Y2	Y3	Y4	Y5	Y6
Aaa	0.00	0.00	0.00	0.07	0.22	0.31
Aa1	0.00	0.00	0.00	0.23	0.23	0.38
Aa2	0.00	0.00	0.06	0.19	0.42	0.51
Aa3	0.05	0.09	0.16	0.24	0.34	0.46
A1	0.00	0.02	0.27	0.43	0.54	0.67
A2	0.04	0.10	0.28	0.57	0.77	0.98
A3	0.00	0.11	0.21	0.29	0.42	0.64
Baa1	0.12	0.40	0.69	1.10	1.52	1.81
Baa2	0.09	0.39	0.76	1.46	2.18	2.98
Baa3	0.37	0.88	1.51	2.47	3.26	4.40
Ba1	0.62	2.03	3.68	5.83	7.67	9.51
Ba2	0.62	2.43	4.75	7.33	9.55	11.27
Ba3	2.43	6.81	11.95	16.64	21.04	25.46
B1	3.47	9.81	15.99	21.64	27.26	32.49
B2	7.18	15.65	22.96	28.87	33.57	36.80
B3	12.45	21.81	29.63	35.80	41.13	45.05
Caa–C	21.61	34.23	44.04	52.18	57.44	62.52
Investment grade	**0.06**	**0.20**	**0.40**	**0.69**	**0.96**	**1.25**
Speculative grade	**3.99**	**9.07**	**13.96**	**18.33**	**22.23**	**25.64**
Total	1.34	3.02	4.62	6.04	7.24	8.27

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Table 1.4 Cumulative average default rates 1981 to 2004 (%)

	Time horizon									
Rating	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
AAA	0.00	0.00	0.03	0.06	0.10	0.17	0.24	0.36	0.41	0.45
AA	0.01	0.04	0.09	0.19	0.30	0.41	0.54	0.64	0.74	0.85
A	0.04	0.13	0.24	0.40	0.61	0.84	1.11	1.34	1.63	1.94
BBB	0.29	0.81	1.40	2.19	2.99	3.73	4.34	4.95	5.50	6.10
BB	1.20	3.58	6.39	8.97	11.25	13.47	15.25	16.75	18.16	19.20
B	5.71	12.49	18.09	22.37	25.40	27.77	29.76	31.32	32.54	33.75
CCC/C	28.83	37.97	43.52	47.44	50.85	52.13	53.39	54.05	55.56	56.45
Investment grade	**0.11**	**0.31**	**0.55**	**0.86**	**1.20**	**1.53**	**1.84**	**2.13**	**2.41**	**2.71**
Speculative grade	**4.91**	**9.76**	**14.05**	**17.52**	**20.22**	**22.46**	**24.32**	**25.80**	**27.13**	**28.25**
All rated	1.64	3.29	4.78	6.04	7.08	7.97	8.71	9.34	9.92	10.45

Source: Standard & Poor's Global Fixed Income Research; Standard & Poor's CreditPro® 7.0. Table entitled 'Cumulative Average Default Rates 1981–2004' published in Annual Global Corporate Default Study: Corporate Defaults Poised to Rise in 2005, Global Fixed Income Research, Dianne Vazza, 2005, reproduced with permission of Standard & Poor's, a division of the McGraw-Hill Companies, Inc.

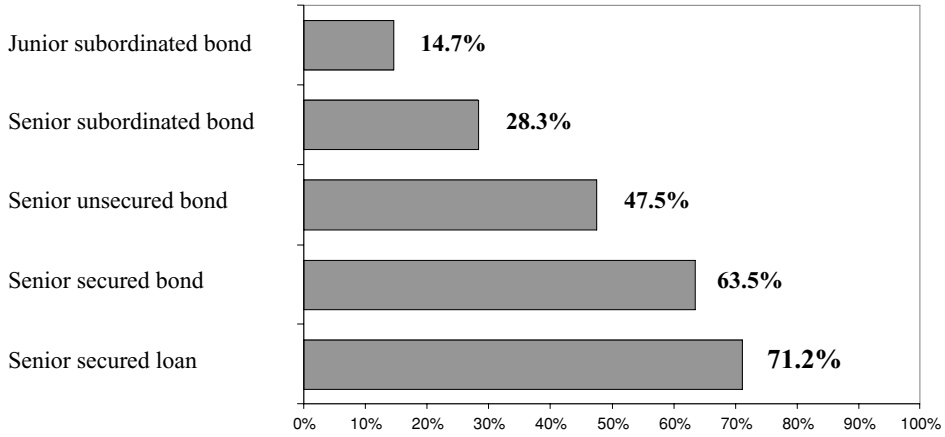

Figure 1.10 Recovery rates
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Table 1.5 Historical volatility of default and recovery rates

Historical volatility of default rates by categories of rating (%)			Historical volatility of recovery rates by type of debt (%)	
	1 year	10 years		1977–1997
Aaa	0.00	0.00	Senior secured loan (1989–1996)	21.57
Aa	0.10	0.90	Senior secured bond	23.87
A	0.10	0.70	Senior unsecured bond	25.81
Baa	0.30	1.80	Senior subordinated bond	23.35
Ba	1.40	3.40	Subordinated bond	22.05
B	4.80	5.60	Junior subordinated bond	14.31

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Table 1.6 One-year rating transition (%)

