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Comparison Between Option Pricing model and Discounted Cash Flow model: A study Case of Electronic Arts Company

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Abstract:

This paper is a comparative analysis of the Discounted Cash Flow (DCF) model and the binomial option pricing model of Electronic Arts company as a case study. The DCF model will be used to determine the intrinsic value of the firm based on financial and market data obtained through public sources. The value of a call option in the stock of the company within a short period is assessed using the binomial model. These findings indicate that the DCF model gives a firm value of about 36.6 billion USD whereas the binomial model gives an option value of about 14.6 USD. The reason behind this immense difference is the inherent differences in model structure and objectives of valuation. The DCF model is a deterministic and linear model, and the binomial model is a stochastic model with volatility and a convex payoff structure. Further discussion shows that the DCF model is better applied in estimating long-term intrinsic value. The results identify the complementary nature of the two strategies and propose a possibility of having a more in-depth picture of firm value, which might be more relevant in the high uncertainty and innovation industry.

Keywords: Discounted cash flow; Binomial option pricing model; Cox ross rubinstein; Firm valuation; Electronic arts.

1. Introduction

Valuation is one of the keys but debated issues in contemporary finance, especially in the setting where the uncertainty, innovation, and swiftly shifting market expectations are the norm. Although the Discounted Cash Flow (DCF) model remains a prevailing framework in estimating intrinsic firm value, more and more research has been cast doubt on the capacity of this framework to fully reflect the uncertainty, strategic flexibility, and non-linear growth opportunities inherent in firms [1]. Concurrently, option-based valuation models have also received a new wave of interest, because they directly incorporate volatility and asymmetric payoffs, thus providing a radically different interpretation of value in the

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context of uncertainty [2]. This has led to the emergence of a brewing tension between intrinsic valuation systems and market-based pricing systems which casts questions on their comparability as well as the interpretation of their results [3].

Recent literature has not just passed on the level of presenting these approaches as competing alternatives but has emphasized their conceptual divergence. Specifically, it has been argued that DCF-based valuations can understate the value of a firm systematically when future opportunities are option-like in nature, particularly in high-uncertainty settings [4]. On the other hand, option pricing models, though analytically strong in terms of volatility and contingent claims, are partial in nature, since they price a particular claim, but not all the firm value [5]. This means that the differences between the two approaches are not only quantitative differences, but actually difference in the very nature of the valuation objects and mathematical structures.

It is based on this observation that the current paper claims that the DCF model and the binomial option pricing model cannot be judged on the basis of numerical consistency, but rather they can be judged on the basis of the dimensions of value that the models are constructed to represent. The paper uses Electronic Arts (EA) as a case study to implement a comparative analysis of the two models in the framework of a single dataset. The point is not to agree on their valuation outcomes, but to show that their divergence does have a theoretical foundation and has economic significance. In this way, the study helps to gain a better understanding of the valuation results under uncertainty conditions.

The rest of this paper is organized in the following way. In section 2, the methodology of the two models is presented. Section 3 provides the empirical findings. Section 4 covers the implication and limitations. Section 5 concludes.

2. Methodology

2.1 DCF model

Discounted Cash Flow (DCF) Model is a basic valuation methodology in finance to estimate the intrinsic value of a company, asset or investment project [6]. As opposed to the Binomial Tree Model and the Black-Scholes Model of option pricing, which consider contingent claims in the face of uncertainty, the DCF model values are calculated using the present value of the anticipated future cash flows.

The main concept of the DCF model can be defined as follows. The value of an asset is the present value of all the future cash flows of the asset.

The DCF model has a number of assumptions: Firstly, future free cash flows (FCF) are estimable with a reasonable level of accuracy using historical data and projection of growth. Second, there is a discount rate, which is usually the Weighted Average Cost of Capital (WACC), which indicates the riskiness of the investment. Third, the present cash flows are more valuable than future cash flows, which should be discounted. Fourth, the company is presumed to last forever, especially regarding estimation of the terminal value.

Through the DCF model, it is assumed that the DCF model is based on the principle of discounting the present value.

