How to Assess the Sustainable Growth of Non-listed SMEs: Based on Factor Analysis Model

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Abstract
Factor analysis model is utilized to find out the key determinants of sustainable development of non-listed companies in the manufacture of communication equipment industry.21 determinants from 4 dimensions in the performance comprehensive assessment system are chosen and 7 determinants are put forward as Principal Component indicators in the result of Principal Component Analysis. The result shows profitability management, efficiency of using assets and sales capacity play pivotal role to unlisted SMEs.
Key words: *sustainable growth rate; factor analysis ;communication-equipment manufacturing；non-listed company; operation performance ;empirical analysis; SMEs*

1 Introduction

Sustainable growth is treated as the main aim of management which enterprises are supposed to pursue, of which the definition can date back as far as the formal work of Babcok[1](1970).The definition of sustainable growth is recognized as maximum rate at which a company sales can increase with operating and financial constraints by Higgins[2] (1977).Pioneering in many researchers' efforts, focused at the large listed companies, Gerard and Michael[3] (2005) utilize the sustainable growth for evaluating the long run performance of bank mergers. The most famous SGR models based on the accounting rationale are created by Higgins[4](2000) and Van Home[5](1988).In an extension to the traditional models, Lihua Wang etal.[6] (2015) acclimatize the model in China. As a multifaceted metric, a growing body of empirical literature have demonstrated the significance to identify the drives of enterprises' sustainable growth.

To provide a growth impetus for sustainable economic development in China, structural reform of the supply front is advocated. In 2015,the added value calculated in communication equipment manufacturing industry being part of high and new technology has recorded a 12.7% growth compared to the one in 2014[7].Under the circumstance of promotion of "Internet plus initiative" programme, the industry gains a promising expectation. This study attempts to provide a way into the observation of non-listed small and medium enterprises (SMEs)in communication equipment manufacturing industry for research on enterprises' operations and development.

2 Study Design

2.1 Sample and performance assessment system

394 enterprises are chosen as a sample and all the data are from the Oriana Asia-Pacific

Enterprises database. To identify active SMEs matched with CSIC39–Computer, communication and other electronic equipment in China, of which the latest year 2014 of accounts can be possessed, it provides the authors with an initial set of 395 companies. Only companies in the normal business operation are selected, the others active but involved in the rescue plan, default of payment, insolvency proceedings, etc. are deleted. Totally 394 companies are left to screen out the number of non-listed companies, which are all unlisted companies. The operation performance comprehensive assessment system generally includes three sections profitability, operating capacity, and solvency at least. In this paper, the productivity analysis into the assessment system is considered either. Financial indices are classified into *Table 1*.

Table 1 –Financial indices classification

	Profitability Analysis		Operational Capacity Analysis		Solvency Analysis
X1	ROE using P/L before tax	X8	Net assets turnover	X15	Solvency ratio (Liability based)
X2	ROA using P/L before tax	X9	Stock turnover	X16	Gearing
X3	ROE using Net income	X10	Collection period		Productivity Analysis
X4	ROA using Net income	X11	Credit period	X17	Profit per employee
X5	Profit Margin		Solvency Analysis	X18	Operating revenue per employee
X6	Gross Margin	X12	Current ratio	X19	Shareholders funds per employee
X7	EBIT Margin (%)	X13	Liquidity ratio (x)	X20	Working capital per employee
		X14	Solvency ratio (Asset based)	X21	Total assets per employee

Note: ROE—return on equity, ROA—return on asset

2.2Test of suitability of standardized data

To eliminate parameters' incommensurability due to the difference of dimension and unit or positive and negative, all the collection of data should be standardized. The mean values of 21 indicators, subtracted by each indicator, divide the standard deviation. The standardized mean value equals 0 and the standard deviation equals 1.

To investigate the existence of the linear dependence before the application of factor analysis, KMO measure and Bartlett's Test of Sphericity are conducted to test correlation. In the result of *Table2*, KMO's value 0.766 means that linear correlation between the variables does not appear to be much different , meanwhile the significance of Bartlett's Test of Sphericity obviously is less than 0.05,the rejection of Spherical assumption states the variances are not respectively independent. Analyses above manifest the indicators chosen are suitable for factor analysis.

