2025

FRM®

EXAM PART I

Financial Markets and Products

GARP®

FRM® | Financial Risk Manager

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PREFACE

On behalf of GARP's Board of Trustees, the FRM advisory committee, and GARP's FRM professional certification program staff. I want to thank you for your interest in and support of the FRM program.

The program's first offering in 1997 saw just over 100 candidates sit for the exam. During the past 27 years, hundreds of thousands of professionals have studied for and taken the FRM exam, with it now being the world's leading financial certification program.

The dynamic nature of the FRM program's curriculum means that it regularly and quickly responds to changes in the global financial marketplace. This ensures that its content and reach always address the risks and challenges of a fast-changing, complex, and globally connected financial system.

For example, for 2025, after much discussion and consideration, the FRM advisory committee made material changes to the program's 2025 market risk measurement and management content. The result is that about half of the subject readings in Market Risk Measurement and Management were updated.

But maintaining a current and highly relevant curriculum is not the sole focus of GARP's professional staff. GARP has focused considerable time and resources during the past year developing tools to assist a candidate in his or her exam program preparation. In addition to providing current content, a primary objective of ours is to ensure as much as possible that a candidate is making the best use of his or her valuable time in preparing for the exam.

In this regard, GARP offers FRM Part I candidates an electronic platform called GARP Learning. GARP Learning is a streamlined digital learning program that can be accessed via a mobile phone, tablet, or desktop computer. GARP Learning allows an FRM candidate to engage meaningfully in a self-directed fashion with the full FRM Part I curriculum. It provides the ability to monitor performance, identify strengths and weaknesses, and assists in creating a personalized study plan.

Supplemental to the support offered by the learning platform, candidates can also utilize end-of-chapter questions to test their understanding of the chapter's content immediately; and, importantly, take a full-length FRM Part I Practice Exam to gain familiarity with how topics are tested and how to pace oneself on the exam to ensure completion in the allotted time.

As you can readily see, we are committed to ensuring the FRM program retains its global reputation as being of the highest quality, and covering the concepts, issues, and challenges that financial risk management professionals must know, and in many cases master.

As always, we wish you the very best as you study for the FRM exams, and much success in your career as a risk management professional.

Yours truly,

Richard Apostolik

President & CEO

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Professor of Quantitative Finance
Associate Dean, Academic Affairs
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Co-Director and Site Director, NSF IUCRC CRAFT,
Lally School of Management
Rensselaer Polytechnic Institute

John Hull, Ph.D.
Senior Advisor
Maple Financial Professor of Derivatives and Risk Management,
Joseph L. Rotman School of Management, University of Toronto

Keith Isaac, FRM
VP, Capital Markets Risk Management, TD Bank Group

William May
Managing Director, Global Head of Certifications and Educational Programs, GARP

Attilio Meucci, Ph.D., CFA
Founder, ARPM

Victor Ng, Ph.D.
Chairman, Audit and Risk Committee
Former Managing Director, Head of Risk Architecture,
Goldman Sachs

Matthew Pritsker, Ph.D.
Senior Financial Economist and Policy Advisor/Supervision,
Regulation, and Credit, Federal Reserve Bank of Boston

Samantha C. Roberts, Ph.D., FRM, SCR
Instructor and Consultant, Risk Modeling and Analytics

Til Schuermann, Ph.D.
Partner, Oliver Wyman

Evan Sekeris, Ph.D.
Head of Non-Financial Risk, MUFG

Sverrir Þorvaldsson, Ph.D., FRM
Senior Quant, SEB

ATTRIBUTIONS

Author

John C. Hull, PhD, University Professor, Maple Financial Group Chair in Derivatives and Risk Management, University of Toronto

Reviewers

Erick W. Rengifo, PhD, Associate Professor of Economics, Fordham University

David W. Wiley, MBA, CFA, President, WHW Investments, LLC

Sam Wong, PhD, CEO and Chief Quant, 5Lattice Securities Limited

Tao Pang, PhD, FRM, CFA, Director of the Financial Mathematics Program, North Carolina State University

