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EVALUATION AND ANALYSES OF CHINESE HOME APPLIANCE ENTERPRISES COMPETITIVENESS AFTER THE GLOBAL FINANCIAL CRISIS

China has become one of the world's biggest manufacturing countries, with made-in-China home appliances seen in almost every corner around the world. However, after the outbreak of the subprime crisis in 2007 that caused the global financial crisis, the competitiveness of its export-oriented home appliance industry is facing unprecedented challenges. This research analyzes the competitiveness of Chinese home appliance industry following the global financial crisis through gray theory, which is characterized by theoretical analysis under a situation of incomplete information. This study takes advantage of the characteristics of gray theory to develop a model of competitiveness. From the current situation of Chinese home appliance industry and the data of listed companies' financial reports, we compare and evaluate the competitiveness of each major home appliances manufacturer. After empirical analyses, we find that applying the gray competitiveness model on the evaluation of competitiveness in the home appliance industry is extremely effective.

Keywords: *competitiveness, gray correlation theory, multi-objective decision, home appliance industry, entropy weights.*

Ко-Вей Лінь

ОЦІНЮВАННЯ ТА АНАЛІЗ КОНКУРЕНТОСПРОМОЖНОСТІ КИТАЙСЬКИХ ВИРОБНИКІВ ПОБУТОВОЇ ТЕХНІКИ ПІСЛЯ СВІТОВОЇ ЕКОНОМІЧНОЇ КРИЗИ

У статті показано, що Китай став одним із найбільших виробників товарів, у тому числі побутової техніки, яка продається у всьому світі. Після початку кризи кредитування в 2007 р., що стало причиною світової економічної кризи, конкурентоспроможність експортоорієнтованого виробництва побутової техніки виявилася під загрозою. Проаналізовано конкурентоспроможність китайського виробництва побутової техніки після світової економічної кризи за допомогою "сірої теорії", яка полягає в теоретичному аналізі в ситуації неповноти інформації. Використано переваги "сірої теорії" для розробки моделі конкурентоспроможності. З урахуванням сьогоднішньої ситуації в китайському виробництві побутової техніки і даних фінансових звітів компаній з акціями на фондовій біржі порівняно та оцінено конкурентоспроможність основних великих виробників побутової техніки. Емпіричний аналіз показав, що застосування "сірої моделі" конкурентоспроможності для оцінювання конкурентоспосбності виробників побутової техніки показує високу ефективність.

Ключові слова: *конкурентоспроможність, сіра теорія кореляції, мультиоб'єктне рішення, виробництво побутової техніки, показники ентропії.*

Ко-Вэй Линь

ОЦЕНКА И АНАЛИЗ КОНКУРЕНТОСПОСОБНОСТИ КИТАЙСКИХ ПРОИЗВОДИТЕЛЕЙ БЫТОВОЙ ТЕХНИКИ ПОСЛЕ МИРОВОГО ЭКОНОМИЧЕСКОГО КРИЗИСА

В статье показано, что Китай стал одним из крупнейших производителей товаров, в том числе бытовой техники, которая продается во всем мире. После начала кризиса кредитования в 2007 году, который стал причиной мирового экономического кризиса,

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конкурентоспособность экспортоориентированного производства бытовой техники оказалась под угрозой. Проведён анализ конкурентоспособности китайского производства бытовой техники после мирового экономического кризиса посредством "серой теории", которая заключается в теоретическом анализе в ситуации неполноты информации. Использованы преимущества "серой теории" для разработки модели конкурентоспособности. С учетом сегодняшней ситуации в китайском производстве бытовой техники и данных финансовых отчетов котирующихся компаний сравнивается и оценивается конкурентоспособность основных крупных производителей бытовой техники. Эмпирический анализ показал, что применение "серой модели" конкурентоспособности для оценки конкурентоспосбности производителей бытовой техники показывает высокую эффективность.

Ключевые слова: *конкурентоспособность, серая теория корреляции, мультиобъектное решение, производство бытовой техники, показатели энтропии.*

Introduction. China's home appliance industry has experienced two large-scale expansions in the history of its development: the first was in the mid-1980s, when a significant enhancement of purchasing power caused by reforms and the opening up of its market triggered strong demand from consumers at the domestic market; the second time was in the mid-1990s when developed regions and countries such as Europe, the United States, and Japan shifted their focus of production to consumer electronics and information technology and gradually withdrew from the traditional home appliance market. However, these developed regions and countries observed the emerging home appliance market in China was having stronger and stronger demand and thus transferred their production to China.