Initial rating	Final rating							
	Aaa	Aa	A	Baa	Ba	B	Caa	Default
Aaa	93.40	5.94	0.64	0.00	0.02	0.00	0.00	0.00
Aa	1.61	90.55	7.46	0.26	0.09	0.01	0.00	0.02
A	0.07	2.28	92.44	4.63	0.45	0.12	0.01	0.00
Baa	0.05	0.26	5.51	88.48	4.76	0.71	0.08	0.15
Ba	0.02	0.05	0.42	5.16	86.91	5.91	0.24	1.29
B	0.00	0.04	0.13	0.54	6.35	84.22	1.91	6.81
Caa	0.00	0.00	0.00	0.62	2.05	4.08	69.20	24.06

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Table 1.7 Global average one-year transition rates 1981 to 2004 (%)

Initial rating	Final rating								
	AAA	AA	A	BBB	BB	B	CCC/C	D	N.R.
AAA	87.44	7.37	0.46	0.09	0.06	0.00	0.00	0.00	4.59
AA	0.60	86.65	7.78	0.58	0.06	0.11	0.02	0.01	4.21
A	0.05	2.05	86.98	5.50	0.43	0.16	0.03	0.04	4.79
BBB	0.02	0.21	3.85	84.13	4.39	0.77	0.19	0.29	6.14
BB	0.04	0.08	0.33	5.27	75.73	7.36	0.94	1.20	9.06
B	0.00	0.07	0.20	0.28	5.21	72.95	4.23	5.71	11.36
CCC/C	0.08	0.00	0.31	0.39	1.31	9.74	46.83	28.83	12.52

Source: Standard & Poor's Global Fixed Income Research; Standard & Poor's CreditPro® 7.0. Table entitled 'Global Average One-Year Transitions Rates 1981–2004' published in Annual Global Corporate Default Study: Corporate Defaults Poised to Rise in 2005, Global Fixed Income Research, Dianne Viazza, 2005, reproduced with permission of Standard & Poor's, a division of The McGraw-Hill Companies, Inc.

Other private companies, such as DRI McGraw-Hill, offer products similar to those of the rating agencies, or credit scoring methodologies (such as the Z-score devised by Professor Edward I. Altman to predict the risk of corporate bankruptcy). The latter technique regresses a parameter representing the company default on a selection of variables (mostly accounting ones) to determine the most significant (historically) in terms of default prediction.

1.2.2.3 Limitations of Statistics and Criticism of Rating Agencies

The statistics supplied by the rating agencies (default probabilities and recovery rates) have some limitations:

- The rating agencies only partly cover reference assets, since they almost always use only bonds. Moody's rated bank debts for the first time in 1995, but the borrowers covered by these analyses were very often already active in the bond markets.
- Most of the statistics are only available for relatively large American borrowers. Therefore the corresponding default probabilities for international borrowers can only be deduced by analogy, since only their default statistics over the past five or ten years are available.
- It is unsatisfactory to base estimates of default probabilities solely on the borrower's rating since each credit risk is uniquely linked to the borrower (the idiosyncratic component).
- Another difficulty with default and recovery rate statistics as supplied by the rating agencies is their versatility over time. They are strongly dependent on the market environment (interest rate levels, economic recession or expansion, etc.). It may therefore be dangerous to apply a default rate valid in the past to a situation in the present. This problem of extrapolation is all the more acute as the agency ratings are based essentially on *a posteriori* accounting measurements.

Rating agencies have faced a mounting barrage of criticism in recent years due to their increasing importance in the financial markets and the significant rise in bankruptcies. The main target of criticism is their incapacity to anticipate sudden failures. It is accepted that the rating agencies were not capable of predicting the Asian crisis in 1997 or the resounding crashes of companies such as Enron, rated BBB a mere three weeks before it went into administration, unlike the financial markets, which measure a borrower's credit risk by credit spread (see later).

It is this that led to the development of prospective models for calculating a borrower's default probability (e.g. KMV,[35] acquired by Moody's in 2002) using market data (spreads or share prices). These methods are more and more frequently used by the rating agencies.

Finally, since the rating agencies will be called upon to play an ever-more important role in the coming years with the implementation of the Basel II rules (under which capital requirements will depend directly on borrowers' ratings), the banking supervisory authorities are today seeking to promote competition in, and diversity of, information sources. Thus, in March 2003, the Canadian firm Dominion Bond Rating Service was recognized as an NRSRO, an event that may be the first nail in the coffin of the oligopoly currently formed by the three leading agencies in the market. We shall return to the role of the rating agencies in relation to the new capital adequacy rules in Chapter 7.

1.2.3 Credit Risk Measured in the Financial Markets: Credit Spread

The credit markets operate by reference to two essential parameters:

1. Borrower rating, as we have seen, which enables investors to rank creditworthiness, and thus to deduce a risk premium by reference to the conditions in which bond issues of the same rating are traded.
2. The credit spread, which can in theory be defined as the market unit that compensates investors for the credit risk (default) inherent in any debt instrument not issued by a sovereign borrower in its own currency (deemed to be risk-free).

Although these two indicators are theoretically considered to be close, in practice they differ frequently, due to a number of factors:

1. Rating agencies are incapable of adjusting their estimations in real time, as and when events peculiar to each borrower occur. The survey by Wakeman (1990) shows that rating changes, whether upgrades or downgrades, only reflect information that has been assimilated long before into the price of the security in the market. See also Larrain *et al.* (1997) on this subject.
2. The nature of credit spreads, which is also distorted by exogenous factors and does not provide a 'pure' measurement of credit risk, as illustrated below.

1.2.3.1 A First Approach to Credit Spread

As a first approach, credit spread can be defined as the compensation (the risk premium) expected by an investor. It depends on two parameters:

- The borrower's probability of default (q).
- The loss severity in the event of default ($1 - R$), where R represents the recovery rate.

