

# Credit Risk Management

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# Chapter 1: Credit Risk Assessment

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**The four chapters of this book focus on credit risks. Chapter 1 focuses on credit risk and the governance of credit risk management, while Chapter 2 analyzes the risk of various credit products.** Chapter 3 discusses credit risk assessment tools, debt pricing, and credit risk hedging, and the final Chapter 4 analyzes the regulatory view of credit risk capital requirements.

This chapter assumes prior exposure to basic credit analysis and focuses on a credit risk assessment framework that is used to value credit-linked obligations, such as loans, bonds and lines of credit, as well as assessing the risk of those obligations. Building on this basis, the chapter addresses credit and its governance—including the credit policies and governance of credit within the bank—before moving to analyze the core risk concerns in the credit assessment process for both bonds and loans. This chapter addresses:

- The differences between credit and market risk
- Credit policy and credit risk
- Credit risk assessment framework
- Inputs to credit models

It is important to recognize that the credit risk terminology used in this book relates to all classes of credit risk listed.

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## 1.1 DISTINGUISHING CREDIT RISK FROM MARKET RISK

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For most bankers, credit risk is much more important than market risk. These are bankers who focus much more on traditional lending and credit, and less on capital market activity. Understanding credit risk requires some familiarity with market risk, a topic outlined and discussed in *Market Risk Management*, another volume in the GARP Risk Series.

### 1.1.1 Credit Risk

Indeed, the basic concepts for measuring credit risk—probability of default, recovery rate, exposure at default, expected loss, loss given default, and unexpected loss—are easy enough to understand and explain. However, even for those involved in risk management who agree on the concepts, it is not always easy to practically implement a method that is fully consistent with an original concept.

Minor differences in how credit risk is estimated and measured can often result in large swings in estimates of credit risk, and how to proactively manage the credit risk. Such movements can have significant impacts on risk assessments and ultimately on business decisions (including the using of collateral, securitization and credit risk mitigation).

The following sections describe some of the core principles of credit risk assessment, which are easily extrapolated to a wider range of credit risk assessment approaches; ranging from: straightforward consumer and retail credit products through sophisticated, multi-layered, structured commercial and institutional credit products, to multi-borrower relationships that may contain corporate as well as sovereign credit risk.

Credit risk is a form of performance risk in a contractual relationship. In any contractual situation, performance risk refers to the possibility that one party in the contract will not honor its obligations to the other. Credit risk is usually defined as the performance risk associated with a financial contract (e.g. a loan, bond, or derivative contract). Hence, the potential failure of a manufacturer to honor a warranty might be called performance risk, whereas the potential failure of a borrower to make good on its payment requirements—which include both the repayment of the amount borrowed, the principal, and the contractual interest payments, would be called credit risk. A borrower or an obligor is defined as any party to a contract that has to perform a financial obligation to the other.

Credit risk and default risk are used interchangeably (often the term credit event is being used to describe default). However, the commonly used terminology in the financial markets—such as the ISDA master agreements, ascribe series of events as a credit event that can impact the possibility of repayment, such as bankruptcy, failure to pay, loan restructuring or repudiation, loan moratorium, and accelerated loan payments to name a few events.

Typically, credit risk resides in those investments that the bank has made in its banking book (loans and certain bonds that the bank holds until maturity, with no intention of selling it to other banks). But, there is also a credit risk that is inherent to trading: counterparty credit risk.

As counterparty credit risk relates to the trading activities of banks, the risk is that the counterparty to a financial instruments and contract traded over-the-counter will default prior to the expiration of the contract by not making all contractu-

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ally required payments. Financial instruments and contracts traded on exchanges are exposed to minimal counterparty credit risk, because these exchanges happen through a clearinghouse, which assumes the risk of non-performance.