In the second half of 2007, the global financial crisis showed signs of its emergence, resulting in unprecedented challenges for China's export-oriented home appliance industry. During the crisis over the next few years, some home appliance firms managed to adjust their strategy and maintain their competitiveness, while other firms collapsed and were eliminated from the market after the setback. Therefore, this research develops a competitiveness evaluation and comparison model through gray theory in order to explore which home appliance firms survived the radical change and difficult economic and trading environments and which home appliance firms confronted possible elimination and adjusted their competitive strategies.

Gray theory model. A black system contains information that is not completely clear and represents knowing nothing about the information in the system. A white system is when information in the system is very clear and one can completely control the information in the system. A gray system is part clear information and part information that is not in the system - that is, one cannot completely and sufficiently control the information in the system. Deng (1982) found that in a controlled field, many control systems are part clear and part not clear. Thus, a new way of thinking about a problem-solution theory model for the gray system was introduced.

Following the new model, the gray system has been widely applied to various academic fields in which information is not clear. Deng (1984) published a paper concerning gray theory and methods of a socio-economic gray system and applied the gray system to social sciences. The theory's model is most suitable for applications of decision-making in business management. As in a practical business operation environment, most business managers have to hurriedly make decisions over which best plans to implement under situations where there is insufficient information or there is a trade-off in conflicting multi-objectives. Business managers are often obsessed by such a situation occurring. Therefore, Deng (1987) further extended the applications of the early developed gray theory to decision-making in business management.

Gray Relation.

Gray relational analysis is based on the similarities and differences of a development posture between system factors so as to measure the level of closeness between the sequences. Hence, we can say that gray relational analysis is a technique that looks at development trends.

In analyzing gray relation, we have to set the standard sequence as a reference sequence before comparing the level of closeness between other sequences and the standard sequence, and then we obtain the gray relational degree to sort out the gray relation. Tseng and Wu (1995) used statistics to test the reliability of a gray relation sequence. Their results confirm that the gray relation sequence is not only highly reliable, but also able to be used in non-linear problems when statistics are not applicable, because statistics often adopt regression analyses as a research method on a system prediction or evaluation. Green and Salkind (2010) stressed that before using regression analyses, it is necessary to test if the system satisfies the normal distribution conditions.

Because application of regression analysis is restricted by these normal distribution conditions, we are able to find, after comparisons, the advantage of Deng's gray system theory is that it almost has no restricted conditions in its application. Deng's comprehensive comparisons (1989) for black, gray, and white systems present the advantages of gray theory, because gray system does not require very clear, definite, or sufficient information. In solving the process, it is more valuable that the theory is flexible and insists on the principle of tolerance in its methodology, attitude, and pursuit of conclusions, while doing its best to solve the problems in the system. Therefore, this study develops a competitiveness model based on Deng's gray relation decision-making system (1985) to evaluate and analyze the present competitiveness of each major home appliance manufacturer in China.

Gray Relation Grade. We now conduct gray relation analysis of the processed sequence and define the gray relation degree formula to measure the degree of relation between two sequences. Assume that there is a sequence in the gray relation spaces:

$$x_i = (x_i(1), x_i(2), x_i(3), \ldots, x_i(n)), \quad (1)$$

in which i=1,2,3,..., m.

Define sequence x_0 as a standard sequence:

$$x_0 = (x_0(1), x_0(2), x_0(3), \ldots, x_0(n)), \quad (2)$$

and by comparing other sequence with the standard sequence, we can establish the difference sequence as:

$$\Delta_{0i} = (\Delta_{0i}(1), \Delta_{0i}(2), \Delta_{0i}(3), \ldots, \Delta_{0i}(n)) \tag{3}$$

in which $i=1,2,3,\ldots, m$. Thus, $\Delta_{0i}(j)$ is the absolute value of the difference between the j_{th} indicator of the i_{th} comparative sequence $x_i(j)$ and the j_{th} indicator of the standard sequence $x_0(j)$:

$$\Delta_{0i}(j) = |x_i(j) - x_0(j)| \tag{4}$$

We next define the gray relation coefficient of the j_{th} term of the i_{th} sequence as:

$$\gamma(x_i(j), x_0(j)) = \frac{\Delta_{min} + \xi\Delta_{max}}{\Delta_{0i}(j) + \xi\Delta_{max}}, \tag{5}$$

in which Δ_{max} and Δ_{min} are respectively the maximum and the minimum values obtained after comparisons of all difference sequence. The formula is:

$$\Delta_{max} = \max_{\forall i}\max_{\forall j} |x_i(j) - x_0(j)| \tag{6}$$

and

$$\Delta_{min} = \min_{\forall i}\min_{\forall j} |x_i(j) - x_0(j)| \tag{7}$$

Here, ξ is the identification coefficient and its value is between 0 and 1, which could be adjusted according to the need for highlighting the difference of the gray relation coefficients.

After obtaining the gray relation coefficients of the sequence and the standard sequence, we note the gray relation grade between each sequence and standard sequence as:

$$\gamma_{0i} = \sum_{j=1}^{n} \gamma(x_i(j), x_0(j)) w(j) \tag{8}$$

in which $w(j)$ is the weight of the j_{th} indicator. The gray relation grade is higher mean the more optimal plans to be more closer to the standard sequence x_0.

Determine the objective weights.

Because the importance of each factor to the system is not the same, before obtaining the gray relation coefficient, we have first to calculate the weight of each factor $w(j)$ and the sum of the weights should be equal to 1, that is:

$$\sum_{j=1}^{n} w(j) = 1. \tag{9}$$

This study adopts the entropy value weight method to calculate the weights of each evaluation indicator. The meaning of entropy in physics is the randomness of a molecular system under a specific situation. Feng (1988) extended the concept of entropy as the grade of surprise when event E happens. The grade of surprise is determined by the probability of the event happening, because when the probability of event E is higher, the grade of surprise when E in fact occurs will be lower. Hence, little information is needed to explain the causes for event E happening.

Feng and Chen (1992) took advantage of the probability of an event happening to define the entropy value. If the probability of a single event E is p, then the entropy value is:

$$h(p)=\ln(\frac{1}{p})=-\ln p, \tag{10}$$

representing the grade of surprise caused by *E*. If in a sample space, the probabilities of events E_1, E_2,..., and E_n are p_1, p_2,..., and p_n, then the expected entropy value of the sample space is:

$$H=\sum_{i=1}^{n}p_i\ln(\frac{1}{p_i})=-\sum_{i=1}^{n}p_i\ln p_i. \tag{11}$$

This represents the average grade of surprise of the sample space or the uncertainty of the grade of information for decision-making.

In formula (1), if we define x_i as the i_{th} plan and $x_i(j)$ is the j_{th} evaluation indicator in i_{th} plan, then we can make a comparison in order to obtain the probability of the i_{th} plan in the j_{th} evaluation indicator as:

$$p_i(j)=x_i(j)/\sum_{i=1}^{m}x_i(j). \tag{12}$$

According to formula (11), the expected entropy value of the j_{th} evaluation indicator is:

$$H(j)=-\sum_{i=1}^{m}p_i(j)\ln p_i(j), \tag{13}$$

when $p_1(j)=p_2(j)=p_3(j)=\ldots=p_m(j)=\frac{1}{m}$, then *H(j)* has the maximum value:

$$Max.H(j)=-\sum_{i=1}^{m}\frac{1}{m}\ln\frac{1}{m}=\ln m. \tag{14}$$

In order to make the entropy value truly represent the uncertainty of the grade of information for decision-making, the value must be between 0 and 1. Thus, we define the entropy value of each evaluation indicator as:

$$e(j)=\frac{H(j)}{\ln m}. \tag{15}$$

The grade of certainty of the information for a policy-decision that the evaluation indicator could deliver is 1 - e (j). Thus, the relative importance (objective weights) of the evaluation indicator is:

$$\begin{aligned} w(j)&=(1-e(j))/(\sum_{j=1}^{n}(1-e(j))\\ &=(1-e(j))/(n-\sum_{j=1}^{n}e(j)) \end{aligned} \tag{16}$$

Applied competitiveness evaluation model. Jin (2004) argued in his report on the competitiveness of enterprises that if one wants to evaluate such competitiveness, then 4 factors should be included: scale, growth, profit, and brand. However, because it is not easy to establish an objective standard for the measurement value of an indicator of the brand factor, the competitiveness model in this study will forsake the brand factor. This study increases the factors of efficiency and risks, described in Table 1.

