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Research on management evaluation of enterprise sales cash flow percentage method based on the application of quadratic linear regression equations

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Abstract

This article introduces an improved sales percentage method to quantitatively calculate the evaluation process of the corporate sales cash flow percentage method in order to obtain more evidence-based financial data and increase the accuracy of the evaluation results. At the same time, the paper uses SPSS to perform regression analysis on related financial indicators and sales revenue and obtains quadratic regression equations and linear regression equations. The thesis predicts other financial index data based on the predicted future sales revenue, uses the revised linear regression equation to obtain the company's future net cash flow and calculates the company value.

Keywords: quadratic linear regression equation, corporate sales, cash flow percentage method**AMS 2010 codes:** 34A34

1 Introduction

The evaluation of corporate value is the basis of various corporate activities. Only by obtaining a reasonable corporate valuation can the value of an enterprise be accurately measured. We found that only by accurately measuring the value of an enterprise can we lay a solid foundation for the various activities carried out between enterprises. In the asset appraisal industry, the research on enterprise value appraisal is the core and the most complicated part. In the appraisal method and the appraisal process, we are constantly innovating methods, simplifying the process and striving for more accurate appraisal values. This article is based on a case study of the improved sales percentage method for corporate value evaluation. The sales percentage method can provide

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an objective data basis for the originally subjective future cash flow forecast of a company. The cash flow forecast is the basis for the income method to evaluate the value of the company. Therefore, the sales percentage method can make the cash flow value of the income method more reliable [1]. However, the traditional sales percentage method has certain limitations. This article improves the traditional sales percentage method to make the cash flow forecast more detailed and reliable and finally analyses the practicality of the improved sales percentage method with actual cases in the evaluation work.

The evaluation case based on this paper is the value of all the equity of ABC company shareholders involved in the proposed equity acquisition of DEF company. This evaluation case uses cost method, market method and income method to evaluate different types of assets of ABC company and uses the evaluation result of the income method as the final evaluation value. The evaluated company's future profit forecast is based on the case evaluation report basis. The case evaluates the entire equity value of the company and then subtracts the value of the debt to obtain the value of the equity. In the process of appraising the value of an enterprise, the appraiser conducted investigation, analysis and judgement on the profit forecast of the appraised company and adopted relevant data on the profit forecast of the appraised company [2]. However, the company's future cash flow forecasts obtained in this way only use qualitative assessments, and the accuracy is low. Therefore, this article proposes to adopt an improved sales revenue percentage method, namely dynamic average method, to use a quantitative method to predict the cash flow of the enterprise and, at the same time, introduce regression analysis and use regression equations to predict related financial indicators and other data that remain unchanged, thereby increasing the accuracy of the enterprise value assessment value and making up for the shortcomings of the original assessment process.

2 Case analysis

2.1 Related methods

2.1.1 Revenue model

In this case, the discount rate of the income method evaluation process selects the weighted average cost of capital (WACC). The calculation formula is as follows:

$$WACC = K_e \times \frac{E}{(D+E)} + K_d \times \frac{D}{(D+E)} \times (1-T) \quad (1)$$

The calculation formula of profitable capital cost is as follows:

$$K_e = R_f + \beta_L \times MRP + R_C \quad (2)$$

In the formula, R_f represents the risk-free rate of return; β_L represents the enterprise risk coefficient; MRP represents the market risk premium and R_C represents the enterprise specific risk adjustment coefficient. The method for determining the risk-free rate of return R_f is as follows: Treasury bonds are generally considered risk free. After calculating the compound interest factor, the average value from 1999 to the evaluation base date is 3.91%, and the risk-free rate of return for this assessment is 3.91%. The calculation formula of enterprise risk coefficient β_L is as follows:

$$\beta_L = [1 + (1-T) \times D/E] \times \beta_U \quad (3)$$

In the formula, T represents the income tax rate, which is 15% of the income tax rate implemented by the enterprise. D/E represents the current actual situation of the company and the capital structure of comparable listed companies, and the management's future financing strategy is determined at 15.60%; β_U represents the risk coefficient of the company without financial leverage.

