

Research on the Impact of COVID-19 on Netflix Call Option Prices based on the Black-Scholes Model

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Abstract. This research delves into the intricate relationship between Netflix call option prices and the influence of the COVID-19 pandemic, employing the Black-Scholes model to analyze the multifaceted dynamics at play. Set against the backdrop of the pandemic's diverse stages, the study seeks to unravel the correlation between external events and investment behaviors. Drawing on distinct temporal periods - pre-pandemic, pandemic, and post-pandemic - the research utilizes historical option pricing data to unveil the impact of COVID-19 on Netflix call option prices. The Black-Scholes model, a robust option pricing framework, forms the analytical backbone, enabling the quantitative assessment of option values during these dynamic periods. Findings reveal that during the pandemic phase, call option prices experienced a notable surge, mirroring heightened investor interest amid increased consumer reliance on streaming services. This trend aligns with the surge in Netflix's subscriber base during the same timeframe. However, post-pandemic, while subscriber numbers continued to rise, call option prices exhibited a decline, underscoring shifting investor sentiments as societies transitioned to a new norm. This research contributes valuable insights into the intricate interplay between global events, entertainment consumption, and investment landscapes. It validates the applicability of option pricing models in understanding pandemic-induced market fluctuations. As financial markets grapple with ongoing changes, the study's implications underscore the profound and adaptable nature of investment behaviors.

Keywords: COVID-19, Netflix, Call Option Pricing, Black-Scholes Model.

1. Introduction

In the dynamic landscape of financial markets, the interplay between external events and option pricing has always been a subject of intense scrutiny. The outbreak of the COVID-19 pandemic in late 2019 introduced unprecedented volatility and uncertainty [1], causing ripple effects across various sectors [2], including the entertainment industry. One company that garnered significant attention during this period was Netflix, a global streaming service. This paper delves into the relationship between the call option prices of Netflix and the influence exerted by the COVID-19 pandemic, employing the widely recognized Black-Scholes model to analyze and interpret the complex dynamics at play. The idea of option isn't novel. Instead, it can trace back to ancient Greek where mathematician and philosopher Thales of Miletus buying the right to use several olives presses the following spring during the off-season. However, the option pricing model became widely used until the 1970s, when economists Fischer Black and Myron Scholes invents the Black-Scholes formula.

The COVID-19 pandemic sent shockwaves through global economies, reshaping consumer behavior, business strategies, and financial markets. With lockdowns and social distancing measures in place, traditional modes of entertainment were disrupted, leading to a surge in demand for online streaming platforms. Netflix, as a prominent player in this sector, experienced both heightened interest and increased scrutiny from investors and market analysts.

There is many research focus on the influence of Covid-19 on the Netflix corporation, like the change in consumer behavior [3], social trend [4], and technology progress [5]. However, merely a few research analyze Covid-19 impact to the Netflix's financial situation and performance in the market, which represent investors' future expectation and confidence on Netflix company. Therefore, this paper seeks to contribute to the existing literature by focusing on the Netflix call option prices and investigating how they responded to the evolving pandemic landscape.

The primary objective of this study is to elucidate the relationship between Netflix call option prices and the influence of the COVID-19 pandemic. The author hypothesizes that the option prices, specifically call options, were subjected to substantial fluctuations in response to market sentiment shifts triggered by pandemic-related news, regulatory changes, and economic indicators. During the "during Covid" period, the call option price would peak, given the widespread encouragement for people to remain indoors, potentially making Netflix a prime avenue for entertainment. To analyze this relationship quantitatively, the research employs the Black-Scholes model, a fundamental tool in option pricing theory.

This study contributes to the field in several meaningful ways. It offers an empirical lens through which the impact of the pandemic on option pricing can be comprehended. By systematically dissecting Netflix call option prices across distinct temporal phases, the research not only unveils the unique responses of investors to the pandemic's various stages but also provides insight into how extraordinary global events can influence investment sentiments and asset valuations. The study empirically examines the connection between entertainment consumption and investment behaviors. By demonstrating the correlation between heightened subscriber counts and call option performance during the pandemic, the research underscores the profound influence of societal trends on financial market dynamics. The findings extend beyond the pandemic context, providing valuable insights into the market's post-pandemic trajectory. With shifting investor sentiments and evolving investment preferences, the research provides a glimpse into how markets adapt to the new economic realities that follow exceptional events. This knowledge holds relevance for investors, policymakers, and researchers navigating the complexities of transitioning from pandemic-induced dynamics to a new norm.

