

# An empirical study into the relationship between advertising density, market share and sales profit in the dairy industry

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Accepted 3<sup>rd</sup> October, 2015

**Abstract.** Many enterprises in the dairy industry have made significant investments into advertising to expand market share and profits. However, the effectiveness of this strategy has not been fully investigated and further study is needed. In this paper, an empirical study is the relationship between advertising density, market share and sales profit in the dairy industry. The research sample consisted of Yeale, Bright Dairy, Wei Wei Dairy and San Yuan Dairy. Relevant data was collected from these dairy enterprises and the wider industry from 2002 to 2011. Unit root tests, co-integration tests and a vector auto-regression model were used to analyze the bidirectional relationship between advertising density, market share and sales profit. Previous advertising density was positively correlated with advertising density, market share and sales profit in the current period. Moreover, previous market share was positively correlated with current advertising density and market share but was negatively correlated with current sales profit. Finally, previous sales profit was negatively correlated with current advertising density but positively correlated with current market share and sales profit.

**Keywords:** Advertising density, market share, sales profit rate, bidirectional relationship.

## INTRODUCTION

Advertisement competition is fierce between dairy enterprises in China. In 2004, Monmilk invested 310 million to become a top bidder for CCTV. In 2012, Monmilk also became the official milk provider for Mongolian athletes in the London Olympics. Similarly, Yeale spent 378 million on advertising in 2008 to become the official dairy sponsor for the Beijing Olympic Games (China Advertising Yearbook, 2013). Collectively, Monmilk, Yeale and Bright Dairy spent a total of 6.916 billion on advertising in 2011, equating to approximately 19 million per day. Several other dairy enterprises, including Wei Wei Dairy, San Yuan Dairy, Qingdao Shengyuan and Khorchin Dairy, have also invested heavily in advertising. In view of this situation, the media and the public have questioned: "is it milk or advertising that we drink?"

Through the new "dairy industry policy," (National Development and Reform Commission, 2009) domestic

enterprises are supported to form advanced level, cross-regional and internationally competitive dairy enterprise groups through mergers, alliances and reorganizations, etc. The sales concentration rate of the top 4 and 8 dairy enterprises ( $CR_4$  and  $CR_8$ ) in China, although far below developed countries, is rising. For example,  $CR_4$  increased from 31.88 to 44.6% between 2003 and 2011 and  $CR_8$  increased from 35.5 to 50.17% between 2003 and 2011. According to Bain classification standards (1951), the concentration rate of China's dairy industry has transformed from a competitive market structure to an oligopolistic IV type market structure.

It is widely accepted that the purpose of substantial investment in advertising is to expand market share and profits. However, the efficacy of this strategy is dependent on the relationship between advertising density, market share and sales profit. Until now, there has been little

research dedicated to the bidirectional relationship between advertising density, market share and sales profit in the dairy industry. This article will analyze this relationship with the application of a vector auto-regression model to advertising density, market share and sales profit rate data for several major dairy enterprises between 2002 and 2011.

## LITERATURE REVIEW

Early scholars in this field studied the relationship between market structure and performance. The majority of these studies cited the Harvard School SCP paradigm. However, the introduction of the Bain principles (1951) for studying the relationship between concentration and performance provided a welcome influx of research in this area. Vidale and Wolfe (1957) applied a single equation regression model to a large amount of sales and advertising data to provide a relationship analysis; however, the single equation regression study only analyzed the one-way impact of advertising on sales and did not address the identification problem. A study by TelSer (1964) could not establish a significant relationship between advertising density and market concentration. Bass (1969) applied simultaneous equation regression methods to limited time series data in sales and advertising and determined that advertising elasticity for filter brands was substantially greater than that for non-filter brands. Sutton (1974) described a quadratic relationship between advertising and performance and proposed an inverted U-shape concept. As the first scholar to study the relationship between advertising, concentration and performance, Martin (1978) demonstrated that the "barriers caused by advertising have no direct impact on profitability, but it can exert indirect influence through market concentration". Pagoulatos and Sorensen (1981) also found that although "advertising had a significant impact on the concentration and profits, advertising also played a true effect of barriers to entry, concentration and profits in hypothetical feedback relationships also had a significant impact on advertising density". Zanas (1994) performed a co-integration analysis of sales and advertising expenditures using time series data and found a long-run equilibrium relationship. An empirical study by Srinivasan and Lilien (2009) examined approximately 3804 listed companies in the United States between 1969 and 2007 and determined that an increase in advertising spending during or after a recession had a positive impact on B2B and B2C company profits, although spending in a recession had no impact on service sector company profits. Boujelben and Fedhila (2011) examined manufacturing firms in Tunisia and found that advertising spending had a positive influence on future cash flow.

