1

Introduction

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Chapter 1 introduces terminology and concepts related to financial derivatives. These topics will be explored in more detail throughout the book.

- Section 1.1 provides the definition of a financial derivative.
  - Based on that definition, section 1.1.1 explains financial purchase contracts using spot transactions as a reference. A spot transaction settles immediately at $t = 0$. It is not considered a financial derivative.
  - A financial derivative differs from a spot transaction in one defining respect: settlement occurs at a future point in time $t > 0$, not at $t = 0$ (see section 1.1.2).
- Section 1.2 introduces the economic feature that gives financial derivatives their name: their value is derived from an underlying variable.
- Section 1.3 presents a forward contract as a typical example of a typical financial derivative. A forward contract is a binding agreement to purchase a financial asset, such as a stock, with settlement at a future point in time $t > 0$.

Details regarding forward contract pricing and valuation form the main content of this book covered in parts II and III.

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1.1 Definition and prerequisites of financial derivatives

Definition 1.1: Financial derivative

A *financial derivative* is a financial contract with settlement at a future point in time $t > 0$.[1]

[1] For a discussion of the definitional scope, see section "*Elements of Each Chapter – Definitions*" on page xxxiv.

Definition 1.1 states the two cumulative conditions that must be satisfied for a contract to qualify as a financial derivative contract:

1. A financial derivative is a financial (purchase) contract (see section 1.1.1).
2. The financial contract is settled at a future point in time $t > 0$ (see section 1.1.2).

The properties of a financial derivative result from its legal structure as a type of financial (purchase) contract and from its dependence on an underlying asset. As a consequence of its structure and timing, a derivative contract develops a value that is derived from an underlying variable (see section 1.2).

1.1.1 Financial (purchase) contracts

A *financial* (*purchase*) *contract* is an agreement[2] for a transaction on a (financial) asset. A (*financial*) *transaction* is the purchase and sale of an asset[3] transferring ownership from one person or entity to another for a price. An *asset* is a right or claim on an item owned and of value.[4] Examples include a stock in a corporation (equity security), a bond (debt security), a currency amount, a receivable, and a commodity.

a) Relevant elements

Two distinct elements of a financial transaction should be distinguished:

Contract initiation *Contract initiation* is the point in time at which the financial contract is concluded and becomes legally enforceable. The terms are agreed upon (*e.g.*, quantity, price, maturity), and obligations become effective for the parties involved. The contract is initiated at $t = 0$ and remains effective until settlement.

Figure 1.1 visualizes the contract initiation and contract relationship between the buyer (B) and the seller (S).

Figure 1.1.: *Contract initiation is the point in time at which the financial contract is concluded and becomes legally enforceable.*

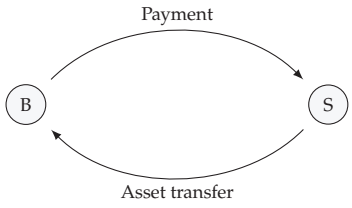


Contract settlement *Contract settlement* is a point in time t when ownership in an asset is transferred and the price is paid. Settlement includes:

1. transfer of ownership in the asset underlying the contract, and
2. payment of the agreed price.

Figure 1.2 visualizes the contract settlement between the buyer (B) and the seller (S).

Figure 1.2.: *Contract settlement is a point in time t when ownership in an asset is transferred and the price is paid.*



An example of a financial (purchase) contract is a spot contract as described in the next section. A spot contract is not a financial derivative, but the description is included here to contrast it from a financial derivative.

[2] see Garner and Black, *Black's Law Dictionary*, entry: contract, *p.* 402.
[3] see Garner and Black, *Black's Law Dictionary*, entry: capital transaction.
[4] see Garner and Black, *Black's Law Dictionary*, entry: asset.

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b) Spot contracts

Definition 1.2: Spot contract or spot transaction

A *spot contract* or a *spot transaction* is a financial contract with immediate settlement at $t = 0$.

- A spot contract is initiated at $t = 0$ with settlement immediately after.[5]
- Spot means on the spot or immediately.[6]
- In practice, immediately means without delay, depending on the contract.[7] Immediate may be within several hours, or even sooner, or within two days after contract initiation.[8]

Figure 1.3 shows a timeline with the relevant instances of a spot transaction. The contract initiation and settlement both occur at $t = 0$.

