



## Audio Script: Introduction to Options, Putting Together the Options Pricing Puzzle

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## Audio Script:

You may wonder how an option moves when the underlying security moves. Does the option move at the same pace as the underlying security? In order to understand how an option reacts to its underlying security, you really need to understand how an option is priced. Today, we are going to put the options pricing puzzle together.

Before we get started, Please take a moment to read through and be aware of all of the information contained in these disclosures. Options involve risk, are not for everyone, and require a separate application and approval. It is important to read the Options Disclosure Document titled "Characteristics and risks of standardized options". You can find a link to this document in the disclosure section at the bottom of the page. You can contact us if you have questions on this information or anything else we cover today.

How are we going to put the options pricing puzzle together? For the first half of our agenda, we are going to cover the foundational concepts of options beginning with the anatomy of an option and the difference of a call and a put. For the second half, we will look at how an option is priced and how that price reacts to stock movement and other factors. Let's dive in.

What exactly is an option? Well, the first option contract was created in the 17<sup>th</sup> century in response to the rising prices of tulips, history refers to this as "tulip bulb mania". During tulip bulb mania, tulip investors wanted a way to execute upon a specified price for a certain period of time, as a result contracts were issued and fluctuated in value just as the tulips did. Do not worry, that is all the history we have in this presentation however, we will absolutely cover mathematics.

The text book definition of an option states that an option is a contract to buy or sell a specific financial product known as the underlying instrument or interest. An option is simply a contractual agreement between a buyer and seller. With every agreement we ask: What quantity are we agreeing on? What product? What price? And what timeframe? With options, we refer to the quantity as the contract amount 1 contract generally represents 100 shares. The agreed upon product is the underlying security, this can be a stock, fund, index or even a commodity or currency. The agreed upon price is called the strike price. The strike price is normally displayed on a per share basis. The agreed upon time frame is referred to as the expiration date. Expiration dates normally fall on Fridays and are sometimes displayed as days until expiration. Options are normally issued on a weekly, monthly, and a quarterly basis.

Let's look at an example of an equity option: 1 XYZ with a \$100.00 strike price expiring on March 24<sup>th</sup>, let's assume we have 30 days left until expiration. This option's contract represents an agreed upon quantity of 100 shares, for the stock XYZ at an agreed upon price of \$100.00 per share until March 24<sup>th</sup>.

The option is issued as a call or a put, which tells us if the option contains the right to buy or sell. A call option represents the right to buy, if this example were a call, the contract would represent the right to buy 100 shares of XYZ at any time up until March 24<sup>th</sup>. A put, is just the opposite. A put option represents the right to sell, if this example were a put, the contract would represent the right to sell 100 shares of XYZ at any time up until March 24<sup>th</sup>.

An option contract can be executed upon. Meaning the call holder, who has the right to buy, can take ownership of the shares purchasing the underlying security at the strike price, and the put holder, who has the right to sell, can sell the underlying security at the strike price. This process is called exercising.

The option contract can expire worthless, which happens when it no longer holds any value. We will talk a little more about this later on. The option can also be bought and sold on an exchange or "traded" if a market exists. And the price at which the option is traded at is called the premium, which is represented on a per share basis.

Let's dive deeper into a call and a put option. The best way to depict this is on a t-chart. We put calls on the left and puts on the right. Let's look at calls first. An option can be bought to open or sold to open. This means that you are entering into the contract as a buyer or seller. If you buy a call to open, you hold a long call. If you sell a call to open, you hold a short call. The purchaser of the long call owns the right to buy the underlying security from the options seller at any time up until expiration.

The seller of the short call has the obligation to sell the underlying security to the long call holder if and when the long call holder chooses to execute upon the terms of the contract or exercise their option. Only long option holders can exercise, short call holders are notified and obligated to sell the shares at the strike. This is called assignment.

Let's look at our example, 1 XYZ \$100 Mar 24th Call at a premium of \$5.00 per share. The long call holder owns the right to buy 100 shares of XYZ at any time until Mar 24th and paid \$5.00 per share for this right to buy. The seller, or short call holder, has the obligation to sell 100 shares of XYZ, if and when the long call holder chooses to exercise. The seller of the call option collects the premium of \$5.00 per share. The seller of a call option will benefit if the stock remains below the strike price and is a bearish strategy. The long call holder will benefit if XYZ moves higher, is bullish, and has unlimited upward potential. XYZ can theoretically go to an infinite number. Because the seller or short call holder has the obligation to sell the shares to the long call holder, the short call holder may have to purchase XYZ at an astronomically high price in order to meet their obligation, if they do not already own XYZ. Because of this, the short call writer faces unlimited loss potential.

