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Suggesting the best bundle for dairy products based on consumers' purchase behavior

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ABSTRACT

Product bundling can be attractive for consumers and also be profitable as a marketing strategy. Based on the importance of this promotion strategy, this study estimated the effect of features on consumers' purchase preferences among 16 dairy products available in the assortment of a popular brand by using a d-level nested logit model. Data about consumer preferences were collected from a sample of dairy products consumers in Sari City, Iran in 2018. By using the results of preferences, this study ran an optimisation algorithm according to a maximum profit criterion and suggested the best bundle for dairy products. Based on the algorithm results, the bundle including 4 out of the 16 available products had the maximum expected profit. This paper found that the profit of selling this product bundle is higher than the profit that could be obtained selling these products separately.

Keywords: Product bundling, dairy products, consumer preferences, nested logit model

INTRODUCTION

Product bundling is a sales promotion approach that consists in presenting together a set of different items as one combined product package. Previous research demonstrates it is a very effective and advantageous marketing technique (Chiamberetto and Dumez, 2012). Sheng and Pan (2009) showed that the brand image of a new product or service would be positively affected if offered as part of a bundle. In bundle pricing, companies and organisations sell the set of goods or services for a total price lower than the sum of prices of the separate items. This strategy has proven to be profitable while giving customers a discount. Bundling helps to increase efficiency, thus reducing marketing and distribution cost. (Merritt, 2019; Chen and Riordan, 2013).

Product bundling can also be attractive for consumers who enjoy having a combined, value-oriented purchase. It allows the consumer to look at one source that offers several possibilities. Customers often prefer to achieve satisfaction from multiple items through one purchase. If a customer has various needs and a pack of products or services addresses some or all of them, this is a convenient one-stop option for the customer (Lloyd, 2016).

Nowadays, this promotion strategy is widely used also for foods offerings and fresh foods. Fang et al. (2018) found that bundling is a practical way to promote sales and advertise fresh food products. Bundling is a marketing approach that can identify and meet consumer requirements, which involve needs, expectations, likes, dislikes, motivations and preferences that affect their purchasing decisions (Spacey, 2016). In increasingly competitive food markets, marketing managers can raise the competitiveness of their company and guarantee its long-term survival by understanding consumer needs,

wants, and purchasing behaviour and by adjusting their strategies regarding offering diversified and high-quality products or services (Hanaysha, 2018; Canavari et al., 2010).

The present study on consumer preferences for product bundling focuses on dairy products. Dairy is one of the most significant livestock products affecting peoples 'health (Rahnama and Rajabpour, 2017). These products contain energy, protein, carbohydrate, cholesterol, vitamin, riboflavin, calcium and other materials which are beneficial for human health (Dror and Allen, 2014).

This study intends to contribute to a growing strand of research focused on consumer buying behaviour relating to dairy products. For instance, Samoggia (2016) analysed the behaviour related to health attributes, Haas et al. (2016) made a segmentation of Kosovar consumers, while Shokrvash et al. (2015) analysed the attitudes of Iranian adolescents towards these products. Yayar (2012) examined packed and unpacked fluid milk consumption and preferences among Turkish households by using a multinomial logit model. Allen et al. (2018) conducted a study on individual preferences for milk and yoghurts with special features by using ordered probit regressions. Bousbia et al. (2017) surveyed the consumption patterns of dairy products. Bhanu et al. (2017) conducted a study on consumer preferences for dairy products in Trivamdrum city (India). Assan (2017) evaluated milk and its products consumption pattern, preferences and purchase behaviour in common areas of the Eastern Cape Province in South Africa. Profeta et al. (2012) specifically considered the country of origin attribute in 6 European countries using choice experiments, while Canavari and Coderoni (2019) analyse consumer preferences for carbon footprint information among Italian dairy consumers using a contingent valuation approach. Ahmadi Kaliji et al. (2019) investigated consumers' preferences and their affecting factors by using the nested logit model. The outcomes of these studies confirm that demographic characteristics may affect preferences for dairy products, but that other elements are relevant, too.

This paper examined the role of demographic variables as well as other socio-economic, attitudinal, and behavioural characteristics and the perceived relevance for the consumer of marketing mix elements (product, price, place, promotion) when choosing product bundles of dairy products presented in a hierarchical structure by using a nested logit model. According to the results of preferences, this paper ran an algorithm according to a maximum profit and suggested the best bundle for dairy products. In other words, this paper tried to suggest a dairy bundle, considering the preferences of the consumers as well as the producer's profits. Data were collected with a consumer survey administered in winter 2018 in Sari, Iran.

