

How the Real Option Reduces Risks in Producing Film Sequels

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Abstract. The film industry history can be traced back to the late eighteenth century when people began to realize the necessity of entertainment. After years of development, more and more people start to pay for watching films, which generates a tempting revenue for the film industry and further helps the industry attract more investment. To handle the risk of investment, signing an option contract and using real options can help investors make decisions more rationally. In this paper, the author will focus on using option theories to reduce risks by purchasing sequel rights. It provides a sample of reducing risks for investment in the film industry and arbitrage from undervalued sequel rights, which can be imitated in similar conditions.

Keywords: Arbitrage; Risk management; Binomial Trees; Black Scholes Model; Film Industry

1. Introduction

Looking back to the development history of the film industry, we have to start from the origin of the entertainment industry. In the late eighteenth century, most people enjoy their entertainment in a haphazard way, like meeting a roadside entertainer or visited by a traveling showman [1]. At that time, there are not many legitimate theatres. During the nineteenth century, countries began to liberalize and deregulate their entertainment industries, including the film industry we will mainly focus on in this article. At the end of the nineteenth century, the world experiences the second industrial revolution, which results in rising in disposable income and free time. The demand for entertainment industries is unprecedented and it drives the development of entertainment. In the twentieth century, billions of tickets were sold to people who were attracted by the shows in the theatre each year. In Italy, today hardly significant in international entertainment, the film industry was the fourth-largest export industry before the First World War. In the depression-struck U.S., the film industry was the tenth most profitable industry, and in 1930s France it was the fastest-growing industry, followed by paper and electricity, while in Britain the number of cinema-tickets sold rose to almost one billion a year [1]. At the turn of the century, the production ability of the entertainment industry was fully realized which makes the entertainment industry experience incremental growth.

From the history of the entertainment industry, we may find out many factors pushing the development of the industry, however, capital is one of the most critical factors that we cannot neglect. How does the capital flow into the entertainment market? There are many investment miracles in the film industry.

Table 1. Some high worldwide gross and return films comparing to their budget [2]

Year	Movie	Budget	Worldwide Gross	% Return*
1980	Mad Max	\$200,000	\$99,750,000	24,837
2004	Super Size Me	\$65,000	\$29,529,368	22,614
2009	Paranormal Activity	\$450,000	\$196,681,656	21,854
1999	The Blair With Project	\$600,000	\$248,300,000	20,591
1993	El Mariachi	\$7,000	\$2,041,928	14,485
1968	Night of the Living Dead	\$114,000	\$30,000,000	13,058
1976	Rocky	\$1,000,000	\$225,000,000	11,150
1978	Halloween	\$325,000	\$70,000,000	10,669
1973	American Graffiti	\$777,000	\$140,000,000	8,909
1994	Clerks	\$27,000	\$3,894,240	7,111
2007	Once	\$150,000	\$18,997,174	6,232

1969	The Stewardesses	\$200,000	\$25,000,000	6,150
2004	Napoleon Dynamite	\$400,000	\$46,140,956	5,667
2004	Open Water	\$500,000	\$52,116,982	5,411
1980	Friday the 13th	\$550,000	\$59,754,601	5,332
1939	Gone with the Wind	\$3,900,000	\$390,525,192	4,906
1915	The Birth of a Nation	\$110,000	\$11,000,000	4,900
1925	The Big Parade	\$245,000	\$22,000,000	4,389
2004	Saw	\$1,200,000	\$103,096,345	4,195
2004	Primer	\$7,000	\$565,846	3,941

Table 2. Some high profit and return on investment films comparing to their budget [2]