Timeline spot transaction

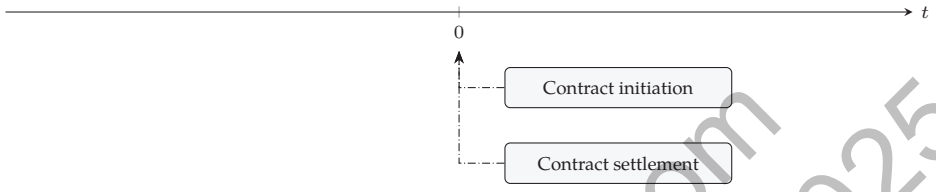


Figure 1.3.: *In a spot transaction, the contract is initiated and settled immediately.*

The agreed and paid price of an asset underlying a spot transaction is referred to as spot price.

Definition 1.3: Spot price

The *spot price* S_0 is the price of an asset at $t = 0$.[9] The *spot price* S_t is the price of an asset at a point in time t. The *spot price* S_T is the price of an asset at maturity $t = T$.

Example 1.1: Spot transaction

A company has a current stock price $S_0 = 100$. At $t = 0$, the buyer (B) agrees to buy from the seller (S) a stock in the company for the current spot price $S_0 = 100$. The stock and the price for the stock are transferred immediately at $t = 0$. Evaluate the transaction.

The agreement to transfer the stock in return for a price is a financial purchase contract. The agreement is initiated today at $t = 0$. The transaction is settled today at contract initiation $t = 0$.

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[5] see Garner and Black, *Black's Law Dictionary*, entry: spot contract, p. 410.
[6] see Oxford English Dictionary (OED) OED, *Spot*, entry no.. 3.
[7] see Garner and Black, *Black's Law Dictionary*, entry: immediate, *p.* 897.
[8] see Garner and Black, *Black's Law Dictionary*, entry: spot contract, *p.* 410.
[9] see Hull, *Options, Futures, and Other Derivatives*, glossary: spot price, p. 833.

There is a difference between the spot price S_t and the forward price F:

- The spot price S_t is the market price of an asset at any point in time t, including at $t = T$.
- The forward price F is agreed and set at initiation $t = 0$, but paid at contract maturity $t = T$.

1.3.2 Positions

Both parties are obligated to complete the transaction at maturity. In forward contracts, the party obligated to buy the underlying asset at the agreed forward price F at contract maturity T is referred to as the *long position* (see definition 3.2). The *short position* in a forward contract is the party obligated to sell the underlying asset at the agreed forward price F at contract maturity T (see definition 3.3).

- The buyer of the underlying asset holds the long position.
- The long position benefits if the underlying asset rises in value. The long position loses if the underlying asset declines in value.
- The seller of the underlying asset holds the short position.
- The short position benefits if the underlying asset declines in value. The short position loses if the underlying asset increases in value (for details, see chapter 3).

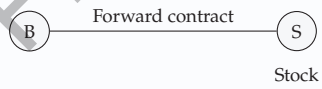
Example 1.7: Equity forward contract valuation

At $t = 0$, the price of a stock $S_0 = 100$. Buyer B (long position) and seller S (short position) enter into a forward contract on the stock. A stock is a share in a corporation and represents an equity instrument. The contract is therefore referred to as an *equity forward* (for details, see chapter 8).
B and S agree that the stock will be delivered in exactly one year at $T = 1$ for a price $F = 110$. This price is agreed today at $t = 0$, and contract settlement will be at $t = 1$ year from now. When the contract is settled at $T = 1$, the spot market price of the stock turns out to be $S_1 = 120$.

1. Illustrate and comment on the transaction at initiation $t = 0$.
2. Illustrate and comment on the transaction at contract settlement $T = 1$.
3. Calculate and comment on the value of the contract for the buyer at $T = 1$.
4. Calculate and comment on the value of the contract for the seller at $T = 1$.

1 Transaction at initiation

The following diagram shows the transaction as initiated at $t = 0$:



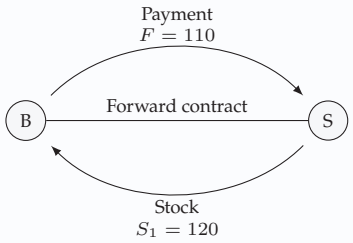
At $t = 0$, the seller S owns the stock underlying the agreement. To conclude the contract, only the contract terms are agreed upon, but no payments are made between B and S. During the contract term, starting at $t = 0$ until $T = 1$, S continues to hold the stock, and no payments are made between the parties. This contract is an example of a financial

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derivative because it is initiated at $t = 0$ and settled later at $T = 1$ year from now. The stock is the underlying asset in this financial derivative contract.