Table 1. **Definitions of Evaluation Indicators for 5 Factors**

Category	Ratio	Formula
Scale Factor	Revenue Scale	2010 Revenue / Total 2010 Revenue of all Enterprises
	Profit Scale	2010 Profit / Total 2010 Profit of all Enterprises
	ROE	2010 Equity / Total 2010 Equity of all Enterprises
Growth Factor	Revenue Growth Rate	$(2010\ \text{Revenue} / 2007\ \text{Revenue})^{\frac{1}{3}} - 1$
Profit Factor	ROA	2010 Net Profit /2010 Average Asset
	ROE	2010 Net Profit /2010 Average Equity
	Profit Margin	2010 Net Profit /2010 Revenue
Efficiency Factor	Asset Turnover	2010 Revenue / 2010 Average Asset
	Accounts Receivable Turnover	2010 Revenue / 2010 Average Accounts Receivable
	Inventory Turnover	2010 Cost / 2010 Average Inventory
Risk Factor	Current Ratio	2010 Current Asset / 2010 Current Liability
	Acid Test	2010 Quick Asset / 2010 Current Liability
	Equity Multiplier	2010 Assets / 2010 Equity

This study picks 12 home appliance manufacturers from the listed home appliance manufacturers with total annual revenue in 2010 exceeding 5 bln. RMB in order to compare and evaluate their competitiveness. The data for analysis are extracted from their 2007-2010 financial statements. We follow the calculation pattern in Table 1 to obtain the evaluation data for these 12 enterprises as in Table 2.

In order to meet the conditions of a comparable sequence as proposed by Jiang et al. (1988), we divide each evaluation indicator by the sum of evaluation indicators and obtain normalized data as displayed in Table 3. Regarding the selection of the standard sequence, we pick the optimal values from the 13 evaluation indicators to form the standard sequence. From Table 3, we learn that, except for the evaluation indicators of the equity multiplier of the risk factor that picked the minimum value, the optimal values of the 12 other evaluation indicators picked the maximum value of the evaluation indicators. If we follow the calculation steps of formulae (12) to (16) and let $m=12$ and $n=13$, then we also get the weighted value of each evaluation indicator as in Table 3.

Table 2. **Evaluation Data on 5 Factors for 12 Home Appliance Manufacturers**

Company	Scale Factor (%)			Growth Factor(%)	Profit Factor (%)			Efficiency Factor (Times)			Risk Factor (Times)		
	Revenue Scale	Profit Scale	Net Asset Scale	Revenue Growth	ROA	ROE	Profit Margin	Asset Turnover	Accounts Receivable Turnover	Inventory Turnover	Current Ratio	Acid Test	Equity Multiplier
SUNING	16.78	20.99	18.15	23.43	12.64	21.88	5.44	1.89	104.03	7.85	1.41	1.02	2.33
MIDEA	16.57	20.67	15.78	28.44	14.73	25.35	5.42	2.02	16.37	7.64	1.11	0.70	2.57
GREE	13.51	22.00	13.49	16.92	8.00	32.14	7.12	1.04	57.19	5.45	1.10	0.87	4.68
TCL	11.53	2.41	9.89	9.91	1.92	4.21	0.91	1.24	9.19	6.22	1.46	1.21	2.96
HAIER	14.38	15.39	9.14	29.97	14.53	28.45	4.05	2.77	29.67	16.11	1.24	1.04	4.65
CHANGHONG	9.27	2.44	14.07	21.51	1.98	2.96	1.14	1.03	10.94	4.07	1.32	0.95	3.05
HISENSE	4.73	4.29	5.59	12.74	9.03	14.72	3.95	1.86	29.22	7.12	1.64	1.25	2.15
KONKA	3.80	0.52	4.07	12.03	0.36	2.10	0.59	1.14	10.46	3.95	1.22	0.90	3.90
KELON	3.93	3.05	0.88	26.10	9.93	108.14	3.37	2.86	14.17	9.72	0.71	0.43	8.80
JOYOUNG	1.19	3.46	2.92	40.13	18.90	20.31	12.64	1.28	165.25	10.54	2.53	2.25	1.43
LITTLE SWAN	2.49	3.12	3.38	30.84	10.79	16.58	5.44	1.89	9.98	10.73	1.40	1.16	2.28
MEILING	1.83	1.67	2.64	26.63	6.13	11.99	3.97	1.43	23.86	4.76	1.32	0.93	2.59

