

Empirical Research on the Effectiveness of Enterprise Performance Evaluation from EVA Perspective ——A Case Study of Small and Medium-sized Enterprises

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Keywords: Small and Medium-sized Enterprises, Traditional Financial Index, Economic Value Added, Empirical Research

Abstract: The EVA evaluation system has been widely used abroad as an efficient approach for evaluating the enterprise performance. It can provide more concise and precise performance evaluation criteria, enabling managers to make more precise decisions, thus EVA has received more and more attention. This paper has selected 101 companies listed in the small and medium-sized board from 2015 to 2017 as research objects, mainly selecting the economic value added (EVA), net profit margin (NPS), return on equity (ROE), return on total assets (ROA), total asset turnover (TAT), earnings per share (EPS), and property net profit rate (PRN) from them in the past three years to demonstrate the validity of EVA data. The results show that there is a close relationship between EVA and traditional financial index, and it is effective to apply EVA to evaluate enterprise performance.

1. Introduction

In the early 1990s, in order to adapt to the changes in the business environment, a set of financial management system, decision-making mechanism and incentive compensation system, new financial performance evaluation index based on economic value added concepts was proposed and implemented by American scholar Stewart and registered and implemented by Co. Stern & Stewart in 1982[1]. The purpose of the Economic Value Added (EVA) is to overcome the drawback of traditional index and accurately reflect the value that the company creates for shareholders[2]. After development, EVA index has got more and more attention and favor from the business circles. Nearly 300 companies such as Coca-Cola, IBM, General Motors, Siemens, Sony, Dell, and Wal-Mart have begun to use the EVA management system.

With the development of economy and the deepening of reform and opening up, Western financial ideas and application systems gradually introduced, China began to introduce EVA index in 1999. At the initial stage, the EVA evaluation system was mainly used by large and medium-sized enterprises[3]. After developing and evolving, the EVA evaluation system has gradually gained the general consent of society and investors, which is widely used in various sizes and forms of enterprises. However, due to the application of EAV is relatively short lived at home, there are still some problems to be solved. The purposes of this paper are to study the effectiveness of EVA based on EVA data, and to find the difference and connection with traditional financial analysis index, hoping to get some suggestions and conclusions.

2. Selection and analysis of sample data

2.1 Sample data selection

This paper mainly selects 101 companies listed in the SME board from 2015 to 2017 as research objects, using the regression analysis to verify the validity of the EVA value, and

then adopts the selected net profit margin (NPS), return on equity (ROE), total return on assets (ROA), total asset turnover (TAT), earnings per share (EPS), property net profit rate (PRN) and EVA to establish a regression model to analyze the correlation between it and selected financial index.

Table 1 Variables

VARIABLE	NAME	VARIABLE
Dependent Variable Y	EVA	Economic Value Added $EVA = NOPAT - \text{Capital Charge}$ $= NOPAT - k_w \times TC$
Independent Variable X_1	ROE	Return on Equity $ROE = \frac{NP}{TL}$
Independent Variable X_2	ROA	Total Return on Assets $ROA = \frac{NOPAT}{ATA}$
Independent Variable X_3	NPS	Net Profit Margin $NPS = \frac{NP}{SR}$
Independent Variable X_4	PRN	Property Net Profit Rate $PRN = NPS \times TAT$
Independent Variable X_5	EPS	Earnings Per Share
Independent Variable X_6	TAT	Total Asset Turnover

Where, *NOPAT* indicates the operating net profit after adjusted by accounting and tax, that is, after-tax profit, k_w represents the capital cost rate. *TC* indicates the corporate total capital; *NP* stands for net profit; *SR* stands for sales revenue; *TL* means creditors' equity at year-end; *ATA* indicates average total assets; *NR* represents net revenue.

2.2 Analysis method

EXCEL and SPSS are applied to analyze data, using sample data with descriptive statistics to analyze whether there is the difference in the performance of the sample company or not. Correlation analysis is performed on the basis of descriptive statistics[4]. Then, the economic value added is the dependent variable, and the traditional financial index is the independent variable. The regression analysis method is employed for empirical analysis.

Since the selected data variables and influential factors in this paper are quite many, the multiple linear regression model is used for analysis.