What distinguishes counterparty credit risk from traditional credit risk, is the bilateral nature of this risk (i.e., the default of one counterparty can trigger a series of defaults with other counterparties which may only be indirectly related to the first defaulting counterparty). Moreover, due to the dynamic nature of trading and pricing, the exposures of financial instruments and contracts can change, and thus further complicate the assessment and quantification of the exposure.

## 1.1.2

### Differentiating Between Credit and Market Risk

In some cases, it is easy to distinguish credit risk from market risk. For example, a USD 100 loan collateralized with USD 200 in marketable securities such as equity has limited market risk, but an uncollateralized obligation to pay an amount linked to the long-term performance of the Nikkei 225 Index (an index that measures the performance of the leading Japanese stocks on the Tokyo Stock Exchange) has more inherent market risk than credit risk. In spite of the overlap between market risk and credit risk, most banks have separate departments to evaluate these two risks, and make special provisions to deal with products that have both market and credit risk. In this chapter, we treat these two risks separately, understanding that a bank will strive to measure its total risk, which includes both market and credit risk in all its products and trading activities.

Credit risk differs from market risk due to obligor behavior considerations. For a discussion of this, see Section 4.6 of Foundations of Banking Risk on the five “C’s” of Credit—Capital, Capacity, Conditions, Collateral, and Character. Sometimes obligors fail to perform because they choose to (lack of character), and sometimes they fail because they become unable to perform (lack of capacity). Sometimes, behavior is particular to a specific obligor (e.g. a company defaults on its debt because of the death of its founder), while other times, obligors fail because of overwhelming macroeconomic influences, such as the credit crisis of 2008-9.

Both credit risk models as market risk models do use historical data, forward looking models and behavioral mod-

els to assess risks. All of these models can be captured in a general credit risk assessment framework, which is explained in section 1.2.

In some cases, credit risk is broader than the risk of non-performance in a contractual setting as mentioned above. Publicly traded issues, such as bonds and traded loans rated by credit rating agencies, may fall in value due to worsening credit conditions attributable to either the specific issuer, or the economy as a whole. Worsening conditions increase the required spread above the risk-free rate, which in turn adversely impacts the value of the issue. This is the risk of credit spread changes, which is different from the impact of reducing the rating of the security, or credit migration risk. Both are integral parts of credit risk.

Risk quantification also affects the spread on the various credit products. As credit quality changes, so will the required interest rate and the price of the credit product. In fact, the spread risk captures the effect of price changes as the return required by investors changes in anticipation of deteriorating market or economic conditions.

It is also important to emphasize the differences in time horizon: while market risk is typically measured over very short time periods (daily), credit risk is typically measured over a long time horizon (annually).

## 1.1.3

### Estimating Credit Losses

For most bankers, the most familiar risk metric will be adequacy of general and specific loan loss provisions and the size of the general and specific loan loss reserve in relationship to the total exposures of the bank. The allowance for loan losses creates a cushion of credit losses in the bank’s credit portfolio and is primarily intended to absorb the bank’s expected loan losses, as determined by management following established credit policy guidelines, which are enacted by the bank’s board of directors (in accordance with supervisory and regulatory input).

Historically these decisions were made in a case by case basis, but with the growing sophistication and automation of lending, as well as the increasing complexity of credit products, computationally complex products have standardized the credit assessment and evaluation of individual retail and commercial borrowers. Furthermore, with the advent of the Basel II Accord, the introduction of bank-wide

# Chapter 1: Credit Risk Assessment

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credit risk software has accelerated, as regulators recognize the need for improved analysis and oversight of the risk assessment process, particularly for more complex credit products (it should be noted that under the terms of the new Accord, banks can qualify to use their own internal expected and unexpected loan loss models to determine their regulatory capital requirements).