Table 3. **Evaluation Data of Each Enterprise after Normalization**

Company	Scale Factor			Growth Factor	Profit Factor			Efficiency Factor			Risk Factor		
	Revenue Scale	Profit Scale	Net Asset Scale	Revenue Growth	ROA	ROE	Profit Margin	Asset Turnover	Accounts Receivable Turnover	Inventory Turnover	Current Ratio	Acid Test	Equity Multiplier
SUNING	0.1678	0.2099	0.1815	0.0841	0.1160	0.0758	0.1007	0.0926	0.2166	0.0834	0.0857	0.0803	0.0563
MIDEA	0.1657	0.2067	0.1578	0.1021	0.1352	0.0878	0.1003	0.0989	0.0341	0.0811	0.0674	0.0551	0.0621
GREE	0.1351	0.2200	0.1349	0.0607	0.0734	0.1113	0.1318	0.0508	0.1191	0.0579	0.0668	0.0685	0.1131
TCL	0.1153	0.0241	0.0989	0.0356	0.0176	0.0146	0.0168	0.0606	0.0191	0.0661	0.0887	0.0952	0.0715
HAIER	0.1438	0.1539	0.0914	0.1075	0.1334	0.0985	0.0749	0.1353	0.0618	0.1711	0.0753	0.0818	0.1123
CHANGHONG	0.0927	0.0244	0.1407	0.0772	0.0182	0.0102	0.0211	0.0503	0.0228	0.0432	0.0802	0.0747	0.0737
HISENSE	0.0473	0.0429	0.0559	0.0457	0.0829	0.0510	0.0731	0.0911	0.0608	0.0756	0.0996	0.0983	0.0519
KONKA	0.0380	0.0052	0.0407	0.0432	0.0033	0.0073	0.0109	0.0557	0.0218	0.0419	0.0741	0.0708	0.0942
KELON	0.0393	0.0305	0.0088	0.0937	0.0912	0.3744	0.0624	0.1399	0.0295	0.1032	0.0431	0.0338	0.2126
JOYOUNG	0.0119	0.0346	0.0292	0.1440	0.1735	0.0703	0.2339	0.0627	0.3440	0.1119	0.1537	0.1770	0.0345
LITTLE SWAN	0.0249	0.0312	0.0338	0.1107	0.0990	0.0574	0.1007	0.0922	0.0208	0.1140	0.0851	0.0913	0.0551
MEILING	0.0183	0.0167	0.0264	0.0956	0.0563	0.0415	0.0735	0.0698	0.0497	0.0506	0.0802	0.0732	0.0626
Standard Sequence	0.1678	0.2200	0.1815	0.1440	0.1735	0.3744	0.2339	0.1399	0.3440	0.1711	0.1537	0.1770	0.0345
Weighted Value	0.0902	0.1656	0.0860	0.0254	0.0783	0.1614	0.0832	0.0211	0.1756	0.0302	0.0147	0.0248	0.0434

