

Marketing Analysis

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Abstract - Data from the past contains information that will be useful in the future. It works because customer behaviors captured in corporate data are not random, but reflect the differing needs, preferences, propensities, and treatments of customers. The paper presents a study related to the 6 indicators (star, helpful votes, total votes, vine, verified, review) which can help a company to be more competitive in the market.

I. INTRODUCTION

Millions of online transactions with online shopping companies generate a lot of data. Compared to the traditional business model, this is a huge change, and this change is witnessing huge growth worldwide [1]. However, most research projects often ignore this data, especially from customer reviews. And, for the most part, the relationship between customer reviews and star ratings remains unclear.

Moreover, the perception of consumers in the emotional field directly or indirectly affects the shopping process and purchase decisions between online customers and online shopping sites [2]. Therefore, using the information contained in customer shopping records to create quantitative models is critical to the company's future growth.

In our research we used a huge amount of preliminary data and, we classify these data by years, ignoring the data before 2010.

We would like to mention that the data before 2010 does not influence the results obtained, because the amount of it is much smaller than the total volume of data used in our research. Also, we considered three products: the Microwave Oven, the Baby Pacifier and the Hair Dryer.

The purpose of this research is to help a company to be more competitive in the market.

II. ASSUMPTION AND NOTATION

A. Assumption

First, we assume that the situation of the market in the next two years is as the same trend as before. However, plenty of uncertain factors like economic crisis, may lead to the collapse of the whole industry, which extremely affect the trend indirectly. Therefore, every forecast we make is based on the former situation and ignore the accidental events.

Second, we assume that January to March is Spring, April to June is Summer, July to September is Autumn and October to December is Winter. However, sometimes it might be less meaningful.

For example, one product is extremely popular in March and April and we conclude the spring and summer are best seasons. This is unreasonable. But based on the information we obtain; we divide it into four seasons and compare them.

Third, we assume that if a specific star rating incites more reviews only results from the factors that we take. However, it might be affected by another factor significantly, whereas the data is not inclusive of it.

Fourth: we assume that the combination of star rating and total reviews which aims to express the potential success and fail is linear.

Finally, we assume that if a word has a higher frequency than another one, then the word is more popular than that one. If a product has more review contents, then it is focused on more than others.

B. Notation

$e(k)$	residual error
C	posterior error ratio
Z^+	vector consists of maximum values of each column
Z^-	vector consists of minimum values of each column
D^+	the distance between a specific vector and vector consists of maximum values of each column

D^-	the distance between a specific vector and vector consists of minimum values of each column
S	the score of the non-normalized part of the itch evaluation object

III. BASIC PROCESSING OF THE DATA AND MODEL BUILDING

In this section, we process the data provided preliminarily and analyze it. We utilize some statistic software and build some models to discover the deeper relationship between the indexes. Furthermore, we forecast the market situation in next two years and conclude the best season for each product by calculating the model.

A. Basic Processing of Data

Sunshine Company has provided us with a big number of users' data with respect to microwave oven, baby pacifier and hair dryer. As approximately thirty thousand users' data are given, it is essential to preliminarily process the data and elaborate the relationship and regulations between the several indexes. By dividing and sorting the enormous data by years, the processed data is attached in the appendix 1.