Masao Matsuda, PhD, FRM, CAIA, President and CEO, Crossgates Investment and Risk Management

Colin White, PhD, FRM, Economist, Canadian Securities Transition Office

Charles Currat, PhD, FRM, SVP, Head of Investment Risk Methodology, Wells Fargo Bank

Claus-Peter Mueller, PhD, FRM, BCS, Head of Group Organization, Transformation, and IT, Heta Asset Resolution

Daniel Homolya, PhD, FRM, ERP, Treasury Risk and Control Manager, Diageo

Jeffrey Goodwin, FRM, Founder and President, Crescendo Investments, LLC

Patrick Steiner, FRM, Large Institution Supervision Coordinating Committee, Federal Reserve Bank of New York

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Banks

Learning Objectives

After completing this reading, you should be able to:

- Identify the major risks faced by banks and explain how these risks can arise.
- Compare the characteristics and applications of economic capital and regulatory capital.
- Summarize the Basel committee regulations for regulatory capital and their motivations.
- Explain how deposit insurance gives rise to a moral hazard problem.
- Describe investment banking financing arrangements, including private placement, public offering, best efforts, firm commitment, and Dutch auction approaches.
- Describe the potential conflicts of interest among commercial banking, securities services, and investment banking divisions of a bank, and recommend solutions to these conflict of interest problems.
- Describe the distinctions between the banking book and the trading book of a bank.
- Explain the originate-to-distribute banking model and discuss its benefits and drawbacks.

Banks are the cornerstone of the world's financial system. The activities of banks in many countries can be subdivided into *commercial banking* and *investment banking*.

Commercial banking involves the traditional activities of receiving deposits and making loans. These activities can be categorized as either retail or wholesale. Retail banking involves transacting with private individuals and small businesses. Wholesale banking involves transacting with large corporations. Loans and deposits are much larger in wholesale banking than in retail banking. As a result, the administrative costs per dollar of deposits (or loans) are lower. The spread between the rates paid on deposits and the rates charged on loans is lower for wholesale banking as well.

Meanwhile, investment banking involves a variety of activities such as:

- Raising debt or equity capital for companies;
- Providing advice to companies on mergers, acquisitions, and financing decisions; and
- Acting as a broker–dealer for trading debt, equity, and other securities.

In some countries, the commercial banking and investment banking sectors are strictly separated. The U.S., for example, once limited the extent to which a single corporation could engage in both commercial and investment banking. Until the repeal of the Glass–Steagall Act in 1999, investment banks were not allowed to take deposits and make loans while commercial banks were not allowed to arrange equity issuances for other companies.

Following the financial crisis of 2007–2008, policymakers in some countries prohibited banks from putting depositors' funds at risk by engaging in proprietary trading (often referred to as *prop trading*). This is the speculative trading that an investment bank does in the hope of increasing its profitability.

1.1 THE RISKS IN BANKING

In this section, we explain three major risks that banks face. In the next section, we will outline the way in which banks are regulated to ensure that they can survive these risks.

Market Risks

Market risks are the risks arising from a bank's exposure to movements in market variables (e.g., exchange rates, interest rates, commodity prices, and equity prices). These market variables are often referred to as *risk factors*. The value of a market variable is determined by trading in the financial markets.

Consider the exchange rate between the U.S. dollar (USD) and the British pound (GBP). If the demand to buy GBP using USD is greater than the demand to sell GBP for USD, the value of the exchange rate (USD per GBP) will increase. Similarly, if the demand to sell GBP is greater than the demand to buy GBP, the exchange rate will decrease.

The values of market variables can be affected by many different events. For example, the value of the British pound decreased in June 2016 after the United Kingdom voted to leave the European Union (an event that market participants viewed as bad news for the British economy). Another example can be seen with the reinstatement of sanctions by the U.S. government on oil-producer Iran in May 2018. This event led to an increase in the price of oil because market participants thought that it could reduce the supply of oil in global markets.

A bank's exposure to movements in the values of market variables arises primarily from its trading operations. As previously explained, proprietary trading by banks is not currently allowed in the U.S. However, banks provide corporate clients and institutional investors with a wide range of products whose values depend on the prices of market variables. Consider again the USD per GBP exchange rate. Among the transactions a corporate client may request are as follows.

