

Value Evaluation of PDD Based on DCF Model

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ABSTRACT

Pinduoduo(PDD) is one of the representatives of Internet e-commerce companies that have developed in recent years, and PDD created a successful and innovative business model of social e-commerce. Compared with the traditional e-commerce model, social e-commerce has certain competitive advantages in the depth of channels and the speed of commodity circulation. As a result, investors and shareholders will always have high hopes for PDD's market capitalization and consider the reported market capitalization to be low. For PDD, because Internet e-commerce companies have novel business models, non-linear profit growth, and other characteristics that are different from traditional companies, various factors need to be integrated into the evaluation. This paper incorporates non-financial factors into the evaluation system and calculates the final value of the company based on the DCF model through adjustment coefficients, thus forming a new Internet company valuation idea. This paper uses the improved DCF model to value PDD and compares the valuation results with the actual market value of PDD on the evaluation day to prove whether the value of PDD is undervalued. The following two inspirations are obtained from this case study: First, the appraiser should fully consider the impact of non-financial factors on the company's value when valuing new Internet companies, to make appropriate adjustments to the valuation model to achieve the purpose of the evaluation; second, the decision of shareholders and investors should be based on a complete understanding of the company's value. Judgments must not only be made based on financial metrics, but also non-financial factors.

Keywords: *PDD, Improve the DCF model, GMV, Free Cash Flow, Enterprise Value Assessment*

1. INTRODUCTION

In today's society where the Internet is highly integrated into people's daily lives, online shopping has gradually become the trend among young people shopping. Many e-commerce Internet companies have gone public for financing. As one of the representatives of successful financing, PDD has gradually become a hot spot of concern for companies and investors.

When valuing PDD companies, using traditional enterprise valuation methods has many limitations. PDD has high initial investment costs, a high-risk coefficient, and uncertain future returns, and the company's value is greatly affected by non-financial factors. Therefore, the traditional DCF model has limitations and needs to be improved. In this paper, the author chooses two Research methods: the case analysis method and the literature research method. This paper selects PDD as the specific case analysis object, has an in-depth understanding of the industry background, analyzes the financial data of PDD, and finally practically applies the improved DCF model to determine whether the company has investment value.

Through the study and summary of previous scholars' research on company valuation methods, the author will analyze the limitations of previous research and improve the model on this basis.

This paper provides a new idea for the value evaluation of Internet companies and helps investors clearly understand the company's operations. It calculates the final value of the company based on the DCF model through adjustment coefficients, thus forming a new Internet company valuation idea.

2. LITERATURE REVIEW AND THEORETICAL FOUNDATION

2.1. Literature review

2.1.1. The basic concept of company valuation

J.B.Williams formally proposed the DCF model to scientifically evaluate the intrinsic value of stocks [1]. The basic idea is to discount all the cash flow of the company in its future existence period to the time of

evaluation, and the obtained value is the value of the company. The DCF model valuation method is the most widely used company valuation method. If the company's capital structure is mature, the development is relatively stable, and it would be ideal to use this method.

Jensen clearly defined the definition of free cash flow [2]. The value of the company is equal to the sum of the discounted value of free cash flow each year in the future. Compared with the net profit in accounting, free cash flow has a greater correlation with the company's real earnings. Using free cash flow to evaluate the benefits of enterprises can reduce the falsification of performance by the company.

William-Sharpe used the CAPM model (capital asset pricing model) to calculate equity capital, and improved the accuracy of the discount rate [3]. For cash flow, he believes that its market value is more important than its book value. His theory clarifies the calculation method of the discount rate, so the DCF model has become the most widely used method in corporate valuation.

2.1.2. Literature Review of Internet Enterprise Valuation

Beranek and Howe conducted relevant research on the study of issuance cost-adjusted yields by analyzing the established financial theory of calculating the allowable rate of return within the DCF framework[4]. Al-Zwaylif proposed to use the balanced scorecard method to evaluate the performance of investment centers to achieve consistency between the DCF decision model and the performance evaluation model [5]. The use of an improved DCF model for financial analysis is warranted. Nikolaieva, Petrova and Lutsenko used the DCF model and robust financial analysis and ARIMA model as a measurement mechanism for point and interval forecasts to forecast the stock prices of Coca-Cola HBC AG and Nestle S.A, and the forecast results were very similar to the real situation [6].

Marc pointed out that the free cash flow of Internet companies has a high degree of uncertainty. To avoid this uncertainty when evaluating the value of Internet companies, the appraiser can appropriately use a valuation model related to probability [7]. According to Takács, Ulbert and Fodor, they priced mispricing and market corrections based on key cash flow ratios defined in an inverse model, and found evidence that U.S. stocks are generally undervalued [8].