In chapters 2-4 of Market Risk Management, a book in the GARP Risk Series, pricing models were used to identify risk drivers in FX, interest rate, equity and commodity products and positions. The same strategy is followed here: a pricing model for credit reveals the factors that drive credit risk measurement:

- PD (Probability of Default): the likelihood that the obligor or borrower, will fail to make full and timely repayment of its financial obligations over a given time horizon (duration)
- EDF (Expected Default Frequency): the estimated risk that a firm will default within a given time horizon (1 year), by failing to make an interest or principal payment
- LGD (Loss Given Default): the amount of the loss if there is a default expressed as a percentage of the exposure's value
- EAD (Exposure At Default): the expected exposure at the time of default
- EL (Expected Loss): the average expected credit loss over a given time period
- UL (Unexpected Loss); the loss in excess of expected loss
- RR (Recovery Rate): the proportion of the EAD the bank recovers
- D (Duration): duration of default
- S (Spread): spread for pricing credit-linked obligations

In addition to measuring the credit risk of an individual exposure, and computing the credit risk and potential credit losses of a credit portfolio, credit concentration risk should also be considered when pricing credits.

The first five factors are consistent with the names in the Basel II Accord's framework. The five credit risk factors have different drivers depending on whether the credit obligation is considered as retail, Small and Medium Enterprises (SMEs), corporate, counterparty or sovereign.

To assess the credit risk of an issue or an issuer, the extent of credit losses needs to be quantified. Using the previ-

ously introduced definitions (EAD, LGD, PD, EL, UL and RR), the losses for the two different types of credit products (loans and bonds) can be quantified.

The core difference between bonds and loans is in the way they are treated from a legal perspective. A loan is a contractual agreement that outlines the payment obligation from the borrower to the bank. The loan contract is designed to cement the relationship between one borrower and one or more lenders. While the bank or banks may have the right to assign the loan to another party, the intention is that the loan will reside in the bank's banking book or credit portfolio, or "keeping the loan on the books". Typically, the loan may be secured with either collateral or payment guarantees to ensure a reliable source of secondary repayment in case the borrower defaults. Also, loans are often written with covenants that require the loan to be repaid immediately if certain adverse conditions arise, such as a drop in income or capital. Notwithstanding the intention of "keeping the loan on the books", it may be sold to another bank, or entity investing in loans.

A bond is a publicly traded loan. The structure is an agreement between the borrower (issuer) and the lenders (purchasers). Bonds are held in the trading book of the bank; in some cases bonds may be assigned to the banking book as the bank intends to keep the bonds until maturity.

Collateral support, payment guarantees, or secondary sources of repayment may all support certain types of bonds, but there are also a wide range of loan products where these secondary sources of repayment are absent. These are considered structuring characteristics—specific to each bond and in the case of default, a bond investor's potential recovery depends on the seniority of a bond, the collateral supporting the bond, as well as other transaction specific conditions. Typically, it is the markets and the investors of the bond that monitor the performance of the borrower (issuer of the bond) and the performance on the bond.

The higher the seniority of the bond, the higher the likelihood the investor will receive the face value. Thus, an investor in a senior bond would expect to receive a larger share of the face value in default than an investor in a junior or subordinated bond. Similarly, the quality of the collateral support may impact the value of the loan and the bond: potential change in the value of the collateral in case of liquidation is often termed recovery risk.

# Credit Risk Management

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## CHAPTER FOCUS

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- Distinguishing credit risk from market risk
- Credit policy and credit risk
- Credit risk assessment framework
- Inputs to credit models

### Credit risk definition

- The potential for loss due to failure of a borrower to meet its contractual obligation to repay a debt in accordance with the agreed terms
- Example: A homeowner stops making mortgage payments
- Commonly also referred to as default risk
- Credit events include bankruptcy, failure to pay, loan restructuring, loan moratorium, accelerated loan payments
- For banks, credit risk typically resides in the assets in its banking book (loans and bonds held to maturity)
- Credit risk can arise in the trading book as counterparty credit risk

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## CREDIT RISK VS. MARKET RISK