It is evident that many previous studies have been based at the industry level, although research based on the enterprise level is developing. This paper examined listed companies in the dairy industry. Single equation regression cannot represent the diverse and complex relationships between economic variables. Previous studies have

focused exclusively on how advertising and market share can increase sales profit margins, while failing to consider that companies with increased sales profit margins will devote more resources to advertising and possess more capital for market expansion. This study applied a vector autoregressive model to study the multidimensional relationship between advertising density, market share and profit rate. The research analysis accounted for the time delay from advertisement launch to consumer purchase and brand loyalty decisions by assessing delayed effects upon the current period. The analysis in this paper will introduce lag variables.

## EMPIRICAL STUDY

### Sample and data selection

In recent years, large investments in advertising in the dairy industry have become increasingly conventional. As a result of the "Twelfth Five Year Plan of Food Industry" guidance, competition and development within the dairy industry has intensified. The relationships between advertising density, market share and sales profit in the dairy industry represents a significant research area. In 2011, the top ten dairy enterprises by sales were Monmilk, Yeale, Bright Dairy, Sanyuan Dairy, Guangxi Huangshi, Beingmate, Wei-wei Dairy, YaShili, Global Dairy and Ausnutria Dairy. Among them, the Guangxi Huangshi and Beingmate companies are more recent ventures, listed in 2010 and 2011, respectively. After systematic consideration, Yeale, Bright Dairy, Wei-wei Dairy and Sanyuan Dairy were chosen to form the research sample.

Firstly, the main business income and net profit data were obtained from the enterprises' income statements, advertising costs were obtained from the "advertising" subproject in the enterprises' cash flow statement notes and total sales figures were taken from the "China Dairy Yearbook" (2013). Advertising density, market share and sales profit rate were selected to represent the advertising investment, market position and revenue performance of the four enterprises, respectively. Specifically, the formulas for the three indicators were as follows:

$$\left\{ \begin{array}{l} \text{advertising density} = \text{advertising investment} / \text{main business income} \\ \text{market share} = \text{enterprise's main business income} / \text{industry's total sales} \\ \text{sales profit rate} = \text{net profit} / \text{main business income} \end{array} \right.$$

The three indicators were based on relative ratio data, and there was no need to apply consumer price index adjustments to the empirical analysis.

### Assumption and modeling

The relationship between advertising density, market share

**Table 1.** Basic statistical indicators of panel data.

Parameters	N	Adv				Pro			
		Mean	Sd	Min	Max	Mean	Sd	Min	Max
Year									
2002	4	0.0346	0.0165	0.0211	0.0580	0.0510	0.0141	0.0354	0.0686
2003	4	0.0308	0.0139	0.0188	0.0499	0.0373	0.0217	0.0098	0.0604
2004	4	0.0219	0.0110	0.0093	0.0352	-0.0026	0.0818	-0.1248	0.0469
2005	4	0.0322	0.0191	0.0108	0.0510	0.0075	0.0485	-0.0645	0.0400
2006	4	0.0289	0.0195	0.0048	0.0469	0.0221	0.0068	0.0149	0.0313
2007	4	0.0221	0.0155	0.0046	0.0418	0.0167	0.0126	-0.0002	0.0279
2008	4	0.0197	0.0122	0.0064	0.0344	-0.0188	0.0492	-0.0802	0.0260
2009	4	0.0771	0.0587	0.0394	0.1641	0.0174	0.0581	-0.0575	0.0837
2010	4	0.0697	0.0411	0.0368	0.1290	0.0135	0.0110	0.0167	0.0428
2011	4	0.0524	0.0318	0.0255	0.0975	0.0202	0.0185	0.0079	0.0489
Enterprise									
Yeale	10	0.0708	0.0445	0.0344	0.1641	0.0162	0.0360	-0.0802	0.0489
BrightDairy	10	0.0276	0.0086	0.0182	0.0450	0.0243	0.0242	-0.0364	0.0472
San-Yuan Dairy	10	0.0323	0.0119	0.0137	0.0487	-0.0103	0.0542	-0.1248	0.0544
Wei-Wei Dairy	10	0.0251	0.0238	0.0046	0.0645	0.0451	0.0203	0.0154	0.0837

and sales profit was examined with several assumptions proposed as follows:

- Due to the time gap between advertisement launch and the subsequent effect on customers' purchasing decisions, the coefficient between previous advertising density and current advertising density, market share and sales profit rate is expected to be positive.
- The goal of expanding market share is to improve sales profit, and market share can be maintained through further investments in advertising, thus the coefficient of the last market share to current advertising density, market share and sales profit rate is expected to be positive.
- The resources for increased advertising and expanded market share are derived from sales profit; therefore, the coefficient of previous sales profit to current advertising density, market share and sales profit rate is expected to be positive.

Based on the aforementioned assumptions, the VAR model was utilized for an in-depth analysis of the bidirectional relationship between advertising density, market share and sales profit. Using advertising density, market share, sales profit and zlagged variables, a vector auto-regression model was used as follows:

$$\begin{cases} \text{adv} = f(c, \text{adv}(-1), \text{share}(-1), \text{pro}(-1)) \\ \text{share} = f(c, \text{adv}(-1), \text{share}(-1), \text{pro}(-1)) \\ \text{pro} = f(c, \text{adv}(-1), \text{share}(-1), \text{pro}(-1)) \end{cases}$$

In the above model, adv, share and pro represent advertising density, market share and sales profit, respectively. In addition, adv(-1), share(-1) and pro(-1) represent the lagged variables.

### Descriptive statistical analysis

Firstly, the statistical indicators of adv and pro, including the mean, sd, max and min, were examined. The results are shown in Table 1.

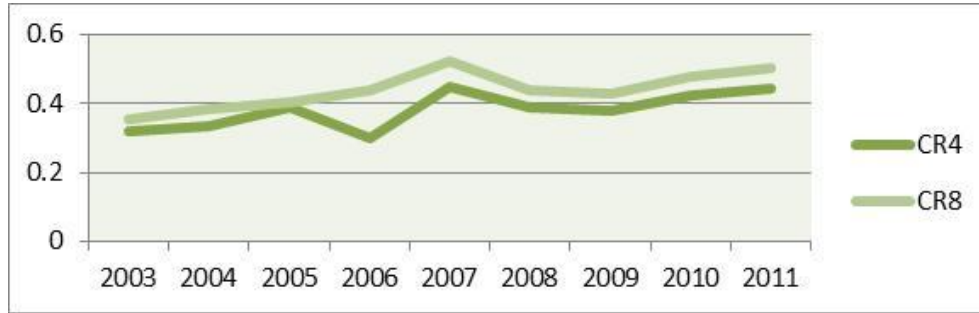
The mean values of adv and pro between 2002 and 2011 (Table 1) revealed a turning point in 2008. This was partially attributed to the Melamine Incident of 2008, which challenged the safety standards of dairy product production. Dairy product companies were forced to respond to this with increased advertising. However, sales profit still saw a significant decrease, which continued for three years and did not show improvement until 2012.

Based on the panel data, significant differences could be discerned between the four enterprises in advertising density and sales profit, and there were few common patterns. The low sales profits reflect the current financial state of the dairy industry, where even negative values have been observed.

As shown in Figure 1, the concentration ratios of the top 4 and 8 dairy enterprises (shown as CR4 and CR8) increased from 31.88 to 44.6% and from 35.5 to 50.17% in 2003 to 2011, respectively. However, this is still considerably lower than in Western developed countries where the concentration ratio of the top 3 dairy enterprises is approximately 70% in Australia and 80% in New Zealand. Concentration ratio increases are essential for furthering the development of the industry.