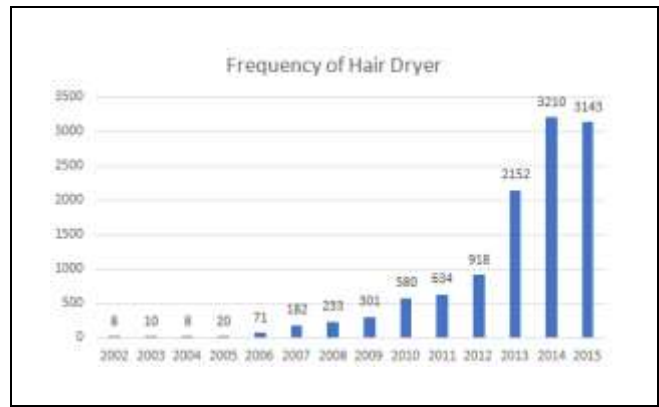


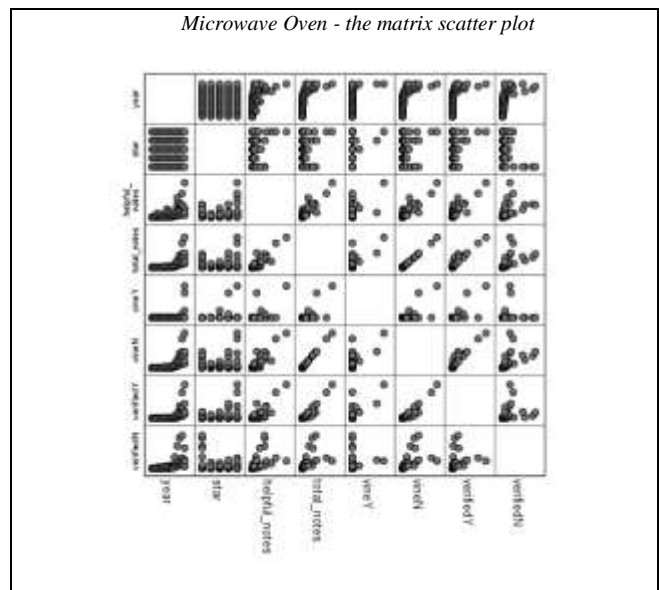
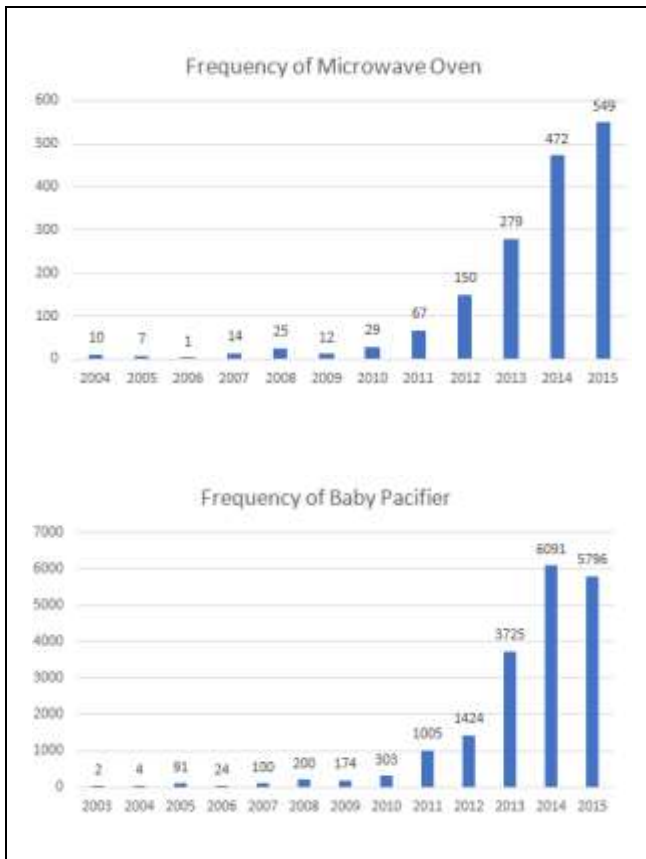
Figure 1. Data by years. Frequency of three products

The attention of these three products has been rising over the past decade. Comparing the three charts, we can find that their trends are similar, which shows that Sunshine Company has similar design and sales strategies of these products and has made significant progress in the past decade.

From the perspective of data processing, the three products are in a state of fluctuation before 2010. It is not obvious to find an upward trend. Therefore, to ensure that a stronger regularity of the conclusion, we will appropriately discard the data before 2010. Furthermore, we will focus more on the data of 2014 and 2015 because the volume of the past two years accounts for more than half of the ten years. These more updated data are more related to the current market situation, which is more instructive to the current analysis and strategy.

B. The Relationships between the Six Indexes

Although the units of these six indicators (year, stars, helpful notes, total notes, vine [3] and verified) are not unified, some qualitative regulations are able to be found by producing matrix scatter plots based on the processed data (figure 2).



