

Empirical Research on Internet Enterprise Value Evaluation Based on Free Cash Flow

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Abstract—Under the background of the continuous development of the global digital economical model, the research on the valuation of Internet enterprises has increasingly attracted scholars' attention. With the drastic change of the Internet industry, the problem of the inability to provide data support for research due to insufficient corporate financial data has gradually been resolved. The discounted free cash flow method is currently the most extensive and theoretically mature method in the field of enterprise value assessment. Its practicability has not been fully proved in the Internet field. The paper uses the free cash flow discount model to estimate the sample enterprise value--taking Jinshan Software as an example, and proves that it is feasible and predictive while using Internet companies as research objects.

Keywords—Enterprise value assessment; Free cash flow; Discount model; Jinshan Software

I. RESEARCH BACKGROUND AND LITERATURE REVIEW

A. Research background

Along with the continuous development of the Internet industry, Internet companies have a large gap with traditional enterprises in terms of operation mode, growth mode and profit stage model. Compared with the traditional enterprise Internet companies, the proportion of physical assets is relatively low, the proportion of software assets is relatively high, and the previous capital investment is high and the investment risk is high. From the perspective of development model, the development of traditional enterprises has gradually grown from a small-scale enterprise to a large company, and it can be profitable from the beginning. Internet companies need a large amount of capital support in the early stage, and accumulate customer base through free or low-cost services. The market pattern is stable after generating revenue, such as Didi taxi, Meituan and shared bicycle market. Under the huge gap between Internet-based enterprises and traditional enterprises, it is worthwhile to explore whether the valuation model of traditional enterprise value is applicable to Internet enterprise value assessment.

B. Literature review

In the literature, the research on the relationship between free cash flow and corporate value of enterprises focuses on traditional enterprises or enterprises related to traditional industries. For example, Rubei, Nanjing University of Finance and Economics, uses the free cash flow discount model to study the value of enterprises [1]. Han Xingguo, School of Economics and Management, Inner Mongolia University of Science and Technology, takes Yili as the research object and evaluates the value of the company through the free cash flow discount model [2]. Shanghai University of International Business and Economics School of Finance and Management, Geng Shangzhou, Wang Yazhen, Cai Yuxin, based on the user

traffic estimation model and the Metcalfe law proposed by Robert Metcalf for the network value analysis, evaluated the ecological value of LeEco [3]. Based on the value creation perspective, Professor Xuan Xiao and Duan Wenqi consider both financial performance and non-financial performance. Through the four key channels of efficiency, locking, complementarity and innovation, they have six capabilities from operation, profitability, growth, users, collaboration and management. Starting from the dimension, the overall conceptual framework of enterprise value creation on the Internet platform was built [4]. Tian Wuxing and Dai Shuangshuang proposed to shift from traditionally relying solely on financial data to non-financial value standards such as users, brands and human resources [5]. Zhu Lei proposes to use non-financial data to help transform banks [6]. At present, scholars' research on the value of Internet enterprises has gradually turned to the evaluation of the value of Internet enterprises based on non-financial data of enterprises. The research on traditional financial value of enterprises has declined, but the traditional three financial statements are still relatively mature systems. With the booming development of the Internet industry, this article chooses Jinshan Software. As a research object, Jinshan Software has been listed since 2007, and its business operations are in good condition. Financial data are disclosed in the Hong Kong Stock Exchange.

II. FREE CASH FLOW DISCOUNT THEORY MODEL

As early as the 1980s, the new concept of free cash flow was proposed by scholars such as Alfred Rabaport of the United States and De Jensen (1982) of Harvard University. The free cash flow of an enterprise is the cash flow that can be allocated to the investors who provide capital to the enterprise to the greatest extent. It is derived from the cash flow generated by the enterprise in daily operations, after deducting the income tax and the investment funds needed for the enterprise to reproduce. The calculation formula is: company value

$$= \sum_{t=1}^T \frac{FCFF_t}{(1+WACC)^t}$$

, in the formula FCFF_t represents the company's free cash flow in the t-th year, T represents the predicted number of years of free cash flow in the enterprise, and WACC represents the weighted average cost of capital. The calculation formula for free cash flow of enterprises is: free cash flow = operating income - operating cost - management expenses - business tax and additional - tax + depreciation + increase in deferred income tax - increase in operating liquid assets - increase in inventory + operating current liabilities - Capital expenditure (fixed assets + depreciation) - goodwill investment (goodwill increase + amortization).