By querying find information, select the Shanghai and Shenzhen A-share computer, communications and other electronic equipment manufacturing listed companies without financial leverage corporate risk coefficient

β_U and use the above calculation formula to calculate the financial leverage corporate risk coefficient β_L . By querying find information, β_U is 0.9124. Then, the formula $= 0.9124 * (1 + (1 - 15.60\%) * 13\%) = 1.03$.

Currently, there is a popular method to measure the risk capital premium in stock markets outside the United States. This method was proposed by A swath Damodaran, a well-known finance professor and evaluation expert at New York University's Stern School of Business. Based on the risk premium and country risk premium in the stock market, the country risk premium for this project is obtained in the Chinese market. After inquiry, the risk premium of mature stock market is 6.18%, and the country risk premium of China is 0.93%. Therefore, the current equity risk premium MPR of the Chinese market is approximately 7.11%. Figure 1 shows the basic model of stock risk premium [3]. The debt capital cost is 4.90% of the bank loan interest rate over 5 years on the assessment base date. Determination of the WACC is given as follows:

$$WACC = K_e \times \frac{E}{(D+E)} + K_d \times \frac{D}{(D+E)} \times (1 - T) = 12.01\% \quad (4)$$

Fig. 1 The basic model of stock risk premium.

2.1.2 Sales percentage method

The sales percentage method assumes that the ratio of assets, liabilities and sales revenue is stable, and so, the assets and liabilities can be predicted based on the estimated sales revenue and percentage, and then, the future cash flow of the company can be predicted. The advantage of this method is simple, practical and understandable, but there are some limitations due to the use of assumptions. The sales percentage method can be used for financial forecasting and can also be used to evaluate the bad debt balance of accounts receivable. This article uses the sales percentage method to predict the company's future cash flow. The thesis uses the sales percentage method to predict the short-term capital needs of the enterprise, and the following assumptions must be met: the proportion of annual income, costs, assets, liabilities and other items is consistent with sales revenue. Only when there is a feasible connection between these projects, the future relevant data can be predicted by the owner's current and existing income, expenses, assets, liabilities and equity [4].

2.1.3 Discounted cash flow method

Cash flow refers to the cash inflows or corporate outflows of cash receipts and payments and cash settlement systems over a period of time. Cash flow management occupies an increasingly important position in corporate management and is an important tool to ensure the company's continued operation. The cash flow status within a certain period of time can provide a theoretical basis for corporate decision-making, and at the same time, corporate cash flow is a decisive factor in the company's value.

The cash put into use will continue to flow and will eventually be converted into cash over time. Therefore, the discounted cash flow is an indicator of the company's value. The basis for estimating the value of cash flows is to calculate the present value of future income through the discount rate. The overall evaluation model can be expressed as a formula:

$$V = \sum_{t=1}^n \frac{FCFF}{(1+r)^t} \quad (5)$$

Among them, V represents the value of the enterprise, n represents the life of the asset, $FCFF$ represents the cash flow of the enterprise in t period and r represents the discount rate.

2.2 Classification of corporate cash flow discount models

By discounting the company's cash flow by WACC, the overall value of the company can be estimated. The discounted corporate cash flow model can be divided into two categories based on different assumptions about future growth, namely, stable growth models and other growth models.

2.2.1 Stable growth model

Among them, V represents the value of the enterprise on the basis of the assessment, $FCFF$ represents the future free cash flow of the company, $WACC$ represents the WACC and g represents the steady growth rate of the company's cash flow. The growth rate in this model needs to be consistent with the macroeconomic growth rate. The discount rate used is WACC. Generally speaking, the WACC of a company is lower than the cost of equity; so, the result of this model is more sensitive to the growth rate.

$$V = \frac{FCFF}{WACC - g} \quad (6)$$

2.2.2 Other growth models

The enterprise value is the sum of the cash flow limit before stabilisation and the present value of the cash flow in the stable state, expressed as follows:

$$V = \sum_{t=1}^n \frac{FCFF}{(1+r)^t} + \frac{FCFF_{n+1}}{(WACC - g)(1+WACC)^n} \quad (7)$$