Let FCF_t denotes the free cash flow at time t, r denotes the discount rate (WACC) and T denotes the forecast horizon. Then, the firm value V_0 is given by

$$V_0 = \sum_{t=1}^{T} \frac{FCF_t}{(1+r)^t} + \frac{TV}{(1+r)^T} \tag{1}$$

where TV denotes the terminal value, representing the value beyond the forecast horizon.

Terminal value needs to be included since firms are supposed to be going on endlessly. Through the application of the Gordon Growth Model to obtain the terminal value

$$TV = \frac{FCF_{T+1}}{r-g} \tag{2}$$

where g is the long-term growth rate. Lastly, one can obtain free cash flow, or the cash that is earned by the company and may be distributed to investors

$$FCF = EBIT \times (1 - \text{TaxRate}) + \text{Depreciation} - \text{CapEx} - \Delta\text{WorkingCapital} \tag{3}$$

2.2 Binomial Options Pricing model

Binomial Options Pricing model is a pricing model used to value options that are binomial. Assume the existing stock price is $S_0 = S$. In one length of time, the stock may only take two possible values:

$$S_u = Su, S_d = Sd \tag{4}$$

where $u > 1$ is the up-factor and $0 < d < 1$ is the down-factor which will be discussed in the latter part [7].

Suppose a derivative (e.g. option) has time-payoffs that are

$$c_u = c(S_u), c_d = c(S_d) \tag{5}$$

This paper aims to determine its no-arbitrage price c_0 at time 0. There are two assumptions used to construct the binomial option pricing model.

The first is replication: either create a portfolio of stock

and cash, which replicates the derivative payoff. A portfolio consists of long Δ shares of stock and short 1 unit of the derivative. Today its value is then $\Pi_0 = \Delta S - c_0$.
At time Δt, the portfolio values are

$$\Pi_u = \Delta S_u - c_u, \Pi_d = \Delta S_d - c_d \tag{6}$$

Choose Δ so that the portfolio is riskless, i.e. $\Pi_u = \Pi_d$. The hedge ratio (delta) is calculated as:

$$\Delta = \frac{c_u - c_d}{S_u - S_d} = \frac{c_u - c_d}{S(u-d)} \tag{7}$$

The above choice makes the portfolio payoff equal in all states and therefore riskless. No-arbitrage, its present value is its discounted future value:

$$\Pi_0 = e_u^{\{-r\Delta t\}\Pi} = e_d^{\{-r\Delta t\}\Pi} \tag{1}$$

Replacing $\Pi_0 = \Delta S - c_0$ and $\Pi_u = \Delta S_u - c_u$, then reshuffling the expressions. It becomes presented in the usual risk-neutral pricing expression $c_0 = e^{\{-r\Delta t\}(pc_u + (1-p)c_d)}$ where $p = \frac{e^{r\Delta t} - d}{u - d}$. The parameter p is the risk neutral probability of an upward movement. It is not the probability in the real world; it is selected such that the discounted stock price is a martingale:

$$\mathbb{E}^Q[S\Delta t\ddot{}OS_0 = S] = pS_u + (1-p)S_d = Se^{r\Delta t} \tag{9}$$

Second, No-arbitrage: the risk-free rate r should be obtained by any riskless payoff. This paper needs to make sure $0 < p < 1$ (no arbitrage). At this point, it uses the backward induction to establish Multi-step Binomial Tree. Let $T = N\Delta t$. In an N -step recombining binomial tree, after i steps with j up moves, the stock price is

$$S_{i,j} = S_0 u^j d^{i-j}, i = 0,1,\ldots,N, j = 0,1,\ldots,i. \tag{10}$$

For a European call option with strike K, $c_{N,j} = max(S_{N,j} - K, 0)$. In the case of a European put option, $c_{N,j} = max(K - S_{N,j}, 0)$. Inverting $i = N-1,\ldots,0$ to obtain the price of the option today $(c_{0,0})$.

