Research on Business Performance Evaluation System for Shaanxi Listed Companies Based on EVA-BSC Coupling

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Abstract. Integrating advantages of EVA (Economic Value Adding) and BSC (Balanced Score Card), this thesis constructs a business performance evaluation system for Shaanxi listed companies and examines its application value. Based on both EVA, a financial indicator mirroring a company's value creating ability, and BSC, a non-financial but strategic indicator for performance evaluation, an empirical research on financial and performance data from 41 listed companies in Shaanxi province is conducted to examine the system's validity and practical applications. Result shows that EVA-BSC based performance ranking in 15 companies is in substantial agreement with that in EVA based raking while 26 companies see variation, demonstrating EVA-BSC based performance evaluation system's comprehensiveness and practical application value.

1. Situation of Performance Evaluation in Shaanxi Listed Companies

There are 46 listed companies in Shaanxi province up to the end of 2017, including entities in manufacture, finance, mining, wholesale and retail, tourism, accommodation and restaurants, typography, electric and gas and broadcast television industries. Twenty-eight manufacture companies account for 61 percent of the group, while the share of 4 mining companies is 8 percent. Three common issues in performance evaluation can be noticed after analyzing 46 companies' 2017 financial report: (1) Financial indicator is heavily weighted to maximize profits; (2) Cost of equity capital has been overlooked; (3) Non-financial indicator lacks enough attention.

2. EVA-BSC Based Performance Evaluation System for Shaanxi Listed Companies

According to the design principle and ideas of performance evaluation system, EVA-BSC based performance evaluation system is structured based on current operation of Shaanxi listed companies as follows(Table 1), while *Standard Value of Enterprise Performance Evaluation 2016* and methods[1] at home and abroad are referenced.

Table 1. EVA-BSC Based Performance Evaluation System for Shaanxi Listed Companies

Grade I	Grade II	Calculation Formula/Meaning	Source & Code
Finance	EVA	NOPAT－Cost of Capital	Model Calculation,X1
	EVA Return Rate	EVA / Total Adjusted Capital	Model Calculation,X2
	Return on Total Asset	Net Profit / Average Total Assets	Annual Report,X3
	Return On Equity	Net Profit / Owners Equity	Annual Report,X4
Customer	Customer Loyalty	Top Five Customers' Revenue Proportion of Operating	Substitution Variables,X5
	Sales Increase	（Current Sales - Last Year's Sales）/Last Year's Sales	Annual Report,X6
Internal Progress	Total Asset Turnover Ratio	Net Sales / Average Total Assets	www.cninfo.com.cn,X7
	Inventory Turnover	Annual Cost of Sales / Average Stock Balance	www.cninfo.com.cn,X8
	R&D Input	R&D Expenditure / Prime Operating Revenue	Annual Report,X9
	Ratio of Profits to Cost	Total Profit / Total Cost	Annual Report,X10

Cont. to Table 1			
Learning and Growth	Employee Quality	College(and above) Educated Employees / Total Employees	Annual Report,X11
	R&D Ratio	R&D Employees / Total Employees	Annual Report,X12
	Per-capita Education Spending	Educational Expenditure / Total Employees	Annual Report,X13

Note: Due to objective reasons including considerable empirical sample, complicated data processing and inaccessible data, this thesis brings in top five customers' revenue proportion of operating in place of customer satisfaction.

3. Empirical Examination on EVA-BSC Based Performance Evaluation System for Shaanxi Listed Companies

3.1 Sample selection and data sources

Forty-one Shaanxi listed companies are selected from 46 in Shanghai and Shenzhen Stock Exchanges, getting rid of three undesirable ones and two (XINGHUA CHEMISTRY and HST) facing withdrawal risks. Disclosed data of 41 listed companies in 2107 are mainly required from audited Annual Report 2016 and 2017 published on www.cninfo.com.cn. SPSS22.0 serves for data statistics and analysis.

3.2 EVA calculation

Rules for Assessing Economic Value Added, published by State-owned Assets Supervision and Administration Commission (SASAC) in 2016, shows: EVA = Net Operating Profit After Tax - Capital Cost = Net Operating Profit After Tax - Total Capital*Weighted Average Cost of Capital = NOPAT－TC*WACC.