John Brginshaw assumed a real options model, which selected several Internet companies as samples for evaluation. The evaluation results have certain limitations: the model can only evaluate companies that are in a state of profit, but is not applicable to loss-making companies" [9].

2.2. Theoretical foundation

2.2.1. The basic concept of company valuation

2.2.1.1. The connotation of company value assessment

Company value evaluation refers to the process in which evaluators makes a comprehensive evaluation of the company's value by using the data at hand, considering various factors, and then they expresses professional opinions, and preparing a research report according to the analysis results.

2.2.1.2. The role of company valuation

Company valuation has important implications for company managers, investors, and decision-makers:

- (1) The need to maximize the value of the company

When the management of the company conducts investment analysis, strategic analysis, and value-based management, the company's valuation can better avoid risks and make judgments to maximize the interests of the company's shareholders.

- (2) Important prerequisites for investment decisions

In order to ensure the rationality of investment behavior, it is necessary to have a correct assessment of the current value of enterprise assets. The evaluation result is not only an important basis for the investment negotiation between the investor and the investee but also an objective criterion for the investee to determine the value of its intangible assets.

2.2.2. DCF Valuation Method

The most important parameters of the DCF model are the following three: free cash flow, cost of capital, and cash flow holdings.

2.2.2.1. Free cash flow

Free cash flow is the future net cash flow during the company's existence. In order to improve the accuracy of the company's valuation, it is necessary to accurately calculate the cash flow. At this time,

$$\text{Free cash flow} = \text{cash inflow} - \text{cash outflow} \quad (1)$$

2.2.2.2. Discount rate

The discount rate can reflect the investment rate of return on the company's future cash flow. During the company's operation, the cash flow will change due to various risks that exist, and the cost of capital will also change accordingly. The more risk a company takes, the higher the expected rate of return and the correspondingly higher cost of capital.

2.2.2.3. Duration of cash flow

The continuous operation of the company is the premise and basis for obtaining cash flow, and the effectiveness of the company's operation will inevitably be affected. In order to ease the difficulty of evaluation, it is generally assumed that the duration of the cash flow is infinite.

3. CONSTRUCTION OF IMPROVED DCF MODELS

3.1 The basic idea of model improvement

(1). According to the characteristics of Internet companies, select several non-financial factors that have the greatest impact on the value of Internet companies

(2). Introduce the analytic hierarchy process to determine the relative weight between non-financial factor indicators.

(3). The adjustment coefficient corrects the DCF model to obtain the final company value.

3.2 Improved DCF model construction

3.2.1. forecast operating income

3.2.1.1. Introduce the GMV indicator

PDD is an e-commerce platform that introduces GMV(Gross Merchandise Volume) to predict its future operating income. GMV is a transaction index unique to e-commerce platform companies. The GMV indicator not only includes the actual payment amount but also includes the part that has not actually been paid. For e-commerce platform companies, the rapid growth of users is far more important than short-term profits. According to Cheng et al, the GMV value may far exceed the actual transaction amount, which is one of the reasons why e-commerce companies are willing to publish GMV data [10].

Total GMV value = the number of active Users x GMV of a single user (2)

Sales revenue = gross GMV x monetization rate (3)

Among them, the number of active users is the number of users who have purchased goods on the platform in the past 12 months, and the monetization rate is the ratio of the conversion and realization of the total amount of commodity transactions, which is also a very important operation index of the Internet e-commerce platform.

3.2.1.2. Historical data backtracking

Table 1. PDD’s Historical data

	2017	2018	2019	2020	2021
Number of active users (100 million)	2.45	4.19	5.85	7.88	8.67
% growth	611%	71%	40%	35%	10%
Personal GMV (\$100 million)	91.19	183.91	281.16	345.79	390.12
%growth	/	102%	53%	23%	13%
Total GMV (\$100 milliom)	223.42	770.59	1644.77	2724.84	3382.35
Monetization rate	1.2%	2.8%	3.0%	3.3%	4.7%
Operating income (\$100 million)	2.85	21.4	49.17	97.21	158.27

As can be seen from the above table, the number of active users and single-user GMV of PDD increased quarter by quarter, but the growth rate gradually slowed down.

3.2.1.3. Expectation of future income

The company's C2M and brand cooperation strategy is expected to promote the improvement of single-user GMV in the long run:

(1). C2M: Make manufacturers (mainly small enterprises) face consumers directly. The company aims to complete cooperation with 100-200 C2M

manufacturers by the end of 2019, and achieve cooperation with 1,000 C2M manufacturers by 2020. The increase in supply types is conducive to the improvement of single-user GMV.