A simple case enabling credit spread to be apprehended is that of a one-year credit-sensitive zero-coupon bond with principal P. Two scenarios can be envisaged:[36]

1. The borrower defaults and the value of the position V at maturity is written

$$V = P - P(1 - R) = PR$$

[35] See Chapter 6.

[36] In the following example, for the sake of simplicity, the discounting of cash flows at the risk-free rate has been omitted.

2. The borrower does not default and pays back the principal (P) at maturity: $V = P$.

It is possible to express the mean value of position Vm as:

$$Vm = q[P - P(1 - R)] + (1 - q)P$$

In a perfect world, the credit spread S is supposed to compensate the investor for his risk of loss (denoted X). In this case, the loss may be expressed in two ways:

- $X = P - Vm$;
- $X = SP$.

It is possible to deduce from these simple relationships the following brief equation:

$$S = q(1 - R)$$

This equation enables us to confirm our intuition as to the nature of spread:

- It increases with the probability of default.
- It evolves in inverse proportion to the recovery rate (which means that for the same issuer, for instance, the credit spread of a subordinated debt will be higher than that for a senior debt).

1.2.3.2 Measurement of the Credit Spread on the Financial Markets: Asset Swaps

Before the arrival of credit derivatives in the financial markets, credit spreads could be measured either against the risk-free rates (that is, the yield-to-maturity on a sovereign issue) or against the swap or Euribor rates (that is, the rates at which the main banks obtain finance). These two measurements reflect the segmentation of the credit market. The former is the classic reference for fixed rate bond issues and institutional investors, but it includes a risk premium remunerating the interest rate risk, in addition to the spread.[37] On the other hand, spread against swap (risk premium on the interbank market) is the reference measurement for banking institutions, which are the main players in the credit markets. It has thus achieved reference status over time. In this context, the credit market has endeavored to separate credit risk from interest rate risk by using a special instrument: the asset swap.

An asset swap may be defined as the combination of a classic interest rate swap and a bond bought in the secondary market and then brought up to par.[38] The difference with a simple rate swap is that an asset swap is structured and offered to investors in the form of a package. The commonest asset swaps are a repackaging of a fixed-rate bond with an interest rate swap into a synthetic floating rate instrument, the value of which depends only on the credit spread and thus is insulated from interest rate fluctuations.

Similarly, it is also possible to change a security with floating interest rate into a synthetic fixed-rate security using an interest rate swap. Figure 1.11 shows the construction principles for an asset swap.

The huge growth in the asset swap market from 1994–95 onwards was a response to the penury in floating rate credit in the financial markets. Given the historically low interest rate level, borrowers were borrowing at fixed rates. These bonds were then bought up by secondary market intermediaries, who combined them with an interest rate swap or possibly a currency

[37] The difference between the swap rate and the risk-free rate is called the Ted spread.
[38] A currency swap may also be built into the structure where necessary.

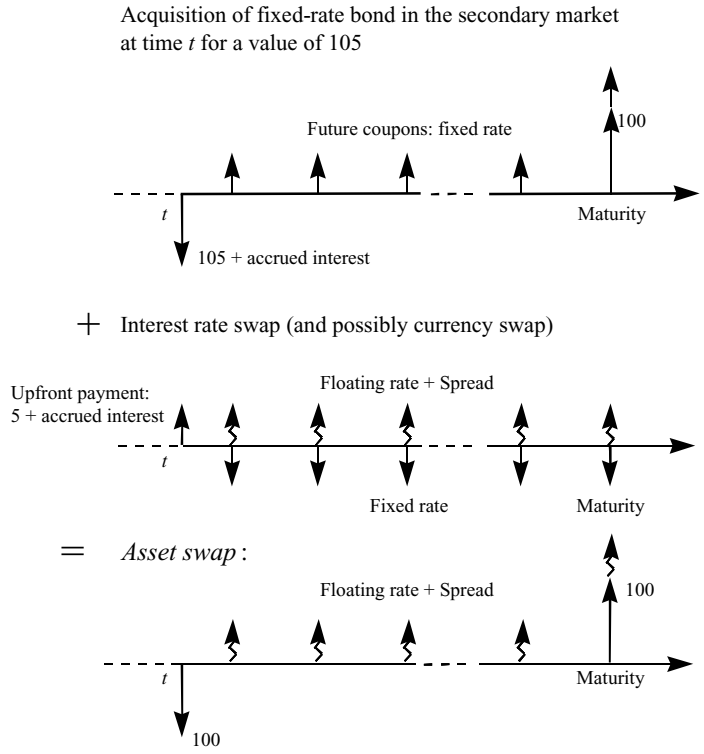

Figure 1.11 Assest swap structuring

swap, and sold them on to investors who funded themselves on a floating rate basis (Libor or Euribor). The result was a synthetic debt instrument with characteristics meeting the investors' requirements (immunization against interest rate risk).

While the asset swap market was previously preferred for observing a borrower's credit risk and its evolution, it has in the past five years been supplanted by the growing derivatives market, which offers 'pure' spreads not influenced by the exogenous factors found in cash instruments, as discussed later.

1.2.3.3 Nature of Credit Spread

As we have seen, spread is a measurement of credit risk. Although it integrates the borrower's real risk of defaulting (default probability and loss severity in the event of default) and the risk premium[39] demanded by investors (the latter are not risk-neutral and their aversion must be compensated for, all the more as a considerable proportion of risk for private issuers, especially corporates, is systemic and cannot therefore be diversified),[40] it cannot be considered as a 'pure' measurement. Altman's work (1989) on the performance of high-yield debt, for example, shows

[39] The Bank for International Settlements reviews the notion of risk premium in its 73rd Annual Report (p. 107) and holds it to be the explanation of why market spreads are significantly higher than theoretical spreads based on default probabilities.