The equation above demonstrates that EVA can be got after necessary adjustment on conventional accounting profit. Various industries, company scales and other factors require following transformation of EVA in the 41 listed companies:

Net Operating Profit after Tax = Net Profit + (Interest Expense + R&D Cost Adjustment + Depreciation reserves)*(1－25%) + Increase in Deferred Income Tax Liabilities + Decrease in Deferred Income Tax Assets

Adjusted Total Capital = Average Equity + Average Total Liabilities - Average Interest-free Current Liabilities - Average Construction in Progress + Impairment Allowance Adjustment

Weighted Average Cost of Capital Rate = (Cost Ratio of Equity Capital* Proportion of Equity Capital in Total Capital) + (Cost of Debt* Asset-liability Ratio)*(1- Income Tax Rate)

The cost of debt is got by taking a weighted average of interest rates of short term and long term. And cost ratio of equity capital can be worked out based on Capital Asset Pricing Model (CAPM): Cost Ratio of Equity Capital = Risk-free Return Rate +β* Market Risk Premium

On the basis of models above, EVA of sample companies is exhibited in Table 2.

Table 2. EVA and EVA Return Rate of 41 Shaanxi Listed Companies

Company	NOPAT	Adjusted Total Capital	WACC	EVA	EVA Return Rate
LONGI	2256779251.96	9792413583.89	5.26%	1741729870.67	17.79%
SHCI	4719900332.17	59914995193.07	5.28%	1558356512.96	2.60%
CHINA XD	1757340888.07	22200001884.03	5.60%	514291744.90	2.32%
CCOOP	1857056204.69	26146254792.45	5.30%	470862364.80	1.80%
AECC AVIATION POWER	1908769722.75	28037701851.63	5.19%	453379941.33	1.62%
CRE	475633560.87	2800257434.51	5.26%	328457589.11	11.73%
SHAANXI GAS	626674892.87	7749324125.48	5.23%	221601638.53	2.86%
SHAANGU	538794534.75	7039387401.57	5.22%	171512109.84	2.44%
FENGHUO ELECTRONICS	219165220.30	1301040590.55	5.36%	149395368.90	11.48%

Cont. to Table 2					
YCHJ	245997362.64	1899899921.01	5.25%	146159948.49	7.69%
HNA-CAISSA TRAVEL	276415211.53	3008224841.16	5.13%	122113977.85	4.06%
ZEMIC	169468879.03	1421147301.21	4.10%	111135649.34	7.82%
CECEP ENVIRONMENTAL PROTECTION EQUIPMENT	182208825.86	1739836247.21	5.19%	91878963.60	5.28%
SHAANXI HEIMAO	425082189.36	6412779742.67	5.21%	90882014.56	1.42%
SCMC	256305892.03	3792749223.50	5.25%	57142175.48	1.51%
SUNRESIN NEW MATERIALS	79545226.09	662820031.94	4.45%	50050505.99	7.55%
TYPICAL	113679004.14	1323374748.95	5.40%	42153770.59	3.19%
CHENXI AVIATION	61864804.48	374086466.80	5.37%	41786526.00	11.17%
BVEA	56620481.08	545166983.28	5.31%	27695910.87	5.08%
GLOBAL PRINTING	47340614.70	526147653.27	5.35%	19207056.76	3.65%
QJCT	86246802.44	1312106241.74	5.32%	16458671.67	1.25%
SHAANXI JINYE	84618383.00	1306127319.84	5.29%	15549652.34	1.19%
SXBN	191018199.80	3326096912.24	5.30%	14750818.66	0.44%
WESTERN METAL MATERIALS	171954861.57	2611001662.68	6.09%	12891834.31	0.49%
NTERNATIONAL MEDICAL INVESTMENT	234290316.81	4276603314.48	5.29%	8050788.48	0.19%
TIANHE DEFENSE	73572353.06	1433124283.67	5.34%	-3023516.06	-0.21%
BUT'ONE	7378268.69	225167070.68	5.06%	-4005118.21	-1.78%
DAGANG ROAD MACHINERY	33554992.12	852417925.30	4.71%	-6589225.29	-0.77%
GINWA	40183792.08	954944525.67	5.35%	-10869269.01	-1.14%
XI'AN CATERING	13887976.12	808677345.54	5.11%	-27472957.44	-3.40%
XI'AN TOURISM	20440613.07	1060401076.02	5.27%	-35411277.09	-3.34%
J&R OPTIMUM ENERGY	317317307.96	7379813720.81	5.17%	-64043467.80	-0.87%
TONG OIL TOOLS	38500973.66	1937568313.42	5.42%	-66590469.59	-3.44%
LIGEANCE AEROSPACE	-29463948.20	1365451689.54	4.98%	-97468823.06	-7.14%
BAOTI	234078901.25	6373354510.41	5.24%	-99951502.80	-1.57%
QINCHUAN MACHINE TOOL	180118854.76	5574325158.35	5.19%	-109276143.83	-1.96%
AEROSPACE POWER	52316802.63	3170752531.26	5.29%	-115535274.57	-3.64%
BODE ENERGY EQUIPMENT	108424811.23	4779765118.72	5.02%	-131367142.15	-2.75%
AVIC AIRCRAFT	895383742.63	19803884327.54	5.20%	-134113861.30	-0.68%
CDD	-90816127.61	2721737134.98	5.10%	-229564498.43	-8.43%
JDCMOLY	99346380.46	12306060110.92	5.43%	-569148790.81	-4.62%