- *Spot transactions:* where GBP is bought or sold for almost immediate delivery.
- *Forward contracts:* where an exchange rate for the purchase or sale of a certain amount of GBP on a future date is agreed.
- *Options:* where one side has the right (but not the obligation) to buy or sell GBP at a pre-arranged price (i.e., the exercise price) at a certain future time.

For many of these contracts, banks act as market makers by quoting both a bid (i.e., the price at which they are prepared to buy) and an ask (i.e., the price at which they are prepared to sell). Banks typically ensure that their exposures to market variables are kept within certain limits, but they do not (usually) eliminate those exposures entirely. As a result, banks are always exposed to some market risk.

Credit Risks

Credit risk arises from the possibility that borrowers will fail to repay their debts. For banks, loans to corporations and individuals are a major source of credit risk. If a borrower defaults, a loss is usually incurred. In a bankruptcy, the size of the loss depends on whether assets have been pledged as collateral and how the bank's claims rank compared with those of other creditors.[1]

[1] This is discussed in more detail in Chapter 17.

A bank builds expected losses into the interest rate it charges on loans. For example, suppose the bank's cost of funds (the average interest rate paid on deposits and on the bank's debt) is 1.5%. The average interest rate charged on loans might be 4%. The difference between the two interest rates (2.5% in our example) is referred to as the *net interest margin*. If a bank expects to lose 0.8% of what it lends, it will be left with 1.7% to cover administrative/operational costs and contribute to profits.

In this example, 0.8% is the bank's expected (or average) loan losses. However, loan losses show significant variation from year to year. During stressed economic conditions, a bank might experience loan losses as high as 4%, while during good economic times these losses might be as low as 0.2%.[2] Current regulations require banks to maintain enough capital to cover losses that are estimated to occur only once every thousand years.[3]

Other bank contracts also give rise to credit risk. For example, banks trade a variety of derivatives (e.g., forward contracts and options). As already indicated, these give rise to market risk because the value of a derivatives contract depends on the underlying market variables. Derivatives also give rise to credit risk. This comes from the possibility that the counterparty to a derivatives transaction will default when the transaction has a positive value to the bank (and therefore a negative value to the counterparty).

Banks typically account for expected losses on transactions as soon as they are initiated. An accounting rule known as IFRS 9, which covers most bank-issued loans, requires banks to show the outstanding principal net of estimated expected losses over the following 12 months on their balance sheet.[4] In the case of derivatives, banks calculate a credit value adjustment (CVA) reflecting the amount they expect to lose over the life of the derivatives due to counterparty default. This is subtracted from the balance sheet value of the outstanding derivatives. In both cases, expected losses, even though they have not (yet) been incurred, are charged to income.

[2] Statistics published by the credit rating agency S&P show that the default rate per year on all rated corporate debt varied between 0.14% and 4.19% between 1981 and 2018. The worst default rate (4.19%) was in 2009, following the financial crisis. Other years with defaults rates greater than 3% were 1991 (3.25%), 2001 (3.79%), and 2002 (3.63%). In 2018, the default rate was 1.03%.

Source: S&P Global. (2019, April 19). 2018 Annual Global Corporate Default And Rating Transition Study. https://www.spratings.com/documents/20184/774196/2018AnnualGlobalCorporateDefaultAndRatingTransitionStudy.pdf

[3] This is explained in more detail in Chapter 6 of *Valuation and Risk Models*.

[4] The Financial Accounting Standards Board (FASB), the accounting standard-setting body in the United States, has a rule similar to IFRS 9. In the case of the FASB rules, it is losses over the whole life of the loan which are subtracted from the net principal. In the case of IFRS 9, losses over the whole life of the loan are considered only when there is a significant increase in credit risk.

Operational Risks

Operational risk is defined by bank regulators as:[5]

> *The risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events.*

This definition includes all risks that are not market or credit risks (with the exception of strategic and reputational risks). Operational risk is harder to quantify than either market risk or credit risk. Examples from seven categories of operational risk identified by regulators include the following.