2. Data and Method

The examination of COVID-19's profound impact on Netflix's stock trajectory entails a meticulous analysis structured around distinct temporal stages: the pre-pandemic phase, characterized by the interval spanning from October 1, 2019, to November 1, 2019; the pandemic phase, which encapsulates the period from October 1, 2020, to November 1, 2020, marked by a surge in infection cases and the absence of accessible COVID-19 vaccines; and the post-pandemic phase, extending from October 1, 2022, to November 1, 2022, representing a stage subsequent to the pandemic's zenith, where a consistent weekly confirmed death count of around 2500 prevailed. The strategic selection of identical months across different years serves as a critical methodological safeguard, effectively neutralizing potential distortions arising from holiday-related effects that could skew subscriber behavior and thereby influence the company's profit margins.

To unravel the intricate dynamics between pandemic phases and Netflix's stock performance, this study leverages Google Spreadsheet functions to acquire historical close prices for Netflix across these pivotal periods. Specifically, the function `"=GOOGLEFINANCE ("NFLX", "price", DATE (2019,8,1), DATE (2019,11,1), "DAILY")"` is employed for the "before Covid" timeframe, while the function `"=GOOGLEFINANCE ("NFLX", "price", DATE (2020,8,1), DATE (2020,11,1), "DAILY")"` and `"=GOOGLEFINANCE ("NFLX", "price", DATE (2020,8,1), DATE (2020,11,1), "DAILY")"` are utilized for the "during Covid" and "after Covid" phases, respectively. By calculating intraday returns as the difference between the current stock price and the previous day's stock price divided by the previous day's stock price and subtracted by 1, a nuanced understanding of Netflix's price movements is gained.

Within this analytical framework, volatility emerges as a pivotal indicator of market behavior. Utilizing the `"=STDEV.S"` function, the volatility is calculated from the intraday returns. Given the three-month span of the analysis, the annual volatility is derived by multiplying the square root of 4. As for the risk-free interest rate, this study grounds itself in the three-month government Treasury bill rate, which stands at approximately 5.3% at July 28th [6]. Notably, the assumption of the strike price

being equal to the current stock price is pivotal, as it aligns with the standard principles of option pricing.

Armed with these essential variables, the Black-Scholes formula takes center stage, enabling the computation of call option prices [7]. The formula $C = S \times N(d1) - Ke^{(-rT)} \times N(d2)$ is executed to derive the call option price, where $d1 = \frac{\ln\frac{S}{K} + (r + \frac{\sigma^2}{2})t}{\sigma\sqrt{t}}$, and $d2 = d1 - \sigma\sqrt{t}$. This sophisticated modeling approach empowers the research to quantitatively unravel the intricate relationships between Netflix's stock performance, pandemic stages, and option pricing [8].

In essence, this intricate methodology underscores the meticulousness with which this study approaches the multifaceted task of disentangling the multifarious ways in which the COVID-19 pandemic has exerted its influence on Netflix's stock performance. The combination of strategic timeframes, comprehensive data acquisition, and sophisticated analytical tools empowers a thorough comprehension of how various pandemic stages have catalyzed distinct financial trajectories.

3. Results

3.1. The Calculated Call Option Price Before Covid

Table 1 shows the calculated Netflix call option price before Covid under Black-Scholes Model. The calculated Netflix stock volatility stands at approximately 0.02195. The annual volatility for the year 2019 is estimated at around 0.0438. The values of d1 and d2 are computed as 0.0725 and 0.0286, respectively. The cumulative probabilities N(d1) and N(d2) are found to be approximately 0.5289 and 0.5114. Consequently, the calculated Netflix call option price for this period is approximately \$12.6131.

Table 1. The Calculated Call Option Price Before Covid

Calculated Call Option Price Before Covid	
Volatility	0.0219
Annual Volatility	0.0438
Stock Price	287.41
Strike Price	287.41
Maturity Time	1
Interest Rate	5.30%
Black-Scholes Model	
d1	0.0725
d2	0.0286
N(d1)	0.5289
N(d2)	0.5114
Price	12.6131

3.2. The Calculated Call Option Price During Covid

Table 2 shows the results for the "during Covid" phase, the calculated Netflix stock volatility is approximately 0.0303, while the annual volatility for 2020 is evaluated at around 0.06075. The values of d1 and d2 are computed as 0.04139 and -0.01937, respectively. The cumulative probabilities N(d1) and N(d2) are determined to be approximately 0.5165 and 0.4923. Accordingly, the calculated Netflix call option price for this period is approximately \$23.62.

Table 2. The Calculated Call Option Price Before Covid

Calculated Call Option Price During Covid	
Volatility	0.0304
Annual Volatility	0.0608
Stock Price	475.74
Strike Price	475.74
Maturity Time	1
Interest Rate	5.30%
Black-Scholes Model	
d1	0.0414
d2	-0.0194
N(d1)	0.5165
N(d2)	0.4923
Price	23.6174

3.3. The Calculated Call Option Price After Covid

Table 3 shows the results for the period "after Covid", the calculated Netflix stock volatility is approximately 0.0370, with an annual volatility of about 0.0740 for the year 2022. The values of d1 and d2 are calculated as 0.0441 and -0.0300, respectively. The cumulative probabilities N(d1) and N(d2) are approximately 0.5178 and 0.4881. The calculated Netflix call option price for this post-Covid period is approximately \$15.97.

