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# Effects of local and national advertising across brands: the case of yogurt in China\*

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This study examines Chinese consumer's demand for yogurt and evaluates the effect of advertising on yogurt demand in four first-tier cities in China. An almost ideal demand system augmented with advertising is estimated, and advertising on local media channels is distinguished from that on national media channels. The main findings are that Chinese demand for yogurt is generally elastic, yet local brands tend to have smallest own-price elasticities. More importantly, while local advertising has generally a positive effect on yogurt demand, national advertising is found to decrease demand in Beijing and Guangzhou. This may be due to households' distinct media preference across cities, as well as advertising cannibalisation within brand. Lastly, advertising one yogurt brand may function similarly as generic advertising in promoting demand for yogurt with other brands. Corresponding marketing implications are drawn for yogurt manufacturers and marketers.

**Key words:** advertising, demand system, local, national, yogurt.

## 1. Introduction

The melamine milk scandal in 2008 caused significant damage to the Chinese dairy industry. Since then, the whole industry has undergone major restructuring, and food safety regulations in China have become increasingly tightened (Jia *et al.* 2012). As a result, consumers' confidence in dairy products is gradually restored. In recent years, demand for dairy products is growing at an annual rate of 6 per cent, faster than the annual production growth rate of 3 per cent in China (Dairy Reporter 2018). The then Ministry of Agriculture of China further projects that China's demand for dairy products will continue to exceed domestic supply until 2026, and imports of dairy products will increase by 50 per cent every year, reaching 25 per cent of the total domestic market share by 2024 (MOA 2017). Yet, this strong growth

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in demand is not equally shared by all dairy products, and evidence suggests that dairy consumption in China is trending towards yogurt, as yogurt consumption has increased by 108.6 per cent from 2013 to 2017, comparing with 18 per cent in fluid milk during the same time (China Daily 2017). Rising household income and consumers' increasing awareness of nutritional diet are important factors that contribute to the popularity of yogurt (Daxue Consulting 2019).

One main characteristic of Chinese yogurt demand is that consumers' preference for yogurt is highly heterogeneous. On one hand, consumers have distinct preferences for a wide range of yogurt attributes. In addition to new flavours and tastes, health-conscious consumers also demand yogurt with health benefits, such as the ability to improve immune system or help digestion. This trend in yogurt demand is consistent with that in the United States and Europe as yogurt is increasingly being regarded as a functional food with health benefits (Bonanno 2016; Bimbo *et al.* 2017). This also motivates manufacturers to continuously differentiate their products. On the other hand, Chinese consumers also have strong preferences for yogurt brands, as can be seen from the substantially different yogurt market structure across cities. Three leading national brands – Bright Dairy of Shanghai, and Yili and Mengniu of Inner Mongolia – occupy major market shares nationwide, while local and regional brands enjoy popularity in their respective local regions. As a result, brand awareness and reputation are of particular importance in China, and understanding yogurt demand at the brand level is important for yogurt manufacturers operating in China to identify competitors and make corresponding marketing campaigns.

To raise brand awareness and compete for market shares, all main yogurt producers in China spend liberally on marketing activities, especially advertising. As of 2015, the advertising expenditure of Bright Dairy, Yili and Mengniu reaches 3.55, 7.28 and 4.09 billion yuan,<sup>1</sup> respectively, far exceeding their net profits. In particular, Bright Dairy's advertising expenditure is 8.5 times of its net profit (Hexun News 2016). Despite the skyrocketing advertising expenditure, its impact on yogurt demand is not well understood. Furthermore, large expenses on advertising may reduce the resources firms need for innovation and food safety improvement, which could undermine the long-term development of the entire yogurt industry. It is thus important to evaluate the effect of advertising on yogurt demand in China. Moreover, the effect of advertising is known to be highly heterogeneous (Henningsen *et al.* 2011). Depending on its coverage and reach, advertising can be categorised into national advertising and local advertising. National advertising refers to advertisement made on national media channels, and it can reach a large number of audiences across the country, whereas local advertising often targets on a region no larger than a

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<sup>1</sup> One USD equals to 6.158 CNY and 6.284 CNY at the annual average exchange rate of 2014 and 2015, respectively.

metropolitan city. For yogurt market in China, national brands routinely engage in both national and local advertising, yet local advertising is usually the only venue affordable and actually taken by most local brands.

In this article, we empirically examine the effect of advertising on yogurt demand in China within the framework of almost ideal demand system (AIDS) proposed by Deaton and Muellbauer (1980). Specifically, we augment the AIDS model with two advertising variables – national and local advertising following demographic translation proposed by Pollak and Wales (1981), and estimate an AIDS model comprised of major brands in each of the four first-tier cities in China: Shanghai, Beijing, Guangzhou and Shenzhen. In addition to the three national brands, we identify and include in our analysis the most popular local brands in each of the four cities. In doing so, we evaluate the impact of local and national advertising on demand for national brands in different cities as well as the impact of local advertisement on demand for local brands in each city. In particular, since Bright is a brand created and headquartered in Shanghai, we use it to further investigate the differential impact of local advertisement on a brand conditional on whether the advertisement is made in the brand's origin city.

Given the increasing share of yogurt among all dairy products, and the intense competition among yogurt brands from different manufacturers, this article makes a first and needed attempt to focus on demand for yogurt products at the brand level in China. Also, the four cities we choose as our study areas represent east (Shanghai), north (Beijing) and south (Guangzhou and Shenzhen) of China, and they have a combined population of over 107 million. By accounting for preference heterogeneity across cities, we contribute to understanding the geographical variation in yogurt market in China. More importantly, we distinguish national advertising from local advertising, which reveals the heterogeneous impact of different types of advertising on demand for yogurt in China. Domestic yogurt producers as well as foreign yogurt manufacturers currently operating in China or who wish to capture the Chinese market can make pricing and advertising strategies based on our findings.

