FRM Part 1

Book 3 - Financial Markets and Products

EXOTIC OPTIONS

Learning Objectives

After completing this reading you should be able to:

- ✓ Define and contrast **exotic derivatives** and **plain vanilla derivatives**.
- ✓ Describe some of the factors that **drive the development** of exotic products.
- ✓ Explain how any derivative can be converted into a **zero-cost product**.
- ✓ Describe how standard American options can be transformed into **nonstandard American options**.
- ✓ Identify and describe the characteristics and payoff structure of the following exotic options: **gap**, **forward start**, **compound**, **chooser**, **barrier**, **binary**, **lookback**, **shout**, and **Asian**, **exchange**, **rainbow**, and **basket options**.
- ✓ Describe and contrast **volatility** and **variance swaps**.
- ✓ Explain the basic premise of **static option replication** and how it can be applied to **hedging exotic options**.

Exotic Derivatives vs. Plain Vanilla Derivatives

- Plain vanilla derivatives represent the most basic version of financial derivatives, including futures contracts, forwards, swaps, and over-the-counter (OTC) instruments used in **fairly liquid markets**.
  - They have a simple expiration date, exercise price and have no additional features.

- Exotic derivatives alter the traditional characteristics to create a complex financial instrument that's tailored to meet the **specifications of a particular counterparty**.
  - For exotic derivatives, most of the features issues are **negotiable**.
- Some of the reasons behind the development of exotic derivatives include the need to:
  - Create a **customized hedge** that reflects the composition of an entity's underlying assets
  - Address **tax** and **regulatory** concerns
  - Develop products that reflect the **direction of future market prices**

Conversion of Derivatives into a Zero-cost Product

- When two or more derivatives with **contrasting features** are combined, a **package** is formed.
  - Common packages include a bull, bear, calendar spread, or even a straddle.
- Through these packages, a trader can create a **zero-cost product**.
- Take a collar, for example.
  - The trader combines a **long position in a put** with a **lower strike price** and a **short position in a call** with a **higher strike price**.
  - If the premium received after selling the call offsets the premium paid for the put, the **overall cost** of the combined position is **reduced to zero**.

Transforming a Standard American Option into a Nonstandard American Option

- Certain things could be done that effectively transform a **standard option contract** into a **non-standard** one. These include:

Restricting early exercise to only a few specified dates.

- Six-month American call could be exercisable only on the last day of each month (**Bermudan option**).

Imposing a lock-out period during which the option cannot be exercised

- Three-month lockout period could be imposed on a six-month call.

Having multiple strike prices in different phases of a contract

- For example, a three-year call could be characterized by strike prices of $30 in the first year, $35 in the second year, and $40 in the final year.

Gap Options

- A gap option has a **strike price**, K_1, and a **trigger price**, K_2 .
  - The **trigger price** determines whether or not the option will have a **nonzero payoff**.
  - The **strike price** determines the actual **amount of the payoff**.
- For a **gap call option**, the payoff will always be nonzero (positive or negative) as long as the **final stock price exceeds the trigger price**.
- For a **gap put option**, the payoff will always be nonzero as long as the **final stock price is less than the trigger price**.
  - If $K_1 = K_2$, the gap option payoff will be the same as that of an ordinary option.

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Gap Options

For a gap call option, when $K_2 > K_1$,

$$Gap\ call\ option\ payoff = \begin{cases} S_T - K_1 & if \quad S_T > K_2 \\ 0 & if \quad S_T \leq K_2 \end{cases}$$

Example: $K_1 = 100$; $K_2 = 105$ (trigger prices exceeds strike price)

At Expiration:

Stock Price	96	100	104	105	112
Call price	0	0	0	5	12

Gap Options

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- If the trigger price is greater than the strike price for a gap call option, negative payoffs could occur.

Example: $K_1 = 108$; $K_2 = 100$ (strike price exceeds trigger price)

At Expiration:

Stock Price	96	100	106	108	112
Call Price	0	-8	-2	0	4

Forward Start Options

- As the words suggest, a forward start option **kicks off at some point in the future**.
- ***Example***
  - Today a trader may purchase a six-month put that will only **come into effect three months from today**.
  - Forward start in-the-money options are usually used as incentives to **boost employee productivity** and encourage employee loyalty.