Table 3. The Calculated Call Option Price After Covid

Calculated Call Option Price After Covid	
Volatility	0.0370
Annual Volatility	0.0740
Stock Price	291.88
Strike Price	291.88
Maturity Time	1
Interest Rate	5.30%
Black-Scholes Model	
d1	0.0441
d2	-0.0300
N(d1)	0.5178
N(d2)	0.4881
Price	15.97

4. Discussion

The evaluation of the impact of COVID-19 on Netflix's stock delves into a meticulous scrutiny of modifications in European call option prices across three distinct temporal phases: pre-pandemic, pandemic, and post-pandemic. This investigative approach, characterized by segmenting the study into these well-defined time frames, facilitates an exhaustive exploration of the multifaceted ways in which COVID-19 has shaped Netflix's stock performance.

The results of this comprehensive analysis are in alignment with the initial predictions, corroborating the hypothesis that the European call option price would manifest its highest value during the pandemic, specifically reaching a peak at \$23.62. This pronounced surge during the pandemic period can be attributed to a myriad of factors. Notably, the widespread stay-at-home directives and increased leisure time likely drove higher demand for Netflix's streaming services, leading to a surge in investor confidence and corresponding call option values.

Interestingly, the post-pandemic period registers the second-highest call option price, reflecting the evolving dynamics of consumer behavior. As societies transitioned beyond the pandemic's peak,

a discernible shift towards integrating Netflix as a reliable source of entertainment became evident. The steady increase in annual subscribers from 2019 to 2022 (151.56 million, 192.95 million, and 220.06 million, respectively) accentuates this trend. The notable surge in subscribers during 2020 aligns with the exceptional performance of call options during the same period, affirming the research prediction.

However, it is noteworthy that the subsequent years exhibit a decoupling between subscriber growth and call option performance. Despite sustaining a robust increase in both annual subscribers and revenue between 2020 and 2022, the call option price exhibits a decline. This divergence could be attributed to several factors. Post-pandemic, as societies gradually regained a sense of normalcy, the initial urgency to seek in-home entertainment might have waned. The decline in investor confidence could also stem from a recalibration of expectations as markets adjusted to a fluctuating landscape. Furthermore, in the research named Financial Analysis of Netflix Platform at the Time of Covid-10 Pandemic by Dr. Josko Lozic, the analysis of Netflix financial position and numbers of users show both show stable increase [9], which is consistent with the conclusion above. However, this research points out that the user growth has not changed significantly in the Covid 19 pandemic. The stability may also be the reason that investors lose confidence on the Netflix's ability to obtain excess return.

The robust positive correlation between subscriber growth and call option performance during the pandemic underscores the profound influence of COVID-19 on investor behavior and market sentiment. These findings collectively underline the nuanced interplay between market dynamics and external events, such as a pandemic, on investment decisions. As it is pointed out by Professor Sara Leroi-Werelds, external events can affect status quo of industries and strategic dimensions of value proposition dynamics. As societies navigate post-pandemic realities, the data suggests a reevaluation of investment confidence, providing valuable insights into the evolving relationship between a streaming giant's popularity and its financial performance [10].

5. Conclusion

In conclusion, this study has ventured into the intricate interplay between the call option prices of Netflix and the sway of the COVID-19 pandemic, employing the potent analytical tool of the Black-Scholes model. The insights gleaned from this investigation have unveiled the profound ways in which external events, particularly the pandemic's diverse stages, can reshape investment behaviors and asset valuations.

The results have illuminated the profound ways in which COVID-19 has reverberated across Netflix's stock performance and option prices. By segmenting the study into three pivotal time periods, we managed to capture the ebbs and flows of investor behavior in response to the shifting pandemic landscape. The peak call option price during the pandemic, mirroring heightened investor interest as individuals sought refuge in Netflix's offerings during lockdowns, underscores the intimate connection between entertainment consumption and investment enthusiasm.

Moreover, the post-pandemic landscape unveiled an intriguing twist: while subscriber numbers continued to swell, the call option price exhibited a decline. This divergence signifies a nuanced shift in market sentiments post-pandemic, with investor confidence potentially recalibrating as the novelty of lockdown-driven entertainment waned. Such dynamic responses underscore the intricate dance between societal contexts, investment dynamics, and stock pricing.

However, there are several limitations in this paper. A primary limitation lies in the relatively short time span considered for analysis. While the selected temporal stages capture critical phases of the pandemic's progression, they may not encompass the full spectrum of its impact. Additionally, relying solely on the Black-Scholes model, while a robust framework, does entail certain assumptions that might not fully account for all nuances of the dynamic financial landscape, which is needed to be further discussed in the future study.

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