The remaining of this article is organised as follows: Section 2 reviews prior studies on the effect of advertising in food marketing and demonstrates the distinction between local and national advertising. Section 3 introduces the dataset and demand system and discusses the econometric considerations in model estimation. Section 4 discusses the results and their implications. Section 5 concludes and draws implications of this research.

## 2. Literature review

Advertising has long been playing an important role in companies' marketing strategies. As a result, extensive literature in economics and marketing has studied its effect. Theoretical work shows several mechanisms through which advertising can affect consumer purchasing behaviours – advertising not only

provides information on product existence and attributes (Nelson 1974; Grossman and Shapiro 1984), but also creates ‘favourable notice’ to the good advertised (Becker and Murphy 1993). Building on these theories, a large body of empirical studies has sought to evaluate the effects of advertising. For food and beverage products, many studies focus on evaluating the effect of generic advertising on promoting consumers’ demand. This is partially due to the fact that funding for generic advertising is allocated under various government-funded checkoff programs in many countries, including the United States. The need subsequently arises to understand the effectiveness of generic advertising (Zheng and Kaiser 2008; Adachi and Liu 2010; Okrent and MacEwan 2014). In these studies, advertising is usually introduced into a demand model as a demand shifter. Another line of more recent literature pays attention to the health consequences of advertising since advertising can be an important factor affecting consumers’ dietary choice, and it is expected that banning advertising on unhealthy food may reduce the consumption of such food, and thus, the public health can be improved. This reasoning is supported in some studies where restriction on advertising food high in fat, sugar and salt is found to reduce consumption of these foods (Liu *et al.* 2014; Silva *et al.* 2015).

Despite its growing importance, the demand for yogurt and other dairy products in China is understudied. As the Chinese yogurt market is increasingly differentiated, studies on the demand for yogurt predominantly focus on estimating consumer willingness to pay for some yogurt attributes (Moro *et al.* 2015; Bonanno 2016). Little is known regarding the effect of advertising on the quantity of yogurt demand. Only several studies found that advertising could influence consumers’ intention to purchase yogurt in China (Tian *et al.* 2016; Peng *et al.* 2018). However, these studies are exclusively based on stated purchases obtained via survey questions and are limited in scope since they examine one single city and are descriptive in nature. Thus, their findings do not quantify the effect of advertising on the demand for yogurt.

Generic advertising is the focus of many studies that evaluate the effect of advertising on demand for food and beverages. However, generic advertising does not distinguish products from different manufacturers, and it is impossible to evaluate the spillover effect of advertising among different brands (Li and Lopez 2015). Moreover, advertising can differ in numerous aspects such as geographical coverage or delivery methods. As a result, by measuring advertising only with total generic advertising expenditure, it is implicitly assumed that advertising effect is homogenous across differing types of advertising, yet this assumption is likely too strong to hold in many markets. In the context of the Chinese yogurt market, generic advertising is virtually nonexistent for yogurt and other dairy products. Instead, brand advertising is the main form of advertising for yogurt. Thus, it is important to investigate the effectiveness of brand advertising given manufacturers’ liberal spending on advertising.

Importantly, yogurt manufacturers in China have the choice of advertising on national media channels or local media channels. National and local advertising function differently in promoting yogurt demand for two main reasons. First, national advertising can reach a large number of audiences, which suggests low specificity and high generality, and thus, it is suitable for the purpose of brand-building (Sridhar *et al.* 2016). The brand-building functionality of national advertising is further strengthened because national media channels such as China Central Television (CCTV) are generally regarded as trustworthy information sources in China (Xu 2013). By contrast, local advertising is highly relevant to specific local markets, and thus, the goal of local advertising is more related to generating immediate sales and it is usually more short-term focused (Popkowski Leszczyc and Rao 1990). Second, since products advertised via national channels are generally perceived as higher quality, national advertising may further contribute to brand-building by enhancing the perceived quality of the brand being advertised, whereas local advertising may gain a short-term advantage at the cost of damaging perceived quality (Han 2019). Therefore, national and local advertising may have differing effects on yogurt demand, and to have a better understanding of the effectiveness of advertising, it is essential to separate national advertising from local advertising.

### 3. Data and model

Our main data source is the Kantar Worldpanel, which is provided by CTR Market Research. This is a household-level scanner dataset with details on yogurt purchases from a representative panel of households in our four first-tier Chinese cities: Shanghai, Beijing, Guangzhou and Shenzhen from 2014 to 2015. Households record detailed information on their yogurt purchases, including product specifications, price and promotion, as well as purchasing channels. In addition, key household demographic information is also recorded. To the best of our knowledge, no previous studies have explored the richness of this dataset to study yogurt demand at the household level in China. Moreover, CTR also tracks yogurt advertisement on all major media channels – television, radio, newspapers, outdoor billboard and the Internet – in the four cities in 2014 and 2015. The information collected about yogurt advertisement includes yogurt name and brand, advertising expenditure, media channel name and other media-specific information. From this dataset, we are able to distinguish yogurt advertising expenditure on national media channels from that on local media channels. Specifically, the only national TV and radio station in China is the CCTV and China National Radio (CNR), respectively. As a result, advertising on CCTV, CNR, national newspapers,<sup>2</sup> as well as through any Internet media is considered national

<sup>2</sup> The five national newspapers of China are as follows: People's Daily, Global Times, Guangming Daily, China Youth Daily and The Economic Daily.

advertising. Advertising made at local TV and radio stations, newspapers, and on billboards and posters is considered local advertising.

