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Research on Valuation of Data Assets Based on the Excess Earnings Method

-- Taking Shede Spirits as an Example

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Abstract: In the Digital Economy Era, data assets, as strategic resources for enterprises, play a vital role in their daily operations and long-term growth, and represent a key achievement of enterprises' digital transformation. Valuing data assets not only provides an intuitive reflection of the outcomes of enterprises' digital development but also advances the theory of data asset valuation. First, based on existing literature, this paper briefly summarizes and analyzes the concept and characteristics of data assets. Second, considering the unique attributes of data assets and integrating them with enterprises' digital transformation practices, it leverages valuation methods for intangible assets to construct an appropriate excess earnings valuation model. Finally, through a case study of Shede Spirits—by forecasting and analyzing its future free cash flows and the contribution values of various assets—this paper isolates the contribution income generated by data assets and estimates their value using the excess earnings valuation model.

Keywords: Digital Economy; Data Assets; Shede Spirits; Excess Earnings Method.

1. Literature Review

1.1. Delimitation of Data Assets

Liang Yan (2020) posits that data assets refer to data resources owned or controlled by specific entities, capable of generating economic value for their holders. Wang & Zhao (2020) analyze the attributes of data assets from the perspectives of their natural appreciation, external influence, and value creation mechanisms, noting that data assets constitute a crucial component of corporate assets and can generate revenue for enterprises. Todd & Singh (2021) regard data as a high value-added asset with the potential to create substantial value. Zhang Yue (2021) suggests that data assets are characterized by their virtual form, business value-added nature, fluctuating value, and ambiguous ownership. Cheng Zhanqin (2022) argues that data assets should encompass elements such as the name, source, scale, type, scope of application, and presentation format of the data. Zhou Xiaobo (2023), considering the characteristics of data assets, categorizes them as intangible assets and believes they can deliver economic value to enterprises. Gong Wen (2024) contends that the value of data assets is primarily influenced by factors such as data quality, market prospects, scarcity, and technological innovation.

1.2. Valuation of Data Assets

Zuo Wenjin and Liu Lijun (2021), from a user perspective, utilized the LINMAP model and a multi-indicator matrix to analyze user preference data. They introduced the price-quality ratio to value comparable data assets, thereby determining the value of the assessed asset. Gao Hua and Jiang Chaofan (2022) argued that data asset valuation must distinguish between scenarios with and without transactions. The B-S model is applicable in non-transaction scenarios, whereas transaction scenarios require the combined use of the excess earnings method and the analytic hierarchy process to ensure the accuracy of the assessment results. Fang Yinjie and Gao Jianwei (2023) developed a real options pricing model based on prospect theory and optimized the model by introducing the least squares Monte Carlo simulation method. Lin Yan (2023) employed the analytic hierarchy process and a BP neural network to address the limitations of the excess earnings method in data asset valuation. They also incorporated a fuzzy comprehensive evaluation method to refine the assessment results, thereby enhancing their accuracy. Dou Qian (2024) improved the predictive accuracy of assessment parameters in the multi-period excess earnings model by comprehensively applying the analytic hierarchy process and variance weight assignment to assign weights to data assets, leading to more precise results.

2. Theoretical Basis

2.1. Definition of Data Assets

Although no unified consensus has been reached so far on the conceptual delimitation of data assets, the core connotation of data assets can be extracted by analyzing the perspectives of various scholars.

From the perspective of resource attributes, data assets are information resources stored in digital or physical forms. Due to their special attributes such as clear ownership, measurable value, and realizability, they differ from general information resources and belong to a special type of information resource.From the perspective of asset attributes, data assets refer to information resources that are formed, accumulated, and independently controllable by enterprises in their daily operations, and have clear economic value.From the perspective of factor attributes, since data elements have been recognized as a new factor of production, data assets in enterprises hold the same strategic status as traditional factors of production and play a key role in promoting the development of the digital economy.

Based on the above multi-dimensional discussion and

analysis, this paper argues that data assets refer to information resources formed, accumulated, and independently controllable by enterprises in their daily operations with clear economic value. They are also an important strategic resource for enterprises, serving not only as a new engine driving enterprises' digital transformation but also as a key driver for the development of the digital economy.

2.2. Excess Earnings Method

Excess Earnings Method refers to an evaluation approach that determines the value of a target intangible asset by discounting and summing up its expected excess earnings. Among these, excess earnings are mainly reflected by the difference in earnings obtained by the enterprise before and after applying the target asset. The logic of using this method is to quantify the value contribution of data assets by comparing the difference in earnings before and after the use of intangible assets. The basic formula is as follows:

$$P_v = \sum_{t=1}^{n} \frac{\Delta R_t}{(1+i)^t}$$

Where P_v denotes the value of the assessed asset, ΔR_t denotes the excess earnings of the assessed asset in year t, n denotes the revenue period, and i denotes the discount rate.