MATERIALS AND METHODS

In marketing research, choice models are useful to analyse consumer behaviour and the decision-making process of an individual or their preferences in a specific situation. These models offer the opportunity to investigate many features affecting consumer behaviour, especially in the field of food marketing research (Louviere et al., 2000). The multinomial logit model is the workhorse of choice modelling (Lancsar et al., 2017). However, researchers have defined some specific types of discrete choice models for special reasons. The nested logit model contains a partial relaxation of the assumptions of the multinomial logit model to improve the realism of the behavioural model behind the statistical analysis. The nested logit model idea consists in grouping similar options into nests to create a hierarchical structure in the choice process (Ben-Akiva and Lerman, 1985; Train, 2009).

The aim of this study is to find the best bundle for dairy products based on profit optimisation and consumers' preferences under the Nested Logit model. This model groups similar alternatives into nests and assumes a hierarchical structure for decision (Ben-Akiva and Lerman, 1985). Let c denote a dairy product and P_{clt} be the probability that product *c* is chosen by someone who decides to purchase a type of dairy product (denote t). Suppose that this probability is influenced by factors included in the vector *x* as independent variables. Under the usual multinomial logit model, the choice of

dairy products (c) conditional on the type of products is (Danaher and Dagger, 2012):

$$P_{cjt} = \frac{e^{\beta_c x_c}}{1 + \sum_{i=1}^{C} e^{\beta_{ci} x_{ci}}} \quad (1)$$

where c_i (types of dairy products) ranges from 1 to 16, that is, the paper main suggested dairy products.

In a nested logit structure, the probability of choosing any products by someone is given by (Danaher and Dagger, 2012):

$$P_t = \frac{e^{\beta_c x_c + \eta I_v}}{1 + e^{\beta_c x_c + \eta I_v}} \quad (2)$$

where I_v is the expected maximum utility (known as the inclusive value) that a person derives from purchasing the types of dairy products, which is defined as (Ben-Akiva and Lerman, 1985):

$$I_v = \log(1 + \sum_{i=1}^{C} e^{\beta_{ci} x_{ci}}) \quad (3)$$

and η is a dissimilarity parameter that can be considered as a measure of the dissimilarity of alternatives or nests.

The consumer demographic characteristics considered in the questionnaire are age, gender, household size, education (based on seven levels of education degrees), occupational status (based on six levels). This paper also considered socio-economic, attitudinal, and behavioural characteristics, namely: average of monthly family costs of living (based on 5 levels) as a proxy of disposable income, importance level of exercise for consumers (5 levels based on a semantic scale), awareness about importance of dairy products (3 levels), their dairy products brand preferences or tendencies (rated with scores from 1 to 9), and their sensitivity to dairy products price. Finally, this study also considered whether the four classical marketing mix elements affect their brand choice. The marketing mix is most commonly implemented through the so-called four Ps of marketing: Price, Product, Place and Promotion. **P**rice is about dairy products value, **P**roduct as quality, packing, etc., **P**lace as access to shopping and **P**romotion as brand reputation, loyalty and advertising. The respondents were asked whether aspects associated with the 4Ps affect their preference, and these four variables are measured as dummy variables (0 or 1) (Table 1).

In the specific case, this paper can describe the process in which a customer chooses the dairy products by using a decision tree. The tree has four levels, corresponding to the 16 products in the fourth level nodes (Figure 1).

Associated with each node j in the fourth level (leaf node), v_j is the attractiveness parameter, capturing the attractiveness of the product corresponding to this node in level 4. A customer associates the preference weight $V_j(B_j)$ with each node, which is a function of the offered bundle $B = (B_j : j \in V)$ and the attractiveness parameters of the products (v_1, ..., v_n). To make a choice, a consumer starts from the *root* in the decision tree, then walks over the in the first, second and third-level nodes (non-leaf nodes) of the tree in a probabilistic fashion until he reaches a node in the fourth level. In particular, if the consumer is at a non-leaf node j, then he follows the node $k \in Children\ (j)$ with probability $V_k(B_k)/\Sigma_{l \in Children\ (j)} V_l(B_l)$. As a function of the offered bundle and the attractiveness parameters of the products, the preference weight $V_j(B_j)$ for each node j in the tree is computed as follows. For each non-leaf node j, the preference weight of this node is computed as (Li et al., 2015):

$$V_j(B_j) = \left(\sum_{k \in Children\ (j)} V_k(B_k) \right)^{\eta_j} \quad (4)$$

η_j is used as a dissimilarity parameter from the nested logit model associated with node j.

