

Financial Securities

This course is all about financial securities and their pricing. A financial security is by definition an instrument that entitles the holder certain ownership, and it usually represents a financial value that changes with time. Financial securities can in general be divided into two categories: debt securities, such as bonds, and equity securities, such as common stocks. The term “pricing” may be one source of confusion as it might suggest that the price of a security was determined in some way by someone. In fact, in a capital market all securities are driven by various market forces with the familiar supply and demand mechanism, and the price emerges from some trading process which can happen either on an exchange, or over-the-counter. Financial securities are made popular and important all because of the wide spread practice of trading.

Trading

Trading of a security involves a buyer and a seller, and it can happen in one of the two ways: on an exchange or over-the-counter. In an exchange, such as New York Stock Exchange (NYSE), there is a highly organized market where buyers and sellers of various securities are matched in a very efficient way through brokers and dealers. It's so efficient that you can get your orders executed with realized price reasonably close to what you just observed on the market. Those securities traded on an exchange are usually standardized and liquid, easy to find buyers and sellers. On the other hand, those securities more structured and specialized may need or prefer to be traded over-the-counter. In that case, the trading is carried out by those market makers who quote both a buy and a sell price. It's their duty to make the market as efficient as possible, at the same time derive the maximum profit for themselves. It should be pointed out that a substantial part of trading these days have been computerized, following some strategies designed by those “quants” equipped with various mathematical models.

Portfolio

A portfolio is just a collection of financial securities, specifically designed for an individual or an institution. The widespread thinking of “not leaving all eggs in one basket” is reflected in the practice of diversification: investing in different securities across industries to reduce risk in specific areas. In the 1950s, Markowitz revolutionized the portfolio theory by proposing the principle of maximizing expected returns for a given amount of risk, which is measured by the variance of the returns.

Short Selling

This is something quite troubling to many of us who just come to modern finance: how could you sell something you don't even own? The process of short selling needs some illustration: first, you indicate to your broker that you wish to short some stock X, the broker then finds a buyer, and executes the trade. Now is the tricky part: how to deliver something that is simply not there? There is something called the clearing firm, who is responsible for making sure all trades are cleared, and it must make delivery on behalf of the seller. The seller must buy the stock from the market or borrow it from a stock-loan desk. Here you see a crucial factor: the number of shares available for borrowing, which varies from time to time. Sometimes it can be difficult to borrow, resulting in some phenomenon that is called “hard-to-borrow”. Your profit and loss will be materialized when you close out that position: the shares will be bought back from the market and the difference gets settled.

Derivative Contracts

A derivative contract is written on one or several underlyings which are necessarily random in nature. You can think of the purpose of a derivative contract is to bet on the underlying's direction. For example, someone buying a call option on the SP500 index usually feels optimistic about the index, on the other hand, a put option holder on the same underlying may have a very different view from the previous one. It should be noted that the final payoff

of the derivative is often made through cash exchange, rather than the actual delivery of the assets. Where can you buy the S&P 500 index to deliver to the other party? As the derivative business developed, they are also used as hedging instruments, meaning that they are employed to offset the impact of market moves that may incur unbearable losses if your positions are not hedged. What we should always be aware of is that a derivative always has one or several underlyings, and we have witnessed in recent decades as how creative the market can be in terms of inventing derivatives that bet on almost every possible future event that can be imagined.

Positions: Long and Short

The term “position” refers to the number of shares you own in this particular security. An interesting situation arises when this number is negative, which means a “short position”. Otherwise it is a “long” position. The original use of the terms can be traced back to mid-nineteenth century and it came from one of the earliest trading practices.

Hedging

It refers to the strategy that employ related financial instruments to offset the impact of market moves in specific directions. This is the source of the claim for almighty financial engineering that we can now manufacture financial products that will be immune to unfavorable market moves, if the portfolio is hedged well according to the mathematical models. The idea behind this claim is that we can design products to eliminate specified risk factors (see below) if they can be identified. Market history of the past years has shown that these claims are just too premature to celebrate.

Profit and Loss (PnL)

The ultimate measure of a trading desk. The PnL is updated constantly and it serves as the sole measure of the desk’s performance and is translated to the year-end bonus of the desk.

Exposures

Suppose you bought a call or put on stock X , you are said to have an exposure in the stock price of company X , as the price moves of stock X will now have an impact on your wealth. In the case of options, we are particularly concerned about the volatility exposure, where a sudden move in the volatility of the stock can have a significant PnL in your portfolio. Other examples include interest rate exposure if you have a large collection of bonds in your portfolio, as a slight move in the interest rate can have a major consequence on your portfolio value. The exposure can be quoted as the amount that the trading desk can lose in a particular scenario.

Risk Factors

The term is usually used in medical sciences and here it finds its use in finance. As you can imagine, it summarizes the source of risk a particular portfolio has and the list can be quite long but uneven. Factor analysis is the study to identify and quantify those sources and it is an important component in modern financial studies, where we use statistical tools to identify the factors that drive the market.

Missions of the Course

It is not our ambition to step into the world of pricing stocks. Instead, we have our goals set to price other financial securities that are related to a stock, with the presumption that the stock is correctly priced and information readily available. It has been argued that pricing a stock derivative is a much easier task than pricing stock itself, and we gladly take this assessment as a confirmation of the studies we engage. It should be understood that everything we derive here is based on the assumption that the stock has been correctly priced. Our goal is to investigate all the relationships among various underlying and derivatives so we can price the derivatives correctly, and find arbitrage opportunities if we believe some derivatives are not in line with their underlyings or other derivatives.