Table 2–Kaiser–Meyer–Olkin Measure and Bartlett's Test of Sphericity

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		766
Bartlett's Test of Sphericity	Approx. Chi–Square	4240.875
Df.		210
Sig.		.000

3Factor analysis model

3.1Principal Component Analysis

Principal Component Analysis is applied to calculate initial common factor Eigenvalue,

contribution and cumulative contribution of variable of 21 indicators. Seen from *Table 3*, the communalities of variables are 1, which implies each variable can be explained. Wherein, ROE using P/L before tax, ROE using Net income, Profit Margin, Current ratio, Liquidity ratio, Solvency ratio (Asset based) and Solvency ratio (Liability based)can be extracted as common factors, because the 7 variables' eigenvalues are more than 0.9.ScreePlot comes into use to consider the amount of common factors, and from the Fig. 1, the drawing line gradually tends to smooth since the 7th factor. Therefore, the 7 common factors are reasonable. In *Table 4*, the result of the accumulated variance achieves 80.593 percent of total variance, when 7 common factors are extracted. As well as the eigenvalues above, the variance signifies 7 common factors can explain original information adequately which possess representative. The total score of SMEs' sustainable growth is:

$$F_i = a_{i1} \times x_1 + a_{i2} \times x_2 + \ldots\ldots + a_{ij} \times x_j (i = 1, \ldots\ldots, 7;\ j = 1, \ldots\ldots, 21) \quad (1)$$

Note: F—total score of comprehensive evaluation to SMEs' sustainable growth

a—contribution rate of variance

x—score of each factor

Table 3 – Communalities

	Initial	Extraction		Initial	Extraction		Initial	Extraction
x1	1.000	.923	x8	1.000	.878	x15	1.000	.912
x2	1.000	.838	x9	1.000	.324	x16	1.000	.732
x3	1.000	.939	x10	1.000	.762	x17	1.000	.739
x4	1.000	.786	x11	1.000	.814	x18	1.000	.807
x5	1.000	.901	x12	1.000	.955	x19	1.000	.860
x6	1.000	.552	x13	1.000	.922	x20	1.000	.627
x7	1.000	.856	x14	1.000	.931	x21	1.000	.867

Note: Extraction Method: Principal Component Analysis

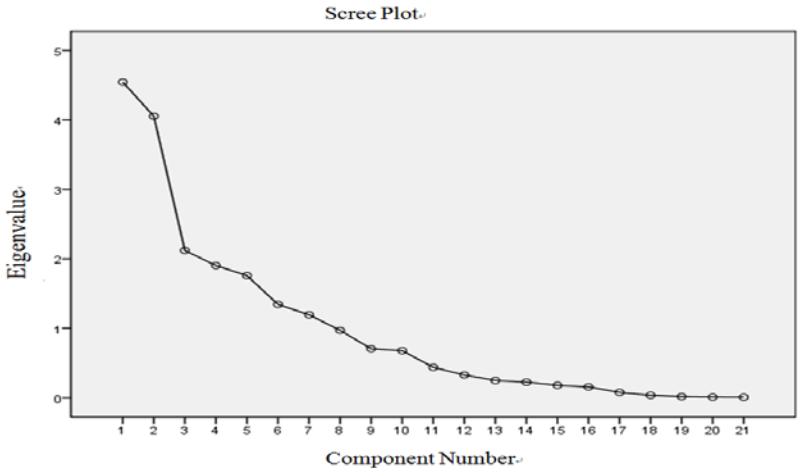

Fig. 1 – ScreePlot

3.2 Economic interpretation of factor analysis

Through the varimax orthogonal rotation, factor loading matrix (*Table 5*) and Component Score Coefficient Matrix (*Table 6*) display the following information: Component 1 mainly includes X_2,X_4,X_5,X_7,X_{17}, which can be on behalf of profitable growth; Component2 mainly includes X14,X15,X19,X20,X21, which represents efficiency of using assets;Component3

mainly includes X1,X3,X8,which means sales ability; Component4 mainly includes X10,X11,which shows operating capacity; Component5 mainly includes x18, which implies labour productivity; Component 6 mainly includes X12,X13, which means cashability; Component 7 mainly includes X6,X9,X16,which shows financing capacity. Component Score Covariance Matrix (*Table 7*) validates the rationality of extracting principal component. Finally, the total score to evaluate the sustainable growth capacity is in the following:

$$F = \sum_{i=1}^{7}(V_i / V^T)\mathrm{F_i} = \left(19.434\mathrm{F}_1 + 12.931F_2 + 12.452F_3 + 11.386F_4 + 9.580F_5 + 8.934F_6 + 5.877F_7 \right)/80.593 \quad (2)$$

Table 4 – Total Variance Explained

Component	Initial Eigenvalue			Extraction Sums of Squared loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %		Total	% of Variance	Cumulative %		Total
1	4.547	21.651	21.651	4.547	21.651	21.651	4.081	19.434	19.434
2	4.054	19.302	40.954	4.054	19.302	40.954	2.715	12.931	32.364
3	2.121	10.099	51.053	2.121	10.099	51.053	2.615	12.452	44.816
4	1.904	9.067	60.120	1.904	9.067	60.120	2.391	11.386	56.202
5	1.758	8.373	68.493	1.758	8.373	68.493	2.012	9.580	65.782
6	1.345	6.406	74.898	1.345	6.406	74.898	1.876	8.934	74.716
7	1.196	5.695	80.593	1.196	5.695	80.593	1.234	5.877	80.593
8	.970	4.618	85.211						
9	.705	3.358	88.569						
10	.678	3.231	91.799						
11	.439	2.088	93.888						
12	.328	1.562	95.450						
13	.248	1.182	96.632						
14	.224	1.067	97.699						
15	.179	.852	98.551						
16	.157	.746	99.296						
17	.077	.367	99.663						
18	.035	.167	99.830						
19	.017	.080	99.910						
20	.010	.050	99.959						
21	.009	.041	100.000						