The data processing procedure is as follows. In addition to the three leading national brands, we identify the most popular local brands in each of the four cities to include in our demand system analysis. Note that due to the existence of numerous small local brands<sup>3</sup> in the province of Guangdong, we group these brands under the name Guangdong. For other variables in the demand system, we aggregate each household's purchase of yogurt by summing the quantity and expenditure for each yogurt brand purchased for every two weeks. From these sums of quantity and expenditure, we calculate the expenditure shares and the average prices for each brand. We then sum yogurt advertising expenditure for each brand for every two weeks, and we distinguish advertising expenditure on national media channels from that on local media channels using the names of the media channels in the dataset. Finally, yogurt purchase data are merged with yogurt advertising data by city and week. It needs to be noted that advertising expenditure can only approximate consumers' exposure to advertisement; nevertheless, it is widely used in empirical studies to evaluate the effect of advertising (Zheng and Kaiser 2009; Zheng *et al.* 2016). Also, for each city, we can only exploit the variation in advertising expenditure over time to identify the effect of advertising because it is impossible to measure household-specific exposure to advertising. After dropping households with key demographic or consumption information missing, and yogurt purchases with extreme prices, we have a final sample of 8,169 households with 97,168 observations of yogurt purchases for the four cities in 2014 and 2015. Descriptive statistics of the household demographics can be found for each city in Table A1 in the Appendix S1.

We use the Linear Approximated Almost Ideal Demand System (LA/AIDS) originally proposed by Deaton and Muellbauer (1980) to model demand for yogurt in each of the four cities in China. The LA/AIDS model provides a first-order approximation of any demand systems, and it satisfies the axioms of choice and aggregation across consumers. Assuming households follow a two-stage budgeting process, the AIDS model can be specified as:

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \log p_j + \beta_i (\log M - \log P), \quad i = 1, 2, \dots, n, \quad (1)$$

where  $w_i$  is one household's expenditure share on yogurt brand  $i$ ,  $p_j$  is the average unit price of yogurt brand  $j$ ,  $M$  is the total expenditure on yogurt, and  $\log P$  is the Laspeyres price index such that:

<sup>3</sup> Though all small, some relatively more prominent local brands include Classy, Yantang and Fengxing.

$$\log P = \sum_{j=1}^n \bar{w}_j \log p_j, \quad (2)$$

where  $\bar{w}_i$  is the mean expenditure share of yogurt brand  $i$ . To evaluate the effects of national and local advertising on yogurt demand, we introduce the advertising variables into the intercepts, following the demographic translation procedure proposed by Pollak and Wales (1981), and  $\alpha_i$  takes the following form:

$$\alpha_i = \alpha_{0i} + \sum_k \lambda_{ik} \log(ladv_k) + \sum_k \mu_{jk} \log(nadv_k), \quad (3)$$

where  $ladv_k$  and  $nadv_k$  are advertising expenditure of yogurt brand  $k$  on local and national media channels, respectively.

Because not all households purchase all brands of yogurt, the expenditure shares of various brands of yogurt are censored in our data. It is well known that ignoring the censoring of the dependent variables can lead to biased and inconsistent estimation of the model parameters. To address this issue, we consider a censored demand system on the basis of our LA/AIDS model. The censored LA/AIDS is a multi-variate extension of the type 2 Tobit model discussed in Amemiya (1984), and it adds a separate selection process to govern whether households purchase a particular brand of yogurt, such that

$$w_i = \begin{cases} 0, & z' \tau_i + v_i < 0 \\ w_i^* = f_i(x, \theta_i) + u_i, & z' \tau_i + v_i \geq 0, \end{cases} \quad (4)$$

where  $f_i(x, \theta_i)$  is the demand system described in Equations (1)–(3),  $z$  is a vector of explanatory variables affecting whether households' purchase one particular brand of yogurt, and  $u_i$  and  $v_i$  are residual terms. Pudney (1989) suggests that only personal characteristics should appear in the selection equation. However, economic factors may also play an important role in determining yogurt brand choice; hence, we include both household demographics and yogurt prices in  $z$  to explain household brand choices.

Two broad categories of strategies have been proposed in the literature to estimate the censored demand system in (4). One assumes  $u_i$  and  $v_i$  follow a joint normal distribution and estimates the demand system with maximum likelihood estimation (MLE). This approach relies on strong distributional assumption of the residuals, which may not hold. In addition, estimation with MLE requires the evaluation of multi-level probability integrals, and it quickly becomes computationally burdensome as the number of equations in the system grows, even for our demand system comprised of five equations. The difficulty with the MLE estimation motivates numerous two-step estimation procedures. Among them, the procedure proposed by Shonkwiler

and Yen (1999) (SY hereafter) provides consistent estimation of Equation (4), and it is also straightforward to implement. We thus follow their procedure to estimate our yogurt demand system.

The SY procedure is based on the unconditional means of the expenditure shares, derived as

$$E(w_i) = \Phi(z' \tau_i) f_i(x, \theta_i) + \delta_i \phi(z' \tau_i), i = 1, 2, \dots, n, \quad (5)$$

where  $\Phi(\cdot)$  and  $\phi(\cdot)$  are the cumulative density function and probability density functions of the standard normal distribution. The first step is to estimate the probability of observing a positive expenditure for each yogurt brand  $i$  using probit models estimated by MLE. In the second step, estimated  $\hat{\tau}_i$  are used to compute  $\Phi(z' \hat{\tau}_i)$  and  $\phi(z' \hat{\tau}_i)$ , replacing their corresponding terms in Equation (5). The following system of equations is estimated with either MLE or seemingly unrelated regression (SUR)<sup>4</sup>:

$$w_i = \Phi(z' \hat{\tau}_i) f_i(x, \theta_i) + \delta_i \phi(z' \hat{\tau}_i) + \xi_i, i = 1, 2, \dots, n. \quad (6)$$

We estimate the system with the command `nlshr` in Stata 14, and we use the iterative FGNLS estimator, which is equivalent to MLE for nonlinear systems (Stata 2015). Also note that the residual  $\xi_i$  is heteroscedastic, and efficiency could be achieved by using heteroscedastic robust standard errors<sup>4</sup> (Shonkwiler and Yen 1999).