Table 4. **The Difference Sequence of Absolute Values**

Company	Scale Factor			Growth Factor	Profit Factor			Efficiency Factor			Risk Factor		
	Revenue Scale	Profit Scale	Net Asset Scale	Revenue Growth	ROA	ROE	Profit Margin	Asset Turnover	Accounts Receivable Turnover	Inventory Turnover	Current Ratio	Acid Test	Equity Multiplier
SUNING	0.0000	0.0101	0.0000	0.0599	0.0575	0.2987	0.1332	0.0473	0.1275	0.0877	0.0680	0.0968	0.0217
MIDEA	0.0021	0.0133	0.0237	0.0420	0.0383	0.2866	0.1336	0.0410	0.3100	0.0900	0.0863	0.1220	0.0275
GREE	0.0327	0.0000	0.0465	0.0833	0.1001	0.2631	0.1021	0.0891	0.2250	0.1132	0.0869	0.1086	0.0785
TCL	0.0525	0.1959	0.0825	0.1085	0.1559	0.3598	0.2171	0.0793	0.3249	0.1050	0.0650	0.0818	0.0370
HAIER	0.0240	0.0661	0.0901	0.0365	0.0401	0.2759	0.1590	0.0046	0.2823	0.0000	0.0784	0.0952	0.0778
CHANGHONG	0.0751	0.1956	0.0408	0.0668	0.1553	0.3642	0.2128	0.0896	0.3213	0.1279	0.0735	0.1023	0.0391
HISENSE	0.1205	0.1771	0.1256	0.0983	0.0906	0.3234	0.1608	0.0488	0.2832	0.0955	0.0541	0.0787	0.0174
KONKA	0.1298	0.2148	0.1408	0.1009	0.1702	0.3671	0.2230	0.0842	0.3223	0.1291	0.0796	0.1062	0.0597
KELON	0.1285	0.1895	0.1727	0.0504	0.0823	0.0000	0.1715	0.0000	0.3145	0.0679	0.1106	0.1432	0.1781
JOYOUNG	0.1559	0.1854	0.1523	0.0000	0.0000	0.3041	0.0000	0.0772	0.0000	0.0592	0.0000	0.0000	0.0000
LITTLE SWAN	0.1429	0.1888	0.1477	0.0333	0.0744	0.3170	0.1332	0.0477	0.3233	0.0571	0.0687	0.0858	0.0205
MEILING	0.1495	0.2033	0.1550	0.0485	0.1172	0.3329	0.1604	0.0701	0.2944	0.1205	0.0735	0.1039	0.0280

Table 5. **Coefficients and Gray Relation Grade of the Home Appliance Manufacturers with Standard Sequence**

Company	Scale Factor			Growth Factor	Profit Factor			Efficiency Factor			Risk Factor			Gray Re-lation Grade	RANK
	Revenue Scale	Profit Scale	Net Asset Scale	Revenue Growth	ROA	ROE	Profit Margin	Asset Turnov er	Accounts Receivable Turnover	Inventory Turnover	Current Ratio	Acid Test	Equity Multiplier		
SUNING	1.0000	0.9480	1.0000	0.7538	0.7616	0.3807	0.5794	0.7951	0.5902	0.6766	0.7296	0.6548	0.8941	0.7283	1
MIDEA	0.9887	0.9325	0.8856	0.8139	0.8275	0.3904	0.5788	0.8175	0.3720	0.6711	0.6803	0.6008	0.8695	0.6819	3
GREE	0.8489	1.0000	0.7977	0.6879	0.6472	0.4109	0.6425	0.6731	0.4493	0.6185	0.6788	0.6283	0.7004	0.6665	4
TCL	0.7775	0.4838	0.6898	0.6286	0.5408	0.3378	0.4582	0.6983	0.3610	0.6361	0.7385	0.6917	0.8324	0.5221	10
HAIER	0.8843	0.7354	0.6708	0.8342	0.8207	0.3995	0.5359	0.9756	0.3941	1.0000	0.7008	0.6585	0.7023	0.6309	5
CHANGHONG	0.7097	0.4841	0.8182	0.7331	0.5417	0.3351	0.4631	0.6720	0.3636	0.5894	0.7141	0.6422	0.8243	0.5263	9
HISENSE	0.6036	0.5090	0.5937	0.6512	0.6695	0.3621	0.5330	0.7899	0.3933	0.6578	0.7725	0.7000	0.9134	0.5356	7
KONKA	0.5859	0.4608	0.5659	0.6454	0.5189	0.3333	0.4515	0.6856	0.3629	0.5870	0.6976	0.6335	0.7547	0.4809	12
KELON	0.5883	0.4920	0.5152	0.7847	0.6903	1.0000	0.5169	1.0000	0.3685	0.7301	0.6241	0.5618	0.5076	0.6103	6
JOYOUNG	0.5407	0.4975	0.5465	1.0000	1.0000	0.3764	1.0000	0.7040	1.0000	0.7563	1.0000	1.0000	1.0000	0.7221	2
LITTLE SWAN	0.5623	0.4930	0.5542	0.8463	0.7115	0.3667	0.5794	0.7938	0.3622	0.7626	0.7278	0.6816	0.8994	0.5347	8
MEILING	0.5511	0.4745	0.5421	0.7911	0.6103	0.3554	0.5336	0.7236	0.3841	0.6036	0.7141	0.6387	0.8675	0.5095	11

With the absolute value obtained from the results of subtracting the normalized data of all the companies listed in Table 3 from the standard sequence values, we establish the difference sequence for each company as in Table 4.