[40] It could even be argued that the growing integration of the capital markets (see Chapter 7) has a direct impact on the risk premium level in credit markets, which increases at the same rate as volatility on the stock markets.

that the excessive yield on risky corporate securities as compared to US Treasury bonds cannot be entirely justified by those securities' default histories. Credit spread is generally influenced by other components, such as:

- The overall supply–demand balance in the credit markets.
- The liquidity of the security.
- The regulations applying to the security.
- Its characteristics (coupon rate, optional clauses, step-up coupons, etc.).

We maintain that, first, the supply–demand balance in credit markets and, therefore, the overall liquidity available to economic agents is a decisive parameter that influences risk assessment. Thus, as the Bank for International Settlements pointed out in its commentary on international banking and financial activity in 1998, 'The abundance of liquidity worldwide and the associated competitive pressures seem to have delayed a reconsideration of credit risk by major lenders.' The pricing conditions in the credit market are also, therefore, dictated by the balance between supply and demand, with each player developing his own assessment of a borrower's credit risk, independently of any theoretical reference. This situation leads structurally to under-pricing of credit risk where there is surplus offer of funds, and vice versa.

The importance of the commercial relationship between banks and borrowers only increases the problem. The former are led to price supplementary credit too low to cover their fixed costs and return on capital, in order not to compromise the privileged relationship they have built up with their best clients. In exchange, the banks expect the latter to come to them for other operations, such as cash management, custody, asset management, new issues, mergers and acquisitions advisory, interest rate and foreign exchange risk management, etc.

Another significant example is the impact of the structured credit product markets on the spread levels of the cash bond markets. The tightening of spreads in 2003 was thus probably due to the arrangers' need to cover exposures in structured products: in this type of transaction, intermediary investment banks are structurally long protection. Although they delta manage these long positions,[41] they are nonetheless led to buy large amounts of credit risk in the markets, which may explain the bond squeeze in 2003 and the resulting spread reduction.[42]

Other factors may intervene in determining credit spreads. One influence is the liquidity of the debt securities considered. This is closely bound up with the size and placement of the issue. Investors usually give a premium to liquid issues that enable them to exit their positions easily. On the other hand, a bond issue placed almost entirely with private investors is more difficult to handle in the market, and is traded at a higher credit spread. Several econometric works in this field have shown the pertinence of this analysis,[43] especially that of Houweling *et al.* (2002). These have sought to compare the liquidity premium of two bond portfolios issued by firms on the basis of four criteria for measuring liquidity: the size of the issue, its maturity, the number of available quotations, and their dispersion. This study resulted in the measurement of a premium for liquidity risk ranging from 0.2 to 47 basis points depending on the measurement criteria assessed.

A second factor determining credit spreads is the regulations on debt for investors, not least that for commercial banks applying the Basel I risk weightings in force since 1988. As recalled in Table 1.8, OECD sovereign borrowers weighted at 0% are likely to be better received by

[41] See section 4.3
[42] See Raulot (2003b).
[43] See Lubochinsky (2002).

Table 1.8 Credit spread by rating categories and types of issuers (January 1998)

Basis points	Sovereign	Banks	Corporates
AAA	−2	+2	+10
AA	0	+5	+15
A	+ 5	+12	+22

Note: Average credit spreads in the five-year asset swap market.
Sources: ISDA (1998), Rabobank, authors' analysis.

banks than corporate borrowers weighted at 100%, inasfar as the banks need not allocate regulatory capital against their position.

The influence of banking regulations on credit spreads can also be illustrated by the following anecdote.[44] On 16 April 1998, the Bank for International Settlements announced a cut in the weighting of debt securities issued by investment banks, from 100% to 20%. The announcement contributed to a rapid tightening of the credit spreads on these securities, until the market operators realized that only the operational subsidiaries of the investment banks were concerned by this measure. However, most of these institutions borrow at holding level, and the holdings are still weighted 100% for investing banks. The latter therefore liquidated their positions and the credit spread returned to its initial level.

One last factor influencing spread levels, independent of credit risk, is the security's characteristics, especially the coupon size. It has been clearly established that this parameter directly influences the discount rate (and therefore the spread for risky bonds.[45]) Thus, the credit spread observable in debt markets does not necessarily reflect the fair value of the credit risk: its liquidity, its intrinsic characteristics and its regulatory treatment are also taken into account by investors.

The emergence of a credit derivatives market has remedied this situation by contributing to the creation of an efficient market in which 'pure' credit risks are exchanged. The following section deals with the conditions under which these new instruments for managing and negotiating credit risk emerged.

1.3 TRADITIONAL METHODS OF CREDIT RISK MANAGEMENT AND THE EMERGENCE OF CREDIT DERIVATIVES

During the 1980s and 1990s, the surging growth of the financial markets and more especially of the derivatives markets was accompanied by considerable efforts to measure and control the market risks run by financial institutions. These efforts were crowned in the mid-1990s by the Value-at-Risk (VaR) method,[46] which has since become the norm for assessing market risks. It has to be acknowledged that credit risk management was not as thoroughly researched prior to this time. It was with the emergence of credit derivatives in 1996–1997 that the scientific and financial communities finally began to immerse themselves in this new field of investigation (see, Chapter 6).

[44] See Manda and Gutscher (1998).

[45] Thus, a simple approach, where a credit spread is determined by the difference between the discount rate of a risky bond and a risk-free security of the same maturity, would be an approximation, since the two securities would not necessarily have the same duration, nor the same modified duration (sensitivity), depending on the size of the coupons.

[46] In particular, with the publication of the RiskMetrics method by JP Morgan in 1994.