- *Internal fraud:* Rogue traders intentionally misreporting positions or employees stealing from the bank by creating loans to fictitious companies.
- *External fraud:* Cyberattacks, bank robberies, forgery, and check kiting.
- *Employment practices and work place safety:* Worker compensation claims, employee discrimination claims, and litigation arising from personal injury claims at bank branches.
- *Clients, products, and business practices:* Money laundering and other actions that are either unlawful or prohibited by regulators.
- *Damage to physical assets:* Terrorism, vandalism, earthquakes, fires, and floods.
- *Business disruption and system failures:* Hardware and software failures, telecommunication problems, and utility outages.
- *Execution, delivery, and process management:* Data entry errors, collateral management issues, and inadequate legal documentation.

Operational risk is regarded by many to be a greater challenge for banks than either market risk or credit risk. Since 2008, banks in North America and Europe have been fined hundreds of billions of dollars for operational risk violations such as money laundering, market manipulation, terrorist financing, and inappropriate activities in the mortgage market.

Significant sources of operational risk in banking include cyber risk, legal risk, and compliance risk (i.e., failure to comply with rules and regulations, either accidentally or intentionally). These risks are discussed further in Chapter 7 of *Valuation and Risk Models*.

1.2 BANK REGULATION

Banks are subject to regulations designed to protect depositors as well as maintain confidence and stability in the financial system. In this section, we outline the development of the global banking regulatory environment.

[5] See Bank for International Settlements, "Working Paper on the Regulatory Treatment of Operational Risk," September 2001.

Capital

It is important for banks to keep sufficient capital for the risks they are taking. The most important capital is equity capital. Because losses have the effect of reducing equity capital, banks must try to maintain enough equity capital to cover potential losses and remain solvent (i.e., have a positive amount of equity capital). Debt capital is the other main category of capital, and it is usually subordinate to assets held for depositors (therefore providing an extra degree of protection for depositors).

Equity capital is sometimes referred to as *going concern capital* because it absorbs losses while the bank is a going concern (i.e., it remains in business). Debt capital is referred to as *gone concern capital* because it is only affected by losses once a bank has failed. In theory, depositors are at risk only when losses are sufficiently large to wipe out both equity and debt capital.

We can distinguish between *regulatory capital* and *economic capital*. Regulatory capital is the minimum capital that regulators require banks to keep. Economic capital is a bank's own estimate of the capital it requires. In both cases, capital can be thought of as funds that are available to absorb unexpected losses. A common objective in calculating economic capital is to maintain a high credit rating (as will be described in later chapters). Economic capital is allocated to a bank's business units so that they can be compared using a *return on allocated economic capital* metric.

The amount of capital that is necessary depends on the size of possible losses. If a bank's equity capital is USD 4 billion and there is a 1% chance that the bank will incur a loss higher than USD 4 billion over a year, the equity capital will be considered insufficient by both regulators and the bank itself. This is because even a 1% chance that the bank will become insolvent is unacceptable. As mentioned earlier, the regulatory capital for credit risk is designed to be sufficient to cover a loss that is expected to be exceeded only once every thousand years.[6]

The Basel Committee

The Basel Committee for Banking Supervision was established in 1974 to provide a forum where the bank regulators from different countries could exchange ideas.[7] Prior to 1988, bank regulation and enforcement varied from country to country. In 1988, there was an international agreement (which became known as Basel I) that required regulators in all signatory countries to calculate capital requirements in the same manner. Initially, these capital requirements were designed to cover losses arising from defaults on loans and derivatives contracts.

By the 1990s, however, bank trading activities had significantly increased. In response, the Basel Committee agreed that banks should keep capital for both market risk and credit risk. This modification to Basel I, known as the *Market Risk Amendment*, was implemented in 1998.

In 1999, the Basel Committee proposed what has become known as Basel II. This agreement revised the procedure for calculating credit risk capital and introduced a capital requirement for operational risk. It took about eight years for the final Basel II rules to be worked out and implemented. The total capital requirement was then the sum of amounts for (a) credit risk, (b) market risk, and (c) operational risk.

