

Unicorn Valuation Model Application: An Analysis of Multinational Internet Companies with ByteDance as an Example

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Abstract. The rapid development of the internet has led to the rise of multinational internet unicorn companies, attracting significant attention from both domestic and international markets. As a result, identifying an appropriate valuation method has become a critical challenge. However, traditional valuation methods cannot always be used on these companies properly due to their relatively short operational history, limited financial disclosures, and the domination of intangible assets. To solve these problems, this study applies an improved Discounted Equity Value Analysis (DEVA) valuation model, incorporating market penetration rates and industry-related coefficients to enhance the accuracy of valuations. Given that ByteDance currently holds the highest valuation among unicorns worldwide, operates on a global scale, and holds a relatively comprehensive disclosure mechanism, it serves as a highly representative case among unicorns. Consequently, this study selects ByteDance as the research subject, ultimately estimating its valuation in 2023 at \$225.3 billion. This figure closely aligns with the \$268 billion buyback valuation reported by Sina Finance. Thus, the improved DEVA valuation model provides a new perspective for assessing the valuation of internet unicorn companies.

1 Introduction

Nowadays, with the help of the rapid advancement of information technology, exemplified by the internet, the international community is becoming closer together. A shared future is now formed with nations getting closer. Non-traditional multinational corporations represented by high-tech industries, such as the Internet, are experiencing rapid growth due to their asset-light business models and global scalability. These companies are now playing a crucial role in reshaping and transforming the international political and economic order [1]. In recent years, a large number of multinational Internet enterprises have emerged in domestic and foreign markets, such as ByteDance, Shein, and Ant Group. Their rapid rise and immense potential have quickly drawn widespread global attention. Collectively, such companies are referred to as "unicorn companies."

The concept of a "unicorn" was introduced in 2013 by Aileen Lee, a venture capitalist at Cowboy Ventures in the United States. It specifically refers to emerging companies that have

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been established for no more than ten years and have reached a valuation exceeding \$1 billion [2]. These companies often exhibit complex business models, rapid growth, and a high degree of uncertainty, all of which pose significant challenges to their valuation. For example, in the case of ByteDance, an innovation-driven company, its valuation involves a complex process of balancing future potential with current performance. In addition, it also requires carefully selecting and integrating multiple valuation methods. Accurately valuing unicorn companies is crucial, as it directly impacts the decision-making of investors and corporate managers and influences capital market confidence and support for high-growth enterprises as well. Unfortunately, traditional valuation methods are not suitable for unicorn companies anymore, and no research has pointed out the most universally applicable valuation methodology [3].

Given that ByteDance holds the highest valuation among unicorns globally, operates across multiple international markets, and represents a highly typical case within this category, this study aims to apply an improved Discounted Equity Value Analysis (DEVA) model to assess its valuation. The objective is to determine whether this valuation method can be universally applied to unicorn companies.

The following content of this paper will first review relevant literature to find out the key challenges in valuing unicorn companies. Then, an introduction about the origins and limitations of the traditional DEVA valuation model will be shown before presenting improvements to enhance its applicability. Finally, an empirical analysis will be conducted to estimate ByteDance's valuation for 2023, followed by an error analysis, leading to the conclusions.

2 The difficulties of unicorn valuation

When valuing companies, investment banking analysts typically rely on traditional valuation methods such as the income, market, and cost approaches. These methods are generally sufficient to provide a reasonable valuation for common companies. However, due to the following unique characteristics of unicorn enterprises, these conventional methods often prove inadequate.

Firstly, unicorn companies are usually in their early stages of growth, with relatively short operational histories. Their profitability models and business paths are often not yet fully defined. Although their revenue levels may be low, they demonstrate significant market growth potential [4]. In such cases, traditional valuation methods—such as the price-to-earnings (P/E) ratio—are difficult to apply directly, as they typically depend on stable profitability.

Secondly, when analysts employ income-based valuation methods, such as the discounted cash flow (DCF) approach, they first forecast the company's future free cash flows (FCF) and then apply an appropriate discount rate (r) to calculate the present value, ultimately determining the company's overall value. However, this method is typically suited for mature, publicly listed companies with robust information disclosures. The main reason why the DCF model is not applicable to unicorn companies is that it relies on the assumption of stable cash flows. Whereas unicorn companies are generally in their growth phase, with a high dependency on innovation and significant investments in product development. This often results in unstable cash flows, which may even be negative [5]. Additionally, such companies frequently have incomplete financial data disclosures, making it even more challenging to predict future cash flows accurately [6]. As a result, the DCF model is not suitable for valuing unicorn companies.