III. SAMPLE COMPANY SELECTION

Kingsoft (3888.HK) was listed on the Hong Kong Stock Exchange on October 9, 2007 with an issue price of HK\$3.6 and a net financing of HK\$626.1 million. The revenue in 2017 was RMB 5,181.3 million, an increase of 35% over the previous year. Online games accounted for 60% of the company's total revenue for the year, cloud services accounted for 26%, and other businesses accounted for 14% of total revenue. Is a typical Internet company. Jinshan Software Co., Ltd. is selected as the research sample in this paper. The reasons are as follows: 1. Jinshan Software as a listed company, all financial statements disclosed in Hong Kong, the financial data source is true and effective; 2. Jinshan software is listed earlier, and the company is quarterly. The company's quarterly financial statements are published, and the amount of data is large, which provides a reliable guarantee for estimating the accuracy of business operations. 3. Jinshan Software's main business is online games, cloud services, office software, etc. It is a typical Internet company; 4. Jinshan Software won the title of "Zhongguancun Science Park Innovation Pilot Enterprise" jointly awarded by the Beijing Municipal People's Government, the Ministry of Science and Technology and the Chinese Academy of Sciences in 2007. In 2013, Jinshan Office Software won the 6th Copyright Annual Conference "China". The most influential companies have dozens of honorary titles.

IV. FREE CASH FLOW DISCOUNT MODEL APPLICATION

A. Free cash flow in history

The calculation formula of historical free cash flow introduced by Professor Xiao Xing of Tsinghua University is as follows: cash flow from operating activities - capital expenditure (additional assets + depreciation) - goodwill investment (goodwill increase + amortization). According to the free cash flow calculation method described above,

combined with the financial data published by Kingsoft, the first analysis of the company's historical free cash flow.

1) Cash flow from operating activities

The cash flow generated by the daily business activities of the enterprise is the main source of cash for the enterprise. The enterprise applies this part of the cash to all transactions and other matters in the past except for investment activities and fundraising activities. The calculation formula is: operating income - operating costs - management fees - business taxes and surcharges = pre-tax operating profit without interest - tax = NOPAT (after-tax operating net profit), NOPAT + depreciation + deferred income tax increase - operating flow Increase in assets - increase in inventory + operating current liabilities = cash flow from operating activities.

2) Capital expenditure

The cash flow from operating activities needs to be deducted from the investment that the company must make in order to maintain the existing scale. It is often used for projects such as fixed assets and is represented by capital expenditure. Its calculation formula is capital expenditure = fixed assets increase + depreciation.

3) Goodwill investment

Goodwill investment is actually an investment that the company purchases in an acquisition that is difficult to identify and is classified as an asset. It should be used as an additional form of capital expenditure increase, so it needs to be deducted. Its calculation formula is: goodwill investment = goodwill increase + amortization.

4) Calculating the free cash flow in history of Kingsoft software

The historical free cash flow of Kingsoft Software 2010-2017 is shown in Table 1 below.