Note: Extraction Method: Principal Component Analysis

4 Conclusion

In this paper, the authors select 21 drives to evaluate the sustainable growth capacity of unlisted SMEs and get the result that profitability management is the most important impact factor. Besides, efficiency of using assets and sales capacity are equally important. Moreover, SMEs still cannot ignore the importance of financing capacity and labour productivity. Although the study is influenced by the limitation of data collection and the evaluation

indicators chosen, factor analysis is conducive to knowing important components of sustainable growth of SMEs objectively and comprehensively.

Table 5 – Rotated Component Matrix

	Component						
	1	2	3	4	5	6	7
x1	.604	-.267	.634	-.191	.192	.063	.090
x2	.873	.073	-.167	.018	-.104	.131	.118
x3	.563	-.239	.672	-.217	.229	.119	.001
x4	.836	.137	-.124	.008	-.074	.211	.054
x5	.866	.082	-.252	.231	-.038	.013	-.162
x6	-.050	.346	.102	-.027	.278	.276	.515
x7	.836	.069	-.239	.255	-.079	.079	-.136
x8	.290	-.517	.678	-.151	.129	-.131	-.099
x9	.130	-.036	-.111	-.128	-.185	.166	.464
x10	-.131	.250	.155	.725	.292	.213	.045
x11	-.228	-.183	.108	.638	.443	.271	-.200
x12	.186	-.570	-.017	-.118	.447	.612	-.079
x13	.222	-.509	-.057	-.020	.486	.610	-.039
x14	-.054	.784	-.051	-.426	.112	.337	-.062
x15	-.072	.774	-.002	-.433	.119	.318	-.072
x16	.058	.058	.046	.260	.008	-.310	.748
x17	.798	.091	-.263	.130	.077	-.035	-.013
x18	.193	.310	.340	.008	-.711	-.207	-.104
x19	-.081	.832	.327	.074	-.042	.204	-.064
x20	-.056	.543	.267	.196	-.424	-.196	.024
x21	-.063	.591	.463	.466	-.283	.015	-.040

Note: Extraction Method: Principal Component Analysis. Rotation Method : Varimax with Kaiser Normalization. A Rotation converged in 6 iterations.

Table 6 – Rotated component Matrix

	Component						
	1	2	3	4	5	6	7
x1	-.010	.052	.364	-.005	.002	.009	.074
x2	.216	.037	-.005	-.010	-.078	-.036	.104
x3	-.017	.093	.383	-.015	-.009	.033	-.001
x4	.213	.089	.011	-.014	-.101	-.002	.052
x5	.247	-.049	-.063	.014	.020	.054	-.115
x6	-.027	.203	.065	-.107	-.060	.108	.436
x7	.250	-.032	-.066	.023	-.032	.069	-.095
x8	-.090	-.079	.350	.040	.062	-.015	-.089
x9	.032	.061	-.028	-.029	-.170	-.108	.372
x10	.041	.004	-.015	.041	-.020	.446	.080

x11	.020	-.005	.022	-.087	-.036	.473	-.136
x12	-.038	-.064	.021	-.023	.515	-.061	-.038
x13	-.011	-.059	.004	-.041	.491	-.002	.000
x14	.009	.380	.001	-.071	-.050	-.049	-.056
x15	-.005	.375	.020	-.062	-.039	-.049	-.065
x16	-.040	-.190	-.019	.064	.123	-.017	.637
x17	.207	-.035	-.045	-.045	.072	.022	.006
x18	.010	-.104	.017	.407	-.064	-.199	-.087
x19	-.008	.214	.049	.174	-.035	.118	-.033
x20	-.020	-.073	-.032	.337	.025	-.047	.036
x21	-.002	-.017	.030	.350	-.043	.175	-.002

Note: Extraction Method: Principal Component Analysis . Rotation Method :Varimax with Kaiser Normalization.Component Scores.

Table 7 – Component Score Covariance Matrix

Component	1	2	3	4	5	6	7
1	1.000	.000	.000	.000	.000	.000	.000
2	.000	1.000	.000	.000	.000	.000	.000
3	.000	.000	1.000	.000	.000	.000	.000
4	.000	.000	.000	1.000	.000	.000	.000
5	.000	.000	.000	.000	1.000	.000	.000
6	.000	.000	.000	.000	.000	1.000	.000
7	.000	.000	.000	.000	.000	.000	1.000

Note: Extraction Method: Principal Component Analysis . Rotation Method :Varimax with Kaiser Normalization.Component Scores.

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