Finally, compared with traditional businesses, unicorns often exhibit an asset-light model. Their core value mainly comes from intangible assets such as user base size, brand influence, technological patents, and innovation capabilities [5]. However, these intangible assets are difficult to quantify precisely in valuation models, and their limited disclosure further

complicates the process, increasing both complexity and subjective judgment in valuations. Moreover, these unique characteristics of unicorn companies make them less comparable to other companies, making market-based valuation methods, such as the comparable company analysis (CCA), less effective. This is because the CCA method estimates a company's value by comparing it with publicly listed companies that have similar business models, market conditions, and financial statuses. However, for unicorn companies that have not been listed, their market positioning, business scale, and technological innovations are likely to be very different from other companies [7]. Therefore, these distinctive characteristics of unicorn companies often hinder meaningful comparisons, limiting the applicability of the method.

Given these challenges, it is evident that traditional valuation methods are no longer suitable for analyzing unicorn companies. Therefore, exploring valuation models that align with the specific characteristics of unicorn companies is of paramount importance.

Given the challenges associated with valuing unicorn companies, this study attempts to conduct a valuation analysis using the improved DEVA model. This is because the DEVA model is a dynamic valuation framework. By incorporating user numbers, it better captures the rapid growth potential and market changes inherent in unicorn companies. Furthermore, the DEVA model does not rely on financial data and places importance on intangible assets such as user value. This makes it particularly suitable for internet-based unicorns like ByteDance, which are user-driven, have incomplete financial disclosures, and primarily rely on intangible assets [8, 9]. Additionally, this greatly reduces the uncertainty stemming from financial data in the traditional DCF model. Moreover, compared to the CCA model, although it is challenging to find similar comparable companies, the DEVA model can still improve its applicability and accuracy by reasonably introducing relevant parameters. Therefore, the DEVA model is well-suited for analysing internet unicorn companies.

3 Methodology

3.1 DEVA valuation model

In 1993, during the period of rapid internet development, renowned American economist George Gilder introduced one of the most representative network effect laws of today's society—Metcalf's Law. This law states that the value of a network is proportional to the square of the number of users within it [10]. The law is named after Robert Metcalfe, the inventor of Ethernet, to honor his contributions to the field of the internet. The formula for Metcalfe's Law is:

$$V = K \times N^2 \quad (1)$$

V represents the theoretical value of the network, K is the value coefficient, and N is the number of users. Metcalfe's Law reveals the positive externality of networks [8], meaning that every additional user increases the utility of all other users, including existing ones. This not only causes the value of the network to grow exponentially but also significantly widens the gap between emerging and established internet companies, making it more difficult for the former to catch up with the latter. This undeniably exacerbates the Matthew Effect.

Based on this theory, former Chief Analyst at Morgan Stanley, Mary M, proposed the application of this formula to estimate the value of companies in The Internet Report (1996) and introduced the well-known DEVA model [9]. The formula for the DEVA model is:

$$E = M \times C^2 \quad (2)$$

E represents the economic value of the company being valued, M is the initial capital invested per user, and C represents the value created by users.

3.2 Improved DEVA valuation model

3.2.1 Improvement based on Zipf's law

Based on the theory of diminishing marginal returns, when other conditions remain unchanged, the additional output generated by increasing a particular factor of production will decrease, eventually approaching zero. In other words, each additional network user brings less and less value. This contradicts the assumption in the DEVA model that the value of a company continuously increases with the number of users. As a result, many scholars and experts have made improvements to the DEVA model based on Zipf's Law [9]. Zipf's Law states that there is an inverse relationship between the contribution of a single user, f_r , and their rank, r . According to Zipf's Law, if a network has n users, the contribution of the n -th user to the network is $f_r = 1/n$. This means that the majority of the contribution comes from a few users, while the contribution of users at the tail end is relatively small. Therefore, the additional utility generated by the n -th user is $1 + 1/2 + 1/3 + \dots + 1/(n-1) = \ln(n)$. Simplifying this, it can be concluded that the total utility generated by n users is $n \times \ln(n)$ [11]. Thus, the DEVA model can be adjusted to:

$$E = M \times C \times \ln(C) \quad (3)$$

E represents the economic value of the company being valued, M is the initial capital invested per user, and C is the value created by the users.