Considering π_j denoting the profit associated with product j, $\Pi_j(B_j)$ is used to denote the expected profit obtained from a consumer that is at node j in the tree during her or his choice process. If the consumer is at a node j in first, second and third levels, then he chooses the node $k \in Children\ (j)$ with probability $V_k(B_k)/\Sigma_{l \in Children\ (j)} V_l(B_l)$. The expected profit from a consumer is written at a node j in first, second or third levels as (Li et al., 2015):

$$\Pi_j(B_j) = \sum_{k \in Children\ (j)} \frac{V_k(B_k)}{\sum_{l \in Children\ (j)} V_l(B_l)} \times \Pi_k(B_k) = \frac{\sum_{k \in Children\ (j)} V_k(B_k)\Pi_k(B_k)}{\sum_{k \in Children\ (j)} V_k(B_k)} \quad (5)$$

Since each customer starts the choice process from the root, if the bundle B *is offered*, then the expected profit obtained from a customer is $\Pi_{root}(B_{root})$. This paper wants to find a bundle that maximises the expected profit from a customer at root, yielding the bundle problem (Li et al., 2015).

$$Z = \max_{B \subseteq \{1,\ldots,n\}} \Pi_{root}(B_{root}) \quad (6)$$

Table 1. Description of independent variables

Independent variables		Description
Age		Years
Gender		male=1 and female=0
Family size		Count
Education		1-Illiterate, 2-Before diploma, 3-Diploma, 4-Associate, 5-Bachelor, 6-Master, 7-Doctoral
Occupational status		1-Unemployed, 2-Academic student, 3-free job (private), 4-Farmer, 5-Employee (government) and 6-Other
family costs		1-less than 500 thousand Tomans (T), 2-Between 500 thousand to 1 million T, 3- Between 1 to 2 million T, 4-Between 2 to 3 million T and 5-More than 3 million T
Exercise importance		Very low=1, Low=2, moderate=3, high=4, very high=5
People awareness about dairy products		Low=1, moderate=2, high=3
Brand preferences		Rating score from 1 to 9 (1=low preference)
Product price		10 Rials (Tomans)
4P elements	Product	Affected by=1 and not affected by=0
	Price	Affected by=1 and not affected by=0
	Place	Affected by=1 and not affected by=0
	Promotion	Affected by=1 and not affected by=0

