

G Which Of The Following Is True? At Expiration The Call Price Must Converge To The Stock Price. High

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Understanding the mechanics of options trading is crucial for investors seeking to optimize their strategies. One common question among traders is whether, at expiration, the call option's price must necessarily converge to the stock's current price. This inquiry touches on fundamental principles of options valuation, intrinsic value, extrinsic value, and market behavior as expiration approaches. In this comprehensive guide, we will explore the relationship between the call option's price and the underlying stock price at expiration, clarify common misconceptions, and discuss the factors influencing this convergence.

What Is a Call Option? An Overview

Before delving into the specifics of expiration behavior, it's essential to understand what a call option is and how it functions within the broader context of derivatives trading.

Definition of a Call Option

A call option is a financial contract that grants the holder the right, but not the obligation, to buy a specified quantity of an underlying asset—such as stocks—at a predetermined price known as the strike price, before or at expiration.

Components of a Call Option

- **Underlying Asset:** The stock or security on which the option is based.
- **Strike Price:** The fixed price at which the holder can purchase the underlying asset.
- **Expiration Date:** The date when the option contract expires.
- **Premium:** The price paid to purchase the option.

Understanding these components sets the stage for analyzing how the call's value behaves as expiration approaches.

The Behavior of Call Options at Expiration

The core of the question revolves around the call option's price at expiration and its relationship with the current stock price.

Intrinsic Value and Time Value

The total value of a call option can be decomposed into two parts:

1. **Intrinsic Value:** The difference between the stock price and the strike price when the stock price is above the strike price. It represents the immediate exercise value of the option.
2. **Time Value:** The additional amount reflecting the potential for further gains before expiration, driven by volatility, time remaining, and other factors.

Mathematically:

- $\text{Intrinsic Value} = \text{Max}(\text{Stock Price} - \text{Strike Price}, 0)$
- $\text{Option Price} = \text{Intrinsic Value} + \text{Time Value}$

At expiration, the time value diminishes to zero, leaving only the intrinsic value (if any).

What Happens at Expiration?

As the expiration date approaches, the time value decreases—a process known as time decay. At expiration:

- The option's price equals its intrinsic value.
- If the stock price is above the strike price, the call is in-the-money and worth the difference.
- If the stock price is below the strike price, the call is out-of-the-money and worthless.

Therefore, the call's price at expiration converges to:

- The stock price minus the strike price (if positive).
- Zero (if the stock price is below the strike price).

Does the Call Price Converge to the Stock Price?

A common misconception is that at expiration, the call option's price must equal the stock price. Clarifying this:

Correct Statement

- At expiration, the value of a call option equals the maximum of (Stock Price - Strike Price, 0).
- This means the intrinsic value of the option aligns with the difference between the stock price and strike price, not the entire stock price.

Misconception Clarified

- The call option's price at expiration does not necessarily equal the stock price.
- Instead, it converges to the intrinsic value, which is at most the stock price minus the strike price.

Example:

- Stock price at expiration: \$100
- Strike price: \$80
- Call option value: \$20 (since $\$100 - \$80 = \$20$)

If the stock price drops below \$80:

- Stock price: \$75
- Call value: \$0 (out-of-the-money, worthless)

In this case, the call's value converges to zero, not to the stock price itself.

Factors Influencing the Convergence of Call Price at Expiration

While at expiration, the call's value aligns with its intrinsic value, several factors influence the behavior leading up to this point:

Market Volatility

- Higher volatility increases the time value of options, delaying the convergence.
- As expiration nears, the impact of volatility diminishes.

Time to Expiration

- The longer the remaining time, the higher the time value.
- Approaching expiration reduces time value, emphasizing intrinsic value.

Interest Rates and Dividends

- Interest rates and dividends can affect the premium's components, slightly influencing convergence behavior.

Market Liquidity

- Liquidity impacts bid-ask spreads, which may cause minor deviations from theoretical convergence.

Practical Implications for Traders

Understanding how call options behave at expiration provides strategic insights:

For Buyers of Calls

- Recognize that as expiration nears, the option's value will mainly reflect its intrinsic value.
- Maximize profit by purchasing calls when they are undervalued relative to intrinsic value.

For Sellers of Calls

- Be aware that the maximum profit occurs when the stock price remains below the strike price at expiration.
- Understand that the value of the option will diminish to zero if out-of-the-money.

For Hedging and Risk Management

- Use knowledge of convergence to set appropriate strike prices and expiration dates.
- Employ strategies such as spreads to manage time decay and volatility risks.