Puts are really just the opposite. A put represents the right to sell. If you buy the put to open you hold a long put. If you sell the put to open, you hold a short put. The purchaser of the long put owns the right to sell at the strike price at any time until expiration, the short put writer has the obligation to buy the shares if and when the long put holder decides to execute upon the contract. In example, let's look at the XYZ \$100 strike price put expiring Mar 24th trading at a premium of \$5.00 per share. The long put holder owns the right to sell 100 shares of XYZ at \$100.00 per share at any time until expiration and pays a premium of \$5.00 per share. The short put writer has the obligation to purchase the shares at \$100.00 and collects the premium of \$5.00 per share.

The short put writer does face substantial risk potential because XYZ can only go to zero. If the long put holder exercised the contract causing the short put writer to buy 100 shares of XYZ at \$100.00 per share, the put writer may have to sell the shares at a full loss. A long put holder benefits, when the stock goes down. Because they would own the right to sell at a higher price, a long put is bearish. The short put writer benefits if the stock remains above the strike price. A short put is bullish.

Basically, a long option holder wants the contract to have value and the short option writer wants the option to expire without any value. As you can see from this chart, a long call and a short put benefit from upward stock movement, and a short call and a long put benefit from downward stock movement. This 'T' chart is used to visually display the relationships of a call and a put. If you fully understand a long call, you can use this chart to clarify the rest. From here on forward, we are going to focus only long equity calls.

We just covered a lot, and introduced quite a few option terms you should be familiar with. Let's do a quick review before we move into options pricing. First, a contract, each option contract generally represents 100 shares. 2 contracts represents 200 shares, 3 contracts represents 300 shares, and so on. A strike price is the agreed upon price at which the contract holder can buy or sell a security. A call represents the right to buy if purchasing, the seller is obligated to sell the shares. A put represents the right to sell if purchasing, the seller is obligated to buy the shares. A long option is created when you enter the contract as the buyer or buy to open. A short option is created when you enter the contract as the seller or sell to open. Exercising an option means that you execute upon the terms of the contract, only long option holders are able to exercise their options. Assignment occurs when the long option holder exercises their option and a short option holder is notified and fulfills their obligation.

A premium is the price paid or received for the options contract, this price is represented on a per share basis. Which leads us to our next question. How is an option priced?

We already know that an option's price is known as the premium. An option's premium is made up of two main components: Intrinsic value and extrinsic value. Intrinsic value really means internal factors that affect the options price. Like if the option's strike price is more favorable than the market price. We call this an in-the-money option. Let's assume XYZ is trading at \$105.00 per share and a XYZ 100 strike 30 days until expiration call is trading at a premium of \$6.00. Well, the call represents the right to buy 100 shares of XYZ at \$100 per share, the contract can be exercised to purchase 100 shares of XYZ at \$100.00 and immediately sold at the current market price of \$105.00 per share, capturing a \$5.00 profit. This means that this contract is in-the-money by \$5.00 per share. Simply because buying at the strike price more favorable than buying at the market price. This in-the-money value of \$5.00 represents the premium's intrinsic value. But, the option is trading at a premium of \$6.00, and \$5.00 represents intrinsic value, therefore, the remaining dollar represents the extrinsic value. Extrinsic value really means external factors that affect the price of the option and is primarily comprised of time value and implied volatility. Interest rates and dividends are also extrinsic value components.

Let's talk about time value, this contract has 30 days left until expiration, other contracts have shorter or even longer expiration dates. The important point is: the more time you have until expiration, the more time you have for the stock to move above or below your strike price, the more expensive the option will be. An option with a \$100 strike price with 90 days until expiration will be more expensive than the same strike with 30 days until expiration. Because the option with 90 days until expiration has more time to become profitable. Time is always working against us, in every aspect, time value is a decaying asset.

The time value of an option begins to diminish the moment the option is created.

What about implied volatility? We are not going to focus heavily on implied volatility but it is important to know the foundational aspects. Implied volatility is the market's forecast in a likely movement of a security. Think about earnings, when a stock is about to report earnings, we know the exact date and time this will occur. Once the stock reports, it normally reacts drastically up or down depending if it hit or missed analysts' expectations. Because, the market anticipates a large price swing up or down, the option will be more expensive. The more likely you are to move above or below your strike, the more expensive the option will be. The price of the option will inflate pre earnings in anticipation of the report and deflate post earnings because there is a less likely anticipated movement up or down after earnings reports and the stock reacts. This is sometimes referred to as the earnings volatility crush.

What's important to take away here is that an option's price is determined based on more than just the price of the underlying security, other external factors can drive the price of an option up or down. Therefore we differentiate between the options' intrinsic and extrinsic value. The option's premium could be comprised of a combination of intrinsic and extrinsic value or it could even be made up of only intrinsic value, or only extrinsic value. This is why the option does not move in tandem or even as much as the underlying security. Let's look at a few more examples to explain this concept more.