$$c_{i,j} = e^{-r\Delta t}\left(pc_{i+1,j+1} + (1-p)c_{i+1,j}\right). \tag{11}$$

In the case of American options, the best course of action can be early exercise. Define intrinsic value as Call: $\phi_{i,j} = max(S_{i,j} - K, 0)$ and Put: $\phi_{i,j} = max(K - S_{i,j}, 0)$.
The value of each node is then the value of each node

$$c_{i,j} = max\left(\phi_{i,j}, e^{-r\Delta t}\left(pc_{i+1,j+1} + (1-p)c_{i+1,j}\right)\right) \tag{12}$$

One of the most popular specifications is Cox-Ross-Rubinstein (CRR)

$$u = e^{\sigma\sqrt{\Delta t}}, d = e^{-\sigma\sqrt{\Delta t}} = \frac{1}{u} \tag{13}$$

where σ is volatility. The result of this choice gives a recombining tree and approaches to Black-Scholes as $N \to \infty$. From a continuous-time viewpoint (Black–Scholes), if S_t follows a diffusion model, then the return term satisfies

$$\frac{dS_t}{S_t} = \mu dt + \sigma dW_t. \tag{14}$$

So, σ controls the instantaneous variability of returns. Equivalently, one may interpret σ as an annualized standard deviation of returns [8].

3. Results

3.1 Data description

This study uses financial data of Electronic Arts (EA) as of 17:59 Beijing Time, March 27, 2026, with the financial base date December 31, 2025. Data sources include Yahoo Finance, Investing.com, SEC filings, and corporate reports. Currency is USD. As shown in Table 1, DCF model parameters include FCF, risk-free rate, beta, market return, interest expense, debt, equity, firm value, and growth rate. Table 2 presents inputs for the binomial option pricing model: current stock price, strike price, risk-free rate, volatility, time to maturity, and steps.

Table 1. DCF Model Input Parameters

Parameter	Meaning	Data	Data Source
FCF	Free cash flow	2.21B	Yahoo Finance
R_f	Risk-free interest rate	4.19%	U.S. Department of the Treasury
β	Systematic risk (beta)	0.75	Yahoo Finance
R_m	Market return	10.20%	S&P 500
Interest Expense	Interest payments on debt	57000M	Yahoo Finance

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Parameter	Meaning	Data	Data Source
Total Debt	Total outstanding debt	0.62B	Yahoo Finance
E	Market value of equity	51.11B	Yahoo Finance
Enterprise Value V	Total firm value	51.80B	Yahoo Finance
g	Long-term growth rate	2.5%	World Bank

Table 2. Binomial Option Pricing Input Parameters

Parameter	Meaning	Data	Data Source
S_0	Current stock price	202.34	Yahoo Finance
K	Strike price	205	Yahoo Finance
r	Risk-free rate	4.44%	U.S. Treasury
σ	Volatility	0.241396	Yahoo Finance
T	Time to maturity	0.5	Assumption
N	Number of steps	500	Model assumption

3.2 DCF valuation

According to the information presented in Section 3.1, the Discounted Cash Flow (DCF) model is utilized to determine the intrinsic value of the firm.

To begin with, the Capital Asset Pricing Model (CAPM) is used to calculate the discount rate. At a risk-free rate of 4.19%, a beta of 0.75 and a market return of 10.20%, the cost of equity (as a proxy of WACC) is:

$$r = 4.19\% + 0.75 \times (10.20\% - 4.19\%) \approx 8.70\% \quad (15)$$

Free cash flow (FCF) will be estimated next within 5 years. With the current FCF of 2.21 billion USD and the growth rate of 2.5% in the long term, future cash flows are projected using a constant growth rate.

The derived discount rate is then used to discount all the projected cash flows to present value. Also, a terminal value is determined using the Gordon Growth Model which assumes perpetual growth of 2.5%. The total firm value can be obtained by adding the discounted terminal value and the sum of the present value of the projected cash flows:

$$DCFFirmValue \approx 36.6 billionUSD \quad (16)$$

This value is the intrinsic value of the firm, calculated by the cash generating capacity in the long term.

3.3 Binomial valuation

To supplement the DCF method, binomial option pricing model is used to assess the worth of a call option of the Electronic Arts stock.

The Cox-Ross-Rubinstein (CRR) model is used to model stock price in 500-time steps, a 0.5-year horizon. The parameter value is a current stock price of 202.34 USD, a strike price of 205 USD, risk-free rate of 4.44 percent, and a volatility of 0.241396.