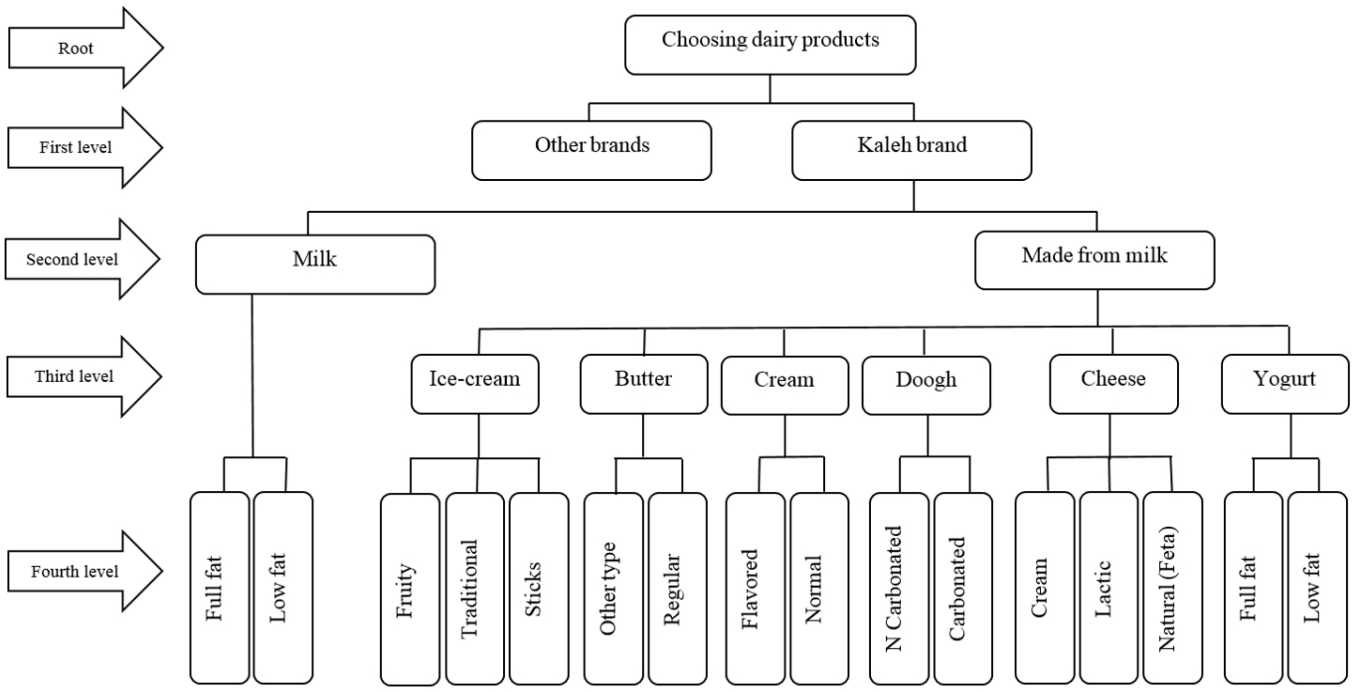

Figure 1. The suggested nested choice tree for dairy products

The data was collected using a face-to-face survey administered in winter 2018 in Sari, Iran. About 30 pre-test questionnaires were collected to estimate the sample variance, and the calculated variance was 0.179. The sample size of 275 was defined using Cochran's sample size formula. The respondents were selected randomly using a mall-intercept method. To estimate the model parameters, the paper used the NLOGIT 5 software package.

RESULTS AND DISCUSSION

Descriptive statistics for the sample revealed that the median of respondents' age was middle age. Men were more than women. The median family size was about three persons. In terms of education level and occupation status, the bachelor was the most frequent degree, and most of the respondents had a non-government job. Family expense level was mainly between 1 to 2 million Tomans (200-400 Euro) monthly. Regarding respondents' willingness to exercise and awareness about the importance of using dairy products, most of the respondents had a moderate tendency to exercise, and their awareness was low. Among dairy producers' brands, the Kaleh company brand was the most preferred among other dairy brands.

The results of the nested logit model estimation (Table 1) indicate that a higher price decreased the probability of choosing dairy products and a 1-unit increase of this variable decreased this probability by 0.31 percentage points. Bhanu et al. (2017), Assan et al. (2017) and Bousbia et al. (2017) also indicated that increasing price negatively affects consumers' preferences for the alternative. Results also show that for every product age, family size, education, exercise and the 4p product variable are statistically significant and increased the probability of choosing milk. The age variable is the most affecting factor. High family living costs decreases the choice probability for low-fat yoghurt, while age and education level variables increase this probability. In other words, according to results, older people tend to choose low-fat yoghurt more than young people.

Meanwhile, the result for full-fat yoghurt showed that factors such as gender had a negative and significant effect on consumers' choice. It showed that men had a lower tendency than women to choose full-fat yoghurt. The preferences for the Kaleh brand, product and price (as for 4p) variables had positive and significant effects on full-fat yoghurt choice. The "Price" variable, as one of the marketing mix variables, had the most substantial effect on this probability, with a coefficient of 0.43 percentage points. Among the variables that affected the choice of cheese, the family living cost variable decreased the choice probability of natural and lactic cheese, and variables such as gender and price (4p) decreased the probability of cream cheese choice. Family size and price (4p) increased the probability of choosing natural cheese. Kaleh brand preference increased choosing of lactic cheese and promotion variable (4p) increased choosing of cream cheese. The results for the Doogh product reveal that age, family size, education and product (4p) variables increased choosing probability, while family size had the most effect on this probability. The "gender" variable increased choosing probability for normal cream and family cost and price (4p) variables decreased this probability. The "cost" variable by 0.70 percentage points had the most effect on this probability. In the case of butter products, age, education level, price (4p) variables increased the probability of choosing regular butter, and that the age variable had the most effect on this. Factors such as gender and family living cost decreased, Kaleh, brand preference and price (4p) increased choosing probability for ice-cream on sticks. In the case of traditional ice-cream, four factors of promotion, education, price and place increased choosing probability.

Table (2) illustrates the results of inclusive value coefficients. These coefficients are known as dissimilarity parameters. It can be considered as a measure of the dissimilarity of alternatives or nests. Results indicated that all of the coefficients were significant and nests were independent. It confirms the nested structure based on Figure (1).