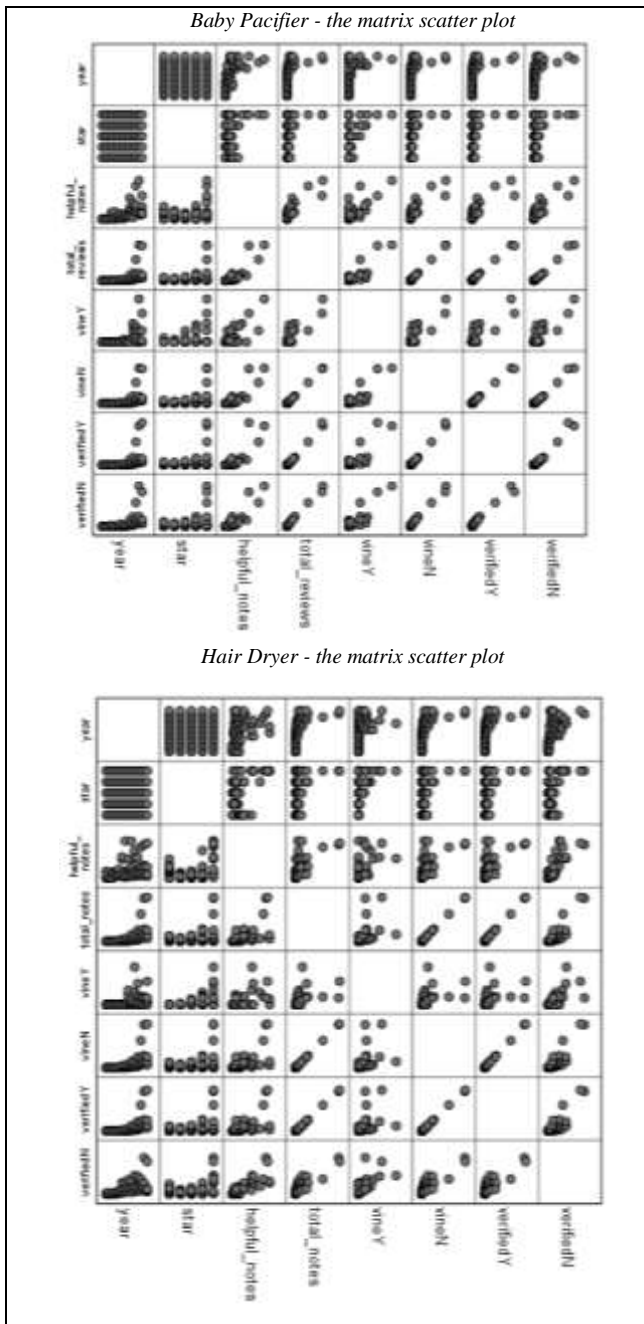


Figure 2. The matrix scatter plot of three products

In case of the Baby Pacifier product - based on the second column on the left, the proportion of people who give five stars is far more than other ones. Furthermore, a big difference compared to Microwave Oven is that it has a strong linear relationship between verified people and non-verified people. This means the number of people who pay attention to the product has a similar possibility to purchase it, and the regulation works for nearly ten year.

The Hair Dryer matrix scatter plot trend is quite like the Baby Pacifier, whereas it has a weaker linear relationship between indexes than Baby Pacifier.

The three figures show that more people focus on the products, more people purchase it, and there is a linear relationship between. To prove that we used the Gray Forecast Model.

IV. GRAY FORECAST MODEL

Gray Forecast Model [5] is a prediction model based on fuzzy long-term description of the law development of things when there is a small amount of incomplete information.

The basic idea is to use the original data to form the original sequence (0) and to generate the sequence (1) by the accumulation method.

We used the data after 2010 to calculate the error ratio of the Microwave Oven (C=0.51285), the Baby Pacifier (C=0.51706) and the Hair Dryer (C=0.49459). All the three products pass the precision test.

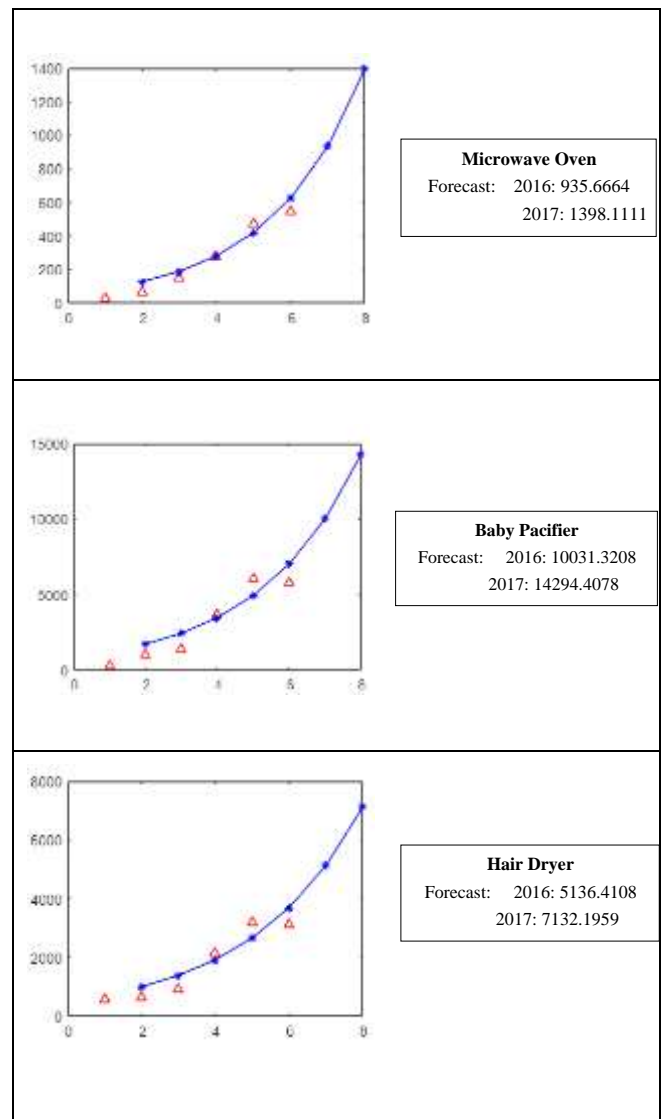


Figure 3. The posterior error ratio

The red triangle stands for the point that we input to the code, which is the number of people who pay attention to each product every year.