Summary of Key Points

- At expiration, a call option's price converges to its intrinsic value, which is the maximum of (Stock Price - Strike Price, 0).
- The call price does not necessarily converge to the stock price itself, only to the intrinsic value component.
- Time value diminishes to zero at expiration, leaving only intrinsic value.
- Market factors such as volatility, interest rates, and dividends influence the convergence process.
- Strategic trading involves understanding this convergence behavior to maximize gains and minimize risks.

Conclusion

The question "Which of the following is true? At expiration the call price must converge to the stock price" stems from a misunderstanding of options valuation principles. In reality, the call option's price at expiration converges to its intrinsic value, which is either the difference between stock price and strike price or zero if out-of-the-money. Recognizing this distinction is essential for traders and investors aiming to develop sound strategies and accurately interpret market movements as expiration approaches.

By understanding the nuanced relationship between the stock price and option value at expiration, traders can make more informed decisions, optimize their positions, and better anticipate market outcomes.

Frequently Asked Questions

What does it mean for a call option's price to converge to the stock price at expiration?

It means that as the option approaches expiration, its value should closely reflect the underlying stock's current market price, especially for in-the-money options, since there's less time value remaining.

Is it true that at expiration, the call option's price must exactly equal the stock price?

No, at expiration, the intrinsic value of a call option is equal to the stock price minus the strike price if positive; otherwise, it's zero. The option's total price converges to its intrinsic value, which is related but not necessarily equal to the stock price.

Why does the call option's price tend to converge to the stock price at expiration?

Because all remaining time value diminishes as expiration approaches, leaving the intrinsic value, which for a call is $\max(0, \text{stock price} - \text{strike price})$, thus causing the option's price to converge toward the stock price minus the strike.

What is the significance of the 'high' in the phrase "At expiration, the call price must converge to the stock price. High"?

The 'high' emphasizes that the call price becomes very close to, or equal to, the stock price at expiration for in-the-money options, reflecting maximum intrinsic value.

Are there any conditions under which the call price does not converge to the stock price at expiration?

Yes, if the option is out-of-the-money or if there are market frictions, the call price may not fully reflect the stock price at expiration, especially if the stock price is below the strike price, resulting in a zero option value.

How does the concept of convergence relate to option pricing models like Black-Scholes?

Models like Black-Scholes predict that as time to expiration approaches zero, the theoretical option price approaches its intrinsic value, which for a call is the maximum of zero or $(\text{stock price} - \text{strike})$, illustrating convergence.

What is the practical importance of understanding how call prices converge to stock prices at expiration?

It helps traders and investors assess the intrinsic value of options, manage risk effectively, and understand how time decay impacts option premiums as expiration nears.

Additional Resources

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Introduction

Options trading is a complex yet fascinating area of finance, offering traders and investors numerous ways to speculate, hedge, and generate income. Among the fundamental concepts in options pricing is understanding the behavior of call options as they approach expiration. One often-encountered statement is that “at expiration, the call price must converge to the stock price”, especially if the call is in-the-money. This notion prompts a deeper exploration into the mechanics of options valuation, the intrinsic and extrinsic components, and the factors influencing the convergence of option prices at expiration.

This detailed review aims to dissect this idea comprehensively, clarify what happens to call options at expiration, and discuss whether the statement holds true across different scenarios. We will also explore related concepts such as intrinsic value, time value, the role of volatility, and the implications of various market conditions.

Fundamental Concepts of Options Pricing

What Is a Call Option?

A call option grants the holder the right, but not the obligation, to purchase an underlying asset (such as a stock) at a predetermined price (the strike price, K) within a specified period.

Components of Call Option Price

The price (premium) of a call option at any moment consists of:

- Intrinsic Value (IV): The immediate value if exercised today. For a call, this is $\max(S - K, 0)$, where S is the current stock price.
- Time Value (TV): The additional amount traders are willing to pay over the intrinsic value, reflecting potential future movements, volatility, time remaining until expiration, dividends, and interest rates.

Mathematically:

$$\text{Call Price} = \text{Intrinsic Value} + \text{Time Value}$$

Behavior of Call Options as They Approach Expiration

At Expiration: Intrinsic Value Dominates

As an option approaches its expiration date, the extrinsic or time value diminishes, a process known as time decay or theta decay. At expiration, the call's value is purely its intrinsic value:

$$\boxed{\text{Call Price at Expiration} = \max(S_T - K, 0)}$$

Where (S_T) is the stock price at expiration.

This convergence is fundamental to options theory and is often summarized as:

- If the call is in-the-money (ITM): The option's value converges to $(S_T - K)$.
- If the call is out-of-the-money (OTM): The option expires worthless, i.e., its value converges to zero.