2 Transaction at maturity

The following illustration shows the transaction as settled at $T = 1$:



At $T = 1$, the contract is settled. The buyer pays the agreed forward price $F = 110$ to the seller, and the seller delivers the stock to the buyer. The seller must transfer the stock to the buyer, regardless of the market spot price of the asset $S_1 = 120$. The market spot price is the underlying variable in this financial derivative contract.

3 Value of the contract for the buyer (long position)

For the buyer, the contract has a positive value $V = 10$ as he receives a stock at a market price of $S_1 = 120$ and pays a forward price of $F = 110$. The positive value means the buyer benefits from the price increase of the stock. The value is the difference between the spot price and the forward price he must pay:

$$\begin{aligned} \text{Value for the buyer} &= \text{spot price} - \text{forward price} \\ V &= 120 - 110 \\ &= 10 \end{aligned}$$

The derived value $V = 10$ of the arrangement depends on the spot price S_1 at contract maturity $T = 1$. For the buyer,

- the higher the spot price S_1, the higher the derived value V;
- the lower the spot price S_1, the lower the derived value V.

It is important to distinguish the price from value for the buyer: the price is what the buyer agrees to pay; the value is what the buyer effectively gains at maturity.

4 Value of the contract for the seller (short position)

For the seller, the contract has a negative value $V = -10$ as he receives the forward price $F = 110$, but he has to exchange it for one stock at a market price $S_1 = 120$. The negative value means the seller suffers a loss because the stock price increased above the forward price he agreed to receive. For the seller, the value is the difference between the forward price he receives and the spot price of the stock he must give away:

$$\begin{aligned} \text{Value for the seller} &= \text{forward price} - \text{spot price} \\ V &= 110 - 120 \\ &= -10 \end{aligned}$$

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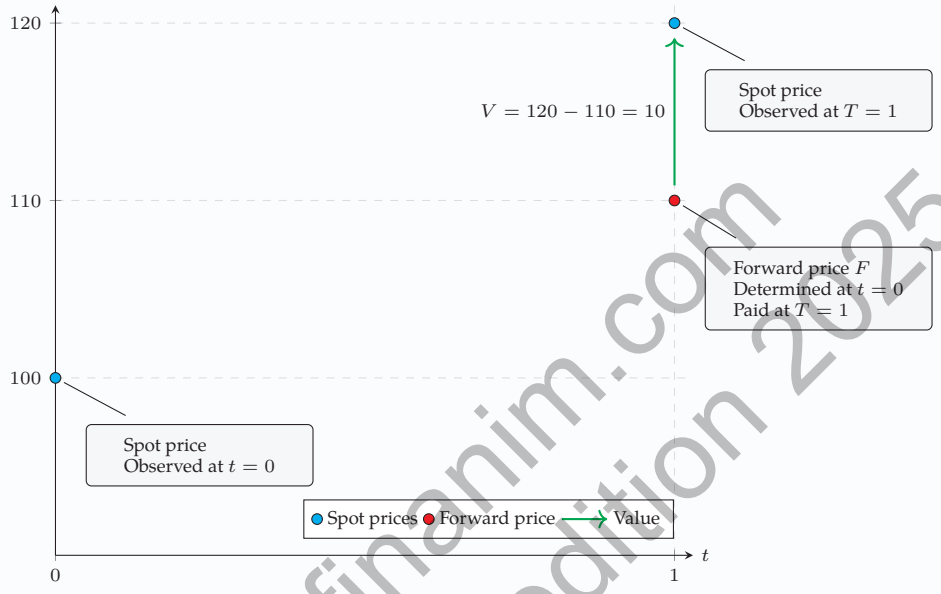
The derived value $V = -10$ of the arrangement depends on the spot price S_1 at contract maturity $T = 1$. For the seller,

- the higher the spot price S_1, the lower the derived value V;
- the lower the spot price S_1, the higher the derived value V.

It is important to distinguish the price from value for the seller: the price is what the seller agrees to receive; the value is what the seller effectively gains at maturity.

The value gained by the buyer is equal to the value lost by the seller. The following graph shows the initial spot price S_0, the final spot price S_1, the agreed forward price F, and the derived value of the contract for the buyer.