3.2.2 Determining the initial capital invested per user

To determine the initial capital invested per user, the cost of customer acquisition can be calculated. i.e., the marketing expenses divided by the number of new users acquired. However, for unlisted companies or those with no public financial data disclosure, this figure is difficult to obtain. Therefore, for unlisted companies, particularly unicorn enterprises, an alternative approach can be used.

In general, at the early stage of the establishment of a company, the initial capital invested is fixed. As a result, the initial capital per user can be determined by dividing the company's registered capital by the number of registered users. However, with the continuous expansion of the scale of companies and the increasing amount of financing, the cost paid by companies is far more than the number of registered capital. To make the data more convincing, many analysts use the total capital raised by the company divided by the total number of users to find out the final result, and so do this study.

3.2.3 Determining the value created by users

In Internet companies, their main earning is users' consumption, with active users being the primary consumer group. This is because active users tend to develop brand loyalty, trust the company, and enjoy the services provided, which makes them more willing to spend for it. Therefore, the total value created by users, C , can be obtained by multiplying the value created by a single user, C_0 , by the monthly active users (MAU), where C_0 can be replaced by average revenue per user (ARPU). Hence, the formula can be obtained:

$$C_0 = \text{Company's Sales} / \text{Total Number of Users} \quad (4)$$

3.2.4 Introducing market penetration rates and industry-related coefficients

In the traditional DEVA model, only two factors influencing company value are considered, which is insufficient. For internet unicorns, they are in the golden age of development, with continuous expansion in their scale. However, according to the theory of diminishing marginal returns, as the market is gradually saturated, the increase of the company's market penetration means the narrowing of its development space. Therefore, it is necessary to adjust the future growth expectations of the company based on its market penetration rate. To address this, this paper introduces the market penetration rate P and industry-related coefficient I in the evaluation of internet unicorns to provide a more flexible and accurate valuation. Hence, the modified DEVA model is as follows:

$$E = M \times (ARPU \times MAU) \times \ln(ARPU \times MAU) \times P \times I \quad (5)$$

4 Case study

4.1 Introduction of ByteDance

Established in 2012, ByteDance is a global internet company driven by technology. In 2019, it was recognized as the most valuable startup in the world [12]. As of January 1, 2024, ByteDance once again claimed the top spot on the Hurun Global Unicorn List 2024, with a valuation of 1.56 trillion RMB, maintaining its position as the world's most valuable unicorn for three consecutive years. The company's core business model revolves around content distribution, short-video social networking, and information aggregation, with key products such as Douyin, Jinri Toutiao, and the international version of TikTok. Thanks to its leading artificial intelligence algorithms, ByteDance has excelled in delivering precise content recommendations and maintaining high levels of user engagement, establishing a strong global presence. Its revenue primarily comes from advertising, while it has also diversified into areas such as content creation, e-commerce, and cloud services. Though ByteDance benefits from the monetization capabilities of its high-traffic platforms, it also faces challenges such as heavy investment in research and development and exposure to policy risks in international markets.

One reason for choosing ByteDance as this case study is because of its representation as a highest-valued unicorn. Besides, due to its vast user base and relatively transparent information disclosure, it can help provide substantial data for assessing the applicability of valuation methods as well.

4.2 Valuation analysis

According to the business model of ByteDance, its core value comes from its vast user base and efficient user engagement. Since the DEVA model can effectively capture the relationship between user growth and the economic value of the platform, it is reasonable to use this model to evaluate ByteDance.

As of December 31, 2023, according to known public data, ByteDance has 6 rounds of financing in total, as shown in Table 1.

Table 1. ByteDance's financing situation.

Time	Financing amount	Series	Investor
2012.7.1	\$1 million	A	SIG Asia Investments
2013.9.1	\$10 million	B	DST Global, Qihoo 360 Technology Co. Ltd
2014.6.1	\$100 million	C	HongShan, Sina Weibo Fund, Shunwei Capital Partners GP Limited
2016.12.30	\$1 billion	D	HongShan, CCB International
2017.8.1	\$2 billion	E	General Atlantic
2018.10.20	\$4 billion	Pre-IPO	SoftBank Vision Fund, KKR, Primavera Capital Group, Yunfeng Financial Group Limited, General Atlantic