The 2007–2008 crisis led to several bank failures and bailouts. Global bank regulators subsequently determined that the rules for calculating market risk capital were inadequate. Thus, the rules were revised in what is referred to as Basel II.5

The Basel Committee also decided that equity capital requirements needed to be increased. This latest set of regulations, called Basel III, includes a large increase in the amount of equity capital that banks are required to keep and is expected to be fully implemented by 2027.[8]

Meanwhile, the rules for market risk have been revised yet again with the *Fundamental Review of the Trading Book*, which is due to be implemented in 2022.

Standardized Models versus Internal Models

Models are necessary to determine bank capital. Some models are standardized tools developed by the Basel Committee, while others are internal models developed by the banks themselves. Generally, banks need approval from regulators before they can use a specific internal model.

The models for credit risk that were introduced in Basel I were standardized models developed by the Basel Committee. This means that two banks, when presented with the same portfolio, should calculate the same capital requirements. The Market Risk Amendment included a standardized model approach and an internal model approach. Banks could determine market risk capital using an internal model provided that the model satisfied the requirements laid down by the Basel Committee and was approved by national regulators. Basel II allowed internal

[6] See Chapter 6 of *Valuation and Risk Models* for further discussion.

[7] The Basel Committee for Banking Supervision is based at the Bank for International Settlements in Basel, Switzerland.

[8] Bank for International Settlements. (2019, March 20). *Basel III monitoring results published by the Basel Committee* [Press release]. Retrieved from https://www.bis.org/press/p190320.htm

Many bankers refer to the second half of the Basel III rules, which were agreed in 2016 and 2017, as Basel IV. These rules include limits on the extent to which internal models can be used and will be described in the next section.

models to be used to determine both credit risk capital and operational risk capital.

Since the crisis, the Basel Committee has decided to reduce bank reliance on internal models. The committee felt that it had given banks too much freedom to choose internal models that would produce the lowest capital requirements. It now requires that banks use a standardized model for determining operational risk capital. For credit risk and market risk, banks must calculate capital using a standardized model and can (if they receive approval from their national regulators) also calculate capital using an internal model. However, these internal models cannot reduce total capital requirements below a minimum level that is set equal to a certain percentage of the capital given by the standardized approach. By 2027, this percentage will be 72.5%. This means that:

$$\text{Required Capital} = \max(\text{IMC}, 0.725 \times \text{SMC})$$

where IMC is the capital given by the internal models and SMC is the capital given by the standardized (Basel Committee) models.

Trading Book versus Banking Book

When calculating regulatory capital, it is important to distinguish between the trading book and the banking book. The trading book (as its name implies) consists of assets and liabilities that are held to trade. The banking book consists of assets and liabilities that are expected to be held until maturity. Items in the trading book are subject to market risk capital calculations, whereas items in the banking book are subject to credit risk capital calculations. These calculations are quite different. In the past, there had sometimes been ambiguity as to whether a transaction (e.g., a credit derivative) should be in the banking book or the trading book. Banks tended to take advantage of this ambiguity by putting each transaction in the book that would lead to the lowest capital requirement (usually this was the trading book).

The *Fundamental Review of the Trading Book* mentioned earlier attempts to clarify the Basel Committee's rules concerning whether an instrument should be in the banking book or the trading book. If a bank has a desk for trading a specific instrument, that instrument will normally be considered to be part of the trading book. Otherwise, it will be part of the banking book.

Liquidity Ratios

Many of the problems experienced during the financial crisis were a result of a lack of liquidity, rather than a shortage of capital. Consider a bank that wants to fund five-year loans. One possibility is to issue five-year bonds so that the maturities of its assets and liabilities are matched. A tempting alternative that could lead to lower funding costs (in many interest rate environments) is to issue a three-month commercial paper. At the end of the three months, a new three-month commercial paper is issued and used to repay the first issuance. At the end of a further three months, there is a third issuance of a three-month commercial paper, which would be used to repay the second issuance, and so on.