One additional issue with the SY procedure is the theoretical restrictions needed to suggest consumer utility maximisation. In the LA/AIDS model, these theoretical constraints – homogeneity, symmetry and adding-up – are routinely imposed by restricting model parameters during estimation, such that:

$$\sum_{i=1}^n \alpha_{0i} = 1, \sum_{i=1}^n \lambda_{ik} = \sum_{i=1}^n \mu_{ik} = \sum_{i=1}^n \beta_i = \sum_{i=1}^n \gamma_{ij} = 0(\text{adding-up}), \quad (7a)$$

$$\sum_{j=1}^n \gamma_{ij} = 0(\text{homogeneity}), \quad (7b)$$

$$\gamma_{ij} = \gamma_{ji}(\text{symmetry}). \quad (7c)$$

Although homogeneity and symmetry can be imposed as they are in the SY procedure, the adding-up cannot be imposed as in (7a), because the

<sup>4</sup> Price calculated as unit value is likely to be endogenous, as discussed in Dhar *et al.* (2003). However, potential endogeneity may not present a problem in our demand system estimation because yogurt expenditure at the household level is less likely to affect the market price of yogurt.

<sup>4</sup> An alternative way to correct heteroscedasticity is to bootstrap the standard errors. However, it becomes computationally infeasible due to the large size of our data.

deterministic part of  $w_i$  in Equation (6) may not add up to one across all  $i$  (Yen *et al.* 2003). Pudney (1989) suggests treating one category of good in the system as a residual good, which does not have its own demand, and estimating a demand system comprised of the remaining  $n - 1$  equations. The adding-up restriction is imposed in the sense that the elasticities involving the residual good and the other  $n - 1$  goods need to form certain relationships derived from homogeneity of the demand curves and the budget constraint.<sup>5</sup> Since we have already included major national and local yogurt brands in our demand analysis in each city, the residual category of yogurt comprised of much smaller brands and is not shown.

From the estimated parameters, own- and cross-price elasticities, and expenditure elasticities can be calculated for the  $n - 1$  goods by differentiating Equation (5) with respect to prices and expenditure, such that:

$$e_{ii} = \left( \frac{\partial E(w_i)}{\partial \log p_i} \right) \left( \frac{1}{E(w_i)} \right) - 1 = \Phi(z'_i \hat{\tau}_i) \left( \frac{\hat{\gamma}_{ii} - \hat{\beta}_i}{\bar{w}_i} \right) - 1, \quad (8a)$$

$$e_{ij} = \left( \frac{\partial E(w_i)}{\partial \log p_j} \right) \left( \frac{1}{E(w_i)} \right) = \Phi(z'_i \hat{\tau}_i) \left( \frac{\hat{\gamma}_{ij} - \hat{\beta}_i \bar{w}_j}{\bar{w}_i} \right), \quad (8b)$$

$$e_{im} = \left( \frac{\partial E(w_i)}{\partial \log m} \right) \left( \frac{1}{E(w_i)} \right) + 1 = \Phi(z'_i \hat{\tau}_i) \frac{\hat{\beta}_i}{\bar{w}_i} + 1. \quad (8c)$$

Also, by differentiating Equation (5) with respect to the advertising variables, local and national advertising elasticities can be expressed as:

$$e_{adv.ilik} = \left( \frac{\partial E(w_i)}{\partial \log(ladv_k)} \right) \left( \frac{1}{E(w_i)} \right) = \Phi(z'_i \hat{\tau}_i) \left( \frac{\lambda_{ik}}{\bar{w}_i} \right), \quad (9a)$$

$$e_{adv.inik} = \left( \frac{\partial E(w_i)}{\partial \log(nadv_k)} \right) \left( \frac{1}{E(w_i)} \right) = \Phi(z'_i \hat{\tau}_i) \left( \frac{\mu_{jk}}{\bar{w}_i} \right). \quad (9b)$$

#### 4. Results and discussion

In the section, we first briefly report the descriptive statistics of our data and then focus on discussing yogurt demand and the effect of advertising using elasticities. Descriptive statistics of total yogurt expenditure, market shares, and prices of each brand in each city are shown in Table 1. Preference for yogurt is heterogeneous across the four cities as indicated by the average household expenditure. In Shanghai, an average of 41.47 yuan is spent on yogurt every two weeks, comparing with that of 24.48 yuan in Guangzhou,

<sup>5</sup> See Silberberg & Suen (2000) p. 309 for a detailed discussion.

**Table 1** Descriptive statistics of yogurt expenditure shares and prices by brand and city

	Shanghai	Beijing	Guangzhou	Shenzhen	National
Average yogurt expenditure (yuan)	41.47 (38.73) <sup>†</sup>	29.17 (29.79)	24.48 (24.77)	30.73 (31.18)	32.02 (32.61)
Expenditure Share					
Bright	0.60 (0.47)	0.09 (0.26)	0.30 (0.44)	0.32 (0.45)	0.30 (0.44)
Mengniu	0.07 (0.24)	0.17 (0.34)	0.04 (0.20)	0.17 (0.36)	0.11 (0.30)
Yili	0.07 (0.24)	0.21 (0.37)	0.06 (0.22)	0.15 (0.35)	0.13 (0.32)
Sanyuan	–	0.37 (0.45)	–	–	0.16 (0.35)
Junlebao	–	0.06 (0.23)	–	–	0.03 (0.15)
Weiquan	0.11 (0.30)	–	–	–	0.03 (0.17)
Danone	0.09 (0.27)	–	0.08 (0.26)	0.01 (0.10)	0.04 (0.20)
Guangdong	–	–	0.27 (0.43)	0.03 (0.17)	0.06 (0.22)
Other	0.06 (0.22)	0.10 (0.28)	0.25 (0.42)	0.32 (0.45)	0.13 (0.32)
Average Price					
Bright	2.15 (0.59)	1.75 (0.27)	2.02 (0.49)	1.90 (0.42)	1.94 (0.47)
Mengniu	1.95 (0.23)	2.01 (0.36)	2.27 (0.43)	2.12 (0.41)	2.05 (0.37)
Yili	2.24 (0.27)	2.04 (0.42)	2.20 (0.29)	1.97 (0.35)	2.13 (0.37)
Sanyuan	–	1.53 (0.36)	–	–	0.66 (0.79)
Junlebao	–	1.59 (0.26)	–	–	0.68 (0.80)
Weiquan	2.24 (0.26)	–	–	–	0.67 (1.03)
Danone	2.27 (0.23)	–	2.45 (0.26)	2.07 (0.91)	1.32 (1.18)
Guangdong	–	–	1.69 (0.25)	1.43 (0.20)	0.44 (0.74)
Other	3.62 (0.50)	1.92 (0.38)	3.08 (0.62)	2.88 (0.72)	2.73 (0.89)
<i>N</i>	28,941	41,733	19,304	7,190	97,168