In applying the Excess Earnings Method to determine the value of data assets, the core issue lies in how to scientifically quantify the excess earnings they generate. Given that data assets share some attributes with intangible assets, this paper classifies them into the category of intangible assets for valuation. Currently, in the field of asset valuation, methods such as the Direct Estimation Method, Allocation Method, and Difference Method are mainly used to determine the excess earnings contributed by intangible assets.Among these, the Direct Estimation Method refers to directly comparing predicted future earnings with benchmark earnings to determine excess earnings. However, this method has a subjectivity-driven flaw, as it heavily relies on the assessor's experience, knowledge, and subjective judgment, making it difficult to ensure the accuracy of results.The Allocation Method estimates excess earnings through the allocation ratio of asset earnings based on the principle of income distribution. The core of this method lies in determining the allocation ratio, but the strong dependency and volatility of data assets' value make it challenging to reasonably determine this ratio.The Difference Method determines excess earnings by comparing the earnings gap before and after the enterprise uses the assessed asset. Nevertheless, this method has high requirements for data quality and completeness, and may face issues of data being difficult to quantify.

In comparison, since the calculation approach of the Difference Method involves first determining the enterprise's total earnings, then deducting the earnings generated by other assets to derive the required excess earnings, this approach is more feasible in practical applications. Therefore, this paper adopts the Difference Method to determine the excess earnings generated by data assets. The specific calculation formula is as follows:

$$P_v = \sum_{t=1}^{n} \frac{\left(E - E_f - E_c - E_{i1} - E_{i2}\right)}{\left(1+i\right)^t}$$

Where P_v denotes the value of data assets, E denotes the enterprise's free cash flows, E_f denotes the contribution value of fixed assets, E_c denotes the contribution value of current assets, E_{i1} d enotes the contribution value of on-balance-sheet intangible assets, E_{i2} denotes the contribution value of other off-balance-sheet intangible assets, n denotes the revenue period, and i denotes the discount rate.

3. Case Study—Taking Shede Spirits as an Example

3.1. Company Profile

Shede Spirits is a well-known Chinese baijiu producer and one of Sichuan Liquor's "Six Golden Flowers". It is also the third listed company and the third recipient of the National Quality Award in China's baijiu industry, occupying an important position in the sector.The digital development achievements of Shede Spirits are mainly reflected in smart packaging factories, the S2B2C model, and member registration. By implementing key smart manufacturing projects, Shede Spirits has vigorously built smart packaging factories integrating IoT, big data, and artificial intelligence technologies, aiming to realize automated ecological filling of products. In addition, Shede Spirits adopts a digital supply chain model and achieves industrial chain collaboration by building intelligent systems—this not only enables full utilization of data assets but also improves operational and management efficiency.

3.2. Forecast of Enterprise Free Cash Flow

Based on Shede Spirits' operating revenue from 2019 to 2023, this paper uses the Least Squares Method to conduct a linear regression analysis of its operating revenue over the past five years, so as to forecast its operating revenue from 2024 to 2028.For the forecast of data related to operating costs, period expenses, income tax, capital expenditures, increase in working capital, fixed asset depreciation, and intangible asset amortization over the next five years, the calculation is performed by multiplying the average proportion of each item to operating revenue over the past five years by the forecasted operating revenue.The results are shown in Table 1.

Table 1. Forecast of Corporate Free Cash Flow for the Period 2024-2028

Year	2024	2025	2026	2027	2028
Sales Revenue	835596.62	957731.85	1079867.08	1202002.32	1324137.55
Cost of Sales	82602.79	94676.45	106750.11	118823.77	130897.43
Taxes and Surcharges	119407.46	136860.69	154313.92	171767.14	189220.37
Selling Expenses	157320.53	180315.33	203310.13	226304.93	249299.74
G&A	95281.59	109208.45	123135.31	137062.18	150989.04
R&D Expenses	7575.43	8682.70	9789.96	10897.23	12004.49
Fin. Exp.	-1139.91	-1306.53	-1473.14	-1639.76	-1806.38
Total Profit	374548.73	429294.76	484040.79	538786.82	593532.85
Income Tax Expense	64752.26	74216.80	83681.33	93145.87	102610.40
After-tax Interest Expense	340.89	390.72	440.55	490.37	540.20
D&A	179196.54	205388.86	231581.17	257773.49	283965.81
Amortization Expense	16853.87	19317.32	21780.77	24244.22	26707.67
CapEx	69558.70	79725.77	89892.84	100059.90	110226.97
Increase in Working Capital	119194.96	136617.13	154039.29	171461.46	188883.63
FCFF	317434.11	363831.97	410229.82	456627.68	503025.53