Year	Movie	Budget	Approx. Profit	Return on Investment*
2009	Paranormal Activity	\$450,000	\$89,347,044	19,755%
2012	The Devil Inside	\$1,000,000	\$37,350,397	3,635%
1953	Peter Pan	\$4,000,000	\$39,799,743	3,395%
1978	Grease	\$6,000,000	\$184,125,978	2,969%
2010	Paranormal Activity 2	\$3,000,000	\$77,209,483	2,474%
2011	Insidious	\$1,500,000	\$34,210,170	2,181%
1974	Young Frankenstein	\$2,800,000	\$57,468,108	1,952%
1946	It's a Wonderful Life	\$3,180,000	\$60,305,658	1,796%
1992	Reservoir Dogs	\$1,200,000	\$22,605,251	1,784%
1975	Jaws	\$12,000,000	\$221,250,638	1,744%
2014	Annabelle	\$6,500,000	\$97,529,180	1,400%
1991	Beauty and the Beast	\$20,000,000	\$284,279,692	1,321%
2014	God's Not Dead	\$2,000,000	\$28,195,931	1,310%
2010	The King's Speech	\$15,000,000	\$196,319,594	1,209%
2012	Magic Mike	\$7,000,000	\$88,586,945	1,166%
2014	The Fault in Our Stars	\$12,000,000	\$145,103,986	1,109%
2013	The Purge	\$3,000,000	\$35,869,963	1,096%
2008	Slumdog Millionaire	\$14,000,000	\$163,105,371	1,065%
2010	Black Swan	\$13,000,000	\$148,267,614	1,041%
2009	The Hangover	\$35,000,000	\$380,383,238	987%

*The percentage returns figures are estimates. They are based on the assumption that 50% of the box office receipts were returned to the distributors by the theatres. These figures are based on theatre ticket sales only. They do not include earnings from other revenue sources such as DVDs, video, VOD, TV licensing, etc.

From table 1 and table 2, we notice that some popular films can be very profitable and their return rate is very tempting compared to the initial investment and budget. Despite the data, some breaking news also shows the film industry is an ideal investment target. For example, the success of Mexican movies reported as The Mexican Wave – “a country that rewrote the script for what a Spanish-language film can supposedly gross at the North American box office when Instructions Not Included took \$44.5m north of its border – and another \$55m from countries elsewhere [2].”

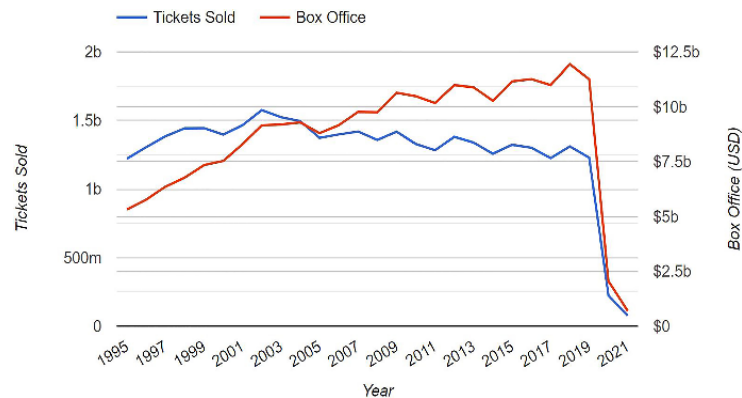


Fig. 1. Statistics of ticket sold and box office from 1995-2021 [3]

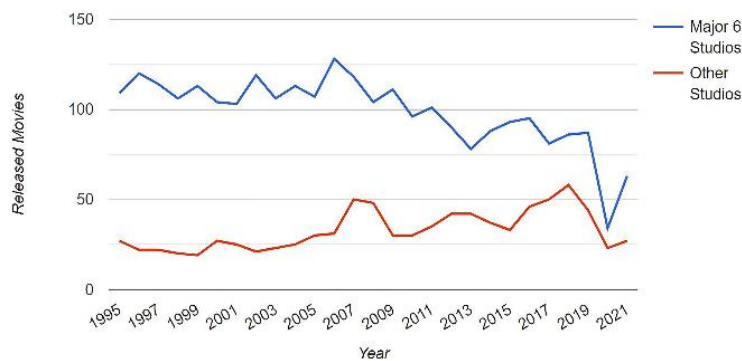


Fig. 2. Numbers of Major six studios and other studios released films from 1995-2021