The subject of this third section is to describe the traditional approaches and measures for credit risk management, be it for issuer or counterparty risk on the derivatives markets, the context in which credit derivatives appeared, and the advantages inherent to these new financial instruments.

1.3.1 Traditional Methods for Managing Credit Risk (Issuer Risk)

Traditionally, exposure to credit risk is managed *a priori* by banking institutions and other investors in the credit market. These use classic financial analysis methods and apply counterparty limits. Once the credit has been granted, if the borrower's creditworthiness deteriorates, there are usually only two solutions for the banks: fall back on provisions or settle the position by posting a loss, the latter solution having a definitive impact on their profit and loss statements, while the former may leave a hope that the borrower will return to better fortune.

Traditional credit risk management is based on three main principles.

1.3.1.1 Micro Management of Credit Risk

A lender may protect himself from borrower default by structuring the transaction such as to limit his risk of loss, not least by controlling the loan terms and conditions:

- The pricing of the loan, which normally corresponds to the cost of funding it (Euribor[47] for a bank with a reasonable rating), the administrative cost of the transaction, and the risk premium (which depends on the borrower's creditworthiness) should cover the potential risk of loss on the transaction.
- Syndication, the most commonly-used method for reducing credit risk on large loans in the primary market.[48] It enables risk to be spread over all the banks in the syndicate that underwrite the risk.
- Debt seniority compared to the borrower's other loans, which offers more or less security in the event of default and liquidation of assets.
- Collateral, earmarking certain assets on which the bank will have priority in the event of borrower default and liquidation.
- Covenants (clauses in the loan contract) providing for early repayment of the loans by the borrower should he not be able to comply with them. These clauses are most often expressed in the form of minimum financial ratios to be achieved, such as interest cover (EBITDA[49] over interest charge), the leverage (net debt over equity capital), the operating margin, or the borrower's rating.
- The credit or rating triggers[50] and other trigger mechanisms enabling the lender to be protected in theory where the borrower's creditworthiness deteriorates. Several types of clause may be identified in this category:
  - Step-up coupons, which provide for automatic increase of the spread if the borrower is downgraded.

[47] Euro Inter-Bank Offered Rate: rate at which good quality banks re-finance in the inter-bank market.

[48] The first syndications took place on the American market in the early 1970s. See CGFS (2003).

[49] Earnings before Interest, Tax, Depreciation and Amortization.

[50] The first triggers were introduced into bond documentation in the United States following the crash in the high-yield bond market at the end of the 1980s. Investors turned away from risky borrowers (corporates) and preferred risk-free borrowers such as states and other supranational organizations. The result of this investment strategy was imbalance in supply and demand in the market for corporate bond issuers, which led to an additional risk premium that they were obliged to offer investors. The introduction of triggers in bond documentation was one way of returning to supply–demand equilibrium.

– Collateral clauses, which provide for pledging of certain assets to lenders where the borrower's rating falls.
– Immediate repayment of the debt: the borrower is supposed to repay the entire debt to the creditors as soon as his rating falls below a predetermined level (usually from investment to speculative grade).
– Margin calls (this clause is usually implemented in third-party contracts or in the case of a guarantee, where the guarantor's rating is not deemed sufficiently sound by its counterparties).

These mechanisms of credit trigger or covenant may, however, have a down side, or lead to a vicious circle: if lenders demand immediate repayment of the debt, this may push the debtor into bankruptcy and thus jeopardize even further the likelihood of repayment. As Eric de Bodard, Managing Director of Moody's France, pointed out, 'The rating trigger is self-perpetuating. If there are too many automatic repayments due to rating triggers, the first deterioration can lead mechanically to several notches being lost in the rating.'[51] This was recently illustrated by the battle between Alstom and its creditors in spring 2004, where the latter criticized Alstom for not sticking to some key financial ratios in the wake of their rescue plan of summer 2003.

Another side effect of rating trigger clauses is to place rating agencies firmly at the helm, any downgrading decision resulting in the death of the borrower in the short or medium term.

1.3.1.2 Macro Management of Credit Risk

Most lenders define limits to obligations (authorizations) in terms of amount and term of the loan for each borrower individually, and also concentration limits for each category of internal rating, industrial sectors, or geographical regions. Credit risk is an idiosyncratic risk that must be diversified over several borrowers, industrial sector, and geographical regions. Such diversification does not reduce the 'systemic' component of credit risk, which is connected to the overall economic climate.

1.3.1.3 A Posteriori Credit Risk Management

Lenders have two solutions when the quality of the assets on their balance sheets deteriorates:

1. Create provisions.
2. Dispose of the assets on the secondary market, if it exists and provides sufficient liquidity. This is valid mostly for market instruments (bonds and similar).

Over the last few years, a secondary market for bank loans has developed. It offers increasing liquidity to banks. We shall return to this in Chapter 7.

Furthermore, banking institutions can use sub-participations in risk and cash flows, a contract under which the bank transfers the cash flows of an asset (and the associated credit risk) to another institution, while maintaining first rank in the commercial relationship. However, this market offers relatively little liquidity, due more especially to the complex legal aspects to be taken into consideration in these operations and the small number of investors for this type of product (other banks).

[51] Cited by Lachèvre (2002).

Firms use traditional instruments such as letters of credit, guarantees, and credit insurance policies, to protect themselves against potential default by a trading partner or breach of contract (performance bonds, surety bonds, etc.). Most of these instruments are insurance contracts (except letters of credit and guarantees delivered by banking institutions).

Moreover, for projects in foreign countries or export contracts, corporates use credit insurance contracts supplied by specialized insurance companies or governmental bodies.[52]

1.3.2 Counterparty Risk Management in Derivatives Markets

Derivatives are traded in either organized or OTC markets. We shall therefore distinguish between these.

