Managing risks has always been at the heart of any bank’s activity. The existence of financial intermediation is clearly linked with a bank’s advantage in evaluating the riskiness of potential borrowers and in building well-diversified portfolios. A bank’s ability to survive adverse economic cycles (and phases of high volatility, as far as market risk exposure are concerned) is linked both to the quality of its risk selection and management processes and to its capital endowment. Capital is therefore a key resource for both shareholders and managers who are interested in a bank’s ability to survive while offering an attractive return for shareholders. At the same time, capital is important for financial system supervisors who are interested in safeguarding the stability of the system by reducing the risk of bank failures (Berger, Herring, and Szégo 1995).

While the difference between the perspective of shareholders (who act as principals) and managers (who act as agents) when determining the optimal level of risk and the optimal amount of capital for the bank is common to any firm, the interest of supervisors in controlling the capital adequacy of industry players is typical of the financial sector. All developed countries have in fact witnessed through time, even if with partially different timetables from country to country, an evolution in financial supervision that has gradually favored increased competition in the banking business while strengthening prudential regulation. Capital ratios, in particular, have been considered the best solution to safeguard the soundness of the banking system, despite the increase in competition, and to guarantee a level playing field for banks from different countries. While the Basel I Accord in 1988, which is discussed in Chapter 2, is often considered the first milestone in defining the link between a bank’s risk and its capital from the supervisors’ point of view, the debate concerning the role of capital as a protection for “unusual” losses from both bankers’ and regulators’ viewpoint is much older (see as an example Watson 1974).
At the same time, the importance of the link between capital and the amount of risk the bank can bear does not derive from supervisors’ constraints only but is instead at the heart of the bank’s management. For instance, many of the key risk management concepts that are now widely used and that became popular with the public at large beginning in the early 1990s were already in use, perhaps in simpler forms, in some large U.S. banks in the early 1970s. In one of the few publicly available documents, George J. Vojta (1973) from Citigroup stated that one of the functions of bank capital was “to provide protection against unanticipated adversity leading to loss in excess of normal expectations.” In the same period, Bankers Trust was developing the concept of risk-adjusted return on capital (RAROC), which is still one of the cornerstones of risk-adjusted performance measurement.

This book deals with risk, capital, and the relationship between the two. Since capital is a costly resource, the issue of jointly determining the optimal amount of risk and capital for the bank (taking into consideration regulatory constraints) is extremely relevant when managing a financial institution. A bank should therefore try to quantify the amount of capital needed to face potential losses deriving from the risks the bank is running and to develop policies and procedures to better manage those risks. Value at risk and capital at risk, which will be defined shortly, are the typical tools used by most banks for this purpose. The purpose of this chapter is to introduce the value-at-risk concept and its potential applications for capital management and capital allocation. The chapter also aims at clarifying why a bank should be concerned not only with how risks are measured but also with how those measures enter decision-making and performance evaluation processes. Risk measurement on the one hand and the use of risk measures as a management tool on the other hand will be discussed in more detail later in the book.

1.1 An Introduction to Value at Risk

The concept of value at risk and its relevance for bank management can easily be introduced through an example. We propose for simplicity a market risk example, even if, from a historical perspective, these measures were originally developed in most banks with reference to credit risk, which is typically the largest single source of risk for a bank. Let us consider a simplified U.S. investment bank that is active in trading three different assets: U.S. equities, British pounds, and U.S. corporate bonds. The bank is structured into three different trading desks (equities, foreign exchange (FX), and bonds) with one trader each that is supervised by a managing director (see Figure 1-1).

The managing director is interested both in preventing the bank from substantially increasing risk and in increasing the value of the bank for its shareholders by producing higher profits. The traditional way to pursue the first aim has always been (apart from direct supervision, which in this simplified case may still be a viable solution) to set notional limits, i.e., limits to the size of the positions each desk may take. For instance, the managing director may allow the equity trader to buy or sell short U.S. equities for a notional amount up to 500,000 U.S. dollars (USD). The FX trader may be allowed to take a long or short position on the GBP/USD exchange rate up to 500,000 USD. And finally the bond trader may be given a position notional limit of 600,000 USD. Since the risk of the bond portfolio will also depend on the sensitivity of the portfolio to changes in interest rates and on the credit quality of the portfolio, the bond trader may be given additional limits, such as a maximum average duration limit for the portfolio or a minimum rating class limit for individual bond issues.
By using notional limits, the managing director would be partially helped in supervising the three trading desks but would still face three major problems. First of all, maintaining the same notional limits would not help him keep a stable maximum level of risk for each desk. The 500,000 USD limit for the equity trader would imply a limited risk in periods of low stock market volatility but a higher level of risk (and potential losses) in periods of high volatility. Just as driving at 40 miles per hour may be too cautious on the highway and too risky when passing in front of an elementary school precisely when all the students are getting out, fixed notional limits do not take into account the variability of external conditions. Incidentally, this may also occasionally force the managing director to ask some of the traders to close or reduce their positions. Unfortunately, this intervention will give a trader who underperformed yearly budget targets a chance to claim that profits would have been greater if a certain trade had not been closed due to the intervention of the managing director.

The second problem is that the managing director has to determine whether traders’ limits are consistent with the capital the bank has. Capital is a cushion to cover losses, so the managing director should be concerned with having too little capital (or, equivalently, too high notional limits), which may imply a risk of default for his bank, and with having too much capital (or overly conservative notional limits), which could result in a poor return on equity for shareholders. In fact, there is no link between the limits that have been set and available capital, and there is no tool to assess the potential diversification across the different bets the traders are making on each single market.