Note: <sup>†</sup>Standard errors in parentheses.

while the national average is 32.02 yuan. Moreover, households prefer different yogurt brands in different cities. While local brands have the highest share in household yogurt expenditure in Shanghai (60 per cent of Bright Dairy) and Beijing (37 per cent of Sanyuan), Guangdong local brands have 27 per cent of the expenditure share in Guangzhou, and only 3 per cent in Shenzhen. Further, the yogurt market is more concentrated in Shanghai and Beijing than in Guangzhou and Shenzhen, as the combined expenditure share of all other brands is only 6 per cent and 10 per cent in Shanghai and Beijing, comparing with that of 25 per cent and 32 per cent in Guangzhou and Shenzhen. In addition, the average price of yogurt also differs substantially across cities, even for the same brand and this may suggest that yogurt manufacturers may adopt different pricing strategies.

Advertising expenditure on national and local media channels for brands included in the demand system is shown in Table 2 for each city. All three national brands have both national and local advertising, yet they target different markets differently. Bright Dairy has the most advertising expenditure on local media channels in Shanghai (3.27 million yuan in 2 weeks), while Yili spends the most on local media channels in Guangzhou (1.29 million yuan in 2 weeks). Mengniu, however, spreads its advertising expenditure more evenly with a focus on Shenzhen, and it also has the largest

**Table 2** Yogurt advertising expenditure by brand and city (in 1,000,000 yuan)

	Shanghai	Beijing	Guangzhou	Shenzhen	National
Local advertising					
Bright	3.27 (3.30)	0.79 (1.77)	0.71 (1.10)	1.15 (2.09)	1.54 (2.53)
Mengniu	0.33 (0.88)	0.59 (1.31)	0.20 (0.68)	1.30 (1.11)	0.49 (1.10)
Yili	0.01 (0.04)	0.17 (0.54)	1.29 (3.10)	– (0.01)	0.33 (1.51)
Sanyuan	–	0.37 (0.71)	–	–	0.16 (0.50)
Junlebao	–	–	–	–	–
Weiquan	1.53 (4.85)	–	–	–	0.46 (2.74)
Danone	1.75 (3.04)	–	–	–	0.52 (1.84)
Guangdong	–	–	0.42 (0.84)	0.03 (0.06)	0.09 (0.41)
Other	1.02 (2.61)	–	0.04 (0.16)	– (0.01)	0.31 (1.50)
National advertising					
Bright	6.58 (3.09)	6.59 (3.12)	6.48 (3.12)	6.51 (3.09)	6.56 (3.11)
Mengniu	11.45 (10.95)	11.64 (11.12)	11.62 (10.89)	11.82 (10.89)	11.59 (11.01)
Yili	3.36 (5.46)	3.28 (5.28)	3.33 (5.34)	3.20 (5.22)	3.31 (5.34)
Sanyuan	0.16 (0.30)	0.14 (0.28)	0.17 (0.30)	0.18 (0.31)	0.15 (0.29)
Junlebao	2.83 (2.62)	2.77 (2.64)	2.79 (2.58)	2.87 (2.55)	2.80 (2.62)
Weiquan	–	–	–	–	–
Danone	0.05 (0.15)	0.05 (0.15)	0.05 (0.15)	0.04 (0.14)	0.05 (0.15)
Guangdong	–	–	–	–	–
Other	0.24 (0.52)	0.24 (0.54)	0.24 (0.51)	0.23 (0.49)	0.24 (0.52)
<i>N</i>	28,941	41,733	19,304	7,190	97,168

Note: Standard errors in parentheses.

advertising expenditure on national media channels among the three national brands. By contrast, the local brands in Guangdong only advertise in local media channels in Guangzhou, whereas Junlebao, a brand of Hebei province in northern China, only advertises on national media channels. Still, brands such as Sanyuan, a local brand in Beijing, adopt a more balanced advertising strategy on local and national media channels.

Results of the first-stage probit model estimation and censored demand system estimation with the SY procedure for each city are reported in the Appendix S1. The models perform generally satisfactorily, and most coefficients are significant at 5 per cent. The results differ substantially across cities, which is expected given consumers' heterogeneous preference for yogurt across cities. Importantly, the coefficients of the correction term  $\phi(z'\hat{\tau}_i)$  are significant for most brands in the censored demand system estimation, which indicate that ignoring censoring of the data would render the demand system estimation inconsistent and biased. Thus, our choice of estimating a censored demand system with the SY procedure is supported. In the following discussion, we focus on discussing uncompensated price elasticities, expenditure elasticities, and advertising elasticities calculated from estimated model coefficients.

The uncompensated price elasticities and expenditure elasticities are presented in Tables 3–6 for each city, respectively. First, own uncompensated price elasticities of all brands of yogurt are negative, ranging from  $-1.065$  for

**Table 3** Uncompensated price elasticities and expenditure elasticities: Shanghai

	Bright	Mengniu	Yili	Weiquan	Danone	Expenditure
Bright	-1.065*** (0.020)	0.278*** (0.030)	0.228*** (0.030)	0.368*** (0.030)	0.400*** (0.031)	1.159*** (0.004)
Mengniu	0.225*** (0.037)	-5.175*** (0.190)	0.367*** (0.095)	0.198* (0.089)	1.057*** (0.103)	1.178*** (0.018)
Yili	0.325*** (0.036)	0.393*** (0.097)	-4.992*** (0.127)	0.617*** (0.083)	0.379*** (0.103)	0.928*** (0.017)
Weiquan	0.534*** (0.035)	0.228* (0.089)	0.605*** (0.082)	-4.617*** (0.127)	0.315*** (0.094)	0.852*** (0.014)
Danone	0.579*** (0.036)	1.048*** (0.099)	0.365*** (0.097)	0.312*** (0.090)	-6.275*** (0.185)	0.804*** (0.016)

Note: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . Standard errors in parentheses.