From figure 1 and figure 2, we notice that even though the number of sold tickets is decreasing, the box office revenue is still increase in the normal years. This may indicate the price of each ticket increase in recent years. Besides, the released films in major studios have a trend of decrease and the released film in other studios have a trend of increment, which indicates that the film industry is heading for an equilibrium. What's more, we notice that all three factors- tickets sold, box office and released films suffer “a cliff-like drop” in 2020. COVID-19 has totally upended the revenue streams that Hollywood could once depend on [4]. As theatres can not fully reopen and draw film fans, studios have to find other ways to release their movies and recoup investments and independent filmmakers face increased budgets to meet new safety protocols. During the pandemic, on-location filming in the L.A. region produced just 18,993 shoot days in 2020, down 48 % from 36,540 shoots days in 2019 — the lowest level in over 25 years. And feature films showed the biggest decline, with just 1,641 shoot days in 2020, down 56% from the previous year [5]. It reminds us to invest in the film industry has many risks under the tempting returns. The author thinks there are five types of risks: Market Risk, Liquidity Risk, Credit Risk, Concentration Risk, Horizon Risk. Without a hedging strategy, the loss in investment cannot be imagined if the investors encounter an unpleasant time. For example, the anticipated film *Mulan* was supposed to catapult to fame. Because of the pandemic, it mainly focused on the online market. To cover their initial investment, the Disney+ platform asked a high price for its ticket from members who have already pay for their membership, which makes this film controversial [6][7]. COVID-19 is a black-swan event, however, there is still uncertainty when we start up a business, like invest in the film industry. How can we handle the risk? Using real options seems a way out of the problem.

Real options analysis (ROA) has been identified in the literature as a quantitative means to evaluate the flexibility inherent in the decision-making process [8][9]. Historical articles show when we consider venture investment projects, we should pay attention to the mixed characteristics of timing and abandonment. Taking the time value of capital, the uncertainty of investment returns and the combination of strategies into consideration, we can use the binomial trees to construct a model of maximizing the net present value [10]. Specifically, a real option allows decision-makers to postpone

further expenditure commitment until a substantial portion of the uncertainty surrounding the investment has been resolved [11]. This model can also evaluate the value of the investment opportunity and can be seen as the operation gist for investors to make rational decisions. Dimitrakopoulos and Sabour [12] utilized ROV and NPV to evaluate an actual Australian gold mine project. They found that the ROV method could improve the return by 11–18% compared to NPV. In this paper, we tried to evaluate the film's risk in the above methods.

This paper concentrates on reducing risks by using real options in the film industry. As figure 1 and figure 2 suggested, we notice that even under the unexpected condition, the six main studios release more films than other studios and it recover back faster in 2021. In that case, the six main studios are the ideal target comparing to other studios. Therefore, this paper will mainly focus on the data of six main studios. Existing articles mainly focus on option pricing and venture investment in financial assets. However, using real options theories to reduce risks in the film industry has hardly be examined. In this paper, the author used the traditional NPV method, Binomial Trees, Binomial Trees with real options and the Black-Scholes model to estimate the value of the sequel rights. The conclusion is that the third method- binomial trees with real options are the best representation of the sequel rights' value for its accuracy and relatively high net present value. It is surprising that the market prices of sequel rights quoted by most studios are lower than the prices they should have. Therefore, we can draw the conclusion that there is an opportunity to arbitrage from the difference in valuation. And we can manage the investment risks by entering option contracts.

The remainder of the paper is organized as follows: Section 2 describes the question we face when investing in the film industry; Section 3 performs the four methods the author used to estimate the value of the sequel rights; Section 4 analyze the results got from section 3 as well as the advantages and disadvantages of the methods; Section 5 introduces some related thoughts when investing the sequel rights. The last session presents my conclusion.