2.2.3 Regression analysis

Regression analysis is the use of a large amount of observation data to analyse the specific form of correlation between independent variables and dependent variables, determine the causal relationship and use mathematical models to express their specific relationship. The statistical method of studying the relationship between one or more random variables ($y_1, y_2, \dots, y_i$) and other variables ($x_1, x_2, \dots, x_k$) is also known as multiple regression analysis. Usually, y_i is the dependent variable and x_k is the independent variable. The main contents of regression analysis are as follows:

(1) Starting from a set of data, determine the quantitative relationship between certain variables, that is, establish a mathematical model and estimate the unknown parameters; (2) test the credibility of these relationships and (3) when many independent variables affect the relationship of dependent variables, it is important to define the influence of independent variables (or smaller); the influence of independent variables is not significant, and independent analyse strings are replaced. In the model, excluding those unimportant variables is usually used to predict or control a specific process using relational hypothesis expressions.

3 The improvement of the original income method to assess the value of the enterprise

In view of the above mentioned shortcomings of the original evaluation process, this study adopted the dynamic average sales percentage method to improve the cash flow forecast of the original income method

evaluation, mainly through the following methods. First, the paper uses SPSS software to perform regression analysis on sales revenue and operating costs, business taxes and surcharges, sales expenses, management expenses and financial expenses disclosed in the evaluation instructions for 2014–2016 to find out the relationship between sales revenue and various financial indicators. Use the regression equation to express so as to obtain the predicted value of various financial indicators and the company's future cash flow after predicting future sales revenue.

3.1 Using the sales percentage method to predict the company's future cash flow

The sales percentage method is a quantitative method for predicting the company's future cash flow. The paper uses the company's sales revenue and the relationship between sales revenue and various financial indicators to predict the company's future cash flow. The industry in which the company ABC is assessed is in constant demand, that is, rising sunrise industry. Its main business is thin clients and desktop systems, and the company occupies a leading position in the industry. Its future cash flow sources are relatively stable [5]. All relevant financial data are directly related to sales revenue. Therefore, the sales percentage method is accurate.

The traditional sales method cannot accurately reflect the capital requirements and the overall value of the continuous company because it ignores the time value of the company's assets and the market situation it faces and therefore often underestimates the company's capital requirements and overall value. Therefore, the proportion of the correct application of sales methods can provide more useful information for corporate financing and provide a basis for decision-making and reference in financing activities, investment activities and dividend distribution. This method is conducive to formulating, planning and implementing the company's strategy and strengthening the company's value, strengthening management based on the maximisation of corporate value. For example, when a company decides to buy another company, an accurate forecast of the company's needs or a proper assessment of the target company's value will help make the right decision.

3.2 Adopt dynamic average improvement sales percentage method

Since money has a time value, when a company evaluates its value, it must consider the impact of the time value of money. Therefore, this time, the dynamic average method is used to improve the sales percentage method to make the forecast value of future sales revenue more accurate and in line with the actual situation. The specific process of the dynamic average method of this study is stated as follows: first use the average cost of capital rate of 12% obtained from the original appraisal report as the discount rate and then calculate the final value of ABC's 2014–2016 sales revenue. The average of the value is used as the sales revenue forecast value in 2017, and when forecasting the sales revenue in 2018, the average value obtained from the final sales revenue value in 2015–2017 is used.

Using this improved method has the following advantages: First, the comprehensive information is powerful. The improved sales percentage method comprehensively analyses historical data. The traditional percentage of the sales percentage method is based on data from the accounting period and is not representative. In addition, the company's estimated financial statements are calculated using the discounted cash flow method with the improved sales percentage method, which fully reflects the company's operating benefits and takes into account the company's overall different economic conditions. Second, the method considers the time value of capital. The traditional percentage sales method uses basic base period data as the basis for calculating financial reports, without considering the influence of factors such as inflation and currency devaluation. In the case of inflation, the value of assets in the base period may be much lower than the current market value [6]. Therefore, financial reports calculated on this basis may not be accurate. The improved sales percentage method reflects the time value of capital. Using this method as the basis for evaluating the company's value can bring more reliable value to investors.