Our underlying security, XYZ, is still trading at \$105.00 per share. Let's look at a XYZ \$95.00 strike price call with 30 days left until expiration trading at a premium of \$12.00. This contract represents the right to buy 100 shares of XYZ at \$95.00 per share at any time until expiration. Well, if we own the right to buy at \$95.00 per share and can immediately sell on the market for \$105.00 per share, then this contract has an intrinsic value of \$10.00. The remaining \$2.00 represents the extrinsic value. Let's look at a higher strike price at a \$100 strike call with 30 days left until expiration trading at a premium of \$8.00. Now, we have the right to buy XYZ at \$100.00 and the market is pricing XYZ at \$105.00. Therefore, the intrinsic value of this contract is \$5.00 per share. The extrinsic value of this contract is the remaining \$3.00.

Let's look at a \$105.00 strike price with 30 days left until expiration trading at a premium of \$5.00, this contract contains the right to buy 100 shares of XYZ at \$105.00 per share. The market price of XYZ is equivalent to the strike price of this contract.

This means this option does not have any intrinsic value because it doesn't make sense to exercise, you can purchase XYZ on the market at the same price the contract can be executed upon. This contract is not in-the-money and is what we call at-the-money. At-the-money options have the same strike price as the market price. The contract's \$5.00 premium is made up of only extrinsic value.

How about a \$108.00 strike price with the same expiration period? The premium is at \$4.00 per share. Well, this contract contains the right to buy 100 shares of XYZ at \$108.00 per share at any time up until the expiration date. If XYZ is trading at \$105.00, buying at the market price of \$105.00 would be more favorable than buying at the strike price of \$108.00. This contract is considered out-of-the-money because it does not have any intrinsic value. Out-of-the money options have a strike price less favorable than the market price. Therefore the entire \$4.00 premium is made up of only extrinsic value. All of these examples have 30 days until expiration. Which means there is "time value" priced into the option. XYZ has 30 days to move above or below the strike; there is extrinsic value as long as there is time. However, as time goes by the time value will deplete, which means the option will not necessarily move dollar for dollar with XYZ. Let's look a little more at time value with some examples.

XYZ is rather sideways and still at \$105.00 per share. Let's look at a XYZ 100 strike call with 0 days until expiration trading at a \$5.00 premium. Well, this contract represents the right to buy XYZ at a price of \$100.00 per share. If the market is pricing XYZ at \$105.00 per share, this contract has to be worth at least \$5.00 per share. The option is in-the-money by \$5.00 per share, which makes up the option's intrinsic value. However, this option has zero days left until expiration, which means today is expiration day. Time has run out and therefore this option is only worth its intrinsic value. If we look at the same XYZ 100 strike option out another 30 days, we see that it is trading at a premium of \$8.00 per share. This option has the same strike as the previous, therefore has the same intrinsic value of \$5.00. This option has an extrinsic value of \$3.00, as the option has more time value.

Let's look at the same strike with 45 days left until expiration, the option is trading at a premium of \$9.00 per share. Again, the intrinsic value remains the same because the strike price has not changed.

However, this option has \$4.00 of extrinsic value. Let's look at the same strike with 60 days left until expiration trading at a premium of \$9.50. The intrinsic value remains at \$5.00 per share, and the extrinsic value is \$4.50. You might have made an observation and saw that time value is not linear and does not move equally. And what I really means is: longer dated options have the most time value and are more expensive, as the option moves closer to expiration it completely loses its time value. The time value component of the option's premium decays at a slower rate the longer dated they are, and as the option nears expiration, the time value begins to rapidly decay. As you can see here, the call with 60 days until expiration decays slower than the call with 45 days left until expiration, it lost 50 cents, and diminishes very quickly as it becomes closer to expiration losing \$1.00 of time value between 45 day and 30 day expiration dates and accelerates within the next 30 day period to zero time value. An option will normally only be worth its executable value or "intrinsic value" on expiration. Which makes sense, time has ran out. Therefore, there is no time value.

If purchasing an option that only has time value, it is out-of-the-money, you may not see the option's price move up as much as the stock moves up. This is because the option is only decaying its time value and is not worth executing upon. The option may move sideways as the stock price increases if it remains out-of-the-money. Let's look at what happens when XYZ does move in price.

Let's look at a hypothetical options trade for XYZ from the buyer's and seller's eyes. XYZ is still trading at \$105.00 per share. The buyer enters the contract by buying to open 1 XYZ \$100 strike call with 30 days left until expiration and pays a premium of \$6.00 per share. The Seller enters the contract by selling to open the same contract and collects the premium of \$6.00 per share. Let's discuss each strategy: The buyer now holds a long call that contains the right to buy 100 shares of XYZ at \$100.00 per share at any time for the next 30 days in exchange for a \$6.00 premium. The long call holder is bullish and will profit if XYZ goes up in value beyond \$106.00 per share, we have to take into account what you purchased the option for in addition to the price you can purchase the stock for.