Table 2. Nested logit model estimation results

Products	Variables	Coefficient	Standard deviation	Z	Marginal effect (percent)
Total products	Price	-1.417***	0.593	-2.39	-0.308
Low fat milk	Age	5.655***	2.077	2.72	1.230
	Family size	1.254***	0.323	3.88	0.273
	Education	0.482**	0.247	1.96	0.105
	Exercise	-1.226***	0.247	-4.97	-0.267
	Product (4p)	1.326*	0.789	1.68	0.288
Yogurt low fat	Age	1.261***	0.512	2.47	0.274
	Education	0.927*	0.550	1.69	0.202
	Cost	-1.244*	0.715	-1.74	-0.271
Yogurt full fat	Gender	-4.249*	2.365	-1.80	-0.924
	Brand	1.620*	0.881	1.84	0.352
	Product (4p)	1.768*	1.004	1.76	0.384
	Price (4p)	1.965**	0.918	2.14	0.427
Natural cheese	Cost	4.812***	1.549	3.11	1.047
	Family size	5.111***	1.762	2.90	1.112
	Price (4p)	2.052**	0.989	2.07	0.446
Lactic cheese	Cost	-3.664***	1.005	-3.64	-0.797
	Brand	1.729***	0.518	3.34	0.376
Cream cheese	Gender	-1.431***	0.555	-2.58	-0.311
	Price (4p)	-4.061***	1.276	3.18	-0.883
	Promotion (4p)	1.746**	0.884	1.97	0.380
N-carbonated doogh	Age	0.456***	0.201	2.27	0.099
	Family size	3.132**	1.448	2.16	0.681
	Education	0.792*	0.462	1.72	0.172
	Product (4p)	2.165**	1.027	2.11	0.471
Normal cream	Gender	0.965**	0.505	1.91	0.210
	Cost	-3.212***	1.436	-2.24	-0.699
	Price (4p)	-1.846**	0.884	-2.09	-0.401
Regular butter	Age	4.062*	2.284	1.78	0.883
	Education	2.644***	0.786	3.36	0.575
	Product (4p)	-1.433*	0.764	-1.87	-0.312
	Price (4p)	0.751*	0.414	1.81	0.163
Other butter	Gender	4.026*	2.264	1.78	0.876
Sticks ice-cream	Gender	-6.408*	3.784	-1.69	-1.394
	Cost	-0.782*	0.428	-1.83	-0.170
	Brand	1.335*	0.260	5.12	0.290
	Price (4p)	0.246***	0.076	3.26	0.053
Traditional ice-cream	Family size	2.413***	1.003	2.40	0.525
	Education	1.753***	0.768	2.28	0.381
	Price (4p)	0.761***	0.347	2.19	0.165
	Place (4p)	2.009*	1.138	1.77	0.437
Fruity ice-cream	Family size	7.043*	4.032	1.75	1.532
	Price (4p)	-3.075***	1.246	-2.47	-0.669

***, ** and * indicate significant at the 1%, 5% and 10% significance level, respectively. McFadden Pseudo R^2 =0.58, Chi squared = 7.44, Log likelihood function= -26.31

Table 3. Estimation results of inclusive value coefficient

	Nest	Coefficient	Standard deviation	Z statistics
Second level	Yoghurt	0.852***	0.261	3.26
	Cheese	0.678***	0.279	2.43
	Doogh	0.468**	0.242	1.93
	Cream	0.497***	0.224	2.22
	Butter	0.503*	0.279	1.80
	Ice-cream	0.566*	0.324	1.75
Third level	Milk products	1.428*	0.87	1.64
	Milk final consumption	0.712**	0.368	1.94
Fourth level	Company brand	2.154***	0.923	2.33
	Other brand	1.514***	0.722	2.10

***, ** and * indicate significant at the 1%, 5% and 10% significance level, respectively

Table 4. Summarised name of dairy products

Dairy products	name	Dairy products	Name
Low fat yoghurt	ylf	Flavored cream	Cf
Full fat yoghurt	yff	Regular butter	Br
Normal cheese	chn	Other type butter	Bo
Lactic cheese	chl	Sticks ice-cream	Is
Cream cheese	chc	Traditional ice-cream	It
Carbonated doogh	dc	Fruity ice-cream	If
Non-carbonated doogh	dn	Low fat milk	Mlf
Normal cream	cn	Full fat milk	Mff

To find the best dairy bundle based on consumer preferences and producer profit, this paper used the parameters π_j (profit associated with product j) and υ_j (attractiveness parameter or consumers preferences) for each node or product in fourth level and η_j (dissimilarity parameter) is given for each node in the first to third levels (coefficients in Table 2). Firstly, the optimal interval for each dairy product is calculated in the third level (yoghurt, cheese, doogh, cream, butter and ice-cream). For this problem, if $B_y = \{\{ylf, yff\}, \{ylf\}, \phi\}$, then one can verify that this collection includes an optimal solution at yoghurt node.