The above method is used to predict the future sales revenue of the company. Since the evaluation base date of this project is September 30, 2016, the sales revenue from October 2016 to December 2016 is first predicted. Specifically, the discount rate is 12%, and the final value is calculated for 2 years. (a) The sales revenue in 2015

is calculated at a discount rate of 12%, and the final value is calculated for 1 year; (b) the period from January 2016 to September 2016 is calculated as 9%. Calculate the final value 'c' for the monthly period. According to the calculation formula $a/4 + b/4 + c/3$, the sales revenue from October 2016 to December 2016 is 207,983,800 yuan; so, the total sales revenue in 2016 is 68,676,500 yuan. yuan.

3.3 Regression analysis of sales revenue and other financial indicators

The paper adopts the regression method of curve estimation: the paper selects linear regression, quadratic regression and logistic regression to test and draws the regression equation between the theory and related indicators.

3.3.1 Operating costs and sales revenue

Figure 2 shows the relationship between operating costs and sales revenue. It can be seen from the figure that the result of the quadratic regression of operating cost and sales revenue is the best, the quadratic function R is 1 and the goodness of fit is the highest and 100% significant. Therefore, the quadratic function relationship of operating cost y_1 and sales revenue x is obtained using the following formula:

$$y = 1.955 \times 10^{-5}x^2 - 1.67x + 6.8897.943 \quad (8)$$

Fig. 2 Regression analysis results of operating costs and sales revenue.

3.3.2 Business taxes and surcharges and sales revenue

Figure 3 shows the results of regression analysis of business tax and surcharges and sales revenue. It can be seen from the figure that the results of the quadratic regression of business taxes and surcharges and sales revenue are the best, and the quadratic function R has a square value of 1, and the goodness of fit is the highest and 100% significant [7]. Therefore, the quadratic of operating cost y_2 and sales revenue x functional relation is as follows:

$$y = 2.042 \times 10^{-7}x^2 - 0.02x + 667.13 \quad (9)$$

Fig. 3 The results of regression analysis of business tax and surcharges and sales revenue.

3.3.3 Sales expenses and sales revenue

Figure 4 shows the results of regression analysis of sales expenses and sales revenue. It can be seen from the figure that the results of the quadratic regression of sales expenses and sales revenue are the best, and the quadratic function R has a square value of 1, and the goodness of fit is the highest and 100% significant. This results in the quadratic function of operating cost y_3 and sales revenue x relationship:

$$y = 3.404 \times 10^{-6}x^2 + 0.461x - 10266.728 \quad (10)$$

Fig. 4 Regression analysis results of sales expenses and sales revenue.

Although the goodness of fit of linear regression is lower than the goodness of fit of the quadratic function because the curve has begun to show a downward trend, if the increase in sales revenue in the later period is still predicted by the quadratic curve, the sales expenses will begin to decline, which does not conform to the actual situation. Therefore, the regression prediction of sales expenses and sales revenue is calculated according to the revised linear regression formula [8].

3.3.4 Adjustment of regression analysis results

Although each financial index has the highest degree of fit with the sales revenue quadratic regression, after actual calculations, when this equation is used for cash flow forecasting, each year's profit is negative [9]. The calculation results are shown in Table 1:

Table 1 The results of the calculation of the secondary regression financial indicators.

	2018 year	2019 year	2020 year	2021 year	2022 years and beyond
Sales revenue	96615.42	107282	124186.4	136467	136467
Less: operating costs	90040.44	114746.3	163012	205082.5	205082.5
Business tax and surcharges	640.93	871.71	1332.63	1740.66	1740.66
Sales expense	5707.35	5984.68	6424.2	6743.49	6743.49
Management costs	9634.48	10157.14	10985.46	11587.2	11587.2
Financial expenses	118.51	339.29	885.07	1432.2	1432.2
Profit	−9526.29	−24817.1	−58452.9	−90119.1	−90119.1

The calculation results show that the annual profit of each forecast is negative, indicating that the regression model does not meet the reality. Therefore, the revised one-variable linear regression model is used for data analysis. The linear model is theoretically more realistic. With the increase in sales revenue, it is reasonable that all revenues such as operating costs and management expenses will increase accordingly. Therefore, the revised linear regression equation is used to re-predict the relevant financial indicators [10]. Based on the revised regression equation, the financial index calculation table is shown in Table 2:

Table 2 The revised linear regression financial calculation table.