### Unit root and co-integration test

Prior to a vector autoregression analysis, the presence of a long-term stable relationship between advertising density, market share and sales profit needed to be verified. Thus, a pool unit root test of EVIEWS6.0 was used to provide a



**Figure 1.** Concentration ratio of the top 4 and 8 dairy enterprise. Source: “China Dairy Yearbook” (2004 to 2012).

**Table 2.** Integration of advertising density, market share and sales profit.

Series	Levin, Lin & Chu t*	Im, Pesaran and Shin W-stat	ADF-Fisher Chi-square	PP-Fisher Chi-square
Adv	-2.95008 0.0016	-0.92000 0.1788	12.5309 0.1290	5.70791 0.6799
d(adv)	-6.30570 0.0000	-2.69952 0.0035	23.7652 0.0025	23.9114 0.0024
Share	-4.74692 0.0000	-1.84553 0.1325	17.2907 0.0272	28.3601 0.0004
d(share)	-4.33035 0.0000	-1.54828 0.0408	15.9160 0.0436	24.7601 0.0017
Pro	-4.29723 0.0000	-1.94689 0.0558	17.5567 0.0248	20.8625 0.0075
d(pro)	-7.53539 0.0000	-3.34265 0.0004	27.9095 0.0005	37.0516 0.0000

single whole property to represent the three pool series, as shown in Table 2.

Four methods were used to test the integration of the three series according to the null hypothesis of the unit root process (Table 2). Three tests failed in the advertising density series as the statistical probabilities were greater than 0.05. It was thus determined that the advertising density series had low stability. However, the different advertising density series showed statistical probabilities of less than 0.05 in the four tests and they were thus deemed stable. Accordingly, the series of advertising density could be expressed as  $adv \sim I(1)$ . Similarly, the market share and sales profit series could also be expressed as  $share \sim I(1)$  and  $pro \sim I(1)$  based on the results of the tests shown in Table 2. Finally, a Johansen co-integration test was conducted for the three series; the results are shown in Table 3.

As shown in Table 2, the null hypothesis was rejected at a 15% confidence level, thus verifying the presence of a co-integration relationship between the three series. Due to the long-term stability between the three series, a vector auto-regression model could be used for further analysis of the influence.

**Vector auto-regression model**

The aforementioned analysis provided support for long-term stability between advertising density, market share and sales profit. However, the degree of influence between the three factors required further study. Therefore, further analysis was conducted using the vector auto-regression model (VAR model); the results are shown in Table 4.

Based on the estimation results shown in Table 4, the VAR model could be expressed as follows:

$$\begin{cases} adv = -0.023657 + 0.68790adv(-1) + 0.854480share(-1) - 0.688710pro(-1) \\ share = -0.028140 + 0.054556adv(-1) + 0.765700share(-1) + 0.423971pro(-1) \\ pro = -0.011423 + 0.029322adv(-1) - 0.015301share(-1) + 0.341031pro(-1) \end{cases}$$

From the abovementioned analysis, the bidirectional relationship between advertising density, market share and sales profit was determined as follows:

- a) When the previous advertising density value increased by one unit, the current advertising density, market share and sales profit values increased by 0.687901, 0.054556

**Table 3.** Co-integration of advertising density, market share and sales profit.

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.15	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None	0.857670	27.64337	29.79707	0.0869
At most 1	0.529209	10.09691	15.49471	0.2733
At most 2	0.308256	3.316851	3.841466	0.0686

Unrestricted Co-integration Rank Test (Maximum Eigen value)				
Hypothesized		Max-Eigen	0.15	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None	0.857670	17.54645	21.13162	0.1478
At most 1	0.529209	6.780062	14.26460	0.5155
At most 2	0.308256	3.316851	3.841466	0.0686

**Table 4.** The estimation results of vector auto-regression model.

	Adv	Share	Pro
Adv(-1)	0.687901 (0.40054) [ 1.71744]	0.054556 (0.27297) [ 0.19986]	0.029322 (0.35215) [ 0.08326]
Share(-1)	0.854480 (0.67448) [ 1.26686]	0.765700 (0.45967) [ 1.66577]	-0.015301 (0.59301) [-0.02580]
Pro(-1)	-0.688710 (0.51123) [-1.34717]	0.423971 (0.34841) [ 1.21689]	0.341031 (0.44947) [ 0.75874]
C	-0.023657 (0.01418) [-1.66802]	-0.028140 (0.00967) [-2.91133]	-0.011423 (0.01247) [-0.91609]

and 0.029322 units, respectively;

b) When the previous market share value increased by one unit, the current advertising density, market share and sales profit values increased by 0.854480, 0.765700 and -0.015301 units, respectively;

c) When the previous sales profit value increased by one unit, the current advertising density, market share and sales profit values increased by -0.688710, 0.423971 and 0.341031 units, respectively;