3.3 Examination on Application of EVA-BSC Based Performance Evaluation System

Factor analysis is applied to examine the feasibility and interpretability of EVA-BSC based performance evaluation system for 41 sample companies. In accordance with dimensionality reduction, several factors are brought in to replace intricate multidimensional data on the basis of their internal matrix, simplifying sample data and minimizing data loss.

3.3.1 Feasibility Examination on PCA

Before principal component analysis (PCA), KMO (Kaiser-Meyer-Olkin) and Bartlett's Test of Sphericity [2] are conducted to examine PCA's feasibility and results are demonstrated in Table 3, in which KMO= 0.482, closing to 0.5, and chi-square is 348.749 in Bartlett's Test of Sphericity, higher than

the critical value (18.3) with a lower significance level of 0.05. Information above indicates reasonable sample selection and feasible PCA.

Table 3 KMO and Bartlett's Test of Sphericity

KMO		.482
Bartlett's Test of Sphericity	Approx. Chi-Square	348.749
	Df	78
	Sig.	.000

3.3.2 Factor Number

Factor Number is usually in agreement with principal component number in PCA so that principal factors can accumulatively contribute to sample variance to a certain extent. Eigenvalue, eigenvalue contribute and cumulative contribute in Table 4 provides reasonable interpretation for the factor model.

Table 4. Total Variance Explained

Factor	Initial Eigenvalue			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.151	31.930	31.930	4.151	31.930	31.930
2	2.080	15.999	47.929	2.080	15.999	47.929
3	1.558	11.983	59.912	1.558	11.983	59.912
4	1.250	9.612	69.524	1.250	9.612	69.524
5	.976	7.510	77.034			
6	.962	7.399	84.433			
7	.678	5.214	89.648			
8	.541	4.158	93.805			
9	.364	2.802	96.608			
10	.218	1.673	98.281			
11	.115	.884	99.165			
12	.100	.769	99.934			
13	.009	.066	100.000			

Eigenvalue of Factor 1(4.151) in Table 4 explains the 31.930% of Variance and present maximum cumulative contribute, indicating its strongest integration capability on original variables, while Factor 2 explains the 15.999% of Variance, 11.983% for Factor 3 and 9.612% for Factor 4, with approximate cumulative contribute of 70%, almost covering 13 components adopted. Above all, 13 components can be reduced to 4 factors.

3.3.3 Factor Analysis

Unrotated factor matrix is showed in Table 5 and rotated factor matrix in Table 6. Normally, the distribution of variables is more dispersed in the factor loading after rotation, meaning better explanation [3] so than further analysis is conducted based on the rotated factor matrix.

Table 5. Unrotated Factor Matrix [a]

	Factor			
	1	2	3	4
X1	.531	.243	.147	-.545
X2	.778	.514	.028	-.121
X3	.851	.403	.061	-.015
X4	.856	.294	.134	-.055
X5	-.344	.618	.186	.000
X6	.085	-.185	-.375	-.274
X7	.712	-.274	.460	.274
X8	.348	-.323	.590	.395
X9	-.716	.304	.522	-.225
X10	.671	-.205	-.617	.237
X11	-.259	.451	-.140	.597

Cont. to Table 5				
X12	-.149	.755	-.255	.306
X13	-.052	.056	-.203	-.270

Table 6. Rotated Factor Matrix [a]