Similarly, if $B_{ch} = \{chn, chl, chc\}, \{chl, chc\}, \{chc\}, \phi\}$, then this collection includes an optimum at the cheese node. Each subset of this collection was constructed based on maximum profit. The preference weight and expected profit of each node in the third level have been calculated based on equation-4 and equation-5 respectively. The profit of each product was calculated based on a standardized 100 grams' quantity to homogenise the dairy products. The preference weight results are shown in the second row of Table 4. These results are multiplied to the expected profit that was calculated based on equation-5 (the results is shown in the third row of

Table 4). To find the optimal interval in the fourth row of this table, consider the lines with the slope $-V_y(B_y)$ and y-intercept $V_y(B_y)\pi_y(B_y)$, where $V_y(B_y)$ has been calculated based on equation-4. Finding the pairwise intersection points of these two lines, if the interval is [∞-, 102], then the highest one of these lines is the one corresponding to the subset *{ylf, yff}*. Similarly, if the interval is [102,145], then the highest line is the one corresponding to the subset *{ylf}*. In other words, if the interval is [∞-, 102], then the optimal solution is given by *{ylf, yff}*. Similarly, if the interval is [102,145], then B_y = *{ylf}*. Thus, the points are given by {-∞, 102, 145, +∞}. Now, consider the lines with the slope -27.7 and y-intercept 3424 and -13.9 and y-intercept 2016. So there are two lines for yoghurt bundles (Figure 2).

The calculation formats of the other products are the same. These parameters were calculated for each dairy product, yoghurt, cheese, doogh, cream, butter, ice-cream and milk (Table 4).

Taking the union of these interval points in Table 4, 15 intervals in Table 5 were obtained for identifying optimal bundles for products made from milk node (second level). In this case, if the interval is [∞-, 8.7], then the optimal bundle for this interval is {ylf, yff, chn, chl, chc, dc, dn, cn, cf, bn, bo, ik, it, if} that includes total products made from milk (except final milk because there is not on the third level). Similarly, if the interval is [8.7, 22], then the optimal bundle is {ylf, yff, chn, chl, chc, dc, dn, cn, cf, bn, bo, it, if}, that shows sticks ice-cream deleted in this bundle. Practically Figure 3 was used to find the union of the optimal bundle based on each interval. This estimation was made based on the optimal interval results of Table 4.

Based on the last algorithm (Table 4 and Table 5) optimal intervals were calculated for products made from milk in the second level. The first interval calculated [-∞,14] with a bundle of {ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if}. These results were used with optimal interval result of milk (last part of Table 4) {mlf, mff} and {mlf} for identifying optimal bundle for Kaleh products node in the first level (Table 7). In the first interval of Table 7 ([-∞,14]), the bundle is {ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if, mlf, mff}. This bundle includes the whole assortment of dairy products offered by the Kaleh company.