Bright in Shanghai to  $-9.245$  for Mengniu in Guangzhou. These results suggest that yogurt demand is in general elastic in China, and low-price strategies could be important to maintain the market demand. To the best of our knowledge, no study has specifically examined yogurt demand at the brand level in China, and we compare our results with those studies on dairy demand. One recent meta-analysis shows that own-price elasticities for dairy products range from  $-0.218$  to  $-1.620$  in China (Chen *et al.* 2016), and the latest study finds that the own-price elasticity for dairy products is  $-1.145$  for Chinese urban consumers (Zheng *et al.* 2019). Although our estimation of own-price elasticities of yogurt is larger, it is consistent with previous findings as fluid milk included in dairy products tends to have much smaller price elasticity (Cheng *et al.* 2015).

Furthermore, despite the generally elastic yogurt demand, local brands in each city tend to have the smallest own-price elasticities:  $-1.065$  for Bright in Shanghai,  $-2.082$  for Sanyuan in Beijing,  $-1.502$ , and  $-1.834$  for Guangdong local brands in Guangzhou and Shenzhen, respectively. These relatively small own-price elasticities for local brands provide evidence that households prefer local brands. This finding is further supported by the expenditure elasticities as all local brands of yogurt have expenditure elasticities exceeding one. The popularity of the local brands of yogurt is expected because yogurt is a product that requires live cultures of bacteria, and local production may be particularly favoured due to its agreement with the digestive tract. Yogurt firms operating in China may need to take this preference for local brands into consideration when expanding into a new market. Lastly, cross-price elasticities are positive with only two exceptions (Danone and Mengniu in Guangzhou, and Danone and Yili in Shenzhen), and this suggests different brands of yogurt are largely substitutes, which supports previous finding that the dairy industry in China is quite competitive (Guo *et al.* 2016).

Advertising elasticities for local and national advertising are reported in Tables 7–10 for each city, respectively. The effects of advertising differ substantially across types of advertising and cities. As expected, local advertising generally has positive effects on yogurt demand for most brands in all cities, which is consistent with the promotional information typically carried by local advertising. The effect of national advertising on yogurt demand, however, is mixed. In Shanghai and Shenzhen, national advertising tends to have positive (and occasionally insignificant) effect on yogurt demand; by contrast, in Beijing and Guangzhou, it has negative (and occasionally insignificant) effect on yogurt demand. Two factors may contribute to the regional difference in the effect of national advertising. First, although national media channels are regarded as more trustworthy, Chinese households in different cities may have different habits of media usage, which could result in less viewership of national advertising in some cities (Huang and Lu 2017). Also, it has long been documented that Chinese consumers demonstrate advertising avoidance (Prendergast *et al.* 2010). Thus, given that the national brands – Bright, Mengniu and Yili – are already

**Table 4** Uncompensated price elasticities and expenditure elasticities: Guangzhou

	Bright	Mengniu	Yili	Danone	Guangdong	Expenditure
Bright	-2.008*** (0.086)	0.826*** (0.059)	0.798*** (0.068)	0.527*** (0.069)	0.969*** (0.048)	1.171*** (0.010)
Mengniu	0.774*** (0.060)	-9.245*** (0.257)	0.450*** (0.135)	-0.641*** (0.129)	0.683*** (0.068)	1.221*** (0.024)
Yili	0.755*** (0.068)	0.454*** (0.135)	-8.668*** (0.286)	0.042 (0.144)	1.047*** (0.076)	1.202*** (0.023)
Danone	0.535*** (0.067)	-0.608*** (0.126)	0.057 (0.140)	-6.318*** (0.197)	0.885*** (0.080)	0.992*** (0.019)
Guangdong	0.924*** (0.048)	0.728*** (0.068)	1.081*** (0.076)	0.877*** (0.083)	-1.502*** (0.107)	1.330*** (0.011)

Note: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . Standard errors in parentheses.

**Table 5** Uncompensated price elasticities and expenditure elasticities: Beijing

	Bright	Mengniu	Yili	Sanyuan	Junlebao	Expenditure
Bright	-5.467*** (0.124)	0.493*** (0.047)	0.499*** (0.040)	0.586*** (0.035)	0.392*** (0.070)	1.000*** (0.013)
Mengniu	0.476*** (0.045)	-3.945*** (0.098)	0.698*** (0.034)	0.632*** (0.033)	0.762*** (0.052)	0.926*** (0.010)
Yili	0.493*** (0.039)	0.715*** (0.034)	-3.801*** (0.071)	0.702*** (0.035)	0.601*** (0.045)	0.820*** (0.009)
Sanyuan	0.516*** (0.031)	0.552*** (0.031)	0.575*** (0.032)	-2.082*** (0.048)	0.616*** (0.034)	1.101*** (0.006)
Junlebao	0.348*** (0.067)	0.714*** (0.052)	0.531*** (0.046)	0.556*** (0.038)	-8.173*** (0.157)	1.301*** (0.016)

Note: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . Standard errors in parentheses.

**Table 6** Uncompensated price elasticities and expenditure elasticities: Shenzhen

	Bright	Mengniu	Yili	Danone	Guangdong	Expenditure
Bright	-1.817*** (0.130)	0.857*** (0.081)	0.787*** (0.091)	0.058 (0.084)	0.175 (0.121)	1.260*** (0.016)
Mengniu	0.847*** (0.083)	-3.746*** (0.208)	0.947*** (0.107)	0.360** (0.126)	0.535*** (0.147)	1.212*** (0.024)
Yili	0.737*** (0.091)	0.914*** (0.104)	-3.335*** (0.245)	-0.309* (0.136)	0.443* (0.185)	1.264*** (0.027)
Danone	0.090 (0.097)	0.404** (0.137)	-0.328* (0.151)	-1.424* (0.575)	-0.305 (0.333)	0.927*** (0.096)
Guangdong	-0.035 (0.119)	0.411** (0.141)	0.344 (0.182)	-0.281 (0.296)	-1.834*** (0.416)	1.667*** (0.055)

Note: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . Standard errors in parentheses.