2. Question description

In 1992, Mr. David was asked to start a business- Arundel partners. This company aimed to invest in the film industry by purchasing sequel rights. Arundel partners purchase sequel rights in one or more major U.S. movie studios without artistic judgments or selection. The price of each sequel right normally deals at \$2 million because studios need cash to start up their producing process and the price is tempting for them. Besides, Arundel partners clinch a deal of all sequel rights of the chosen studio before the first films begin to make. This method ensures Arundel Partner that neither of them has the information advantages of films [13].

Table 3 descriptively show the statistics of U.S. Theater Rentals, Other Revenue, Distribution Fees, Distribution Expense, Negative Cost, PV of Net Inflows at Year 1, PV of Negative Cost at Year 0, One-Year Return for the First Films by Six Major Studios (in millions of 1991 \$).

Table 3. Descriptive Statistics of the First Films' performance in the film industry

	Min.	Max.	Mean	S. D.
U.S. Theater Rentals	0.00	165.60	14.88	22.91
Other Revenue	12.70	414.20	48.79	55.54
Distribution Fees	3.40	154.50	16.95	20.90
Distribution Expense	0.80	102.00	17.42	15.29
Negative Cost	2.20	60.40	17.65	10.34
PV of Net Inflows at Year 1	1.30	311.50	27.68	41.41
PV of Negative Cost at Year 0	2.20	59.10	17.27	10.12
One-Year Return	-0.91	12.24	0.67	2.07

Table 4 descriptively show the statistics of U.S. Theater Rentals, Other Revenue, Distribution Fees, Distribution Expense, Negative Cost, PV of Net Inflows at Year 1, PV of Negative Cost at Year 0, One-Year Return for the Hypothetical Sequel by Six Major Studios (in millions of 1991 \$).

Table 4. Descriptive Statistics of the hypothetical sequels' performance in the film industry

	Min.	Max.	Mean	S. D.
U.S. Theater Rentals	0.00	115.90	10.42	16.04
Other Revenue	12.70	293.70	37.97	38.87
Distribution Fees	3.40	109.20	12.86	14.64
Distribution Expense	7.80	82.30	14.49	10.31
Negative Cost	2.60	72.50	21.15	12.41
PV of Net Inflows at Year 4	1.10	229.10	21.57	31.54
PV of Negative Cost at Year 3	2.80	77.60	22.64	13.29
One-Year Return	-0.94	6.48	-0.08	1.21

From the statistical data and estimated data, we can see the negative cost of sequels is 120% of the first film and the rentals are 70% of the first film. This is an empirical law in the film industry.

There is no doubt that investing in the sequel rights has risks. The film industry is a risky business since it is very hard to ensure the film you released is associated with the moviegoers' tastes and predicting the success of anyone film was extremely difficult. Therefore, using real option can give you choices as to whether or not to produce sequels. The performance of the first film is in the statistical data and we can calculate the performance of hypothetical sequels before we decide to produce a sequel or not. This waits and sees strategy is fantastic because it offers us options to decide and avoid certain losses comparing to producing sequels blindly. Avoiding certain losses can raise the net present value as well as adding value to the investment opportunity. As the empirical data suggested, studios think a \$2 million cash investment is tempting. To simplify the model, we take \$2 million as our initial investment.