1.3.2.1 Organized Markets

In organized markets, counterparty risk is much reduced by the institutional arrangements between players:

- There is a clearinghouse centralizing all transactions and playing a systematic role as counterparty for each participant in the market.
- There is a daily mark-to-market on which margin calls are calculated. The positions of the counterparties are re-assessed daily and variations in these positions must be settled in cash or Treasury bonds.
- Traders deposit an initial margin, often small compared to the amount of the transaction, serving as collateral in the event of default.
- Position limits are imposed on individual brokers and on the institutional members of the clearinghouse.

1.3.2.2 OTC Markets: Netting and Collateral Agreements

Counterparty risk in OTC derivatives markets has quickly become a major anxiety for traders with the explosion in the numbers and volume of transactions. The main banks working in this market have therefore sought to implement risk management mechanisms via their representative association, the International Swaps and Derivatives Association (ISDA).

From the early 1990s, netting and collateral agreements were set up between the main players. The bilateral netting arrangements enable players regularly trading on these markets to make algebraic sums of their long and short market positions (expressed in mark-to-market values) with the same counterparty, thus producing a lower net 'at risk' value. This practice has been made possible by the use by all market players of a standard legal document, the Master Agreement, drawn up by the ISDA. This covers a more-or-less wide range of products, depending on the bilateral negotiations between the two counterparties.

Once the at risk value has been determined between two counterparties, the debtor party may be called upon to provide collateral in the form of cash or securities (risk-free Treasury bonds) to the creditor party (a mechanism comparable to that of margin calls in the organized markets). Positions are re-assessed daily for standard instruments by the main players in the markets.

[52] Such as the Export–Import Bank in the United States, Coface in France, or Sace in Italy.

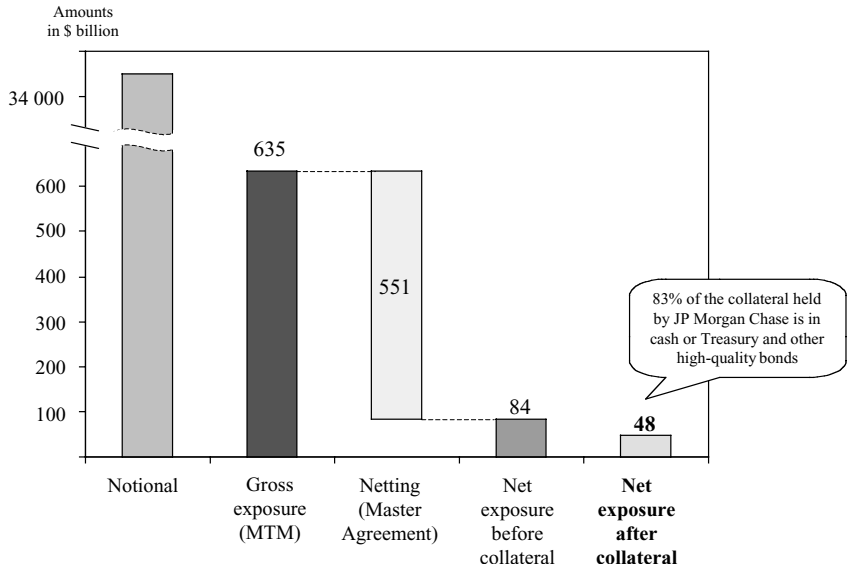

Figure 1.12 Derivative counterparty risk exposure: JP Morgan Chase (31 December 2003)
Sources: JP Morgan Chase, authors' analysis.

These netting and collateral mechanisms have contributed to drastic reduction of counterparty risk in the OTC derivatives markets. Figure 1.12 shows the figures for the exposure of JP Morgan Chase, the world leader in the derivatives markets, to counterparty risk in these markets at 31 December 2003.

In this example, it can be seen that the netting and collateral agreements contributed to cutting the counterparty risk by 92% (based on the gross amount of exposure). This corresponds in real terms to a mere 0.14% of the notional amounts handled by the bank.

1.3.2.3 Other Methods of Counterparty Risk Management in the OTC Markets

Other traditional methods for managing counterparty risk in the OTC markets are as follows:

- Position limits[53] with each counterparty are defined and managed on a portfolio basis (country or sector limits).
- Very often, participants in OTC swaps markets require the counterparty to pay an initial margin, deposited in an escrow fund, or to provide collateral, most often in the form of securities.
- The practice of re-couponing modifies the swap coupon periodically, to bring the market value of the swap back to zero. This arrangement implies a cash payment to the swap counterparty in-the-money, thus lowering the counterparty risk.
- Credit triggers have also gained popularity, not least for long-term transactions. These mechanisms offer protection by triggering early settlement of the swap by a cash payment where a credit event occurs (such as a rating downgrade).

[53] Banks usually fix two types of limit to hedge against credit risk, which is typically dynamic, on derivatives transactions. The first type is a limit beyond which a bank cannot undertake a new transaction with its client because it wishes to protect itself against any unfavorable change of value in its credit exposure to the counterparty. The second type is a higher limit beyond which the bank is involved in finding ways to decrease its passive exposure.

Counterparty rating in the OTC derivatives markets is of paramount importance. In this regard, some market players have been led to create specialized subsidiaries with triple-A ratings to do their transactions for them. These Derivative Product Companies (DPCs) are the strategic response of the main merchant banks not possessing an asset base and market capitalization comparable to those of the main commercial banks[54] when confronted with downgrading. DPCs have higher ratings than their parent companies due to their excellent capitalization and sophisticated risk management approaches. There are three classic types of DPCs: structured DPCs are distinct from the others in eliminating the market risk inherent in their activities by undertaking 'mirror' transactions with their parent or affiliated companies. The survey by Remolona *et al.* (1996) notes that although there are more and more of these specialized subsidiaries, they still only handle a marginal number of OTC derivatives transactions. Many of the main traders in the OTC markets (JP Morgan Chase, Citibank, Bank of America and the large European banks – Deutsche Bank, BNP Paribas, UBS, CSFB, etc.) do not use DPCs.