	2018 year	2019 year	2020 year	2021 year	2022 years and beyond
Sales revenue	96615.42	107282	124186.43	136467.02	136467
Less: operating costs	71607.87	80471.79	94519.38	104724.55	104724.6
Business tax and surcharges	582.98	657.64	775.98	861.94	861.94
Sales expense	5707.35	5984.68	6424.2	6743.49	6743.49
Management costs	9634.48	10157.14	10985.46	11587.2	11587.2
Financial expenses	118.51	339.29	885.07	1432.2	1432.2
Profit	8964.23	9671.44	10596.35	11117.63	11117.63

As shown in Table 2, the indicator values and annual profits are basically in line with reality, indicating that the forecast is effective and credible [11].

3.4 Re-evaluation of ABC company's corporate value

The paper uses the improved sales percentage method to predict the new net cash flow. Based on this net cash flow, the value of the company is re-evaluated [12]. The discount rate, long-term equity investment and other financial indicators are all used in the original evaluation conclusions, thus drawing the company's total equity value. The paper discounts the net cash flow, and the results are shown in Table 3:

Table 3 Net cash flow discount table.

Project	2018	2019	2020	2021	2022 and beyond
Net cash flow	7,964.41	8,777.32	9,715.67	10,252.93	10,252.93
Years	2.25	3.25	4.25	5.25	6.25
Discount rate	12.01%	12.01%	12.01%	12.01%	12.01%
Discount factor	0.77	0.69	0.62	0.55	4.59
Net present value	6,170.83	6,071.27	5,999.43	5,652.44	47,060.97
Net present value sum	78439.11				

Based on this, the paper determines the evaluation results:

The overall value of the company = the discounted present value of the company's free cash flow + the value of surplus assets + the value of non-operating assets and liabilities + long-term equity investment = 78,439.11 + 1,986.88 + 2,245.81 + 152.78 = 82,825.00 million yuan (rounded up).

The value of all shareholders' equity = the overall value of the company-interest-bearing debt = 82,825.00 – 12,800.00 = 70,025,000 yuan (rounded up).

3.5 Comparison of evaluation results before and after improvement

The overall value of the enterprise obtained by the income method reassessment is 828.25 million yuan, the total equity value of the equity is 700.250 million yuan, the original assessment of the overall value of the enterprise is 1,492,190,000 yuan and the value of all shareholders' equity is 1,364,190,000 yuan. The appraisal value has declined due to the introduction of an improved sales percentage method to predict the company's future cash flow, which makes the appraisal value more objectively based, to a certain extent, reduces the interference of human factors that only use subjective forecasts and makes appraisal value and book value. Compared with the book value of the total equity value of the re-evaluated shareholders, the valuation increase was RMB 524,966,800, with an increase rate of 299.5% and the original income method evaluation rate of 678.28%. According to calculations, during the original assessment process, the average growth rate of sales revenue was 29%, and the average growth rate of net cash flow was 16%. According to the data of the National Bureau of Statistics, the sales revenue of new products in the high-tech industry of China's electronic device manufacturing industry in 2016 was 528,541,600 yuan and in 2015 was 421,300.953 million yuan, with a year-on-year growth rate of 25%; other electronic equipment manufacturing high-tech industry new product sales revenue in 2016 was 112,633,196 million yuan and in 2015 was 104,673.759 million yuan, with a year-on-year growth rate of 7.6%. From this, it can be seen that the original assessment process had too optimistic subjective predictions on the future operating conditions of the company, and the sales revenue forecast was too high. Considering the improvement of the time value of funds, the average growth rate of sales revenue is 8%, and the average growth rate of net cash flow is 10%. The estimated value is closer to reality.

In addition, the financial expenses were not calculated in the original evaluation process, but the latest China Social Financing Cost Index shows that the average social financing cost in my country has reached 7.6%, and enterprises will inevitably incur financial expenses in the actual operation process, and financial expenses are expected to increase. Therefore, the improved evaluation process is more reasonable, and there are reasons to believe that the income method evaluation value obtained in this study is more accurate.

4 Conclusion

This paper selects the case of DEF company acquiring the value of all shareholders' equity of ABC company as the research object. Based on the improved sales percentage method, the company's future cash flow is predicted, and the original case is re-evaluated to obtain the corporate value and all shareholders' equity value.

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