3.3. Forecast of Contribution Values of Other Assets

Forecast of Fixed Asset Contribution Values.This paper forecasts the fixed asset balance for 2024-2028. Based on the ending balances of fixed assets from 2019 to 2023, the fixed asset balance for 2024-2028 is calculated by multiplying the average proportion of fixed asset ending balances to operating revenue over the past five years by the forecasted operating revenue for 2024-2028. Then, the fixed asset contribution values for 2024-2028 are predicted. The fixed asset return rate refers to the five-year bank loan interest rate, which is 4.20%.

Forecast of Current Asset Contribution Values.This paper forecasts the current asset balance for 2024-2028. Based on the ending balances of current assets from 2019 to 2023, the current asset balance for 2024-2028 is calculated by multiplying the average proportion of current asset ending balances to operating revenue over the past five years by the forecasted operating revenue for 2024-2028. Then, the current asset contribution values for 2024-2028 are predicted. The current asset return rate refers to the one-year bank loan interest rate set by the central bank, which is 3.65%.

Forecast of Intangible Asset Contribution Values.Intangible assets are divided into on-balance-sheet and off-balance-sheet intangible assets. For the forecast of Shede Spirits' on-balance-sheet intangible asset balance from 2024 to 2028, this paper uses the on-balance-sheet intangible assets from 2018 to 2023 as the basis, and calculates it by multiplying the average proportion of on-balance-sheet intangible assets to operating revenue over the past five years by the forecasted operating revenue from 2024 to 2028. Since intangible assets are similar to fixed assets, the five-year loan benchmark interest rate of 4.20% is still used as the return rate.Off-balance-sheet intangible assets mainly refer to salaries payable. This paper forecasts the salaries payable from 2024 to 2028 using the average proportion of salaries payable to operating revenue (5.15%) from 2018 to 2023, then multiplies it by the labor contribution rate of 33.50% to obtain the contribution value. The calculation results are shown in Table 2.

Table 2. Forecasted Value of Other Assets for 2024-2028

Year	2024	2025	2026	2027	2028
Contribution of Fixed Assets	179410.42	205440.49	231470.55	257500.62	283530.68
Contribution of Current Assets	32618.03	36290.52	39963.01	43635.50	47307.98
Contribution from Recognized Intangible Assets	17380.60	19866.54	22352.48	24838.42	27324.36
Contribution from Unrecognized Intangible Assets	14411.89	16518.41	18624.93	20731.45	22837.97

3.4. Discount Rate and Earnings Period Determination

Since this study sets the earnings period at five years, the cost of debt capital (R_d) adopts the five-year bank loan interest rate of 4.2% published by the central bank on the valuation base date. The risk-free rate (R_f) adopts the yield to maturity of the ten-year government bond of 2.56% on the valuation base date. The average market risk premium (R_m) adopts the average return rate of the CSI 300 Index over the past ten years, which is 6.75%. The β coefficient adopts the average value of Shede Spirits' beta from 2019 to 2023, which is 0.984, as published by Tonghuashun. By incorporating the above indicators into the formula, the cost of equity capital (R_e) is calculated.

$$R_e = R_f + \beta \times (R_m - R_f)$$
$$= 2.56\% + 0.984 \times (6.75\% - 2.56\%) = 6.68\%$$

This paper uses the average proportion of equity capital and debt capital to total assets of Shede Spirits from 2019 to 2023 as the weights for forecasting the equity capital and debt capital in the projection period. The proportions of equity capital and debt capital to total assets in the projection period are 62.23% and 37.77%, respectively. The calculation results are presented in Table 3.

Table 3. Shede Spirits' Capital Structure from 2019 to 2023

Year	2019	2020	2021	2022	2023
Equity Capital	324044.02	378130.20	499652.41	653768.64	756121.82
Debt Capital	253606.52	267266.15	309691.31	326006.18	355449.24
Total Capital	577650.55	645396.35	809343.72	979774.82	1111571.06
Equity Ratio	56.10%	58.59%	61.74%	66.73%	68.02%
Debt Ratio	43.90%	41.41%	38.26%	33.27%	31.98%

In summary, the Weighted Average Cost of Capital (WACC) for Shede Spirits is calculated as follows:

$$WACC = R_e \times \frac{E}{E+D} + R_d \times \frac{D}{E+D} \times (1-T)$$
$$= 6.68\% \times 62.23\% + 4.2\% \times 37.77\% \times (1-25\%) = 5.35\%$$