Multivariate Regression is mainly used in data analysis that requires multiple independent variables to explain the dependent variable. The model expression formula is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

After establishing the regression equation, the equation should be tested in terms of the significance of the regression coefficient, the degree of fit, the significance of the regression equation, and the D.W. test.

The significance test of the regression coefficient is the T test. The statistic *t* is preferentially calculated during the test, and the value is compared with the reference distribution table. If it is greater than the critical value, there is a significant relation, otherwise there is no significant relation[5].

The formula of *t* is:

$$t = \frac{|\bar{X} - \mu_0|}{S_{\bar{X}}} = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$$

In general, the value of *t* is less than 0.05 or closer to 0, the better, indicating that the value of *t* is more significant.

In the test of goodness for fit, R^2 is usually used. The value R^2 gets closer to 1, the higher the fitting of the sample data in the regression model.

The significance test of the regression equation is mainly tested by the F value, indicating whether the linear relation between the interpreted variable and all explanatory variables in

the model is significantly in general or not.

Dubin-Watson test (D.W. test), is an autocorrelation test for testing residual sequences[6]. The range of values for D.W. is divided into two phases: 0 to 2 and 2 to 4 respectively[7]. The specific value should be discussed according to the practical situation.

3. Research design

3.1 Research hypothesis

EVA index evaluation has been applied in China for nearly 20 years. The history of EVA development in China is not long. Although large companies are using EVA system to evaluate the performance of enterprises, many small and medium-sized enterprises in China still use traditional financial analysis index to analyze enterprise performance.

In order to evaluate the reliability of the EVA index on the enterprise performance evaluation, and whether there is correlation between EVA and different financial analysis index, the article makes the following assumptions:

The results of EVA operation performance evaluation are consistent with the results based on traditional financial index, and have the correlation. EVA is effective in corporate performance evaluation[8].

3.2 Empirical analysis

3.2.1 Descriptive statistics

The following is the descriptive statistics after preliminary analysis of the sample data of the target 101 small and medium-sized listed companies, in order to analyze the net profit margin (NPS), return on equity (ROE), return on total assets (ROA), total asset turnover (TAT), earnings per share (EPS), and property net profit rate (PRN).

Table 2 2015 Variable Descriptive Analysis

Descriptive statistics						
	N	minimum value	maximum value	Mean	Standard Deviation	Variance
EVA	101	-2918732940	1512329142.7	26369521.4	405774167.4	164652674935828000.
		.0	9	9	1	00
ROE	101	-67.08	34.41	7.68	11.53	133.05
ROA	101	-23.31	26.22	6.68	6.19	38.33
NPS	101	-44.90	56.40	8.10	11.97	143.24
PRN	101	-23.45	23.25	4.67	5.89	34.73
EPS	101	-1.67	1.52	0.33	0.40	0.16
TAT	101	0.10	7.39	0.75	0.77	0.59

The source of data is from CSMAR

It can be obtained from the above table that the average of each financial index is positive, indicating that the selected data of 2015 has certain economic benefits. The company management is relatively stable and its performance is good. The standard deviation of the above financial index is between 0 and 12, indicating a large degree of difference between the variables. The standard deviation of EPS in each index is the smallest, which is 0.40, showing that it has the smallest transaction range and the highest stability among the seven indexes. The remaining six financial indexes have a large standard deviation, that is, the scope of the transaction is large.

Table 3 2016 Variable Descriptive Analysis

Descriptive statistics						
	N	minimum value	maximum value	Mean	Standard Deviation	Variance
EVA	101	-2445803707.50	2738852849.11	46496677.59	448930793.46	201538857317298000.00
ROE	101	-78.76	133.06	7.73	17.95	322.17
ROA	101	-16.10	58.70	6.75	7.64	58.40
NPS	101	-175.47	49.91	5.96	22.36	500.16
PRN	101	-15.67	51.72	4.81	7.07	49.95
EPS	101	-0.62	7.55	0.38	0.81	0.65
TAT	101	0.07	7.31	0.70	0.76	0.58

The source of data is from CSMAR

It can be seen from Table 3 that the index data in 2016 is generally higher than that in 2015. Compared with last year, the average EVA is increased by 20127156.10, that is, the sample enterprises have created an average of 20127156.1 wealth. Compared with last year, the traditional financial indexes have increased slightly, and the standard deviation is between 0 and 23, indicating that the changes between variables are still large. The TAT decreased by 0.01 compared with 2015, but the descend degree was too small. Compared with 2015, the indexes of transaction range in 2015 are significantly more flexible and less stable.