Does the Call Price Converge Exactly to the Stock Price?

No, the statement "at expiration, the call price must converge to the stock price" is not entirely accurate; rather, it converges to the intrinsic value, which is the difference between the stock price and the strike price, if positive, or zero if not.

Key clarification:

$$\text{At expiration, } C_T = \max(S_T - K, 0)$$

The stock price itself, (S_T) , is not necessarily equal to the call price unless the strike is zero (which is not practical) or if the call is deep in-the-money with no remaining time value.

Deep Dive: Why Does the Call Price Converge to Intrinsic Value?

Theoretical Foundation

- No Time Value at Expiration: Since there's no remaining time for the stock price to move, the extrinsic component shrinks to zero.
- Arbitrage Arguments: If the call were priced above its intrinsic value at

expiration, an arbitrageur could exploit the difference by buying the cheaper asset and selling the overpriced call, leading to riskless profit.

- Option Pricing Models: The Black-Scholes model and other models confirm that, at expiration, the option's value equals its intrinsic value.

Practical Illustration

Suppose:

- Strike Price $(K = \$50)$
- Stock Price at expiration $(S_T = \$55)$

Then:

$$C_T = \max(55 - 50, 0) = \$5$$

If $(S_T = \$45)$:

$$C_T = 0$$

This demonstrates the convergence behavior clearly – the call price aligns with intrinsic value, not necessarily the stock price itself.

Factors Influencing the Convergence

1. Time to Expiration (T)

The amount of time remaining affects the extrinsic value. As T approaches zero:

- Extrinsic value diminishes.
- The total value approaches intrinsic value.

2. Volatility

- Higher volatility increases extrinsic value, especially when there is significant time remaining.
- As expiration nears, the impact of volatility diminishes, but the potential for large price jumps can still influence the option's final payoff.

3. Dividends

- Expected dividends can influence early exercise decisions and the final payoff.
- For American-style options, early exercise may be rational if dividends are

expected, which affects convergence behavior.

4. Interest Rates

- Impact present value calculations and can influence the premium, especially for options with longer durations.

The "High" Call Price at Expiration: Is It Possible?

The phrase "High" in the original statement suggests a context where the call price is significantly above its intrinsic value near expiration. It is important to clarify:

- At expiration, the call's total price cannot be higher than the intrinsic value (excluding transaction costs). It converges to this intrinsic value, which is bounded by $(S_T - K)$.
- If the call is deep in-the-money, its value at expiration equals $(S_T - K)$, which can be substantial.
- If the call is out-of-the-money, its value at expiration is zero.

Therefore, the call price is not arbitrarily "high" at expiration; it is tightly bound to the intrinsic value, which depends on the underlying stock price.

Special Cases and Exceptions

Early Exercise for American Calls

- For non-dividend-paying stocks, early exercise is generally suboptimal because the time value outweighs the benefit of immediate exercise.
- For stocks paying dividends, early exercise might be rational if the dividend outweighs the remaining time value.

Options with Zero or Very Low Strike Price

- If $(K \rightarrow 0)$, then:

$$\lim_{K \rightarrow 0} C_T = S_T$$

which is effectively the stock price, aligning with the statement but only in this specific limit.

Summary of Key Points

- At expiration, a call option's value converges to its intrinsic value, i.e., $\max(S_T - K, 0)$.
- The call price cannot be higher than the stock price minus the strike price at expiration.
- The statement "at expiration, the call price must converge to the stock price" is not accurate; it converges to the intrinsic value, which is related to but not necessarily equal to the stock price.
- The extrinsic (time) value diminishes to zero at expiration.
- Market arbitrage mechanisms ensure that options are correctly priced relative to their intrinsic value at expiration.

Practical Implications for Traders and Investors

Understanding these principles is vital for:

- Option writers: To recognize when to close out positions before expiration.
- Option buyers: To anticipate the intrinsic value at expiration and manage expectations.
- Hedgers: To understand how options behave near expiration and adjust strategies accordingly.
- Market analysts: To interpret option premiums and implied volatility as expiration approaches.

Final Thoughts

The dynamics of options prices at expiration are fundamental to option valuation and trading. While the idea that the call price "must converge to the stock price" is a common misconception, the reality is that it converges to the intrinsic value, which is intimately tied to the stock price but not necessarily equal to it. Recognizing this distinction is crucial for effective trading, pricing, and hedging strategies.

By grasping these nuances, traders can better navigate the complexities of options markets, avoid common pitfalls, and make more informed decisions as expiration approaches.

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