**Table 7** Advertising elasticities: Shanghai

	Bright	Mengniu	Yili	Weiquan	Danone
Local advertising					
Bright	0.006 (0.003)	0.013 (0.013)	-0.027 (0.014)	0.034** (0.011)	-0.015 (0.013)
Mengniu	0.004*** (0.001)	-0.000 (0.004)	-0.015*** (0.004)	-0.002 (0.003)	-0.005 (0.003)
Yili	-0.003* (0.001)	-0.014* (0.005)	0.016** (0.005)	0.008* (0.004)	0.003 (0.005)
Weiquan	-0.013*** (0.001)	0.019*** (0.004)	0.052*** (0.004)	-0.003 (0.003)	-0.007* (0.004)
Danone	-0.004*** (0.001)	0.013*** (0.004)	0.013*** (0.004)	-0.010*** (0.003)	0.012*** (0.003)
National advertising					
Bright	0.055*** (0.009)	0.073* (0.037)	-0.100** (0.036)	-0.117*** (0.030)	-0.151*** (0.035)
Mengniu	0.002 (0.001)	0.012 (0.007)	-0.012* (0.006)	-0.006 (0.005)	-0.018** (0.006)
Yili	-0.006*** (0.001)	0.012*** (0.003)	0.027*** (0.003)	-0.016*** (0.002)	0.014*** (0.003)
Danone	0.004* (0.001)	-0.014* (0.006)	-0.035*** (0.006)	0.014** (0.005)	0.013* (0.006)

Note: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . Standard errors in parentheses.

**Table 8** Advertising elasticities: Guangzhou

	Bright	Mengniu	Yili	Danone	Guangdong
Local advertising					
Bright	-0.007*** (0.002)	0.014** (0.005)	0.020*** (0.005)	0.020*** (0.004)	-0.006** (0.002)
Mengniu	0.002 (0.002)	0.071*** (0.006)	-0.009 (0.006)	-0.028*** (0.004)	0.002 (0.003)
Yili	0.003 (0.002)	-0.041*** (0.005)	0.034*** (0.005)	0.013** (0.004)	-0.006** (0.002)
Guangdong	0.004 (0.002)	-0.017** (0.006)	-0.019*** (0.005)	-0.008* (0.004)	0.008*** (0.002)
National advertising					
Bright	-0.001 (0.022)	-0.505*** (0.061)	0.327*** (0.053)	-0.054 (0.044)	-0.015 (0.024)
Mengniu	0.025*** (0.004)	-0.131*** (0.013)	-0.061*** (0.013)	-0.035*** (0.006)	0.026*** (0.004)
Yili	0.008*** (0.002)	-0.045*** (0.005)	-0.011* (0.004)	-0.008* (0.004)	0.011*** (0.002)
Danone	-0.006* (0.003)	-0.019* (0.008)	0.006 (0.007)	-0.019** (0.006)	0.018*** (0.003)

Note: \*  $P < 0.05$ ; \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$ . Standard errors in parentheses.

**Table 9** Advertising elasticities: Beijing

	Bright	Mengniu	Yili	Sanyuan	Junlebao
Local advertising					
Bright	-0.010** (0.003)	-0.006*** (0.002)	0.005** (0.002)	0.000 (0.001)	0.013*** (0.003)
Mengniu	-0.003 (0.002)	0.000 (0.001)	-0.002 (0.001)	-0.002* (0.001)	0.016*** (0.003)
Yili	-0.005* (0.002)	-0.006*** (0.002)	0.002 (0.001)	-0.001 (0.001)	0.017*** (0.003)
Sanyuan	-0.002 (0.006)	-0.012*** (0.004)	-0.012*** (0.003)	0.000 (0.003)	0.062*** (0.008)
National advertising					
Bright	-0.057* (0.028)	-0.037 (0.020)	0.005 (0.018)	-0.079*** (0.013)	0.598*** (0.038)
Mengniu	0.003 (0.005)	-0.001 (0.004)	-0.012*** (0.003)	-0.010*** (0.002)	0.069*** (0.005)
Yili	-0.006** (0.002)	-0.001 (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	0.044*** (0.002)
Sanyuan	-0.017** (0.006)	0.012** (0.004)	0.005 (0.004)	-0.003 (0.003)	-0.017* (0.008)
Junlebao	0.005* (0.002)	-0.002 (0.002)	-0.000 (0.002)	-0.008*** (0.001)	0.037*** (0.003)

Note: \*  $P < 0.05$ ; \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$ . Standard errors in parentheses.

**Table 10** Advertising elasticities: Shenzhen

	Bright	Mengniu	Yili	Danone	Guangdong
Local advertising					
Bright	-0.002 (0.003)	0.018*** (0.004)	-0.008 (0.005)	-0.020 (0.018)	-0.017 (0.010)
Mengniu	-0.013** (0.004)	-0.034*** (0.006)	0.064*** (0.007)	-0.007 (0.024)	-0.041** (0.014)
Yili	0.005 (0.006)	-0.041*** (0.009)	0.011 (0.010)	-0.012 (0.039)	-0.008 (0.021)
Guangdong	0.011** (0.004)	0.008 (0.005)	-0.021*** (0.006)	0.011 (0.025)	0.025 (0.013)
National advertising					
Bright	0.051 (0.035)	0.117* (0.054)	-0.232*** (0.062)	0.179 (0.216)	0.357** (0.127)
Mengniu	0.005 (0.008)	0.024* (0.012)	-0.065*** (0.017)	0.065 (0.055)	0.054 (0.031)
Yili	-0.001 (0.003)	0.005 (0.004)	0.006 (0.004)	-0.032 (0.017)	-0.013 (0.009)
Danone	-0.002 (0.005)	-0.007 (0.009)	0.015 (0.010)	0.056 (0.034)	0.017 (0.020)

Note: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . Standard errors in parentheses.

widely known in China, consumers may be more likely to ignore national advertising. Second and more importantly, many yogurt manufacturers differentiate their products under different sub-brands and advertise these sub-brands separately. It is likely that advertising featuring a particular sub-brand increases its demand at the expense of other sub-brands, resulting in a cannibalisation effect (Dawes 2012; Hailu *et al.* 2014), and a large cannibalisation effect among sub-brands may lead to decreasing demand for the parent brand. For yogurt producers, a strategy to coordinate advertising among sub-brands and minimise the advertising cannibalisation effect is important to maximise the effect of advertising.