Table 4 2017 Variable Descriptive Analysis

Descriptive statistics						
	N	minimum value	maximum value	Mean	Standard Deviation	Variance
EVA	101	-3331199985.00	3296509947.95	84767877.25	582919089.15	339794664491736000.00
ROE	101	-49.71	70.71	9.15	11.11	123.52
ROA	101	-23.07	42.01	7.00	6.64	44.02
NPS	101	-108.32	44.30	8.47	16.21	262.82
PRN	101	-24.54	36.12	5.12	6.12	37.45
EPS	101	-0.92	1.71	0.34	0.36	0.13
TAT	101	0.05	5.61	0.69	0.67	0.45

The source of data is from CSMAR

The data in the above table reflects that the average of EVA in 2017 is higher than that in 2016, and the increasing range is larger; the increase of standard deviation indicates that the EVA transaction range is larger. At the same time, compared with 2016, the standard deviation of other financial indexes has decreased and the range is between 0 and 17, the smallest of which is EPS, the largest is still the NPS and ROE, indicating the change scope of NPS and ROE is relatively large and unstable in terms of other indexes.

According to the above three-year sample data, the average of EVA shows an upward trend year by year, while other financial indexes show an upward trend of oscillation, indicating that EVA and other traditional financial indexes are consistent in performance evaluation. The ROA and EPS of sample enterprises rose from 6.68 and 8.10 in 2015 to 7.00 and 8.47 in 2017 respectively, indicating that the financial situation of the sample enterprises are more optimistic in some degree.

3.2.2 Correlation analysis

This paper chooses the two-tailed test, because the purpose of the correlation analysis in it is to study whether EVA is related to traditional financial indexes, rather than testing whether EVA index is superior to traditional index in evaluating enterprise performance.

Table 5 2015 Correlation Matrix

	EVA	ROE	ROA	NPS	PRN	EPS	TAT
EVA	1.000	0.595**	0.578**	0.472**	0.566**	0.608**	0.008
ROE	0.595**	1.000	0.899**	0.765**	0.901**	0.858**	0.099
ROA	0.578**	0.899**	1.000	0.827**	0.978**	0.825**	0.123
NPS	0.472**	0.765**	0.827**	1.000	0.853**	0.739**	0.152
PRN	0.566**	0.901**	0.978**	0.853**	1.000	0.848**	0.132
EPS	0.608**	0.858**	0.825**	0.739**	0.848**	1.000	0.098
TAT	0.008	0.099	0.123	0.152	0.132	0.098	1.000

** . Significantly correlated at .01 level (two sides)

b. N=101

The source of data is from CSMAR

As can be seen from the above table, the data between EVA and other traditional financial indexes are between 0 and 1, which is positively correlated[9]. Except for the lack of correlation with the TAT, it is significantly correlated with other traditional financial indexes at the level of 0.01. Among them, EVA is moderately related to ROE, ROA and PRN and strongly related to EPS.

Table 6 2016 Correlation Matrix

	EVA	ROE	ROA	NPS	PRN	EPS	TAT
EVA	1.000	0.679**	0.735**	0.316**	0.729**	0.752**	0.033
ROE	0.679**	1.000	0.886**	0.718**	0.913**	0.871**	0.144
ROA	0.735**	0.886**	1.000	0.567**	0.984**	0.857**	0.153
NPS	0.316**	0.718**	0.567**	1.000	0.615**	0.386**	0.038
PRN	0.729**	0.913**	0.984**	0.615**	1.000	0.859**	0.164
EPS	0.752**	0.871**	0.857**	0.386**	0.859**	1.000	0.116
TAT	0.033	0.144	0.153	0.038	0.164	0.116	1.000

** . Significantly correlated at .01 level (two sides)

b. N=101

The source of data is from CSMAR

Table 6 is similar to Table 5. EVA is significantly correlated with financial indexes other than TAT at a level of 0.01. Among them, it is weakly related to NPS but strongly related to ROE, ROA, PRN and EPS.