The credit risk management methods described above are relatively standard to all banks, lenders, and other investors in the credit markets. They have not been adequate to avert the disasters due to under-performing loan portfolios leading to excessive provisions. Fixing commitment limits does not enable a clear identification of the relationship between risk and expected profitability. Further, it is very probable that credit pricing does not properly compensate for the risk taken by banks due to the competition in the credit markets. This is a particularly clear tendency when there is surplus liquidity.

In addition to these factors, the most flagrant defect of the traditional credit risk management methods remains the impossibility to detach credit risk from the underlying asset, thus enabling it to be transferred to a third party.

1.3.3 Emergence and Advantages of Credit Derivatives

Generally speaking, a credit derivative is any derivative enabling the pricing and trading of the credit risk on an underlying asset, independently of the other market risks inherent to it. In this section, we shall return to the context in which credit derivatives were created, and then present their main characteristics. We shall explore their nature and *raison d'être*.

1.3.3.1 Creation and Emergence of Credit Derivatives

The term credit derivative, used for the first time in 1992, referred to a new class of derivative the creation of which was intended to remedy the inadequacies of traditional methods and instruments used by banking institutions for managing credit risks.

Reasons for the emergence of credit derivatives

Among the various reasons for creating credit derivatives in the early 1990s are the following:

- The wish of financial intermediaries to protect themselves more effectively against credit risk.
- The observation that there was a growing discrepancy between increasingly sophisticated market (interest and exchange rate) risk management and credit risk management.[55]

[54] The commercial banks using such structures are those having been sharply downgraded, such as Crédit Lyonnais.

[55] Indeed, it is no accident that one of the early proponents of credit derivatives was the American bank Bankers Trust. It was a pioneer in the ordinary derivatives market in the 1980s, then in structured derivatives, while at the same time developing the most sophisticated internal risk management system in the world (RAROC, Risk-Adjusted Return on Capital). At the same time, Bankers Trust continued its historic activity as a commercial bank. The expertise in credit risk assessment gained during those years of active participation in the high-yield bond market also contributed to its analysis of credit derivatives.

- Banks' capital adequacy regulations, as defined by Basel I in 1988, which required financial intermediaries to gain better knowledge of the relationship between risk and profit, not least in terms of capital allocation, and much more dynamic asset/liability management.
- Exponential growth of OTC derivatives activities and the deep involvement of banks in these markets, which quickly led to overstepping the limits of counterparty authorization. This was one of the deciding factors leading financial institutions to seek solutions and generate new credit lines.
- Finally, for the most sophisticated financial intermediaries, which were responsible for structuring and offering such instruments, credit derivatives met the strategic need for innovation and use of new opportunities to generate higher profits than the by then traditional, so-called plain vanilla, derivatives, the intermediation and trading margins of which rapidly eroded under the pressure of the many new entrants in the market.

Products pre-figuring credit derivatives

The principle of credit risk derivatives was not entirely new. Products for similar purposes did exist in the financial markets (e.g. bank guarantees). One of the first forms of credit derivative could be seen in bonds with put options, which gave the investor the right to sell the security back to the issuer at certain dates or during a precise period for a predetermined price, thus enabling him to limit his credit risk exposure. The price of the option was included in the bond characteristics, in the form of a reduced premium or coupon. The exercise of this option could depend on certain parameters.

These securities became popular in the late 1980s, when bond investors were seeking hedges against certain events (hostile takeovers, LBOs, etc.) likely to deteriorate an issuer's creditworthiness significantly. The 1980s also saw the development of other debt products integrating similar hedging mechanisms:[56]

- Floating rate rating-sensitive notes: the coupon rate was reset on a quarterly basis and adjusted depending on the reference rate (usually the Libor). On this occasion, the spread paid by the borrower increased according to a predetermined scale, if his rating deteriorated.
- Spread-adjusted notes: the spread over the reference rate was re-determined at each interest payment date via a Dutch auction.[57]
- Spread-protected debt securities: investors had a put option to sell the securities back to the issuer after two years at a price equal to the net present value of the cash flows remaining to be paid, discounted at the risk-free rate plus a spread fixed in advance.

Finally, since 1971, options on default risk have been offered in the American municipal bonds market by the American Municipal Bond Association Corp (AMBAC) in the form of bond insurance.[58]

Thus, even though the foregoing instruments that already exist in the debt markets comply with the principle of, and have the same goals as, credit derivatives, they still do not offer the advantages of credit derivatives, not least, their capacity to unbundle the credit risk component and deal with it separately.

[56] See Finnerty (1993).
[57] Dutch auctions in the bond markets use the average bid to serve investors' orders.
[58] However, these products are limited to this market.

Birth of credit derivatives

The first credit derivatives were designed by Wall Street investment banks for their own needs. They were facing growing counterparty risks on their swaps portfolios, due to the explosive growth of the OTC derivatives market. To reduce their risks, these financial intermediaries were led to repackage and transfer these credit risks.