TABLE I FREE CASH FLOW IN HISTORY

Project	The historical free cash flow of 2011-2017			
Time	2017	2016	2015	2014
Cash Flow from Operating	189038.5	139321.8	143533.4	95226.4
Capital Expenditure	72220.0	102340.0	80610.0	83410.0
business reputation	955.9	0.0	2374.6	0.0
intangible assets amortization	10462.4	13311.7	13411.9	7348.8
Historical free cash flow	105400.2	23670.1	47136.9	4467.6
Time	2013	2012	2011	2010
Cash Flow from Operating	93812.4	55594.6	45176.8	39133.6
Capital Expenditure	13510.0	8480.0	16800.0	10060.0
business reputation	0.0	0.0	284.9	237.7
intangible assets amortization	3296.8	2689.3	2808.0	137.3
Historical free cash flow	77005.6	44425.3	25283.9	28698.6

* Unit: 10,000 yuan

B. Expectation of free cash flow in the future

1) The calculation method of free cash flow in the future

In 1990, the famous American scholar Professor Copland elaborated on the calculation of free cash flow: free cash flow = net operating profit after tax + depreciation and amortization - (capital expenditure + working capital increase). The

calculation method of each cash flow in the formula is as follows: 1. Net profit after tax. The net operating profit after tax refers to the profit after the company deducts the income tax from the operating system according to the cash basis. The specific calculation formula is: after-tax operating net profit = operating income (pre-tax profit after interest) - operating cost - sales expenses - Administrative expenses - income tax -

business tax and surcharges; 2, depreciation and amortization. Depreciation in the general case refers to the depreciation of fixed assets and amortization refers to items that cannot be included in fixed assets, amortization of expenses, such as long-term amortization expenses, amortization of intangible assets, etc. 3. Capital expenditure and net operating capital increase. Capital expenditure is the expenditure incurred by an enterprise in order to obtain long-term assets. The working capital is the net amount of the current assets minus the current

liabilities. This part of the cash can be used for the daily turnover of the enterprise.

2) The calculation of the main financial ratio

Based on Jinshan Software's 2010-2017 financial statements, this paper obtains the ratio of major financial data to operating income, and prepares for predicting the future free cash flow of Jinshan Software. The specific values are shown in Table 2 below.

TABLE II MAIN FINANCIAL INDICATOR RATIO

Project	Main financial indicator ratio			
Time	2017	2016	2015	2014
Operating costs/operating revenue	0.43	0.07	0.24	0.25
Sales tax and extra charges/operating revenue	0.014	0.032	0.020	0.016
selling expense/operating revenue	0.10	0.12	0.31	0.22
administrative expense/operating revenue	0.36	0.49	0.37	0.39
Depreciation, amortization/operating revenue	0.09	0.16	0.06	0.04
Net increase in working capital/operating revenue	-0.50	0.53	0.22	0.65
Capital Expenditures/operating revenue	0.14	0.37	0.14	0.23
Time	2013	2012	2011	2010
Operating costs/operating revenue	0.17	0.15	0.18	0.16
Sales tax and extra charges/operating revenue	0.033	0.025	0.018	0.014
selling expense/operating revenue	0.17	0.16	0.12	0.13
administrative expense/operating revenue	0.38	0.40	0.42	0.42
Depreciation, amortization/operating revenue	0.04	0.06	0.09	0.13
Net increase in working capital/operating revenue	0.95	0.38	0.18	0.00
Capital Expenditures/operating revenue	0.06	0.06	0.16	0.10

* Unit: %

a) Operating income

Jinshan Software has a steady increase in business revenue through online games, cloud services and office software, as shown in Table 4 below. By March 2018, Jinshan Cloud is expected to complete the D-series financing, with a financing scale of US\$720 million. In 2016, due to the impairment provision for the Thunder and Century Interviews invested by Kingsoft, the negative growth of operating income, but this one-time factor will not affect Jinshan Software's main

business in the future. In summary, combined with the company's average revenue growth rate of 42% in the past six years, assuming that 2018-2022 is the express growth stage of Kingsoft, the growth rate of operating income is chosen to be 45%, assuming 2023-2027 is the transition period. The development rate has slowed down, and 40% is selected as the operating income growth rate at this stage.