The blue line is stretched by Gray Forecast Model and it forecasts the number of people who pay attention to each product over two years. The graph shows the expansion on sales because of the increase in popularity and the strengthening of the market position.

V. SEASON SELECTION MODEL (TOPSIS METHOD)

This model shows which season is the best season to sell. More precisely which season gets the highest composite score. We focus on it because different seasons might have different situation of a specific product in the market, and once we find “the product behavior”, we can schedule a strategy for different seasons.

Since those people who have “vine” can extremely affect the number of helpful votes, to make the comparison meaningful, we eliminate the influence of data by those people with “vine”.

Microwave Oven

	helpful votes	vine(N)	verified rate
spring	2348	429	2.432
summer	2513	408	2.344
autumn	1479	426	2.065
winter	1595	333	1.75

Baby Pacifier

	helpful votes	vine(N)	verified rate
spring	4243	5045	8.683
summer	3401	4160	6.704
autumn	4157	5082	5.028
winter	3617	4519	6.050

Hair Dryer

	helpful votes	vine(N)	verified rate
spring	9015	3459	5.932
summer	5838	2661	7.960
autumn	5601	2738	5.985
winter	4019	2433	7.304

The Microwave Oven attracts more people in spring and summer. Perhaps the company can produce more Microwave Oven and expand the market in spring and summer.

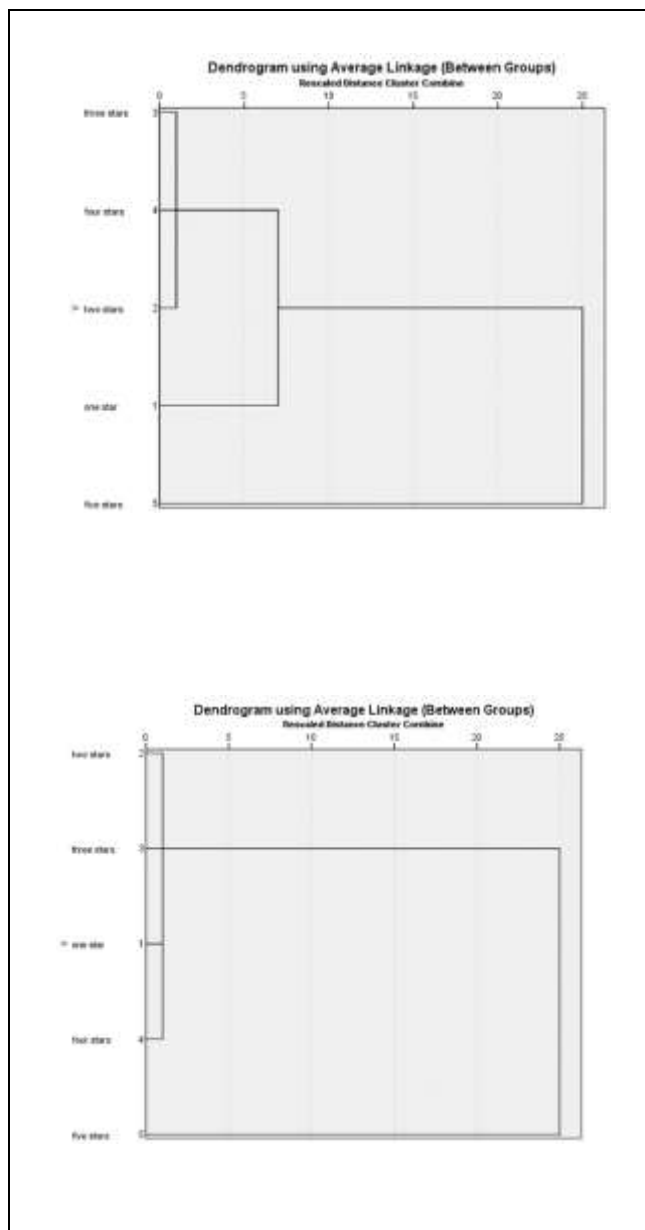
The Baby Pacifier attracts more people in spring, and it is the best time of advertising and selling Baby Pacifier. Also, the company can consider expanding the market.

The Hair Dryer attracts more people in spring than in winter. Company can consider producing more Hair Dryer in spring and control the manufacturing in winter.

V. STAR RATING MODEL (CLUSTER ANALYSIS)

To develop the Star rating model [5], we used the Cluster Analysis. It is a method for partitioning a data set into a fixed number of clusters. By varying the number of clusters and studying the resulting clustering characteristics and graphical representations, one can then often decide on a “most suitable” value of number of clusters.

Our research’s goal is to cluster the participants using their given star for products, and the metric for the distance between two people is simply the difference in their stars.