The first transactions in credit derivatives were arranged in late 1991: Bankers Trust issued structured notes referenced to the default risk of a basket of several names of Japanese banks, placed with Japanese investors. These notes enabled the bank to hedge its exposure to the credit risk of the banks underlying the product, to which it had sold Nikkei-linked bonds mostly in-the-money. That same year, Bankers Trust also arranged the first total return swap with Mellon Bank, enabling the latter to advance a new loan to one of its biggest clients, while transferring the associated credit risk to Bankers Trust. As of 1992, structured notes and off-balance-sheet products on credit risk, in the form of swaps and options, began to be offered by the other large American banks. At that time, the transactions had mostly a defensive object, the main purpose being to generate new credit lines. Investors were offered a considerably enhanced yield compared to those available in the market for similar credit qualities, a usual feature of placements of particularly innovative structures.

In retrospect, it is clear that the credit derivatives market was first driven by supply and by the higher yields offered to investors on these new products. Demand for higher yielding instruments was high in an environment of falling interest rates and tightening credit spreads on loans, euro-credits, etc. The supply of products rapidly became diversified, covering the entire range of derivatives, including swaps, options, and structured notes.

After this brief outline of how credit derivatives came to be created, we shall show their main common characteristics, those making them a unique financial product.

1.3.3.2 Nature of Credit Derivatives

Some of the characteristics of credit derivatives resemble those of other derivatives in certain aspects, while at the same time differentiating them substantially in others.

OTC derivatives

Credit derivatives belong to the category of tailor-made derivatives such as forwards, options, swaps, or structured products, that are traded on the OTC market. As for the other types of derivative, the principle of hedging via credit derivatives means taking a position on the derivatives market such that any loss on the underlying asset in the cash market can be compensated for by a gain in the derivatives position.

A new class of products

Some market observers postulate that credit derivatives are a new class of product distinct from traditional derivatives.[59] This is because ordinary derivatives, unlike credit derivatives, can be unbundled into building blocks. It is always possible, for instance, to analyze an interest rate swap as a portfolio of forward rate agreements (FRAs) or futures. On the contrary, a credit default swap is a building block in itself. Thus, a bank debt or a bond can be seen as a

[59] See Parsley (1996)

Table 1.9 Equity and credit compared

	Equity	Credit
Characteristics	Homogeneous	Heterogeneous
Maturity	Perpetual	Between 30 days and perpetuity
Classes	Usually between one and three	Numerous, depending on seniority, rating and covenants
Investors	Individuals and institutional investors	Mainly institutional investors: banks, insurance companies and asset managers
Issuers	Firms	Firms (including financial institutions), local authorities, governments, supranational organizations
Markets	Transparent and organized	Mainly over-the-counter markets

combination of a risk-free instrument with duration, and a swap on the issuer's default risk. Under the terms and conditions of such contracts, the holder of a risky bond receives a risk premium to compensate him for a possible loss should the borrower default.

Thus, although it is possible to create interest rate swaps *ex nihilo* in a market they do not exist in, by analyzing rate differentials and using risk-free instruments, there is no theory allowing construction of a derivative hedging the credit risk of a nonrated counterparty in a market, without listed debt securities traded publicly.

This is why it is possible to view credit derivatives as a new class of products in themselves. We shall return to this in Chapter 7.

A unique underlying risk: credit

The value of a credit derivative instrument is a function of the price of a credit-sensitive underlying (or reference) asset. These reference assets usually include bonds, loans, and asset swaps, which strongly differ from traditional underlying assets of other derivative contracts, such as equity, as illustrated in Table 1.9.

1.3.3.3 Advantages of Credit Derivatives

Like all financial innovations, credit derivatives meet a basic need for traders in the financial markets, which is to be capable of identifying credit risk, trading it easily via simple market instruments, and hedging it.

Unbundling of market and credit risks

The innovation introduced by credit derivatives is that credit risk can be separated from the other risk components of an asset (usually referred to as market risks), and can be transferred to other market players. Unbundling of the credit risk is usually possible whatever the underlying asset. Thus, credit derivatives enable credit risk to be managed and hedged separately from the other types of risk associated with the underlying asset.[60]

[60] To some extent, interest rate fluctuations can cause the creditworthiness of the asset underlying a credit derivative to deteriorate, by impairing the debtor's profitability, for example. It is therefore possible to say that immunization is never perfect.

Trading credit risk

In the early days of this market, Citibank promoted credit derivatives with the following slogan: 'Instead of selling the asset, sell the risk associated with the asset.'[61] The second *raison d'être* of credit derivatives, directly linked to the first, is therefore that it can unbundle the credit risk of a debt instrument and transfer it to a third party. As Ron Tanemura, former joint head of credit derivatives at Deutsche Bank, points out: 'credit derivatives are a new application of the risk-transference property of derivatives.'[62] Credit derivatives enable the credit risk to be transferred without abandoning the ownership of the asset; for banks, they enable credit risk to be dissociated from the funding risk.

Hedging of credit risk

Each debtor is unique and has credit risk characteristics that cannot easily be compared to those of other borrowers. Moreover, as previously underlined, debt securities are very heterogeneous, depending on their maturity and seniority, and on the associated covenants. Rating of debt securities has proved to be inadequate to homogenize this risk, as evinced by the varying spreads observed in the market for a class of assets with the same rating. This is why it is not possible to hedge the credit risk of a given borrower by means of a market index, since there is very low correlation between a counterparty's default risk and that represented by a basket of underlying obligors, even if they are in similar sectors of activity. Therefore the best way of hedging credit risk is to use instruments directly linked to the borrower. This is the role played by credit derivatives.

Credit derivatives came about because banks needed a simple market instrument to help them manage credit risk dynamically. These new products have common general features, as we have shown. We shall identify the different types of credit derivatives in the next chapter, and also show how they work and how they are applied.

[61] Nisbet (1995).
[62] Van Duyn (1995).