Table 5. The U.S. theater rentals and other revenue

Studios	Statistical Indicators	Min.	Max.	Mean	S. D.
MAC UNIVERSAL	U.S. Theater Rentals	4.60	55.00	22.58	14.54
	Other Revenue	23.90	146.10	67.46	35.26
	Distribution Fees	7.60	53.60	23.96	13.27
	Distribution Expense	9.50	43.10	23.76	9.53
	Negative Cost	6.60	34.10	17.36	7.56
	PV of Net Inflows at Year 1	6.90	100.10	40.11	26.43
	PV of Negative Cost at Year 0	6.50	33.30	16.97	7.39
	One-Year Return	-0.46	3.65	1.44	1.31
PARAMOUNT PICTURES	U.S. Theater Rentals	0.00	36.30	13.92	13.78
	Other Revenue	12.70	100.80	46.48	33.39

	Distribution Fees	3.40	36.50	16.09	12.56
	Distribution Expense	0.80	41.70	18.72	12.85
	Negative Cost	8.80	33.00	19.25	8.59
	PV of Net Inflows at Year 1	2.10	55.40	23.97	21.82
	PV of Negative Cost at Year 0	8.60	32.30	18.83	8.41
	One-Year Return	-0.91	3.45	0.43	1.41
	U.S. Theater Rentals	0.00	75.80	8.71	16.12
	Other Revenue	12.70	196.50	33.81	39.07
	Distribution Fees	3.40	72.60	11.32	14.70
	Distribution Expense	0.80	51.70	12.65	11.11
SONY PICTURES ENTERTAINMENT	Negative Cost	2.20	57.10	17.53	9.91
	PV of Net Inflows at Year 1	1.60	142.30	17.40	29.11
	PV of Negative Cost at Year 0	2.20	55.90	17.16	9.70
	One-Year Return	-0.90	12.24	0.28	2.36
	U.S. Theater Rentals	4.40	80.00	24.35	24.40
	Other Revenue	23.40	206.70	71.73	59.17
	Distribution Fees	7.40	76.40	25.58	22.28
	Distribution Expense	10.40	58.60	24.71	15.76
	Negative Cost	7.70	24.20	18.06	4.77
	PV of Net Inflows at Year 1	7.80	145.50	43.46	43.95
THE WALT DISNEY COMPANY	PV of Negative Cost at Year 0	7.50	23.70	17.67	4.68
	One-Year Return	-0.47	5.15	1.19	1.82
	U.S. Theater Rentals	0.00	45.60	11.52	14.59
	Other Revenue	12.70	123.20	40.63	35.36
	Distribution Fees	3.40	44.90	13.87	13.29
TWENTIETH CENTURY FOX					

	Distribution Expense	1.40	39.10	15.7 5	12.0 4
	Negative Cost	4.40	49.40	17.0 9	12.0 5
	PV of Net Inflows at Year 1	1.30	80.80	21.1 0	24.1 3
	PV of Negative Cost at Year 0	4.30	48.40	16.7 3	11.8 0
	One-Year Return	- 0.90	2.01	0.24	0.98
	U.S. Theater Rentals	0.00	165.6 0	16.7 3	38.6 2
	Other Revenue	12.7 0	414.2 0	53.2 8	93.6 3
	Distribution Fees	3.40	154.5 0	18.6 5	35.2 4
	Distribution Expense	0.80	102.0 0	16.9 6	23.7 8
WARNER BROTHERS	Negative Cost	4.40	60.40	17.3 0	15.2 8
	PV of Net Inflows at Year 1	3.80	311.5 0	32.7 1	71.3 1
	PV of Negative Cost at Year 0	4.30	59.10	16.9 3	14.9 6
	One-Year Return	- 0.80	10.76	0.84	2.74

To estimate the performance, we consider the standard deviation, maximum, mean and one-year return of each studio. From the standard deviation, we can find out each studio has different stability in its film production and exhibition. From table 5, we notice that the maximum of U.S. theater rentals and other revenue both comes from WARNER BROTHERS. However, when considering the average of U.S. theater rentals and other revenue, MAC UNIVERSAL and THE WALT DISNEY COMPANY perform better. In that case, if the investors prefer more risks and returns, they may invest in WARNER BROTHERS for its tempting return. Otherwise, he may invest in MAC UNIVERSAL or THE WALT DISNEY for their relative high rentals and stability. After calculating the one-year return, we conclude that MAC UNIVERSAL ranks first, THE WALT DISNEY COMPANY ranks second and WARNER BROTHERS ranks third. All of their one-year returns are higher than the industry's average one-year return of 0.67, which suggests these three main studios performing better in the film producing industry.