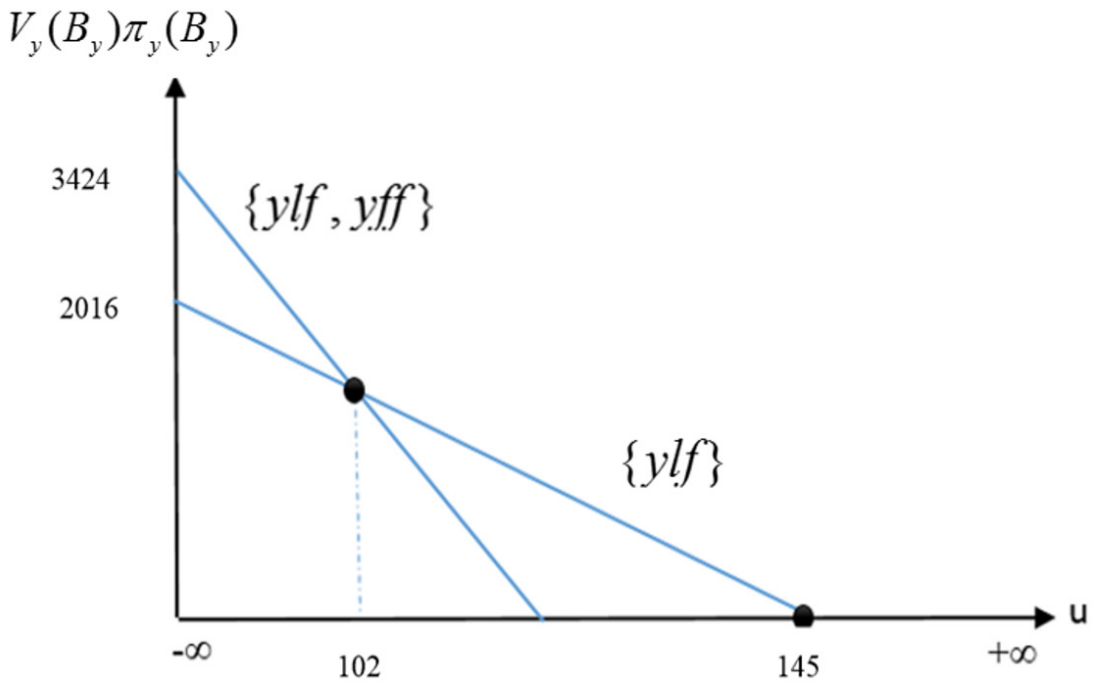

Figure 2. The lines and points for yoghurt collection

Table 5. Calculation of the optimal interval for dairy products in the third level

B_y (Bundle for yoghurt products)	*{ylf, yff}*	*{ylf}*	ϕ	
$V_y(B_y)$	27.7	13.9	0	
$V_y(B_y)\pi_y(B_y)$	3424	2016	0	
optimal interval	[∞-, 102]	[102,145]	[145, ∞+]	
B_{ch}	*{chn, chl, chc}*	*{chl, chc}*	*{chc}*	ϕ
$V_{ch}(B_{ch})$	14	9.9	7.3	0
$V_{ch}(B_{ch})\pi_{ch}(B_{ch})$	2016	1557	1204	0
optimal interval	[∞-,123]	[123,136]	[136,165]	[165, ∞+]
B_d	*{dc, dn}*	*{dc, dn}*	ϕ	
$V_d(B_d)$	7.1	5.3	0	
$V_d(B_d)\pi_d(B_d)$	172	133	0	
optimal interval	[∞-,22]	[22,25]	[25, ∞+]	
B_c	*{cn, cf}*	*{cf}*	ϕ	
$V_c(B_c)$	3.3	2.2	0	
$V_c(B_c)\pi_c(B_c)$	509	356	0	
optimal interval	[∞- ,139]	[139,162]	[162, ∞+]	
B_b	*{br, bo}*	*{br}*	ϕ	
$V_b(B_b)$	4.4	2.6	0	
$V_b(B_b)\pi_b(B_b)$	777	572	0	
optimal interval	[114, ∞-]	[114,220]	[220, ∞+]	
B_i	*{is, it, if}*	*{it, if}*	*{if}*	ϕ
$V_i(B_i)$	6.6	5	3.2	0
$V_i(B_i)\pi_i(B_i)$	315	301	240	0
optimal interval	[∞-,8.7]	[8.7,34]	[34,75]	[75, ∞+]
B_m	*{mlf, mff}*	*{mlf}*	ϕ	
$V_m(B_m)$	16.7	8.9	0	
$V_m(B_m)\pi_m(B_m)$	1553	872	0	
optimal interval	[∞-,87]	[87,98]	[98, ∞+]	