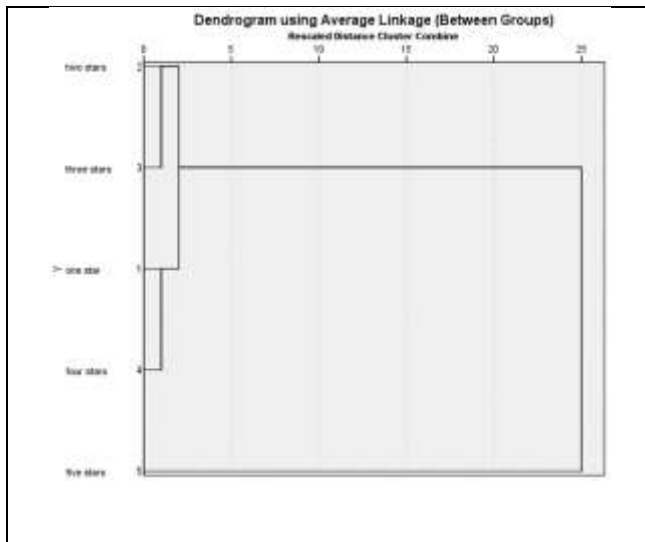


Figure 4. Agglomerative clustering

A good measure to use with agglomerative clusters is the difference between the distance value at which it was formed and the distance value at which it is merged into the next level. This is a measure of the durability of the cluster.

In conclusion, all the three products have the same “special” point: five stars. The figures demonstrate that the reviews which obtain five stars are much more liable to be voted (either helpful or not helpful). This has shown the relationship between specific stars and reviews.

VI. COMBINATION OF REVIEWS AND RATINGS

We have done a multiple regression analysis to find the best combination of total reviews and star ratings (potential success or fail).

a. *Dependent Variable: verified*

b. *Predictors: (Constant), total_reviews, star*

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-14.474	2.976		-4.864	0
	star	3.89	0.906	0.139	4.292	0
	total_reviews	0.796	0.028	0.933	28.721	0
ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	101398.114	2	50699.057	452.118	.000 ^b
	Residual	7513.157	67	112.137		
	Total	108911.271	69			

Microwave oven: Verified=0.796 total reviews +3.89 star rating -14.474

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12442807.48	2	6221403.738	6838.738	.000 ^b
	Residual	60951.896	67	909.73		
	Total	12503759.37	69			

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.629	8.56		-1.008	0.317
	star	-1.684	2.708	-0.006	-0.622	0.536
	total_reviews	0.571	0.005	0.999	110.308	0

Baby Pacifier: Verified=0.571 total reviews -1.684 star rating -8.629

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-6.036	4.156		-1.452	0.151
	star	-2.077	1.328	-0.009	-1.563	0.123
	total_reviews	0.93	0.005	1.002	179.598	0
	Total	7933989.271	69			

Hair Dryer: Verified=0.930 total reviews -2.077 star rating -6.036

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7919541.338	2	3959770.669	18362.808	.000 ^b
	Residual	14447.934	67	215.641		
	Total	7933989.271	69			

VII. ANALYSIS ON CUSTOMERS' DETAILED REVIEWS

Since catering customers' specific demands is a key of a successful product, which core attribute is of great priority and which part is less significant need to be clarified. Only by acquiring these data can a company shrink the budgets for comparative low-concern aspects and devote more resources on high-concern aspects.

A. Wordcloud

In this case, we extracted top 50 words (mainly are nouns) to make wordclouds by using python API windcloud [3].

In wordclouds, the fonts of words represent the frequency of words, which illustrating the customer's concerns.

Microwave		
Top	Word	Frequency
1	service	270
2	kitchen	243
3	space	228
4	samsung	217
5	problem	194
6	food	188
7	warranty	178
8	price	173
9	size	167
10	counter	159

Pacifier		
Top	Word	Frequency
1	she	4536
2	he	4302
3	daughter	2323
4	mouth	1951
5	seat	1294
6	bag	1107
7	quality	1030
8	size	985
9	night	952
10	car	926

Hair Dryer		
Top	Word	Frequency
1	setting	1875
2	cord	1664
3	heat	1504
4	price	1268
5	she	851
6	speed	777
7	conair	732
8	quality	534
9	reviews	524
10	size	505

Figure 5. The frequency of words

B. Customer's' Gender

When reading the frequency table, it is found that “he” and “she” are frequent in the reviews. Therefore, we may roughly calculate the proportion of different genders.