Table 3 Jinshan Software Operating Income and Growth Rate, 2010-2017

TABLE III OPERATING INCOME AND ITS GROWTH RATE

Project	Operating income statement			
Time	2017	2016	2015	2014
Operating income (ten thousand yuan)	531883.70	273261.20	574965.10	368569.90
Operating income growth rate (%)	0.95	-0.52	0.56	0.63
Time	2013	2012	2011	2010
Operating income (ten thousand yuan)	225631.50	143977.00	106455.90	100292.50
Operating income growth rate (%)	0.57	0.35	0.06	0

b) Operating cost / operating income

In 2017, due to the increase in the use of cloud service users, the cost of broadband and Internet data centers has increased, and Kingsoft has invested heavily in cloud services. As a result, a sharp increase in operating costs occurred in 2017, accompanied by The number of users is stable, and the operating costs will also have a significant downward trend. The average operating cost/operating income ratio of Jinshan Software in 2010-2017 is 20.71%, so the value of the first stage is 20%, and the second stage is slightly down, with a value of 19%.

c) Business tax and addition/operating income

The average ratio of business tax and additional/operating income of Jinshan Software in 2010-2017 was 2.17%, and the ratio fluctuated slightly around the average. Therefore, the values of the first phase and the second phase are both 2%.

d) Sales expenses / operating income

The sales expenses have been increasing year by year in 2010-2015. The reason is that the sales expenses and the marketing expenses increased with the increase of the company's expansion. The proportion of sales expenses decreased significantly in 2016, and remained stable in 2017. . Therefore, the first stage takes 12% and the second stage is 10%.

e) Income tax / operating income

The Jinshan software business is mainly distributed in mainland China. It is taxed at a tax rate of 25%. The business generated in Hong Kong, China is accrued at a rate of 16.5%. By analyzing the tax status of enterprises in 2010-2017, about 90% of the tax amount of enterprises occurs in mainland China. By analyzing the respective taxes on the mainland and the tax payments in Hong Kong, the actual income tax rate for the next few years is forecast to be 24%.

f) Depreciation, amortization/operating income

Depreciation and amortization account for a low proportion of operating income and remain stable. There is a downward trend in 2017, but overall, it has remained stable. Therefore, the first stage takes 7%, and the second stage takes 5%.

g) Net increase in working capital / operating income

Due to the restructuring and expansion of the company's business, Jinshan Software's net increase in working capital has fluctuated sharply in the past four years. Therefore, when selecting the proportion of net increase in working capital, the average of 2010-2017 and the year of 2017 will be significant. In the case of a decline, choose the first stage to take a value of 20% and the second stage to have a more average value combination of 19%.

h) Capital expenditure / operating income

From 2014 to 2017, Jinshan Software's capital expenditures showed a wave shape and a downward trend. The proportion of capital expenditures in 2016 and 2014 remained at 14%. With the stable development of the Group, the forecasted capital expenditure will be small. The decline in the first phase is 10%, and the second phase is 8%.

i) Management fees / operating income

Through the analysis of Jinshan software management fees in 2010-2017, the proportion of management expenses to operating income is about 40%. From the overall trend, there is a tendency to decline slowly. Based on the above, the first phase of management fees is 38%, and the second phase is slightly down, 37%.

In summary, the forecast ratios of various financial indicators are shown in Table 4 below.

TABLE IV MAIN FINANCIAL INDICATOR FORECAST RATIO

* UNIT: %

Project	Financial indicator forecast				
Time	2018	2019	2020	2021	2022
Operating income increase rate	45	45	45	45	45
Operating cost / operating income	20	20	20	20	20
Business tax and additional/operating income	2	2	2	2	2
Sales expenses / operating income	12	12	12	12	12
Management fee / operating income	38	38	38	38	38
Depreciation, amortization / operating income	7	7	7	7	7
Net increase in working capital / operating income	20	20	20	20	20
Capital expenditure / operating income	10	10	10	10	10
Time	2023	2024	2025	2026	2027
Operating income increase rate	40	40	40	40	40
Operating cost / operating income	19	19	19	19	19
Business tax and additional/operating income	2	2	2	2	2
Sales expenses / operating income	10	10	10	10	10
Management fee / operating income	37	37	37	37	37

Table IV, cont					
Depreciation, amortization / operating income	5	5	5	5	5
Net increase in working capital / operating income	19	19	19	19	19
Capital expenditure / operating income	8	8	8	8	8

Based on the free cash flow proposed by Professor Copeland = net operating profit after tax + depreciation and amortization - (capital expenditure + increase in working

capital), Jinshan Software predicts free cash flow in 2018-2027, as shown in Table 5 below.