This section analyzes the various types of assets in Shede Spirits' corporate annual reports from 2019 to 2023 and their proportion to total assets, and calculates the return on intangible assets. The specific details are as follows:

Table 4. Proportion of Various Asset Categories in Shede Spirits from 2019 to 2023

Year	2019	2020	2021	2022	2023
Current Assets Ratio	77.26 %	76.42 %	81.43 %	79.28 %	72.82 %
Fixed Assets Ratio	11.89 %	12.74 %	10.61 %	10.79 %	14.39 %
Intangible Assets Ratio	2.39%	4.26%	3.76%	3.10%	3.75%

As shown in Table 4, the average proportions of current assets, fixed assets, and intangible assets to total assets for Shede Spirits over the past five years were 77.44%, 12.08%, and 3.45%, respectively. Additionally, as previously discussed, the return rates on current assets and fixed assets were 3.65% and 4.20%, respectively. Based on the above analysis, the discount rate for data assets can be calculated as:

$$i_j = \frac{WACC - (W_f \times i_f) - (W_c \times i_c)}{W_j}$$
$$= \frac{5.35\% - 12.08\% \times 4.2\% - 77.44\% \times 3.65\%}{3.45\%} = 58.44\%$$

The revenue period of data assets refers to the time span during which data elements can continuously generate revenue for enterprises. In recent years, Shede Spirits has achieved rich results in digitalization construction, with its data assets covering all links from production to sales. However, due to special attributes of data assets such as timeliness, adjustments and optimizations to data assets are required from time to time when estimating their value. To ensure the reliability of valuation results, the revenue period should not be set too long. Therefore, this paper assumes that the timeliness of data assets is 5 years, so it sets its revenue period as 5 years, from 2024 to 2028.

3.5. Calculation of Data Asset Valuation Value

Based on the analysis results from the previous sections, the excess earnings contributed by data assets can be calculated by deducting the contribution values of Shede Spirits' current assets, fixed assets, on-balance-sheet intangible assets, and other off-balance-sheet intangible assets from its predicted free cash flows. Then, the value of data assets can be determined by discounting and summing up these excess earnings. The details are as follows:

Table 5. The Assessed Value of Data Assets of Shede Spirits

Year	2024	2025	2026	2027	2028
FCFF	317434.11	363831.97	410229.82	456627.68	503025.53
Contribution from Current Assets	32618.03	36290.52	39963.01	43635.50	47307.98
Contribution from Fixed Assets	179410.42	205440.49	231470.55	257500.62	283530.68
Contribution of Recognized Intangible Assets	17380.60	19866.54	22352.48	24838.42	27324.36
Contribution of Unrecognized Intangible Assets	14411.89	16518.41	18624.93	20731.45	22837.97
Excess Earnings from Data Assets	73613.16	85716.01	97818.85	109921.69	22024.53
Discount Rate	58.44%				
Assessed Value	134865.14				

Through the calculation of the above model, the value of Shede Spirits' data assets is estimated to be 134,865.14 ten thousand yuan, indicating that the data assets of Shede Spirits have reached a considerable scale. From this case study, it can be seen that data assets play an important role in the actual operations of enterprises, and their core value is reflected in helping enterprises carry out strategic planning, optimize asset management efficiency, stimulate innovative applications of data, and enhance enterprise competitiveness.Meanwhile, the valuation of enterprises' data assets can not only help enterprises fully understand the strategic significance of data elements, but also support management decisions by quantifying the value of data and optimize the efficiency of data resource allocation. Furthermore, it can help enterprises deeply tap the economic potential of data assets, thereby cultivating new profit growth points and enabling sustainable development.

4. Conclusions and Prospects

This research has certain limitations in the valuation of enterprises' data assets. First, there is a certain degree of subjectivity in predicting specific parameters in the valuation model, which may lead to deviations from the actual situation and thus affect the accuracy of the final valuation results. Second, the revenue period in this study is set based on the prudence principle, provisionally at five years. However, due

to the special attributes of data assets themselves—such as the significant impact of timeliness on their value—it is difficult to achieve precise division when defining their actual revenue period. Third, since this study does not consider the impact of brand value on enterprise revenue, the contribution value of data assets may include the contribution from brand value, resulting in valuation results that could be higher than the actual value.

In the field of asset valuation, research on the valuation of data assets has become the focus of many scholars' attention. However, most existing studies focus on high-tech industries such as new media and the Internet, while only a small number of scholars have paid attention to traditional industries like manufacturing and pharmaceuticals. It is expected that in future academic explorations, scholars can focus on other industries with rapid digitalization progress, construct more widely applicable valuation models, and thus promote the development and improvement of theories related to data assets.

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