Up and down factors are determined in terms of volatility and risk-neutral probability is obtained in order to guarantee non-arbitrage. The recombining binomial tree is built and backward induction is used to calculate the option value at each node.

The payoff at maturity $max(S - K, 0)$ is established to be the value of a European call option. The price of the option is then determined by discounting the future payoffs that are expected under the risk-neutral measure.

The value of the option obtained is:

$$CallOptionPrice \approx 14.6USD \quad (17)$$

It is essential to mention that this outcome does not reflect the value of the firm. Rather, it is the worth of a conditional claim to the stock price which reflects the possible positive gain in a short-term horizon in case of uncertainty.

3.4 Evaluation

This is very different from the time horizons of DCF model as compared to the binomial option pricing model. The DCF model is long term in nature and normally forecasts cash flows over a number of years whereas the binomial model is short term and is time to option maturity. This is the main distinction between derivative pricing and firm valuation.

In addition, the discrepancy between the DCF valuation (36.6 billion USD) and the market capitalization (51.11 billion USD) indicates the difference between intrinsic value and market price. The DCF model is based on the conservative assumptions of growth and discount rates whereas the market provides the investor expectations and the growth opportunities and intangible assets that are hard to capture under a cash flow model.

This is an indication that the market can reflect better future growth or strategic potential than the DCF valuation does [9].

The fact that the company estimation based on DCF (36.6B) is not similar to the one provided (51.11B) could be due to the assumption of $g = 2.5$ being conservative. As long as the market considers it a high value leading to an increase in the Market Cap.

Besides, the CAPM-based discount rate (around 8.7%) can be greater than the market-implied rate. An increase in discount rate decreases the present value of the cash flows in the future hence decreasing the DCF valuation. Conversely, when the investors believe that the firm is less risky, then they can use a lower required return, and this raises the market valuation.

4. Discussion of the Methods

4.1 Comparison

The mathematical formulation and the input data used in the Discounted Cash Flow (DCF) model and the binomial option pricing model can be compared in detail to have a comprehensive comparison of the two models.

As a part of the DCF model, the value of firms is calculated by discounting future cash flows:

$$V = \sum_{t=1}^{n} \frac{FCF_t}{(1+r)^t} + \frac{TV}{(1+r)^n} \quad (18)$$

Where $\left(TV = \frac{FCF_n(1+g)}{r-g}\right)$. According to the data in Section 3.1, the model utilises a free cash flow of 2.21 billion USD, long-term growth rate of 2.5%, and discount rate calculated by CAPM. These contributions create a company worth about 36.6 billion USD. This model is deterministic in its structure because future cash flows would be projected in one direction, which is expected.

The binomial option pricing model, on the contrary, is founded on a stochastic process where the stock price will be developed as per:

$$S_{t+1} = S_t \cdot u \text{or} S_t \cdot d \quad (19)$$

where $\left(u = e^{\sigma\sqrt{\Delta t}}\right)$ and $\left(d = \frac{1}{u}\right)$. The value of the option is obtained by backward-induction using the risk-neutral probability $p = \frac{e^{r\Delta t} - d}{u - d}$, and terminal payoff is defined as $C = max(S_T - K, 0)$.

Based on the data in Section 3.1, the model takes current stock price of 202.34 USD, a strike price of 205 USD, a volatility of 0.241396, a risk-free rate of 4.44%, a maturity of 0.5 years and 500-time steps. This gives a value of option of about 14.6 USD. As opposed to the DCF model, this framework takes into account the various potential future price paths and therefore it is inherently stochastic.

The mathematical structure makes the difference in data requirement. The DCF model uses accounting-based inputs as its main sources of information, such as: the free cash flow, growth rate and discount rate, which are obtained based on financial statements and macroeconomic assumptions. Conversely, the binomial model is based on variables in the market like the stock price, volatility, and risk-free rate, which are real-time market expectations.

Additionally, the uncertainty role is also considerably different. The DCF model implicitly incorporates risk in the discount rate, and volatility is not explicitly included in the valuation. By contrast, in the binomial model, σ directly affects the up and down factors and therefore the dispersion of possible outcomes. Because of the convex payoff curve, the greater the volatility, the greater the option value, as it increases the possibility of gain but does not equally raise the risk of loss [10].