TABLE V FORECAST FOR FREE CASH FLOW * UNIT: 10,000 YUAN

Project	Forecast free cash flow				
Time	2018	2019	2020	2021	2022
Forecast free cash flow	20052	29075	42159	61131	88640
Time	2023	2024	2025	2026	2027
Forecast free cash flow	362742	574660	804524	1126334	1576867

3) Cost of equity capital

This paper applies the Capital Asset Pricing Model model proposed by American scholars William Sharpe and John Lintner to estimate the cost of capital of Jinshan Software. The cost of equity capital = $R_f + \beta (R_m - R_f)$, where R_f represents the risk-free rate of return, the beta generation market risk factor, and R_m represents the market rate of return.

a) Risk-free rate of return

Internationally, the yield of national debt is generally used as the risk-free rate of return. Based on the international experience of determining the risk-free rate of return, this paper selects the five-year government bond interest rate issued by 2018 as the risk-free rate of return used in the model. Therefore, R_f is selected. =4.72%.

b) Market rate of return

To calculate the market rate of return itself is more difficult, so the market index is used instead of the actual application. The annual index is often defined as the market rate of return,

and its calculation formula is $R_t = \frac{\text{Index} - \text{Index} - 1}{\text{Index} - 1}$. According to the Hong Kong Hang Seng Index data analysis from September 31, 2012 to December 31, 2017, the average value is selected as the market portfolio interest rate, and its value is $R_t = 10.41\%$.

c) Factors causing market risk

The beta coefficient is a tool for assessing the systemic risk of securities. It measures the volatility of a portfolio of securities or an investment portfolio relative to the overall

market. It is common in investment terms such as stocks and $\text{Cov}(R_m, R_i)$

funds. The formula is $\beta = \frac{\text{Cov}(R_m, R_i)}{\text{Var}(R_m)}$, where $\text{Cov}(R_m, R_i)$ represents the covariance of the market portfolio market rate and the yield of the selected firm; $\text{Var}(R_m)$ represents the variance of the market portfolio return. Based on the enterprise data from September 31, 2012 to December 31, 2017 and the Hang Seng Index, this paper has a beta value of 0.50 based on a total of 44 sets of quarterly reports.

In summary, the cost of equity capital = $R_f + \beta (R_m - R_f) = 0.0047 + 0.5 * (0.1041 - 0.0472) = 7.3\%$

4) Asset-liability ratio

The asset-liability ratio calculated based on the data provided by Kingsoft's 2010-2017 financial statements is shown in Table 7 below, with an average of 32.19%. 2014 is a key year for Jinshan Software's strategic business turnaround. Jinshan Software feels focused on enterprise cloud services. In 2014, the company invested huge amounts of money in cloud technology development, talent recruitment, market expansion and cloud service infrastructure construction. As a result, liabilities have increased significantly. The impairment provision made by Thunder in 2016 also has an impact on the asset-liability ratio. However, Jinshan Software has developed well in the past two years. In summary, the asset-liability ratio of Jinshan Software's three-stage enterprise is: 35%, 30%, and 25%.