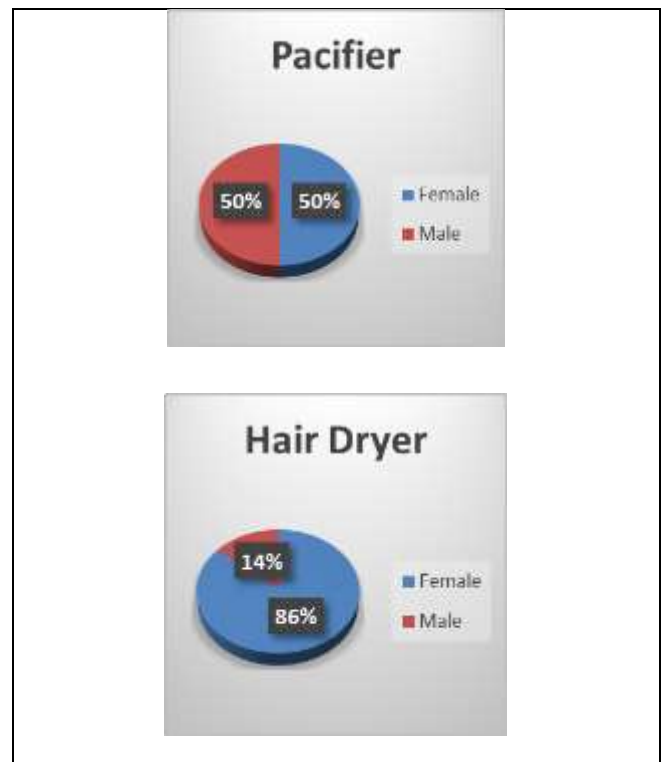
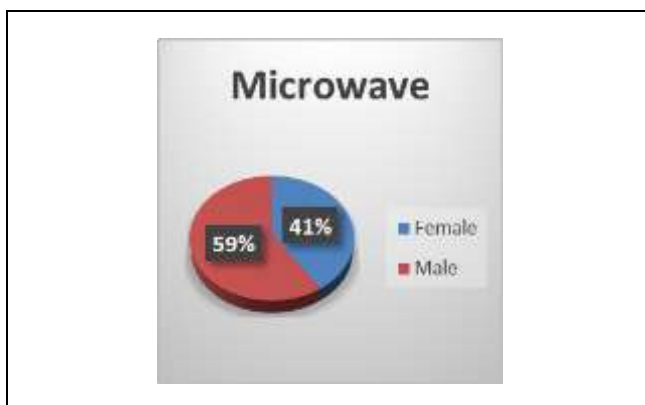


Figure 6. Customer's gender

Based on the three figures, we can conclude that Hair Dryer has a clear gender trend. The customers who are female are six times more than male's, from which we can deduce hair dryers are more popular among females. However, it does not show a gender diversity on Baby Pacifier. For the Microwave Oven, with limited sample capacity plus slight difference of proportion, we cannot assure that whether the product is more popular among males or females.

C. Relationships between Stars and Words

There also exists an interesting phenomenon when collecting those data, which is the frequency of typical commendatory and derogatory in these three products follows some similar rules.

Microwave					
	★	★★	★★★	★★★★	★★★★★
Top1	no	like	no	like	great
Top2	like	no	like	good	easy
Top3	never	good	good	great	love
Top4	good	great	nice	easy	no
Top5	died	never	great	no	good
Top6	recommend	loud	fine	nice	like
Top7	bad	fine	hard	fine	perfect
Top8	great	bad	never	perfect	nice
Top9	error	recommend	easy	love	recommend
Top10	failed	easy	loud	pretty	perfectly

Pacifier					
	★	★★	★★★	★★★★	★★★★★
Top1	like	like	like	like	great
Top2	no	great	great	great	love
Top3	disappointed	good	good	good	loves
Top4	good	no	cute	love	like
Top5	hard	cute	no	easy	easy
Top6	never	hard	love	nice	cute
Top7	recommend	disappointed	easy	cute	good
Top8	love	love	hard	loves	no
Top9	cute	never	nice	no	perfect
Top10	bad	easy	pretty	recommend	recommend

Hair Dryer					
	★	★★	★★★	★★★★	★★★★★
Top1	no	like	like	like	great
Top2	like	no	good	great	love
Top3	never	good	great	good	like
Top4	good	great	no	love	good
Top5	stopped	fine	fine	no	no
Top6	great	stopped	nice	nice	recommend
Top7	disappointed	recommend	pretty	powerful	easy
Top8	bad	disappointed	love	pretty	powerful
Top9	died	never	ok	fine	nice
Top10	recommend	died	loud	recommend	perfect

Figure 7. Relationships between Stars and Words

Firstly, those charts illustrate that the terms people used to praise or criticize a product are quite similar, though they are different types of products.

Secondly, as the stars increases, commendatory words gradually account for higher percentage. Meanwhile, the first time that derogatory word exist is delayed.

Thirdly, commendatory words mainly are in lower star and vice versa. In addition, four stars and five stars are quite similar except that five stars may use more stronger words like “perfect”.

VIII. CONCLUSIONS

In this paper, were used six indexes (star, helpful votes, total votes, vine, verified, review) to discover the relationship between them and to state a series of useful conclusions for an online sales strategy and find the potential features that enhance the desirability.

Most star rating is five stars. More stars, more helpful votes, more people focus on it. The reviews with more positive words tend to get a high star rate, and they would be more helpful. The reviews with five stars are much more reliable to obtain the votes, both helpful and non-helpful.