The most the long call holder can lose is limited to the premium paid of \$6.00. If XYZ moves down in value, the long call holder does not have to execute on the contract and it will not make sense to. If the contract is not worth anything at expiration, it will simply expire worthless. Which is the worst case scenario for the long call holder. The seller will hold a short call that contains the obligation to sell 100 shares of XYZ at \$100.00 per share at the buyer's discretion. The short call holder is bearish to neutral and will reach maximum profit if the contract is not worth exercising and XYZ is below the strike price of \$100.00 at expiration. If the long holder were to exercise the contract and buy 100 shares of XYZ at \$100.00, the short call holder would have the obligation to sell the shares at \$100.00 per share. If the short call holder does not own any XYZ, or the right to buy XYZ, and is obligated to sell the shares, they may have to buy XYZ at the market in order to meet their obligation. XYZ can theoretically go to an infinite number exposing the short call holder to unlimited loss potential. If XYZ were to move up in value, the short contract holder will break-even at \$106.00, when the market price of XYZ is equivalent to the strike price plus the premium collected. Let's see what happens if XYZ is at \$110.00 per share at expiration.

At expiration, the option normally prices in only its intrinsic value. In this case, \$10.00 per share. Again, this is because the option contains the right to buy at \$100, and the market is priced at \$110. The contract is in-the-money because the option is more favorable by \$10.00 per share. The long call holder would have a gain of \$4.00 per share. They purchased the option for a \$6.00 premium and would be able to sell to close the option if a market exists for \$10.00 resulting in a \$4.00 per share gain. The short call holder would have a loss of \$4.00 per share. They sold the option, collected a \$6.00 premium, and would be able to buy to close the option for \$10.00 if a market exists resulting in a \$4.00 loss per share. If a market exists, on expiration, the long call holder does not have to exercise their contracts, they can sell to close the option at the market. The short call holder can buy to close their option to end their obligation. What if XYZ were at \$105.00 at expiration? The XYZ call is still in the money, this is because the strike price of \$100.00 is still more favorable than the market price of \$105.00. The option will be worth the intrinsic or in-the-money value of \$5.00 per share. The long call holder can sell to close the option on the market at \$5.00 per share, which will result in a \$1.00 loss. The short call holder, can buy to close at \$5.00 per share, resulting in a \$1.00 gain.

The short call holder was able to profit in this scenario because the option lost all of its time value. The short call holder is able to buy the option to close at a lower price than what it was sold for even though the underlying remained at \$105.00 per share. The long call holder lost all of the time value purchased. Notice, how the stock did not move and the option still lost value, this is another example how an option will not move in tandem with the stock. This option was purchased with intrinsic value at the time of the opening transaction. If the option was at-the-money or out-of-the money at the opening of the trade, the option would have been purchased at a lower price, but the holder would need XYZ to move more in order to capture profit.

What would happen if XYZ were at \$90.00 per share at expiration? The option contract would be out of the money as buying 100 XYZ at \$100.00 per share is not more favorable than the market's price of \$90.00 per share. The option does not have any intrinsic value, and time has ran out, therefore, the option is worthless. The long call holder will reach their maximum loss at \$6.00 per share. The short call holder will reach their maximum gain of \$6.00 per share. In this scenario, not only did the time value completely decay, the stock moved down below the strike price and the option lost its intrinsic value. In these examples, we looked at what would happen to an options price at expiration. You do not have to hold your option until expiration. In fact, if a market exists, it is very common for buyers and sellers to close out their options prior to expiration in order to recoup time value purchased, remove risk, and ultimately when your exit price points are hit.

Let's look again at our goals and objectives. You should now understand the components of an option and the difference between a call and a put. That an option is a contractual agreement between a buyer and seller that contains the right to buy if the option is a call or the right to sell if the option is issued as a put.

And contains an underlying security at a specified price within a specified time frame in exchange for a premium. The buyer of the option pays the premium, the seller collects the premium. You should have an understanding of how an option is priced. An option's price is influenced by more than its underlying security, time, implied volatility and other factors can affect the price of the option. And finally, how an option's premium moves as the stock moves. An option does not necessarily move in tandem or as much as its underlying security. It's important to be aware of all of the external factors influencing the price of the option.

Options can be complex and we thank you for taking the time to expand your knowledge of the options universe. If you are looking for additional resources, you can access the options education hub on [Merrilledge.com](http://Merrilledge.com), you can find the hub before you log in by clicking on investor education and then selecting options from the drop down menu or when logged in, by clicking on research, selecting options and the education tab. Please feel free to give us a call with any questions or concerns at 877.653.4732

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