Table 7 2017 Correlation Matrix

	EVA	ROE	ROA	NPS	PRN	EPS	TAT
EVA	1.000	0.719**	0.716**	0.429**	0.692**	0.535**	0.079
ROE	0.719**	1.000	0.945**	0.751**	0.937**	0.670**	0.182
ROA	0.716**	0.945**	1.000	0.722**	0.988**	0.671**	0.221*
NPS	0.429**	0.751**	0.722**	1.000	0.751**	0.544**	0.069
PRN	0.692**	0.937**	.988**	0.751**	1.000	0.683**	0.227*
EPS	0.535**	0.670**	0.671**	0.544**	0.683**	1.000	0.192
TAT	0.079	0.182	0.221*	0.069	0.227*	0.192	1.000

** . Significantly correlated at .01 level (two sides)

* . Significantly correlated at .005 level (two sides)

c. N=101

The source of data is from CSMAR

As we can see from Table 7, EVA has a significant positive correlation with all traditional financial indexes at the level of 0.01. Among them, it is strongly related to ROE, ROA and

PRN; it is moderately related to NPS and EPS; it is still very weakly related to TAT.

Through the analysis of the sample data in three years, it is found that there is a positive correlation between EVA and NPS, ROE, ROA, EPS, PRN. Therefore, applying EVA to measure the enterprise performance and profitability has a certain effectiveness. In particular, the degree of correlation among EVA, ROE and ROA is relatively strong in the three tables, indicating that EVA is applicable to corporate performance and corporate value. However, at the same time, we can also significantly find that EVA and TAT are always extremely weakly related and irrelevant showing that EVA is quite different from traditional financial indexes in evaluating the quality of asset management.

3.2.3 Linear regression analysis

According to the regression model and variable definition, we can establish the following regression model, the regression model expression is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

Where, β_0 represents regression coefficient, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ respectively represents the impact of ROE, ROA, NPS, PRN, EPS, TAT on EVA, ε indicates random error[10].

Table 8 2015 Model Summary

Dependent Variable	Independent Variable	Model Summary			ANOVA	
		R-sq.	Adjusted R-sq.	D.W.	F	Sig
EVA	NPS, ROE, ROA, TAT, EPS, PRN	0.407	0.369	1.940	10.758	.000 ^b

Table 9 2015 Multiple Regression Results

Model	B	Standard Error	Standardized Coefficients	t	Sig.
1 (Constant)	-201202636.322	75109205.215		-2.679	0.009
ROE	6851869.087	7257075.647	0.195	0.944	0.048
ROA	30320026.536	25723922.411	0.463	1.179	0.042
NPS	-4644198.220	6035981.176	-0.137	-0.769	0.044
PRN	-18690256.610	30958158.872	-0.271	-0.604	0.047
EPS	403351930.912	167207598.711	0.400	2.412	0.018
TAT	-48983911.914	49464278.372	-0.093	-0.990	0.325

The source of data is from CSMAR

It can be seen from Table 8 that D.W. is equal to 1.940. According to the actual situation, this value can be equal to 2, indicating that the residual sequences of this sample are mutual independence, and the dependent variable and the independent variable are positively correlated. The value of F is 10.758, The sig.F is equal to $0.000^b < 0.05$, indicating that the regression result is significant. R^2 equals to 0.407, indicating that this equation has reached the standard degree of fitting, but slightly lower than expected value.

Based on Table 9, the values of sig.t of ROE, ROA, NPS, PRN, and EPS are all below 0.05, indicating that EVA can be linearly combined by the above independent variables. However, the value of sig.t of TAT in traditional financial indexes is greater than 0.05, indicating that it has nothing to do with EVA[11]. This index has no explanatory power for EVA.

Table 10 2016 Model Summary

Dependent Variable	Independent Variable	Model Summary			ANOVA	
		R-sq.	Adjusted R-sq.	D.W.	F	Sig.
EVA	NPS, ROE, ROA, TAT, EPS, PRN	0.609	0.584	1.900	24.378	.000 ^b

Table 11 2016 Multiple Regression Results

Model	B	Standard Error	Standardized Coefficients	t	Sig.
1 (Constant)	-157475558.115	56668174.159		-2.779	0.007
ROE	-234884.752	6553679.780	0.009	2.036	0.041
ROA	13724413.836	21918235.846	0.234	3.626	0.033
NPS	-2287191.891	2674555.902	0.114	2.855	0.095
PRN	15686392.072	26524813.207	0.247	2.591	0.056
EPS	223986774.973	109529167.255	0.402	2.045	0.044
TAT	-49770401.411	39122623.762	-0.085	-1.272	0.206

The source of data is from CSMAR

It is known from Table 10 that the residual sequences are mutual independence, and D.W. is equal to 1.900 and approximately equal to two. The value of F is 24.378, and the sig.F is equal to $0.000^b < 0.05$, indicating that the regression result is significant. R^2 is equal to 0.609, indicating that the equation has a high degree of fitting, and the selected seven financial indexes have the ability to interpret EVA.