(2). Branding: At present, about 800 brands have settled in PDD. Compared with the 100,000 cooperative brands of Tmall, there is more room for branding in the future, which will directly help increase the unit price of customers.

Based on the expectation that both the number of active users and single-user GMV will increase, the forecast for PDD's future operating income is given as follows:

Table 2. Forecast for PDD's future data

	2022	2023	2024	2025	2026	After 2026
Number of active users (100 million)	9.36	9.93	10.12	10.23	10.33	10.43

% growth	8%	6%	2%	1%	1%	1%
Personal GMV (\$100 million)	429.13	463.46	491.27	520.75	551.99	595.11
%growth	10%	8%	6%	6%	6%	6%
Total GMV (\$100 milliom)	4016.68	4702.18	4971.27	5327.24	5702.07	5998.58
Monetization rate	5.0%	5.20%	5.20%	5.20%	5.20%	5.20%
Operating income (\$100 million)	200.83	244.51	258.53	277.02	296.51	311.93

Table 3. PDD's 2021 financial data

3.2.1.4. Calculate free cash flow

The general formula for free cash flow is:

Free cash flow = EBIT - taxes + depreciation and amortization - changes in working capital - capital this expenditure (4)

As PDD is an asset-light operating model, changes in its working capital are not considered when calculating free cash flow. The company has no interest-bearing liabilities, no interest is considered, and the amount of depreciation and amortization is extremely small, so the above formula can be simplified as:

Free cash flow = profit - tax (5)

The specific calculation process is as follows:

(1). Determine the sales percentage of each item based on the 2021 financial data

Program	2021's data (\$100 million)
Operating costs	31.48
Selling expenses	67.20
Management costs	2.46
R & D spending	11.24

The high proportion of sales expenses is mainly due to the fact that the company is in a period of rapid development at this stage, and the advertising expenditure is relatively large. In the future, as the company develops and stabilizes, the proportion of advertising expenditures will gradually decrease, and the sales expense ratio will show a downward

(2) Calculate free cash flow based on sales revenue and sales percentage trend, and eventually tends to a stable level.

Table 4. Forecast for PDD's future financial data

(\$100 million)	2022	2023	2024	2025	2026	After 2026
Operating income	79.36	113.70	145.35	152.63	160.24	165.33
Operating costs	16.67	23.88	30.52	32.06	33.65	35.33
Selling expenses	47.62	45.50	36.35	30.52	32.06	33.65
Management costs	3.41	4.88	6.25	6.56	6.88	7.24
R & D spending	10.17	14.55	18.60	19.54	20.51	21.53
Pre-tax profit	1.50	24.93	53.64	63.95	67.15	70.51

Table 5. Forecast for PDD's future free cash flow

(\$100 million)	2022	2023	2024	2025	2026	After 2026
Income tax	25%	25%	25%	25%	25%	25%
Free cash flow	40.23	47.96	55.63	64.53	74.85	86.83

3.2.2. Determining the discount rate

PDD's discount rate is calculated through the weighted cost of capital (WACC) model. Since the company currently has no interest-bearing liabilities, the company's discount rate is equal to its cost of equity capital. This paper adopts the classic capital asset pricing model (CAPM) to estimate the company's cost of equity capital.

3.2.2.1. Determine the risk-free rate of return

PDD is listed on Nasdaq in the United States. The United States generally regards the short-term Treasury bond rate as a risk-free rate. This article selects the U.S. 3-month Treasury bond yield as the risk-free rate. The latest data as of December 31, 2021 is 5.47%, i.e. $R_f=5.47\%$.

PDD is a Nasdaq-listed company, and the expected rate of return of the market portfolio is the Nasdaq annualized rate of return.

Table 6. 2011-20221 Nasdaq index and annual return

Year	Nasdaq Index	Annual rate of return
2011	2605.15	-1.80%
2012	3019.51	15.91%
2013	4176.59	38.32%

2014	4736.05	3.40%
2015	5007.41	5.72%
2016	5383.12	7.50%
2017	6903.39	28.24%
2018	6635.28	-3.88%
2019	8972.60	35.23%
2020	12888.28	43.63%
2021	15644.97	22.05%

After calculation, the annualized return of the Nasdaq index over the past ten years is $R_m=19.61\%$

3.2.2.2. Determine the B value of the company

Beta is estimated by ordinary least squares regression of the stock's return on the market's return. Beta is

affected by the length of the data period and the frequency of observations. For fast-moving markets, Bloomberg uses a 2-year Weekly data is the most suitable, so this paper selects the weekly data from December 1, 2017 to December 1, 2019.