3. Methods

To estimate the value of sequel rights, this paper uses four ways- the traditional NPV approach; binomial trees, binomial trees with real option and Black-Scholes model with real option. There are two hypotheses in all of the methods:

- 1) All sequels should be purchased before the first film begin to make.
- 2) All or most of the film from the chosen studios should be purchased and they cannot negotiate film by films.

3.1 Traditional NPV Approach

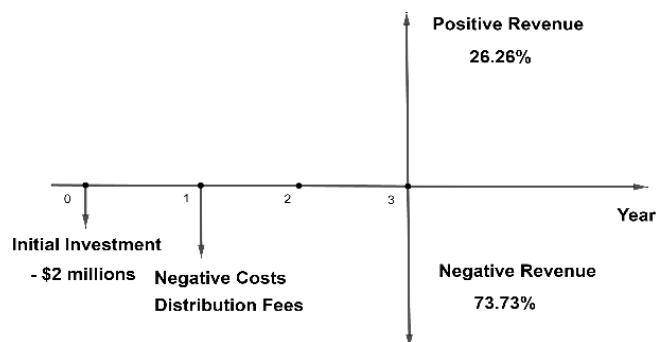


Fig. 3. Cash flows of using the traditional NPV method

The traditional net present value (NPV) approach to the valuation of capital investment projects is to calculate the expected present value of future cash flows and then subtract the present value of the cost of investment. From figure 3, the author lists the processes of cash flows. At year 0, investors have an initial investment to studios, which is \$2 million in this paper. When studios begin to film the movies, they have negative costs and distribution fees for the first film. And if they produce a sequel at year 3 blindly, they may have 26.26% to have a positive return and 73.73% to have a negative return. In this paper, we use empirical data in the 1990s- inflation rate at 1.5% semiannually and negative costs discounted rate at 6% semiannually. Thus, the annual negative costs discount rate is 12.36%. We can use the following formula (1) to calculate the present value of earnings. From the appendix table 1, we can find out the average PV of new inflows at year 4 is \$21.6 million.

$$PV = \frac{C}{(1+r)^n} \quad (1)$$

In the following passage, we calculating the average net profit of producing a sequel. Since the annual discount rate is 12.36% and we know that the average PV of new inflows at Year 4 is \$6 million so that the 4 years yield is \$13.54 million. The average PV of negative cost at Year 3 is \$22.6 million, discounted by 3 years yield is \$15.92 million. Taking the difference yields -2.38 million in NPV.

3.2 Binomial Trees Method

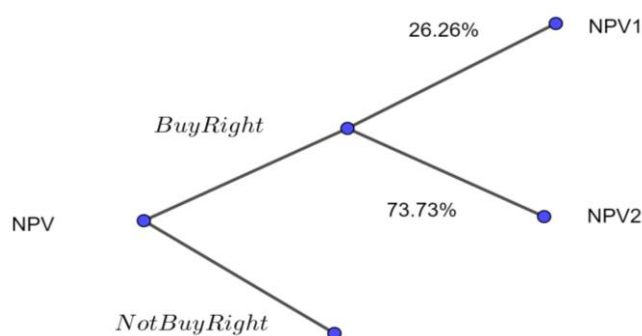


Fig. 4. Binomial trees without real options

In the second method, we can use the binomial trees method to calculate the net present value of the sequel right. To generate the net present value (NPV in Figure 1), we have to buy the sequel right. Based on the risk-neutral theory, we will have the NPV 1 if the film sequels go popular and we will have the NPV 2 if the film performs not as expected. From historical data, we find out 26.26% we can have a positive return and 73.73% we may lose money if we blindly produce a sequel. As the formula (2) suggested, we can calculate the net present value. The risk-free interest rate in the 1990s, we choose 8%. The time step is 3 years. The probability of gain or loss is p , which we take a positive

return as p equal to 26.26%. NPV 1 is the f_u and NPV 2 is the f_d . We can calculate them from the historical data. The 26 films have positive returns with a total NPV of \$482.72 million. Therefore, each positive return film's yield is f_u equal to \$18.57 million. Similarly, the negative returns with a total NPV of \$-723.54 million and f_d are \$-9.91 million.