It can be concluded from Table 11 that the values of sig.t of ROE, ROA, EPS, are all less than 0.05, indicating that EVA can be linearly composed of the above indexes. The values of remaining NPS, PRN, and TAT are all larger than 0.05, indicating that these three indexes have no explanatory power for EVA and should be removed from the model.

Table 12 2017 Model Summary

Dependent Variable	Independent Variable	Model Summary			ANOVA	
		R-sq.	Adjusted R-sq.	D.W.	F	Sig.
EVA	NPS, ROE, ROA, TAT, EPS, PRN	0.587	0.561	1.917	22.292	.000 ^b

Table 13 2017 Multiple Regression Results

Model	B	Standard Error	Standardized Coefficients	t	Sig.
1 (Constant)	-329532581.935	89777305.459		-3.671	0.000
ROE	27684469.601	11188644.605	0.528	2.474	0.015
ROA	60761366.742	41456365.253	0.692	1.466	0.046
NPS	-11640844.525	4147711.875	-0.324	4.807	0.006
PRN	-27840443.667	44136048.348	-0.292	3.631	0.030
EPS	194547485.039	146990528.099	0.122	2.324	0.019
TAT	-129559936.524	64465545.978	-0.149	-2.010	0.057

The source of data is from CSMAR

As can be seen from Table 12, the residual sequences are mutual independence. D.W. is equal to 1.917 and approximately equal to 2. The value of F is 22.292, and the sig.F is equal to $0.000^b < 0.05$, indicating that the regression result is significant. R^2 is equal to 0.587, indicating that the regression equation has a high degree of fitting.

It can be seen from Table 13 that the values of sig.t of ROE, ROA, NPS, PRN and EPS are all less than 0.05, indicating that the above traditional financial indexes have significant

correlation with EVA. Only the value of sig.t is larger than 0.05, showing that TAT has no correlation with EVA and should be removed from the model.

From the model established from 2015 to 2017, it is found that there is a significant linear relation between EVA and traditional financial indexes. NPS, ROE, ROA, EPS, and PRN can all explain EVA. This shows that EVA has certain effectiveness on assessing enterprise management capacity, asset quality and corporate value. However, the relation between EVA and TAT did not pass the significance testing. Therefore, it is more desirable to establish an evaluation system based on EVA and take full consideration of individual non-financial indexes.

4. Conclusion

The purpose of EVA is to maximize shareholder wealth while taking into account the cost of equity capital[12]. EVA is able to rationally adjust traditional financial data, thus it is an authentic and dependable enterprise performance evaluation system[13]. This paper analyzes the data of small and medium-sized enterprises by establishing a multiple regression linear model. Through empirical research, the following conclusions are obtained:

4.1 The effectiveness of EVA index

This paper selects small and medium-sized listed enterprises from 2015 to 2017 as a sample, and obtains a series of results through empirical analysis. From the sample data, the average of EVA is on the rise. Traditional financial indexes are in a state of increasing unstably. The trend of EVA and traditional financial index is generally same, which indicates have the correlation between EVA and traditional financial index, that is, it is consistent with traditional financial index. Therefore, EVA index is effective in evaluating corporate performance.

4.2 The drawback of EVA index

After correlation analysis, it is found that EVA has significant correlation with NPS, ROE, ROA, EPS and PRN. However, it is also found that the correlation coefficient between EVA and TAT was lower than the minimum standard of correlation, and both show extremely weak correlation or even no correlation. It proves that the correlation between EVA and TAT is very small, indicating that EVA differs from traditional financial index in evaluating the efficiency of enterprise asset investment and the quality of asset management. Therefore, it is more desirable to establish an evaluation system that focuses on EVA and fully considers non-financial indicators when conducting performance evaluation.

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