	Factor			
	1	2	3	4
X1	.726	-.097	-.303	-.178
X2	.919	.144	.137	.020
X3	.893	.240	.101	.157
X4	.864	.223	-.023	.207
X5	.081	-.554	.457	-.115
X6	-.011	.281	-.215	-.363
X7	.413	.264	-.288	.738
X8	.087	.045	-.215	.820
X9	-.255	-.924	.073	-.059
X10	.253	.929	.039	-.032
X11	-.164	-.026	.777	.122
X12	.146	-.108	.826	-.190
X13	.033	-.002	-.061	-.340

According to Table 6, Factor 1 presents high load on X1(EVA), X2(EVA Return Rate), X3(Return on Total Asset), X4(Return On Equity) and X7(Total Asset Turnover Ratio); Factor 2 presents high load on X5(Customer Loyalty), X9(R&D Input) and X10(Ratio of Profits to Cost); Factor 3 presents high load on X1(EVA), X5(Customer Loyalty),X11(Employee Quality) and X12(R&D Ratio); Factor 4 presents high load on X6(Sales Increase), X7(Total Asset Turnover Ratio), X8(Inventory Turnover) and X13(Per-capita Education Spending).

Further, factor score coefficient matrix, which matches factors and corresponding original variables, is showed in Table 7.

Table 7. Factor Score Coefficient Matrix

	Factor			
	1	2	3	4
X1	.303	-.187	-.235	-.217
X2	.307	-.045	.076	-.062
X3	.272	.000	.082	.025
X4	.262	-.021	.011	.048
X5	.109	-.243	.196	-.014
X6	-.006	.136	-.137	-.277
X7	.051	.016	-.072	.417
X8	-.045	-.045	-.036	.519
X9	.047	-.435	-.064	.026
X10	-.043	.454	.123	-.074
X11	-.089	.098	.485	.185
X12	.063	.027	.462	-.045
X13	.045	-.001	-.076	-.238

According to Table 7, linear relationship between 4 factors and 13 indicators is as follows:

$Y1 = 0.303X1 + 0.307X2 + 0.272X3 + 0.262X4 + 0.109X5 - 0.006X6 + 0.051X7 - 0.045X8 + 0.047X9 - 0.043X10 - 0.089X11 + 0.063X12 + 0.045X13$

$Y2 = -0.187X1 - 0.045X2 + 0X3 - 0.021X4 - 0.243X5 + 0.136X6 + 0.016X7 - 0.045X8 - 0.435X9 + 0.454X10 - 0.098X11 + 0.027X12 - 0.001X13$

$Y3 = -0.235X1 + 0.076X2 + 0.082X3 + 0.011X4 + 0.196X5 - 0.137X6 - 0.072X7 - 0.036X8 - 0.064X9 + 0.123X10 + 0.485X11 + 0.462X12 - 0.076X13$

Y4＝－0.217X1－0.062X2＋0.025X3＋0.048X4－0.014X5－0.277X6＋0.417X7＋0.519X8＋0.026X9－0.074X10＋0.185X11－0.045X12－0.238X13

Combining with data from 41 Shaanxi listed companies in 2017, formulas above work out factor scores, which are then weighted by variance, contribute / aggregate variance to get composite score and performance ranking for 41 companies based on formula Y＝45.90%Y1＋23.00%Y2＋12.20%Y3＋13.80%Y4.

4. Conclusion

Result demonstrates negative EVA in 16 sample listed companies, illustrating that they get accounting profit without financial value creation. In these companies, TIANHE DEFENSE, TONG OIL TOOLS, BUT'ONE, CDD, LIGEANCE AEROSPACE, BODE ENERGY EQUIPMENT and XI'AN CATERING are in the red, while another 9 companies get positive net profit with extremely low equity capital utilization, such as JDCMOLY and AVIC AIRCRAFT, making up the deficits and getting surpluses by comprehensive income items adjustment. Meanwhile, these 16 companies are experiencing value impairment. For instance, LONGI, working on R&D, production and sales of silicon rod, wafer and battery, bear highest EVA, which stands for increasing market share and extensive prospect. On the other side, 26 companies see ranking variation during the research, especially SXBN, GINWA, BUT'ONE, WESTERN METAL MATERIALS, LIGEANCE AEROSPACE and SCMC, which partly proves the comprehensiveness and actual value of EVA-BSC based performance evaluation system after bringing non-financial indicators into the conventional one.

5. Reference

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