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- **Market risk is the potential loss due to changes in market prices or values**
  - Assessment time horizon: typically one day
- **Credit risk is the potential loss due to the nonperformance of a financial contract, or financial aspects of nonperformance in any contract**
  - Assessment time horizon: typically one year
  - Credit risk is generally more important than market risk for banks
  - Many credit risk drivers relate to market risk drivers, such as the impact of market conditions on default probabilities
  - Differs from market risk due to obligor behavior considerations
    - The five “C’s” of Credit—Capital, Capacity, Conditions, Collateral, and Character
- **Both credit and market risk models use historical data, forward looking models and behavioral models to assess risks**

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## CREDIT PRODUCTS—LOANS VS. BONDS

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### Loans

- A contractual agreement that outlines the payment obligation from the borrower to the bank
  - May be secured with either collateral or payment guarantees to ensure a reliable source of secondary repayment in case the borrower defaults
  - Often written with covenants that require the loan to be repaid immediately if certain adverse conditions exist, such as a drop in income or capital
- Generally reside in the bank’s banking book or credit portfolio
  - Although banks may sell loans another bank or entity investing in loans

### Bonds

- A publicly traded loan—an agreement between the issuer and the purchasers
  - Collateral support, payment guarantees, or secondary sources of repayment may all support certain types of bonds
  - Structuring characteristics that determine a bond investor’s potential recovery in default
- Generally reside in the bank’s trading book

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## UNDERSTANDING CREDIT RISK—A SIMPLE LOAN

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Contractually, how a loan should work:

1. Bank loans borrower USD V
2. Borrower repays loan across time with periodic payments

**Credit risk arises because there is the possibility that the borrower will not repay the loan as obligated**

1. Bank loans borrower USD V
2. Borrower fails to repay loan across time with periodic payments

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## ESTIMATING CREDIT LOSSES

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- Most familiar risk metric is often the adequacy of general and specific loan loss provisions and the size of the general and specific loan loss reserve in relationship to the total exposures of the bank
  - Allowance for loan losses creates a cushion of credit losses in the bank's credit portfolio
    - Primarily intended to absorb the bank's expected loan losses
- Historically credit decisions were made in a case by case basis
- Growing sophistication and automation of lending and the increasing complexity of credit products have spawned the development of computational approaches to credit assessment and evaluation of individual retail and commercial borrowers
  - Introduction of bank-wide credit risk software has accelerated
    - In part driven by regulatory pressures, as regulators demanded improved analysis and oversight of the risk assessment process

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## ESTIMATING CREDIT LOSSES—COMMON MEASURES

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- **Probability of Default (PD)**  
The likelihood that the borrower will fail to make full and timely repayment of its financial obligations
- **Exposure At Default (EAD)**  
The expected value of the loan at the time of default
- **Loss Given Default (LGD)**  
The amount of the loss if there is a default, expressed as a percentage of the EAD
- **Recovery Rate (RR)**  
The proportion of the EAD the bank recovers

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## ESTIMATING CREDIT LOSSES—EXPECTED LOSS

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- Banks are expected to hold reserves against expected credit losses which are considered a cost of doing business
- The most basic model of expected loss considers two outcomes: default and non-default
  - In the event of non-default, the credit loss is 0
  - In the event of default, the loss is loss given default (LGD) times the current exposure (EAD)

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## ESTIMATING CREDIT LOSSES—UNEXPECTED LOSS

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- Statistical approaches are used to estimate the distribution of possible loss values
- For individual products in default, loss amounts are not deterministic due to uncertainty about LGD and collateral value
- For a portfolio of credit products with defaults, loss amounts are also uncertain due to correlation of defaults between products
- Credit loss distributions tend to be largely skewed as the likelihood of significant losses is lower than the likelihood of average losses or no losses
- Active loan portfolio management embracing diversification of exposures across industries and geographic areas can reduce the variability of losses around the mean
- Unexpected loss represents the minimum loss level for a given confidence level a  $UL(a)$  is the maximum loss a bank will suffer  $a\%$  of the time