

## Chapter 1

# Basic Concepts and Practice in Finance

*B*efore we consider the mathematics of hypermodels and modelling finance with them, we give in this Chapter a basic review of the concepts, definitions, terminologies and practice in financial markets. No doubt they will be familiar to financial practitioners, but may not be so much for academicians.

An overview and hopefully some feeling about financial market activities are produced in this chapter. Introduction to financial securities such as stocks, bonds, options is given. Together they form the fundamental objects of our study in this volume. Their prices, risks, sensitivity to various parameters pose a complex challenge for mathematical modelling. Although intense research has already been underway for sometime in almost every corner of the globe, the science of financial modelling is still in its infancy—to say the least. From this perspective, in order to gain any insights to the problems, it is important for academicians to have a good feel of or even take part in financial activities.

### 1.1 Introducing mathematical finance

As indicated in the preface, the globalization of the economy and the information technology revolution create new and even democratic opportunity for almost every citizen of the globe to take part in financial markets of some sort: from the accounting office of a giant multinational corporation to the food stall of a small village, activities are intricately linked, with perhaps the exception of those few nations in the world that are isolated (hence immunized) from the rest of the humanity.

With the almost free flow of wealth in various form, one seeks investment and trade from a huge spectrum of possibility, such as bonds and stocks

and their derivatives: options, contracts, swaps, ... of course in the hope of maximum profit and minimum risk. For long term gain and the desirability of creating a healthy win-win situation for every one, participants of the market need to come up with the notion of fair prices even though common consensus is hard to come by.

Therefore there is need for pricing, risk management and analytic theory explaining the market. This leads to research in quantitative tools based on mathematical methods, *i.e.* the theory of *Mathematical Finance*. Especially since the pioneer work of Black, Scholes and Merton in the 70's, there is an explosive growth of the study of mathematical finance.

From the literature, one finds a numbers of names for parts or the whole area that can be called the science of finance.

### **Mathematical finance and financial engineering**

We just comment on the term *Financial Engineering*. It appears that the following distinguishes financial engineering from mathematical finance:

- financial engineering concerns more the design and the implementation of new financial instruments, whereas mathematical finance deals with the quantitative and analytic theory and pure modelling of existing financial instruments;
- financial engineering is a group effort involving mathematicians as well as people like computer programmers, financial analysts, lawyers, traders, ..., whereas mathematical finance is becoming a pure academic discipline of its own right.

Since the last quarter of the 20th century, new mathematical theory and techniques have transformed the investment process and the financial market. Investment firms and banks constantly utilize such new theory and techniques to gain competitive advantage from better risk management and profit strategies.

Mathematical financial models based on advanced mathematical theory are being implemented by powerful computers and used to predict returns, measure risk, and set prices. These developments have led to greater need for the study of mathematical finance.

The core objects of study of mathematical finance is that of securities.

### **Cataloging securities**

We will consider securities such as stocks, bonds, options, ... *etc.* They are divided into two types:

- *basic securities*
- *derivative securities*

they will be reviewed in the first two sections.

Loosely, any claim on the wealth of an individual, a corporate or government can be regarded as a security. Formally, a security is just a certificate—a financial contract—indicating a realized or potential ownership or indebtedness of some instrument or commodity traded in a market.

By basic securities (or *primary securities*) we mean stocks, bonds, bank accounts, currencies and commodities, although in this book we will deal with the first two kinds only.

Derivative securities form a special kind of financial contracts. As the name suggests, their value *derives* from *basic securities*. Usually such a contract is constructed so that there is a fixed expiry date and the contract's value is determined on the basis of market prices of its underlying basic securities at or before the expiry date.

Examples of derivative securities are options, future and forward and swaps, and in this book we will concentrate on options only.

Another common name for derivative security is “contingent claim.”