TABLE VI BALANCE SHEET

Project	Forecast free cash flow			
Time	2017	2016	2015	2014
Total assets (ten thousand yuan)	1776239	1757895	1548488	1038160
Total debt (ten thousand yuan)	520942	757723	557352	426506
Assets and liabilities(%)	29.33	43.10	35.99	41.08
Time	2013	2012	2011	2010
Total assets (ten thousand yuan)	580433	364126	301452	244481
Total debt (ten thousand yuan)	197364	96634	80140	51075
Assets and liabilities(%)	34.00	26.54	26.58	20.89

5) Debt capital cost

Jinshan Software's interest-bearing loan amount in the year or on demand reaches 37,416,5000 yuan. In the application, for the convenience of calculation, the debt cost of the enterprise can be regarded as the bank's loan interest rate. The query determines that the corporate debt cost is 4.35% or $K_b = 0.35\%$.

6) Overweight cost of capital

The weighted average cost of capital is a method of calculating the company's cost of capital based on the weighted average of the total capital source of each type of capital. The calculation formula is: $WACC = (E/V) \times Re + (D/V) \times Rd \times (1 - T_c)$, where Re : equity capital cost, E/V : shareholder equity ratio, D/V : asset-liability ratio, Rd : debt capital cost, T_c represents tax rate, and Jinshan Software's three-stage weighted capital cost is as follows:

High-speed growth stage:

$$WACC1 = 0.35 \times 0.0435 \times (1 - 0.24) + 0.65 \times 0.073 = 0.059;$$

excessive phase:

$$WACC2 = 0.3 \times 0.0435 \times (1 - 0.024) + 0.7 \times 0.073 = 0.061;$$

stable growth stage:

$$WACC3 = 0.3 \times 0.0435 \times (1 - 0.024) + 0.75 \times 0.073 = 0.063;$$

7) Determination of the intrinsic value of the company

From the free cash flow discount model, the enterprise value is the discounted free cash flow of the company during the forecast period. It can be seen that the enterprise value = $V_1 + V_2 + V_3$. According to the above predicted value of Jinshan Software's future free cash flow, and the weighted capital cost of the corresponding stage, the present value of the company's free cash flow in the next 10 years can be obtained, as shown in Table 7. V_3 is a stable growth stage, generally giving a perpetual growth rate of around 2%-5%. Considering the unique nature of the Internet industry, it gives a limit of 6%. It is concluded that $V_3 = 924586.07$ million. Upon inquiry, Jinshan Software's closing price on December 29, 2017 was 26 yuan, which reduced the net debt value of the company's three-stage free cash flow. The final calculated stock price was 25.9305 yuan, table 8 is shown.

TABLE VII THE PRESENT VALUE OF THE PREDICTING FREE CASH FLOW

Project	Predicting the present value of free cash flow				
Time	2018	2019	2020	2021	2022
Forecast the present value of free cash flow (ten thousand yuan)	18934	25925	35498	48604	66550
Time	2023	2024	2025	2026	2027
Forecast the present value of free cash flow (ten thousand yuan)	254276	379667	500975	661041	872251

TABLE VIII CALCULATION OF THE VALUE OF EACH SHARE

Project	Calculation results
$V_1 + V_2 + V_3$ total (ten thousand yuan)	3596591.95
2017 Jinshan Software Shares	1312975387
Calculate the price per share (yuan)	26.93
Actual price per share (ten thousand yuan)	3404872.06
Net debt value (yuan)	26

V. CONCLUSION

Based on the discounted cash flow model, the price per share of Jinshan Software's 2010-2017 corporate financial data is 25.9305 yuan. On December 29, 2017, Jinshan Software's closing price is 26.00 yuan, a difference of 0.0675 yuan. 0.26%, within acceptable limits. With the continuous development of the Internet industry, the financial data of Internet companies is gradually improving, and the operation of Internet companies is gradually entering a stable period. Through the empirical analysis of this paper, it is concluded that the value evaluation model applied to traditional enterprises still applies to Internet-based enterprises, therefore, I believe that we should increase the emphasis on traditional methods of assessing corporate value. Of course, Internet companies still have a big difference in the development cycle, growth and profit model compared with traditional enterprises. Especially in the early stage of enterprise development, Internet companies will invest a lot of capital to attract customers, so they are doing business. In the evaluation of value, the model should also be optimized for Internet enterprise characteristics.

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