Finally, let us assume that at the end of the year the three traders have made an equal profit and start competing for bonus allocation. The FX trader would claim that while obtaining the same profit with the same notional limit, he or she should be awarded a higher bonus than the equity trader, since the GBP/USD exchange rate is less volatile than U.S. equity prices. Similarly, the bond trader would argue that, since bonds are safer than other assets, despite the higher notional limits, the performance of the bond desk was the best one and should hence be rewarded accordingly. The equity trader would argue instead that since notional limits are the only objective measure, they should not be questioned and he or she should therefore be paid at least as much as the FX trader and more than the bond trader. At the end, it is impossible for the managing director to evaluate the risk–return performance of each trader. The problem here is that the measures of exposure behind the three desks are not really comparable: Even if formally they are all in dollars, 500,000 USD invested in equities is not as risky as 500,000 USD invested in a foreign currency.

What could solve the managing director’s problems is to express the risk of all positions in terms of how many dollars the shareholder might lose, i.e., as the potential loss of each position. In this case (1) all risks could really be compared on the same ground, thus enabling a clearer perception of the risk–return profile of each business in fair terms, (2) risks could be compared with available capital, and (3) if properly measured, potential...
losses should be sensitive to the level of volatility in the market. Yet measuring the potential loss requires defining a time horizon and a confidence interval so as to exclude the worst potential loss, which would otherwise coincide again for most positions with the notional amount of the exposure. For instance, the managing director may be willing to consider only 99% of cases, thereby neglecting the losses that might be realized in the worst 1% scenarios. This risk measure is exactly what we define as value at risk (VaR), i.e., the maximum potential loss of a given position or business area or business unit within a given time horizon (e.g., one day, one month, one year) and confidence level (e.g., 99%, 99.97%).

The managing director and the bank as a whole would now face two completely different, even if intertwined, sets of problems. The first one is risk measurement: How should value at risk be calculated? How can risk be measured in a consistent way, especially when it is necessary to consider different kinds of risks (e.g., market, credit, operational, business risk) requiring different methodologies and models? How can those numbers be aggregated at the bank level, taking diversification into account? At the same time, there is a second and equally crucial issue: How should those measures be used in internal decision-making processes? How can a limit system based on value-at-risk measures be built? And which are the consequences of alternative choices? How should a risk-adjusted performance measure be defined? In practice, building a risk management system requires being not only familiar with state-of-the-art risk measurement techniques but also experienced enough to address carefully the organizational issues deriving from the revision of a bank’s internal processes.

1.2 Capital Management and Capital Allocation: The Structure of the Book

The simplified example we just developed has introduced the idea that value-at-risk measures may be helpful to the manager in two crucial problems. The first one is capital management, which concerns the definition of the optimal capital structure of the bank. The second problem is capital allocation, which we define as the set of choices and decision-making processes concerning the optimal allocation of capital across the different business units inside the bank. All decision-making processes leading to capital allocation therefore include, for instance, the definition of risk-adjusted return targets for the different business units and the measurement and evaluation of their ex-post performance.

In an ideal world, the risk manager should be able to support in a perfect way top management decisions on both issues. The ideal risk manager should have a homogeneous and sound measure for any kind of risk the bank might take, should be able to aggregate these measures in a single number telling to the CEO how much capital the bank needs in order to support optimal capital management decisions, and should be able to measure perfectly the business units’ risk-adjusted returns so as to support the bank’s capital allocation decisions.

The real world, however, is strikingly different, and it may be useful to point out why, to identify some of the main problems that are dealt with in the rest of the book. For instance, capital management is complex since the risk manager does not have a perfect measure for all the risks the bank is facing. There are sound methodologies for most, but not all, risk types. And even when these methodologies exist, they cannot always be applied (for the simple reason that they may be too costly to implement). Moreover, since value-at-risk measures for different risks may be heterogeneous and complex to aggregate,
deriving a single value-at-risk number for the whole bank is far from easy. And even assuming such a number may have been derived, capital management decisions have to consider many other factors, such as the viewpoint of outsiders (e.g., the rating agencies), who may be cautious in trusting the numbers of aggregated values at risk derived by internal models they are unable to check.

At the same time, capital allocation cannot be considered equal to a simple asset allocation among different asset classes in an equity portfolio. The risk manager may in fact estimate at best with a certain precision past risk-adjusted returns. But future returns can be markedly different and may be estimated only through a deep understanding of the strategic perspectives of each business. Reallocating capital among businesses may imply, whether advertently or not, altering the bank’s strategy, and this should not be driven only by measures of past financial performance such as the ones the risk managers may produce. Moreover, measuring risk-adjusted returns for business units and reallocating capital among them (instead of financial assets) has to do with people and is far from being a purely technical exercise. It is linked instead with the internal organization of the bank, with the structure of its incentive systems, and with its culture, so often one cannot look for the optimal solution but should rather look for the solution that best fits the bank’s current or desired organizational system characteristics.

In summary, while risk measurement may be considered a science, risk management, capital management, and capital allocation remain largely a blend of science, experience, and art. This book starts by discussing in greater detail, in Chapter 2, the problem of capital management, pointing out the different notions of capital that may be relevant for the risk manager and the implications of Basel II and the new accounting standards, IAS/IFRS, for capital management. Chapters 3–6 are devoted to risk measurement and risk integration. They first discuss how market, credit, operational, and business risk can be measured, and then they analyze how a single value-at-risk measure for the bank as a whole may be derived. The rest of the book discusses the use of value-at-risk measures to support the bank’s decision-making process and its internal capital allocation and therefore deal with the definition of value-at-risk-based limits for market and credit risk, the definition of risk-adjusted performance measures, and the process of capital allocation and its links with the planning-and-budgeting process.