A risk with this strategy comes when the commercial paper cannot be rolled over in the way we have described. If the market (rightly or wrongly) loses confidence in the bank, it is likely that the maturing commercial paper cannot be replaced (or must be replaced at much higher interest rates). Unless the bank has other guaranteed lines of credit, it could default on its debt and go bankrupt. Note that if the five-year loans had been financed with five-year debt, this problem would have been avoided because the loan repayments could have been used to repay the debt.

The failure of Northern Rock in the United Kingdom can be traced to this type of liquidity problem. The British bank had a mortgage portfolio that it was partly funding with commercial paper. While this mortgage portfolio was not unduly risky, problems in the U.S. mortgage market made investors nervous, and the commercial paper could not be rolled over. Lehman's demise in 2008 was also largely a result of liquidity problems of this type.

As a result of the liquidity problems encountered during the crisis, the Basel Committee has (as part of Basel III) developed two liquidity ratios to which banks are required to adhere. *The Liquidity Coverage Ratio* is a requirement designed to ensure that banks have sufficient sources of funding to survive a 30-day period of acute stress (e.g., where it is downgraded, loses deposits, or has drawdowns on its lines of credit). The *Net Stable Funding Ratio* is a requirement that limits the size of mismatches between the maturity of assets and the maturity of liabilities.

1.3 DEPOSIT INSURANCE

To maintain confidence in the banking system, many countries have introduced deposit insurance. This typically provides a certain amount of protection to a depositor against losses arising from a bank failure. In the U.S., the amount is currently USD 250,000. In some jurisdictions, all banks pay the same insurance premium per year per dollar of deposit insured. In other jurisdictions (such as the U.S.), the insurance premium is based on an assessment of each bank's risk.

If deposit insurance were provided to a bank without any other measures being taken, the insurance might encourage banks to take on more risks than they would otherwise. For example,

banks could offer slightly above average interest rates to depositors and then use the funds to make risky loans at relatively high interest rates to borrowers. Without deposit insurance, this would not be possible because depositors would withdraw their money when the risks being taken became apparent. With deposit insurance, the strategy might be feasible because depositors know that they are protected in the event of bank failure and will appreciate the above average interest rates they are receiving.

This argument is an example of what is known as a *moral hazard*, which can be defined as the risk that the behavior of an insured party will change because of the mere existence of the insurance, and thus the insurance contract will become riskier. It is a serious consideration in deposit insurance, because governments certainly do not want to set up a program that encourages a bank to take *larger* risks.

Risk-based deposit insurance premiums reduce the moral hazard to some extent. The moral hazard is also lessened by regulations that ensure that a bank's required capital increases with the risks it takes (see Section 1.2).

1.4 INVESTMENT BANKING

A major activity of a bank's investment banking arm is raising capital for companies in the form of debt, equity, or more complicated securities (e.g., convertible debt). This process is referred to as *underwriting*. Typically, a company will approach the investment bank to discuss its plans to issue securities. Once the plans have been agreed upon, the securities are originated along with documentation itemizing the rights of investors who purchase the securities. A prospectus detailing the company's past performance and future prospects is also produced. This includes a discussion of risks, any outstanding lawsuits, and other relevant information. There is usually a *road show* in which senior management from the issuing company and executives from the investment bank attempt to persuade investors to buy the securities. Finally, a price for the securities is agreed upon between the bank and the issuing company, and the bank then proceeds to market the securities.

There are two types of offerings.

1. *Private placements:* where the securities are sold (or placed) with a small number of large institutional investors (e.g., pension plans and life insurance companies).
2. *Public offerings:* where securities are offered for sale to the general public.

In the case of a private placement, the investment bank receives an agreed upon fee. In the case of a public offering, the agreement between the investment bank and the issuing company can be on a *best efforts* or a *firm commitment* basis. As its name implies, best efforts means that the bank will do its best to sell the securities for the agreed upon price. However, there are no guarantees. The bank is paid a fee that usually depends (to some extent) on how successful it has been in selling the securities for the agreed upon price.