The Gray Forecast Model can help to find the trend corresponding to time and forecast the number of verified people in the next two years. The reason for measuring the reputation with verified people is that more people verified,

more famous the brand is, and better reputation the company could be.

The Clustering Model and Elbow’s Law were used to classify based on the star ranking. All the five stars are located far away from the others, which suggests that the reviews with five stars are more reliable to be commented.

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Appendix.1

microwave								pacifier								hair_dryer							
year	star	helpful_notes	total_reviews	vineY	vineN	verifiedY	verifiedN	year	star	helpful_notes	total_reviews	vineY	vineN	verifiedY	verifiedN	year	star	helpful_notes	total_reviews	vineY	vineN	verifiedY	verifiedN
2002	1	0	0	0	0	0	0	2002	1	0	0	0	0	0	0	2002	1	26	1	0	1	0	1
2002	2	0	0	0	0	0	0	2002	2	0	0	0	0	0	0	2002	2	0	0	0	0	0	0
2002	3	0	0	0	0	0	0	2002	3	0	0	0	0	0	0	2002	3	320	1	0	1	1	0
2002	4	0	0	0	0	0	0	2002	4	0	0	0	0	0	0	2002	4	4	1	0	1	0	1
2002	5	0	0	0	0	0	0	2002	5	0	0	0	0	0	0	2002	5	158	5	0	5	1	4
2003	1	0	0	0	0	0	0	2003	1	2	1	0	1	0	1	2003	1	0	0	0	0	0	0
2003	2	0	0	0	0	0	0	2003	2	0	1	0	1	0	1	2003	2	0	0	0	0	0	0
2003	3	0	0	0	0	0	0	2003	3	0	0	0	0	0	0	2003	3	3	2	0	2	0	2
2003	4	0	0	0	0	0	0	2003	4	0	0	0	0	0	0	2003	4	4	2	0	2	0	2
2003	5	0	0	0	0	0	0	2003	5	0	0	0	0	0	0	2003	5	32	6	0	6	0	6
2004	1	59	3	0	3	1	2	2004	1	0	0	0	0	0	0	2004	1	10	2	0	2	0	2
2004	2	12	1	0	1	0	1	2004	2	2	2	0	2	0	2	2004	2	5	1	0	1	1	0
2004	3	82	3	0	3	2	1	2004	3	0	0	0	0	0	0	2004	3	5	1	0	1	0	1
2004	4	19	1	0	1	1	0	2004	4	1	1	0	1	0	1	2004	4	8	1	0	1	0	1
2004	5	131	2	0	2	0	2	2004	5	0	1	0	1	0	1	2004	5	286	3	0	3	0	3
2005	1	0	0	0	0	0	0	2005	1	86	14	0	14	0	14	2005	1	246	2	0	2	1	1
2005	2	0	1	0	1	0	1	2005	2	20	6	0	6	0	6	2005	2	92	1	0	1	0	1
2005	3	0	0	0	0	0	0	2005	3	100	7	0	7	0	7	2005	3	92	3	0	3	1	2
2005	4	49	3	0	3	0	3	2005	4	50	12	0	12	1	11	2005	4	266	2	0	2	1	1
2005	5	109	3	0	3	2	1	2005	5	306	52	0	52	1	51	2005	5	188	12	0	12	3	9
2006	1	0	1	0	1	0	1	2006	1	7	3	0	3	1	2	2006	1	317	17	0	17	5	12
2006	2	0	0	0	0	0	0	2006	2	22	4	0	4	0	4	2006	2	262	9	0	9	1	8
2006	3	0	0	0	0	0	0	2006	3	0	0	0	0	0	0	2006	3	156	8	0	8	4	4
2006	4	0	0	0	0	0	0	2006	4	8	2	0	2	0	2	2006	4	149	18	0	18	8	10
2006	5	0	0	0	0	0	0	2006	5	352	15	0	15	1	14	2006	5	401	19	0	19	7	12
2007	1	10	1	0	1	1	0	2007	1	37	12	0	12	2	10	2007	1	862	24	0	24	7	17
2007	2	0	0	0	0	0	0	2007	2	25	10	0	10	2	8	2007	2	105	9	0	9	4	5
2007	3	0	0	0	0	0	0	2007	3	3	4	0	4	2	2	2007	3	84	13	0	13	3	10
2007	4	11	4	0	4	4	0	2007	4	105	30	0	30	12	18	2007	4	195	39	0	39	16	23
2007	5	102	9	0	9	4	5	2007	5	140	44	0	44	9	35	2007	5	965	97	0	97	46	51
2008	1	286	4	0	4	0	4	2008	1	68	17	0	17	2	15	2008	1	319	38	0	38	8	30
2008	2	56	5	0	5	0	5	2008	2	75	11	0	11	1	10	2008	2	39	16	0	16	6	10
2008	3	2	1	0	1	0	1	2008	3	64	16	0	16	5	11	2008	3	71	18	1	17	10	8