$$f = e^{-r\Delta t}[pf_u + (1 - p)f_d] \quad (2)$$

As the formula (2) suggested, we can figure out the net present value using binomial trees is \$-2.43 million, if we do not take real option into consideration.

3.3 Binomial Trees with Real Options

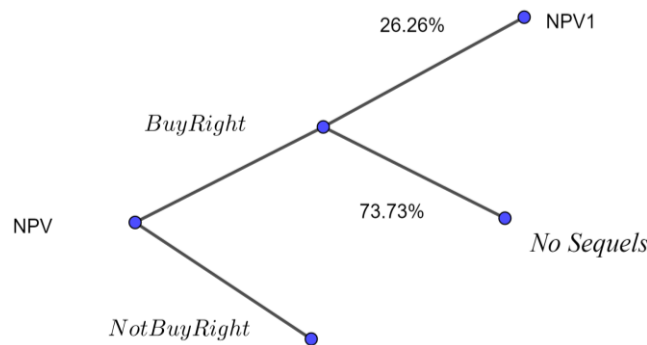


Fig. 5. Binomial trees with real options

The third method we took to estimate is the binomial trees with real options. Similar to the second method, we have the right to decide whether or not to film the sequels. Taking real options theories into consideration, we can quit if we know producing a sequel will be a loss after calculation [14]. In that case, we can avoid a certain loss rate of 73.73%, which will promote the NPV and increase the value of the investment opportunity. As formula (2) suggested, we can figure out the net present value is \$ 4.88 million, which is remarkably higher than the second method.

3.4 Black-Scholes Model with Real Options

$$c = S_0 N(d_1) - K e^{-rT} N(d_2) \quad (3)$$

$$d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} \quad (4)$$

$$d_2 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} \quad (5)$$

Buying sequel rights can be seen as buying an American call option [15]. Black-Scholes Model is one of the most effective and accurate ways to calculate the option price. And variables in the sequels project are similar to the variables in the Black-Scholes Model. The volatility of the stock price is corresponding to the standard deviation; the present stock price is corresponding to the present value of all the sequels; the strike price is the average negative cost of making a sequel; the lifetime of the option is three years after the first film released and the interest rate is the risk-free interest rate in the 1990s. From historical data, we find out the σ standard deviation is 0.69, the S_0 is \$ 13.55 million, the strike price is \$ 22.6 million, the time step is three years and the risk-free interest rate is 8%. As the formula (3) (4) (5) suggested, we can figure out the value of sequel rights is \$5.09 million.

Table 6. Comparison of Factors in Traditional Call Option and Sequel Rights

	Traditional call options	Sequel rights
σ	Volatility of stock price	Standard deviation
S_0	Present stock price	Present value of the portfolio
K	Strike price	Average negative cost
r	Risk-free interest rate	Risk-free interest rate
T	Lifetime of the option	Three years after the first film

4. Results

We summarized the results in Table 6. In the first two methods, we find that the NPV (net present value) is negative, which seems we cannot exercise to make money. However, when we add the real option ideology into this problem, we find out that the NPV can cover the initial investment (\$2 million) and become positive. Even though different methods can generate different net present values. We can regardless of the slight difference between the first two methods and the last two methods. Therefore, the first conclusion is adding the real options into the investment of sequel rights can significantly increase the net present value because the option allows us to quit. Besides, the Black-Scholes model is n-steps binomial trees. When seeking the limit of n-steps binomial trees, the outcome is the same as the Black-Scholes Model. Thus, whether we use the third or fourth method depends on the former films' performances and how many sequels we would like to produce.