We now obtain Δmax=0.3671 and Δmin=0. Let ξ=0.5, substitute the difference sequences, Δmax and Δmin, into Formula (5), and then figure out the gray relation coefficient of each company's evaluation indicator as in Table 5. We further substitute the weights of the relation coefficient and each evaluation indicator into Formula (8) to obtain each company's gray relation grade. A higher gray relation grade means being closer to the standard value of competitiveness for the enterprise and shows that its competitiveness is stronger. Thus, we obtain the rankings of competitiveness in Table 5.

Results and discussions. From Table 5 we see that SUNING is at the top of the rankings. The key to their success is their outstanding scale factor in which they are the leading home appliance chain store China that sells 3C products and their chain outlets cover 300 cities in China, including outlets in Hong Kong and Japan. They have over 1200 stores and the number of employees exceeds 150,000. They have taken advantage of the timing of Chinese government's implementation of the home appliances-to-the-countryside policy. With an average revenue growth of 23.43% (annual growth of sales of 10 to 20 bln. RMB), they have quickly grabbed the highest market share.

JOYOUNG is the second place in the rankings. In 2008, when a domestic tainted milk scandal broke out, JOYOUNG coincidently launched a quality soybean milk machine, driving the demand for home-made soybean milk and helping the company grab more than 80% of the soybean milk machine market share in China. Despite their ranking in the scale factor being far behind, their performances in the profit factor and efficiency factor are extremely excellent.

MIDEA ranks the third. Upholding the concepts of effective, robust, healthy, and scientific development, MIDEA ranks number one in the scale, growth, and profit factors while the evaluation indicators of efficiency and risk are in the middle-upper tier. Their competitiveness evaluation ranks the third too.

In the last place under the competitiveness evaluation is KONKA. They are now facing the effects of lower prices for color TVs, mobile phones, and white home appliances, as well as a higher minimum wage, an increasing CPI, and a higher loan cost. Thus, as cost and expenses continue to increase and their exports have rapidly shrunk following the global financial crisis and European debt crisis, KONKA ranks last in the profit factor.

Ranking second to last in competitiveness, the main products of MEILING are refrigerators, freezers, washing machines, solar water heaters, and small home appliances. Similar to KONKA, MEILING is facing the effects of a continuing appreciation in RMB against USD, resulting in a large number of foreign home appliances entering the market. Even worse, sustained domestic inflation has spiraled higher the costs of raw materials, labor costs, and transportation fees, pushing production costs ever greater. Due to strong competition, they were forced to cut the prices of their main product, refrigerators, in order to reduce inventory. From the double pressure of declines in sales and profits, their revenue scale, profit scale, and net asset scale rank second to last.

Ranking third to last, TCL is the abbreviation for "The Creative Life", representing creativeness touches life. In 2007, their overseas revenue was greater than their China market revenue, allowing it to truly be a transnational company. However, impacted by the slowdown of the global economy, TCL did not grasp the market trend and held a large quantity of inventory of backlight LCD TVs, reducing their profit significantly. Thus, TCL ranks near the bottom.

Conclusions. The reason why those enterprises, which got the first, second, and third places, have excellent competitiveness is their capability to grasp the timing of the Chinese government's implementation of the home-appliance-to-the countryside policy and the subsidy for farmers to buy home appliances. For example, SUNING rapidly expanded stores and developed market outlets, whereas responding to the government's energy-saving policy, JOYOUNG and MIDEA designed and manufactured energy-saving home appliances that met customers' growing needs. Conversely, the reason why those home appliance enterprises rank in the bottom is because as the global economic situation became worse, their export proportion in their operations was just too big to resist being impacted. The global financial crisis triggered a sequence of economic effects that gave these 3 home appliance manufacturers a heavy blow to their bottom line.

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