Lastly, time has contrary functions in the two models. The present value is discounted in the DCF model with an increase in the time horizon. The longer the time to maturity, the higher the value of the option in the binomial model as it increases the number of potential states in the future, and the value of uncertainty.

4.2 Shortcomings

Based on the above results, the difference in the DCF valuation and the binomial option pricing value can be explained further through a modeling perspective. The DCF model summarizes all future uncertainty in a single direction of expected cash flow where the major variables, including the growth rate (2.5%) and discount rate (about 8.7%) completely define the outcome of the valuation. This form means that the possibility of any change in the actual future performance relative to the supposed one is not directly modelled but rather absorbed into these fixed parameters. Consequently, the DCF estimate 36.6 billion USD represents a smooth and averaged representation of the firm value [11,12].

Conversely, binomial model explicitly projects future uncertainty as a distribution of possible stock price paths using the parameters $u = e^{\sigma\sqrt{\Delta t}}$, and $d = 1/u$, as well as the risk-neutral probability p [13]. With a volatility of

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0.241396 and 500-time steps over a 0.5-year horizon, the model generates a wide range of potential outcomes, but only values the payoff defined by $max(S_T - K, 0)$. This results in a valuation of 14.6 USD that only represents the upside aspect of the equity value and truncates the downside risk at zero. As a consequence, the binomial outcome is not the overall firm value, but the optionality value of short-term price fluctuations [14].

The difference between the two outcomes shows a paramount limitation of the direct comparison of these models. The DCF methodology is a generalization of long-term expected cash flows into one present value whereas the binomial model separates and prices state-contingent results as a result of volatility and time. Thus, the quantitative difference between 36.6 billion USD and 14.6 USD is not just a difference in magnitude, a manifestation of quite different objects of valuation and mathematical structures. This indicates that the question of the role of uncertainty should be approached to make a meaningful comparison, but not the absolute size of the results.

1. Conclusion

In the valuation of Electronic Arts, this paper presents a comparative analysis of DCF model and the binomial option pricing model. Using the two approaches to the same dataset, the paper has pointed out the underlying differences in the logic of the valuation, data inputs and the outcome. The DCF model is a model of the firm value that is computed through projecting free cash flows and is discounted at a constant rate, which gives approximation of 36.6 billion USD. This method represents the inherent worth of the company in a deterministic context, in which the future performance will be described in a single expected trajectory. By contrast, the binomial model provides an option value of about 14.6 USD as the stock price is modeled as a stochastic process that can have multiple states in the future. The methodology values the contingent claim, and not the firm itself.

The comparison of the two models proves that they differ not only in terms of numerical assumptions, but in terms of their mathematical structures they differ. The DCF model is linear and does not explicitly model volatility whereas the binomial model models the existence of stochastic dynamics, convex payoffs structures, and a specific role of uncertainty. Volatility is beneficial in the option framework because it increases the value of the option because of asymmetric payoff, but it does not affect the DCF model directly. Equally, time decreases value in DCF by discounting and adds value in the option model by widening the scope of possible results. These results indicate that the DCF model is more appropriately used to reflect the basic value of the company in terms of its anticipated cash-generating capability, whereas the binomial model is more appropriately used to examine risk, adaptability, and upside potential. This is particularly applicable in industries where the results are very unpredictable and asymmetric in terms of rewards, e.g., gaming.

Nevertheless, the two models are limited. The DCF model is strongly dependent on the assumptions about the growth and discount rates, which can be underestimating the worth of the intangible assets and opportunities in the future. The binomial model, conversely, emphasizes short-term contingent claims, and it directly does not give a measure of overall firm value. Thus, not either of the methods can be used to represent the full valuation of a company. Finally, the findings determine the complementary characteristics of the two models. Although DCF gives a point of reference of intrinsic value, option pricing models can also give further information on the value of uncertainty and real options within the firm. These two perspectives should be taken into account in a complete valuation to reflect the complexity of the real-world financial decision-making.

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