Table 7. Results of Four Different Methods

Methods	Returns
Traditional NPV	\$-2.38 million
Binomial Trees	\$-2.43 million
Binomial Trees with real option	\$4.88 million
Black-Scholes Model with real option	\$5.09 million

In summary, the author embraces the view that the third method is the best way to estimate the value of the sequel rights for the following reasons. Firstly, the traditional NPV method and the first binomial trees method do not consider the real options. Even though they can provide the value of the sequel rights, it underestimates the worth of this option. To quit at any time can help investors avoid a certain loss and elevate the net present value of the sequel rights. Therefore, considering the real options is more suitable in valuing the sequel rights. Secondly, the binomial tree method with the real option is better than the Black-Scholes model for its accuracy. In general, using the Black-Scholes model to calculate the option price is more accurate because the Black-Scholes formula can be seen as the unlimited steps on binomial trees. However, in the setting of this paper, the binomial tree method with real options seems a better way. Whether we will produce a sequel depends on the performance of the first film and the number of sequels almost impossible to reach unlimited. Thus, the Black-Scholes model may overvalue the worth of the sequel rights. These two factors determine that using two steps binomial trees is the best choice.

5. Discussion

All of the four methods have two common advantages: 1) The hypothetical sequel data could make valuation reliable; 2) Using the average performance of six major studios can offer us an intuition of the film industry's performance. Two disadvantages are: 1) Some studios may not accord with the assumption that the sequel film negative costs will become 120% and revenues will become 70% compared to the first film; 2) Some outliers should be excluded when calculating the net present value. For the four methods we use, we take all historical data into consideration. However, if we want to figure out the performance of the industry and whether it is worth for investment, we may focus more

on the general performance. Some outliers are random event, which may affect the result of valuation and should be excluded for precise calculation.

Besides, there may have some problems when investing in the film industry. Firstly, there exists asymmetric information. Arundel may be cheated by studios for their film production process and quality, which may lead to a higher quote. To tackle this issue, Arundel should carry out careful background investigations to achieve information symmetry with studios. Besides, they should make sure they sign the contracts with studios before none of the first films begins to make and buy all sequel rights without negotiating film by film. Secondly, Moral Hazard may happen because the studios have already led their profits. Moral Hazard refers to an entity that will increase its exposure to risk to maximize its utility because it does not bear the full cost of that risk. Once the contracts were signed, studios may lower their quality of production and exhibition since their profits were fixed. The method to deal with this is to make their sequels' performance and revenues related to their revenues. For example, we can use option-like derivatives to trigger their enthusiasm.

6. Conclusion

The film industry has developed very well in the past decades, which makes it attract more and more investment. However, this investment can be really risky since it is very hard to predict the moviegoers' taste. To reduce the risks in investment, the author suggests that investors can sign an option contract and using real options to help estimate the value of their investment target. In this paper, we established four different evaluation models. Using the binomial tree method and the Black-Scholes model with the real options, we can estimate the value of sequel rights with accuracy and even find out an opportunity to arbitrage.

From the four different methods, we get four results: Traditional NPV yields \$-2.38 million, Binomial Trees yields \$-2.43 million, Binomial Trees with real option yields \$4.88 million and Black-Scholes Model with real option yields \$5.09 million. Consider accuracy and high returns, the author embraces the view that the binomial tree method with real options is the best way to estimate the sequel rights.

Using investment in the sequel rights as an example, this paper illustrates how can we use option contract and real options to reduce risk or even arbitrage from the undervalued projects. However, we have some limitation in this study. The specific performance of each studio and different investment methods are not taken into consideration.

Various crucial aspects will be investigated in my future works, such as the usage of the option contract, real options theories in other investment methods and how can we make our calculation more accurately when there exists an undervalued investment target.

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