In the case of a firm commitment, the bank does guarantee that the securities will be sold for an agreed upon price. The bank buys the securities at the agreed upon price and then attempts to sell them for a higher price. Its profit is the difference between the two prices. If it misjudges the market and is unable to sell the securities for more than the agreed upon price, it will incur a loss. A firm commitment is sometimes referred to as a *bought deal*.

A firm commitment arrangement is riskier for an investment bank (but less risky for the issuing company) than a best efforts arrangement. Suppose that a company wants to issue 10 million new shares. It is currently publicly traded, and its share price (which has risen recently) is USD 58. In negotiations with its investment bank, there are two offers on the table:

1. A best efforts arrangement where shares will be sold at the best possible price and the bank will be paid USD 1.50 per share sold (to keep the example simple, we assume that the bank's fee does not depend on the price at which the shares are sold); and
2. A firm commitment arrangement where the bank guarantees that the shares can be sold for USD 50.

Table 1.1 summarizes these alternatives from the perspective of the investment bank and considers two outcomes. In the first one, the shares can be sold for USD 55; in the second one, they can be sold for USD 48. The best efforts alternative is certain to give the bank a gross profit of USD 15 million. On the other hand, the firm commitment alternative is much riskier. If the shares can be sold for USD 55, the bank will make USD 50 million. If the shares can only be sold for USD 48, however, the bank will lose USD 20 million.

The decision taken by the bank will depend on the subjective probabilities it assigns to different outcomes in conjunction with its risk appetite. For the company, the risks are less with a firm commitment because it knows it will realize USD 500 million (regardless of the final market price). Under the best efforts arrangement, the maximum amount realized (after considering the bank's fee) would be USD 535 million for the first scenario in Table 1.1 and a maximum of USD 465 million for the second scenario.[9]

[9] Table 1.1 may understate the risks of a best efforts arrangement to the company. If there is a dramatic market downturn, the issue may be withdrawn so that the company raises no capital.

Table 1.1 Profit to Bank from Best Efforts and Firm Commitment Alternatives to Sell 10 Million Shares (USD Million)

	Best Efforts, Fee Equals USD 1.50 per Share Sold	Firm Commitment, Bank Buys Shares for USD 50
Price Realized = USD 55	+15	+50
Price Realized = USD 48	+15	−20

IPOs

An IPO (initial public offering) is a first-time offering of a company's shares to the public. Prior to an IPO, shares are typically held by the company's founders, venture capitalists, and others who have provided early stage funding. The shares being sold can be a mixture of existing and new shares, which can provide additional capital for the company. Sometimes the founders retain control by arranging for the shares they keep in the company to have better voting rights than other shares.

Because the company's shares do not yet trade on an exchange, it is difficult for an investment bank to accurately assess what the share price will be after the IPO.

For example, suppose the company wishes to raise USD 100 million. The investment bank must try and estimate

$$\frac{\text{Value of Company After USD 100 Million Cash Injection}}{\text{Number of Shares Post IPO}}$$

Typically, the investment bank sets the offering price below its best estimate to make it more likely that it can sell the issue at the offering price.

There is often a substantial increase in the share price after an IPO. This means that the company could have probably issued shares at a higher price, thereby raising more money. It also indicates that IPOs tend to be good investments. Unfortunately, it is often difficult for small investors to buy IPOs.

Dutch Auctions

The advantage of using investment banks to handle an IPO is that they have the necessary expertise as well as relationships with potential investors. However, some issuers feel that they would prefer for the market to decide the right price for their company. One way they can do this is through a Dutch auction. This is a procedure where all investors (not just clients of an investment bank) are invited to submit bids indicating how many shares they would like to purchase and at what price.

As a simple example of how a Dutch auction works, suppose that a company wants to sell 500,000 shares and has received the bids presented in Table 1.2. To evaluate the bids, it is necessary to sort bidders from the highest to the lowest. This has been done in Table 1.3. We then search for the maximum price at which 500,000 shares or more can be sold. From Table 1.3, we see that 30,000 shares have been bid for at USD 70 or more, 130,000 have been bid for at USD 65 or more, 170,000 have been bid for at USD 63 or more, and so on. Furthermore, 480,000 shares have been bid for at USD 56 or more and 680,000 have been bid for at USD 55 or more. The maximum price at which 500,000 shares can be sold is therefore USD 55. All successful bidders pay this price. The seven highest bidders in Table 1.3 get the full amount of the shares for which they bid. Bidder D gets 20,000 shares (the difference between the 500,000 being sold and the 480,000 for which a higher price than USD 55 has been bid).