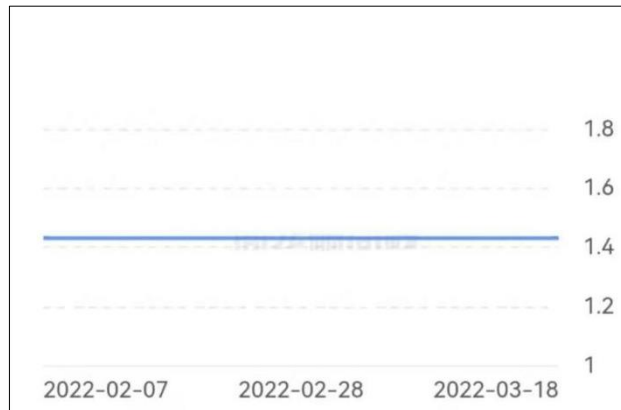


Figure1. The recent β values

$\beta = 1.42$

3.2.2.3. Calculate the cost of equity capital

The company's cost of equity capital determine the company's stable growth rate. In the long run, the growth

rate of enterprises during the stable period tends to be consistent with the national GDP growth rate. This article conservatively estimates that the growth rate from 2022 to 2026 will be 6%.

Thus, $WACC = 25.55\%$

Table 7. China's 2016-2026 GDP growth rate (including expected values)

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Selling expenses	6.7%	6.9%	6.8%	6.1%	2.3%	8.1%	6.0%	6.0%	6.0%	6.0%	6.0%

The arithmetic mean is 6.69%, that is, the company's stable growth rate $g=6.69\%$.

Without considering non-financial factors, PDD's company value calculation process is shown in the following table:

3.2.3. Calculation of company market value

Table 8. Forecast for PDD's future value

(\$100 million)	2022	2023	2024	2025	2026	After 2026
Free cash Flow (FCCF)	40.23	52.30	67.99	88.39	114.90	149.37
Discount rate	25.55%	25.55%	25.55%	25.55%	25.55%	25.55%
Fixed number of years	0	1	2	3	4	5+
Present Value	40.23	41.66	43.13	44.66	46.24	526.68
Sum of present value					215.92	526.68

$$V = \sum_{t=1}^n \frac{FCF_t}{(1+WACC)^t} + \frac{1}{(1+WACC)^n} \times \frac{FCF_{n+1}}{WACC-g} \quad (6)$$

PDD's company value if non-financial factors are excluded.

$V = 215.92 + 526.68 = 742.6$ (\$100 million)

3.2.4. Calculating Non-Financial Adjustment Factors

The following figure shows the hierarchical model constructed by yaahp software:

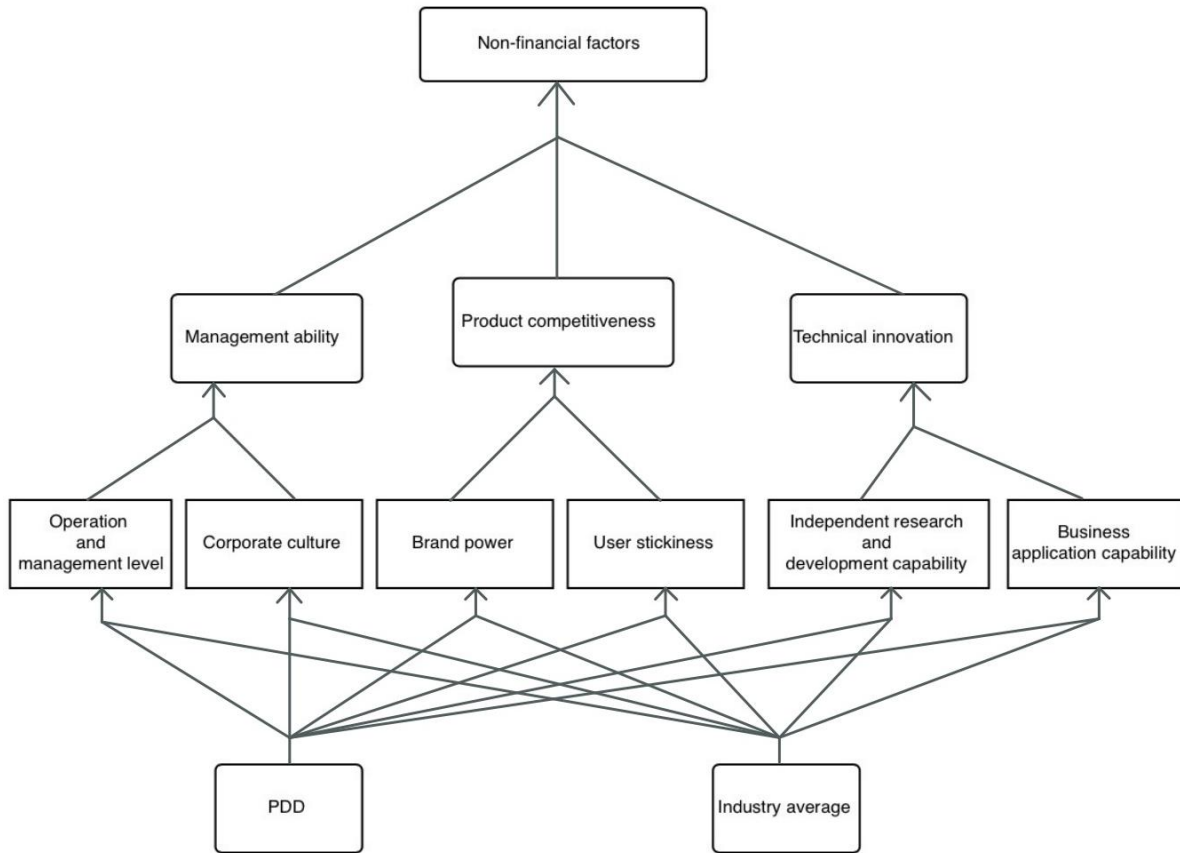


Figure 2. Hierarchy model diagram

The Construct judgment matrix and perform consistency check:

Table 9. Consistency test results

	Management ability	Product competitiveness	Technical innovation
Management ability		1/2	1/2
Product competitiveness			2
Technical innovation			

Then calculate the weights of the factors:

Table 10. Weight of First-level indicators

Non-financial factors	Management ability	Product competitiveness	Technical innovation	Wi
Management ability	1	1/2	1/2	0.1958
Product competitiveness	2	1	2	0.4934
Technical innovation	2	1/2	1	0.3108

Table 11. Weight of secondary indicators

First-level indicator	Secondary indicator	Weights
Management ability	Operation and management level	0.6667
	Corporate culture	0.3333
Product competitiveness	Brand power	0.7500
	User stickiness	0.2500
Technical innovation	Independent research and development capability	0.6667
	Business application capability	0.3333

What's more, it gets the Calculate weights:

Table 12. Calculate weights

Element	Weights
PDD	0.5940
Industry average	0.4060

It can be concluded that the score of PDD in terms of non-financial influencing factors is higher than the average level of the same industry, and its ratio is the non-financial index adjustment coefficient k sought in this paper:

$$k = 0.5940 / 0.4060 = 1.4631$$

The enterprise value is corrected using a non-financial indicator adjustment factor:

$$\begin{aligned} \text{The final value of PDD} &= k \times V \\ &= 1.4631 \times 742.6 \\ &= 1086.50 \text{ (100 million dollars)} \end{aligned}$$

That is, the final valuation of PDD, calculated by improving the DCF model, is 108.65 billion dollars. The evaluation date is December 31, 2021. The actual market value of the company is 73.067 billion dollars. The valuation result using the improved DCF model is 108.65 billion dollars, and the gap between that and the actual market value is 35.583 billion dollars. It can be seen that the market value of PDD is obviously underestimated.

4. CONCLUSION

For evaluators, the traditional DCF valuation method does not take into account the value of non-financial factors and is not suitable for the valuation of Internet companies with highly uncertain earnings. The improved model can provide a more accurate, and the assessed enterprise value can fully reflect the intrinsic value of the Internet company. Therefore, the evaluation value calculated by the improved model can provide a more accurate and credible value basis for the operation and management of the enterprise and the introduction of strategic investors.

In order to obtain excess returns, investors must buy shares of the company when the market value of the company is undervalued and sell shares when the market value of the company is relatively reasonable or overvalued. In large part due to the information asymmetry between the company and investors, PDD's company value is undervalued. Ordinary investors have limited information obtained from the company's publicly released financial reports, and it is not enough for investors to statically analyze various financial indicators. Investors should also fully understand the basic characteristics of the company's business model and fully consider the Internet company's management capabilities, product competitiveness, technological innovation and other potential value of non-financial factors.

This paper idealizes the future investment and expenditure to a certain extent. It is still necessary to analyze the market value according to specific circumstances, because PDD's transformation direction may change due to market saturation and other reasons. In addition, the improved CDF model can improve the financial defects and help companies to complete merger and acquisition or investment planning.

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