According to Wallstreetcn, ByteDance reached 1.8 billion *MAU* in 2023, with the majority of its users being young adults aged 18 to 34 and demonstrating strong user engagement. Therefore, it is assumed that *MAU* accounts for 70% of the total user base. Based on this, the initial capital invested per user, *M*, can be calculated using Formula (1), which results in 2.76. According to Sina Finance, ByteDance's total revenue in 2023 reached \$120 billion, with nearly all of it coming from advertising. Using Formula (4), the value created by a single user, *C*₀, is calculated as \$46.7. Furthermore, since ByteDance's primary revenue is generated from the global internet market, its market penetration rate can be approximated by the proportion of its advertising revenue relative to global ad revenue. According to MEGNA's global advertising revenue forecast, global ad revenues were about \$853 billion in 2023. Therefore, ByteDance's market penetration rate for 2023 is calculated as: $P=1200/8530=0.141=14.1\%$. Thus, using Formula (5), ByteDance's estimated enterprise value for 2023 is:

$$E = 2.67 \times 8.406 \times 1010 \times 25.2 \times 0.141 \times I \quad (6)$$

Meta and ByteDance both have vast user bases worldwide and primarily rely on advertising as their revenue model. Moreover, both companies compete in the social media and short-video space, especially when it comes to attracting younger users and data-driven content recommendations. Additionally, as a publicly listed internet giant, Meta has a robust information disclosure system. Therefore, selecting Meta as a comparable company to ByteDance is reasonable, allowing for the calculation of the industry-related coefficient *I* using Meta's data. According to Meta's 2023 annual report, its enterprise value, *E*, is \$884.72 billion, with an *ARPU*, or *C*₀, of \$44.6. Its *MAU* stands at 3.07 billion, and its advertising revenue is \$103 billion. From this, Meta's market penetration rate for 2023 can be calculated as 12.1%. Given that Meta, as the industry leader, has a strong user base and brand loyalty, it is assumed that 70% of its *MAU* constitutes the total number of users. This gives a total user count of 4.39 billion. According to Meta's disclosed early-stage financing data, it raised \$32.3 billion, which results in an *M*-value of 7.37. Substituting these values into Formula (5) yields, solving for *I*, which is 0.283.

Finally, substituting $I = 0.283$ into Equation (6) gives the estimated value of ByteDance for 2023 as 225.3 billion USD.

5 Bias analysis

The valuation obtained in this study (\$225.3 billion) is lower than the unofficial buyback valuation of ByteDance reported by Sina Finance in December 2023, which was \$268 billion. The discrepancy between the calculated and actual values is approximately 16%, falling within the acceptable error range (20%). Possible reasons for this discrepancy include: Firstly, the data used for ByteDance in this study is sourced from online platforms, and financial platforms may introduce estimation biases. Secondly, there is a lack of comprehensive data on ByteDance, and some values had to be substituted with figures from comparable companies. However, differences in scale, user numbers, and revenue models among companies may lead to discrepancies in valuation. Thirdly, the financing data for ByteDance available in this study only goes up until 2018. According to reports, the company raised additional funds between 2018 and 2023, but no actual data was released, which resulted in a lower calculated value for the initial capital invested per user, M . Fourthly, Meta's primary business includes more than just advertising, and its diversified development goals may prevent the company from fully focusing on expanding its share of the global advertising market. As a result, using its share of global ad revenue as a proxy for market penetration may have inflated the value, leading to a lower industry-related coefficient I . Fifthly, this study uses only one comparable company (Meta), which may limit the accuracy of the industry-related coefficient and lead to an overly simplified analysis. Finally, there may be an overestimation of Meta's user stickiness, leading to a higher assumption of the proportion of monthly active users to total users. This would result in an inflated M -value for Meta, causing the calculated I to be lower.

6 Conclusion

This study uses an improved DEVA model to estimate the enterprise value of ByteDance, a leading unicorn company. By introducing two correction factors, market penetration rate and industry-related coefficient, the model's accuracy in forecasting the value of unicorn companies was enhanced. Although the valuation result of \$225.3 billion is slightly lower than the \$268 billion valuation disclosed by authoritative media (Sina Finance), it still validates the applicability of the DEVA model for unicorn company valuations. However, this study only introduced two factors to modify the DEVA model, which limits the scope of correction, making it challenging to fully reflect the complexity of the company. Furthermore, limitations in the available data, such as incomplete financing history and user statistics of ByteDance, may result in valuation discrepancies. Additionally, the choice of a single comparable company (Meta) to calculate the industry-related coefficient may have led to oversimplifying the assumptions of the model, thereby affecting the reliability of the valuation.

Future experiments could improve the DEVA model by incorporating multiple factors, such as user growth rate, user lifecycle, and brand value. By obtaining internal company data from relevant parties and increasing the number of comparable companies, the model could be further optimized to enhance its precision.

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