Furthermore, advertising one brand does not necessarily have adverse impact on the demand for other brand, and there may exist positive spillover in advertising for some brands. This seemingly surprising finding is not uncommon for many consumer products (Lopez *et al.* 2015; Shapiro 2018). On the one hand, advertising one brand can have negative impact on the demand for other brands due to competition among these brands. In particular, advertising Mengniu or Yili has mostly negative effect on the demand for each other in all cities, indicating the competition among these two brands due to their similarity in brand positioning and origin. On the other hand, brand advertising may function similarly as generic advertising in promoting yogurt demand even for other brands. This finding is consistent with the rapid increase of the demand for yogurt in recent years.

Lastly, we test the difference between advertising made at the local level but controlling the factor whether local advertising is made in a brand's origin. Bright is the only brand in our data that is advertised on national media channels but more importantly also advertised on local media channels in every city. This allows us to compare local advertising effects conditional on the brand's origin city (Shanghai). Bright's local advertising has positive albeit insignificant advertising elasticity (0.006) in Shanghai. By contrast, its local advertising elasticities in the other three cities are  $-0.010$ ,  $-0.007$  and  $-0.002$ , all demonstrating negative effect on demand. This result provides evidence of the ineffectiveness of local advertising in promoting a non-local brand. As we discussed earlier, local advertising may contain more promotional information, which may only become effective in brand promotion when consumers have already developed preference for this brand, which may be achieved through national advertising.

## 5. Conclusion

Despite the heavy hit taken by the Chinese dairy sector after a series of recent food safety concerns, consumers' confidence has been largely restored, as evidenced by increasing demand and subsequent production of dairy products. Yogurt has enjoyed the highest growth rate in recent years, and dairy consumption in China is gradually trending towards yogurt. To compete for market share, yogurt manufacturers spend liberally on

advertising, yet little is known regarding the effect of advertising on yogurt demand. In this article, we fill this research gap by estimating an advertising-augmented demand system comprised of major national and local brands available in each of the four first-tier cities in China.

Our main findings are that demand for yogurt, as a whole, is elastic, indicating that yogurt is not yet a necessity food item in China. However, local brands of yogurt generally have the smallest own-price elasticities, which suggest consumer preference for local brands. More importantly, local advertising is found to promote demand, which is consistent with the information on sales usually seen in local advertising. By contrast, national advertising in Beijing and Guangzhou tends to decrease demand, which may be due to inattention to national media channels in these cities and cannibalisation among sub-brands within one brand. In addition, advertising by one brand does not necessarily decrease demand for other brands and, in some cases, can even increase demand for other brands. This result implies that brand advertising may function similarly as generic advertising, promoting the demand for yogurt in general. Lastly, through a particular brand Bright, we are also able to differentiate the effects of local advertising on a brand may or may not be from a local area. We find that local advertising in the case of yogurt may be only effective in the origin city.

Our analysis may have several implications for future research. First, in this study, we match actual scanner purchase data and producers' advertisement data to examine Chinese yogurt demand at the brand level. This can directly benefit competition and market dominance research in a broader setting given that similar to many other sectors in China and in other countries, China's yogurt sector features the coexistence of a few large players with nationally recognisable brands and many smaller players who prioritise on regional brand exposure. Second, we contribute to the general understanding of the effect of advertising in the food and beverage sector. Specifically, we demonstrate the differing effect of local and national advertising on yogurt demand through the lens of a diverse set of local markets. Future research as well as yogurt marketers should recognise that not all advertising produces similar responses in consumer demand and the dynamics between local and national advertising must be assessed jointly with product features such as origin.

It needs to be noted that our results regarding local and national advertising on the Chinese yogurt market may have several limitations. Not all findings may be generalisable to other food items or other countries. In particular, the different effects of Bright's local advertising in Shanghai and the three other cities may not be generalised to suggest that local advertising is generally ineffective outside a brand's origin city. Further research can improve our analysis in several aspects. First, different types of advertisement may work as a system (He *et al.* 2015); thus, the interaction between local and national advertising warrants more investigation. Second, as dairy products begin to penetrate Chinese rural areas, understanding rural demand is not

only important for new market development, it will also be needed for producers to better strategise production and marketing/advertising plans to best take advantage of the urban–rural dynamics.

### Data availability statement

The data that support the findings of this study are available from CTR Market Research in China ([http://www.ctrchina.cn/ecompany\\_Detail.asp](http://www.ctrchina.cn/ecompany_Detail.asp)) with permission. Restrictions may apply to the availability of these data, which were used under joint agreements between the authors and CTR Market Research in China.

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### Supporting Information

Additional Supporting Information may be found in the online version of this article:

**Appendix S1.** Table A1 Descriptive statistics of the household demographics. Table A2 First-stage probit estimation: Shanghai. Table A3 Censored AIDS estimation with SY procedure: Shanghai. Table A4 First-stage probit estimation: Beijing. Table A5 Censored AIDS estimation with SY procedure: Beijing. Table A6 First-stage probit estimation: Guangzhou. Table A7 Censored AIDS estimation with SY procedure: Guangzhou. Table A8 First-stage probit estimation: Shenzhen. Table A9 Censored AIDS estimation with SY procedure: Shenzhen.