Compound Options

- A compound option is simply an **option on an option**
  - In other words, an option for which the **underlying is another option**.
- A compound option can take one of four different forms:
  - **A call on a call** (CoC) gives the investor the **right to buy a call** option at a set price for a set period of time.
  - **A call on a put** (CoP) gives the investor the **right to buy a put** option at a set price for a set period of time.
  - **A put on a call** (PoC) gives the investor the **right to sell a call** option at a set price for a set period of time.
  - **A put on a put** (PoP) gives the investor the **right to sell a put** option at a set price for a set period of time.

Chooser Options

- In a chooser option, the holder is **allowed to decide whether it is a call or a put** prior to the expiration date.
  - The choice between the two depends in large part on the value of each.

Binary Options

- In a binary option, the payoff is either a **fixed monetary amount** or **nothing at all**. Binary options are of two types:
  - **Cash-or-nothing option** which pays a fixed amount of cash if the option expires in-the-money.
  - **Asset-or-nothing option** which pays an amount equivalent to the value of the stock when the contract is initiated if the option expires in-the-money.

Barrier Options

- A barrier option is an option whose existence depends upon the underlying asset's price **reaching a predetermined barrier level**.
- It can be either:
  - A knock-out, implying it **expires worthless if the underlying exceeds a certain specified price**, effectively limiting profits for the holder but limiting losses for the writer.
  - A knock-in, implying it has **no value until the underlying reaches** a certain specified price.

Lookback Options

- A lookback option allows the holder to exercise an option **at the most beneficial price** of the underlying asset, over the life of the option.

Asian Options

- In an Asian option, the payoff depends on the **average price of the underlying asset over a period of time** as opposed to standard options where the payoff is determined by the price of the underlying at a specific point in time.

Exchange Options

- An exchange option gives the right but not the obligation to exchange money denominated in one currency, say, the USD, into another currency, say, the Euro, at a **pre-set exchange rate on a specified date**.

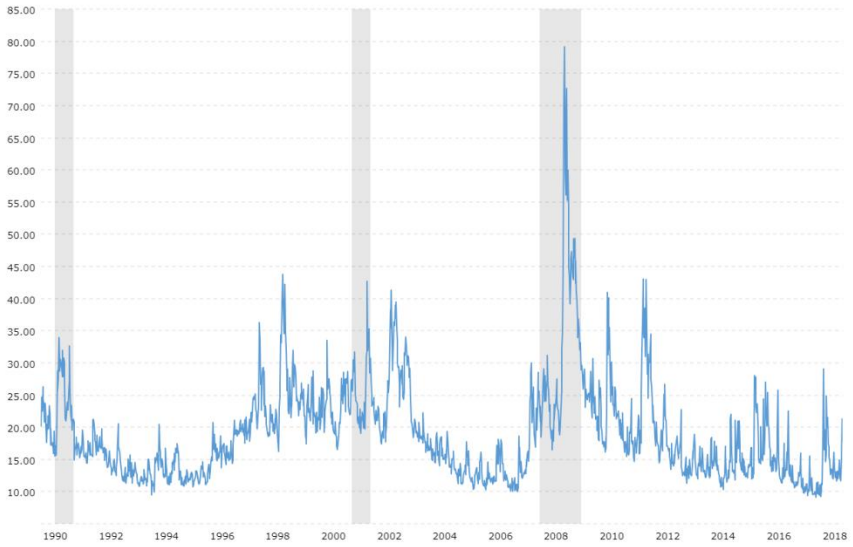
Basket Options

- A basket option gives the right but not the obligation to buy or sell a **basket of securities**.
  - The components of the basket could be **bonds**, **stocks**, **currencies**, etc., and may be specified in advance.

Volatility and Variance Swaps

- In a volatility swap, **volatility** is exchanged based on a notional principal.
  - Similarly, a variance swap involves the exchange of variance – the square of volatility – based on a notional principal.
- Volatility and variance swaps **do not bet on the price of the underlying**.
  - Variance swaps can be **replicated using a collection of puts and calls,** which are easier to price compared to volatility swaps.

VIX – CBOE Volatility Index (1990 – 2018)



Hedging Exotic Options

- Hedging of exotic options can be done by creating a **delta neutral position** and **rebalancing frequently** to maintain delta neutrality.

- However, some exotic options such as **barrier options** are relatively **difficult to hedge**.
  - To hedge a barrier option, the portfolio that **replicates its boundary** conditions must be **shorted** and **unwound** when any part of the **boundary is reached**.

➢ Static options replication **does not require frequent rebalancing**.

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