Forward contract value for the buyer (long position)



The spot prices $S_0 = 100$ and $S_1 = 120$ are observable market prices at points in time $t = 0$ and $T = 1$ respectively. They reflect the current market price of the underlying asset at the time of observation. By contrast, the forward price F is not observed on the market but determined through the forward pricing process. The pricing process is described in chapter 5.

The stock is the underlying asset. The spot price is the underlying variable that determines the value of the forward contract at settlement. The value gained by the buyer of the forward contract equals the value lost by the seller. The figure illustrates the contract elements: the spot price at initiation S_0, the final spot price at settlement S_1, the agreed forward price F, and the resulting contract value for the buyer at maturity.

Example 1.7 brings together the concepts introduced in chapter 1.

- A financial derivative is an agreement (financial purchase contract) between two parties.
- The settlement does not happen at contract initiation $t = 0$ but is deferred to the future $t = T$.
- The contract value depends on the market spot price of the underlying variable.

A more detailed classification of types of underlying variables follows in section 2.2. The characteristics and concepts of pricing and valuation of forward contracts will be covered in part II.

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Properties

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Definition 3.1: Forward

A *forward* or *forward contract* is a financial contract entered at $t = 0$, in which two parties agree to settle a transaction at a future date $T > 0$ for a forward price F.

- A forward is a derivative contract in which a buyer commits to purchasing an underlying asset from a seller at a future date $T > 0$ for an agreed forward price F.
- A forward contract is entered at $t = 0$, which means that all contract terms and obligations are agreed upon at contract initiation $t = 0$.
- The contract parties use information available at $t = 0$ to determine a forward price F. The forward price is the delivery price in a forward contract. The process of setting a forward price is referred to as pricing (see chapter 5).
- The contract is settled at a future date $T > 0$, which distinguishes it from spot transactions. Spot transactions are settled immediately.
- A forward is customized. Customization means the contract terms are individually negotiated to meet the specific needs of the contracting parties.
- A forward contract is traded directly between the parties in the over-the-counter (OTC) market. In OTC trading, no third-party intermediary, such as a securities exchange, facilitates the contract and its settlement. The OTC market is a decentralized and informal network where market participants negotiate customized derivatives contracts.

The main benefit of forward contracts compared to exchange-traded transactions is their minimal regulatory oversight. The limited regulation allows participants to flexibly tailor contracts to specific portfolio needs or business requirements. However, a market participant must find a suitable counterparty for each transaction because forward contracts are privately negotiated. Executing and managing a forward contract can be costly.

Additionally, forward contracts carry counterparty risk. The main counterparty risk is that one party in the agreement may default on its obligations. Credit checks of counterparties and credit

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protections, such as collateral and bank letters of credit, are commonly used to guard against losses from counterparty default.[1]

3.1 Positions

3.1.1 Long

Definition 3.2: Long position in a forward contract

The *long position* in a forward contract is the party obligated to buy the underlying asset at the agreed forward price F at contract maturity T.

- The buyer of the underlying asset holds the long position.
- The long position benefits if the underlying asset rises in value. The long position loses if the underlying asset declines in value.
- The long position is said to have long exposure. Long exposure represents the risk that the long position will be obligated to buy the asset at the forward price even if its market value has declined.

3.1.2 Short

Definition 3.3: Short position in a forward contract

The *short position* in a forward contract is the party obligated to sell the underlying asset at the agreed forward price F at contract maturity T.

- The seller of the underlying asset holds the short position.
- The short position benefits if the underlying asset declines in value. The short position loses if the underlying asset increases in value.
- The short position is said to have short exposure. Short exposure represents the risk that the short position will be obligated to sell the asset at the forward price even if its market value has risen.

3.1.3 Economic objectives

Market participants take long or short positions in forward contracts based on their economic objectives.

- Pension funds may take a long position in a forward contract to secure a purchase price for an asset they plan to invest in.
- An airline that regularly buys fuel may take a long position in a commodity forward contract on jet fuel to hedge against rising prices.
- Commodity producers, such as oil or gold mining companies, may take a short position to secure a fixed selling price for future commodity production. By shorting the commodity, they can reduce the risk of falling prices.
- Speculators take either a long or short position based on their market expectations. They aim to profit from short-term price movements.

[1] see McDonald, *Derivatives Markets*, p. 34.

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