## DISCUSSION AND CONCLUSION

1. When the previous advertising density value increased by one unit, the current advertising density, market share, sales profit values increased by 0.687901, 0.054556 and 0.029322, respectively. This reflected a delay and cumulative effect attributable to the time lag between initial

advertisement launch and consumer purchasing decisions and the time process required for expanded market share. The hysteresis of advertising density requires marketing and advertising to comply with long-term development and overall business objectives. The use of advertising bombing as a short-term campaign for quick success and instant benefit may be detrimental to the long-term development of a corporate brand image, resulting in ineffectual investment. In addition, the lag effect should be considered when evaluating advertising effectiveness. Although it can be highly effective, the effects of advertising should not be exaggerated to decision-makers as matching the development pace of an enterprise can be challenging and undue assumptions can inhibit growth. For successful future development, an advertising budget should be determined before commencing advertising. The effects of advertising campaigns should be quickly evaluated so timely feedback can be provided.

2. When the previous market share increased by one unit, the current advertising density, market share and sales profit values increased by 0.854480, 0.765700 and -0.015301, respectively. Although there was an increase in previous market share, current sales profit margins show a decline because the industry has moved into an integrated development stage where big enterprises are forced to increase market share through continuous price reductions, which has caused a whole industry downturn in sales profit and even produced a loss in the San Yuan Dairy company. This is a normal phenomenon that can increase production capacity in the industry. The sales concentration in the Chinese dairy industry has shown a rapid increase, particularly when compared to developed countries, such as Australia and New Zealand; although a significant gap still remains. Rather than placing governmental restrictions on low prices to increase profit margins, efforts should instead focus upon encouraging the vertical integration of large dairy company operations through mergers and acquisitions, supporting horizontal scale formations for optimized organizational structures and promoting an oligopolistic market structure.

3. When the previous sales profit rate increased by one unit, the current advertising density, market share, sales profit values increased by -0.688710, 0.423971 and 0.341031, respectively. The relationship between the previous sales profit rate and current advertising density was not in agreement with our third assumption. The coefficient -0.688710 was not directly linked to the increase previous sales profit rate but was instead attributed to the overall trend of declines in sales profit rates and increases in advertising density in recent years. Since 2008, the dairy products industry has invested heavily in advertising in order to reshape brand images and expand its market share. In addition, production costs, raw material costs and auxiliary material costs have increased in recent years. There is also limited product differentiation in the Chinese dairy industry and price competition is fierce, which has contributed to continued decline in sales profit rates.

Monmilk, Yeale and Bright Dairy are known to have a capital advantage over other enterprises, while local brands have a geographical advantage. The former should thus exploit their capital advantages under the guidance of the 12th five-year policy by accelerating mergers for increased production capacity. They can thus enhance their capital, technology and brand advantages for further improvements in brand awareness through advertising, expansion of their market share using economies of scale and reductions in competition to avoid price wars. Meanwhile, the latter should exploit their geographical and human strengths. Decentralized production can reduce transportation costs and other preservation costs for increased sales margins.

Dairy production technology in China has been relatively stable in modern times as mature production lines have mainly been imported from foreign developed countries. However, in recent years, important product innovations have changed the landscape of the dairy industry; for

example, Monmilk developed "Deluxe milk," Yeale developed "LGG yoghurt" and Bright Dairy developed "comfortable sleeping milk." These latest achievements have encouraged further innovations in the Chinese dairy industry. Enterprises should increase R&D investment for further technical innovations and the development of products diverse in type and function to self-differentiate from their core competitors and gain a market pricing advantage.

## ACKNOWLEDGEMENTS

This study was supported by National Natural Science Foundation of China (Project No.71173085), the Fundamental Research Funds for the Central Universities (Program No.52902-0900201212) and Humanities & Social Science Foundation for The Excellent Youth Scholars of Huazhong Agricultural University.

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