2008	4	115	5	0	5	3	2	2008	4	79	32	0	32	13	19	2008	4	80	54	1	53	29	25
2008	5	186	10	0	10	5	5	2008	5	256	124	0	124	48	76	2008	5	1687	107	0	107	56	51
2009	1	106	6	0	6	2	4	2009	1	20	9	0	9	4	5	2009	1	375	32	0	32	8	24
2009	2	0	0	0	0	0	0	2009	2	166	19	0	19	10	9	2009	2	58	21	1	20	7	14
2009	3	13	1	0	1	0	1	2009	3	34	14	0	14	10	4	2009	3	217	25	4	21	13	12
2009	4	12	1	0	1	0	1	2009	4	36	29	2	27	19	10	2009	4	130	70	9	61	39	31
2009	5	178	4	0	4	1	3	2009	5	171	103	0	103	55	48	2009	5	871	153	13	140	88	65
2010	1	65	8	0	8	0	8	2010	1	212	21	0	21	7	14	2010	1	340	85	0	85	50	35
2010	2	12	5	0	5	0	5	2010	2	84	21	0	21	17	4	2010	2	176	44	0	44	31	13
2010	3	9	2	0	2	0	2	2010	3	119	20	0	20	16	4	2010	3	305	42	1	41	35	7
2010	4	17	6	0	6	5	1	2010	4	277	48	0	48	40	8	2010	4	510	114	2	112	87	27
2010	5	88	8	0	8	7	1	2010	5	236	193	0	193	141	52	2010	5	1680	295	5	290	237	58
2011	1	134	31	0	31	5	26	2011	1	282	77	0	77	47	30	2011	1	322	84	0	84	48	36
2011	2	39	5	0	5	2	3	2011	2	144	77	0	77	53	24	2011	2	81	45	1	44	27	18
2011	3	58	6	0	6	2	4	2011	3	109	92	0	92	72	20	2011	3	139	59	2	57	43	16
2011	4	77	11	0	11	6	5	2011	4	530	170	2	168	133	37	2011	4	1253	132	11	121	97	35
2011	5	220	14	0	14	12	2	2011	5	981	589	0	589	458	131	2011	5	892	314	34	280	230	84
2012	1	442	57	0	57	6	51	2012	1	453	100	3	97	63	37	2012	1	387	108	0	108	72	36
2012	2	37	14	0	14	3	11	2012	2	92	76	2	74	62	14	2012	2	164	58	0	58	43	15
2012	3	91	11	0	11	5	6	2012	3	82	99	8	91	70	29	2012	3	157	86	2	84	73	13
2012	4	173	18	0	18	13	5	2012	4	397	252	12	240	215	37	2012	4	240	160	8	152	136	24
2012	5	683	50	0	50	39	11	2012	5	774	897	13	884	731	166	2012	5	945	506	19	487	425	81
2013	1	450	85	0	85	16	69	2013	1	427	218	0	218	167	51	2013	1	430	142	0	142	115	27
2013	2	66	23	0	23	12	11	2013	2	400	178	0	178	161	17	2013	2	102	137	0	137	116	21
2013	3	212	24	0	24	16	8	2013	3	307	296	4	292	256	30	2013	3	209	196	1	195	178	18
2013	4	195	43	0	43	31	12	2013	4	631	587	11	576	514	73	2013	4	512	438	7	431	400	38
2013	5	497	104	0	104	87	17	2013	5	1539	2446	8	2438	2235	211	2013	5	1404	1239	7	1232	1171	68
2014	1	437	115	0	115	40	75	2014	1	346	357	0	357	278	79	2014	1	582	250	0	250	204	46
2014	2	121	28	0	28	14	14	2014	2	200	280	0	280	242	38	2014	2	166	172	0	172	157	15
2014	3	92	37	0	37	24	13	2014	3	206	448	1	447	384	64	2014	3	332	273	5	268	243	30
2014	4	455	85	1	84	79	6	2014	4	318	867	8	859	756	111	2014	4	529	561	7	554	510	51
2014	5	842	207	0	207	183	24	2014	5	1802	4139	30	4109	3615	524	2014	5	1520	1954	6	1948	1789	165
2015	1	269	91	0	91	45	46	2015	1	591	363	0	363	322	41	2015	1	505	247	0	247	221	26
2015	2	64	30	0	30	25	5	2015	2	328	260	0	260	236	24	2015	2	91	126	1	125	116	10
2015	3	317	49	2	47	43	6	2015	3	204	430	1	429	408	22	2015	3	179	272	4	268	255	17
2015	4	160	123	7	116	104	19	2015	4	270	686	8	678	637	49	2015	4	169	504	6	498	481	23
2015	5	1219	256	9	247	239	17	2015	5	1090	4057	20	4037	3717	340	2015	5	1585	1994	21	1973	1847	147