An advantage of Dutch auctions is that (if all potential investors in a company bid) the price charged is the one that balances supply and demand in the market. In theory, the post-IPO price should be similar to the pre-IPO price.

One high profile IPO that used the Dutch auction approach was that of Google in 2004. This auction was a little different from

Table 1.2 Bids for Ten Participants in a Dutch Auction when 500,000 Shares are Being Sold

Bidder	Number of Shares Requested	Price Bid (USD)
A	100,000	65
B	50,000	60
C	30,000	70
D	200,000	55
E	70,000	58
F	150,000	61
G	40,000	63
H	40,000	56
I	80,000	54
J	100,000	50

Table 1.3 Bids in Table 1.2 Sorted from Highest to Lowest

Bidder	Number of Shares Requested	Cumulative Number of Shares Requested	Price Bid (USD)
C	30,000	30,000	70
A	100,000	130,000	65
G	40,000	170,000	63
F	150,000	320,000	61
B	50,000	370,000	60
E	70,000	440,000	58
H	40,000	480,000	56
D	200,000	680,000	55
I	80,000	760,000	54
J	100,000	860,000	50

the "plain vanilla" Dutch auction we have described. Instead, Google reserved the right to change (at the last minute) the number of shares that would be offered and the percentage of the requested amount allocated to each bidder. When it saw the bids, it decided that the number of shares being offered would be 19,605,052 at a price of USD 85. The total value of the offering was therefore USD 1.67 billion, and investors who had bid USD 85 or more got 74.2% of the shares for which they had bid. This was a surprising decision. Google could have raised USD 2.25 billion instead of USD 1.67 billion with a more usual Dutch auction (where investors bidding USD 85 or more got 100% of the shares for which they had bid). Perhaps founders Sergei Brin and Larry Page anticipated (correctly as it turned out) that they would be able to issue more shares at a much higher price later on.

On the first day of the new issuance, Google's shares closed at USD 100.34 (i.e., 18% above the issue price). This was followed by a further 7% increase on the second day. In this example, the use of a Dutch auction did not eliminate the IPO underpricing problem we mentioned earlier. Google did use two investment banks (Morgan Stanley and Credit Suisse First Boston) to assist in the issuance. However, the fee paid was less than it would have been for a regular IPO.

Advisory Services

In addition to handling securities issuances, investment banks also offer advice to corporations on decisions involving mergers and acquisitions, divestments, and restructurings. Specifically, they assist companies in finding acquisition partners and in finding buyers for divisions that are to be divested. Investment bankers will also advise companies that are the subject of a takeover attempt by another company.

In advising Company A on a potential takeover of Company B, it is necessary for an investment bank to value Company B and to assess any potential synergies (i.e., cost savings, economies of scale, market share, or other benefits from merging the two companies). It must also consider the type of offer that should be made. This could be a:

- *Cash offer:* where the existing shares of Company B are purchased for cash,
- *Share-for-share exchange:* where newly issued shares of Company A are exchanged for those of Company B so that Company B's shareholders become shareholders of Company A, or
- Combination of a cash offer and a share-for-share exchange.

In a cash offer, the acquisition's risk and uncertainties are borne by the acquiring company. In a share-for-share exchange, they are shared between the two companies.

The initial offer is not usually the final offer, and the investment bank must use its experience to develop a reasonable plan for the price negotiations. The investment bank must assess the best way to approach the management of the target company. The takeover may be hostile (i.e., opposed by existing management) or friendly (i.e., supported by management). In some instances, it may be necessary for investment bankers to consider antitrust concerns and whether regulatory approval for the merger will be necessary.

The companies targeted by takeover attempts are also advised by investment bankers. Sometimes a company (often with the