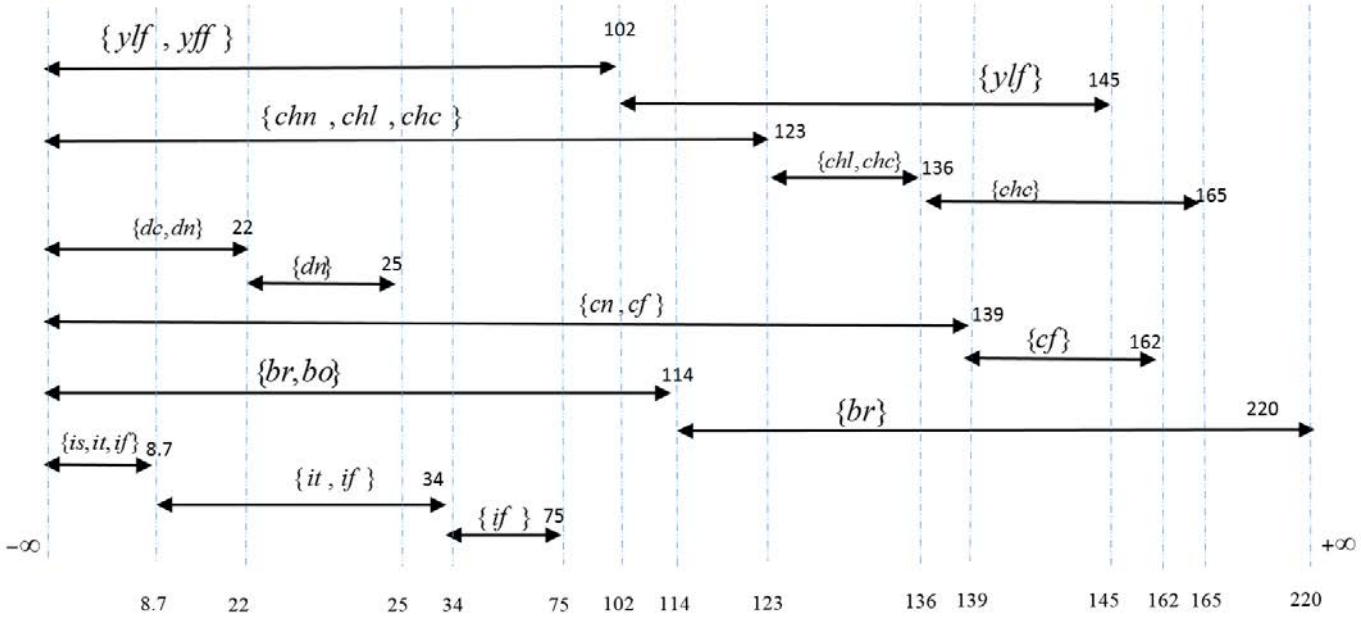

Figure 3. Union of bundles based on optimal intervals

Table 6. Identifying the optimal bundle for products made from milk node (second level)

interval	[∞-, 8.7]	[8.7,22]
bundle	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if}	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, it, if}
interval	[22,25]	[25,34]
bundle	{ylf, yff, chn, chl, chc, dn, cn, cf, br, bo, it, if}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, it, if}
interval	[34,75]	[75,102]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if}	{ylf, yff, chn, chl, chc, cn, cf, br, bo}
interval	[102,114]	[114,123]
bundle	{ylf, chn, chl, chc, cn, cf, br, bo}	{ylf, chn, chl, chc, cn, cf, br}
interval	[123,136]	[136,139]
bundle	{ylf, chl, chc, cn, cf, br}	{ylf, chc, cn, cf, br}
interval	[139,145]	[145,162]
bundle	{ylf, chc, cf, br}	{ chc, cf, br}
interval	[162,165]	[165,220]
bundle	{chc, br}	{br}
interval	[220, ∞+]	
bundle	ϕ	

Table 7. Calculation optimal interval for products made from milk node (second level)

bundle	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if}	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, it, if}
$V_{mp}(B_{mp})$	160	155
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	18403	18333
optimal interval	[∞-,14]	[14,46]
bundle	{ylf, yff, chn, chl, chc, dn, cn, cf, br, bo, it, if}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, it, if}
$V_{mp}(B_{mp})$	150	137
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	18103	17420
optimal interval	[46,52]	[52,67]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if}	{ylf, yff, chn, chl, chc, cn, cf, br, bo}
$V_{mp}(B_{mp})$	124	115
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	16546	15712
optimal interval	[67,93]	[93,107]
bundle	{ylf, chn, chl, chc, cn, cf, br, bo}	{ylf, chn, chl, chc, cn, cf, br}
$V_{mp}(B_{mp})$	76	75
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	11520	11405
optimal interval	[107,115]	[115,125]
bundle	{ylf, chl, chc, cn, cf, br}	{ylf, chc, cn, cf, br}
$V_{mp}(B_{mp})$	64	57
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	10029	9046
optimal interval	[125,140]	[140,145]
bundle	{ylf, chc, cf, br}	{ chc, cf, br}
$V_{mp}(B_{mp})$	54	21
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	8615	3234
optimal interval	[145,153]	[153,167]
bundle	{chc, br}	{br}
$V_{mp}(B_{mp})$	17	3.2
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	2499	419
optimal interval	[167,245]	[245,273]
bundle	ϕ	
$V_{mp}(B_{mp})$	0	
$V_{mp}(B_{mp})\ \pi_{mp}(B_{mp})$	0	
optimal interval	[273, ∞+]	

Table 8. Identifying optimal bundle for Kaleh products node (first level)

interval	[∞-,14]	[14,46]
bundle	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if, mlf, mff}	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, it, if, mlf, mff }
interval	[46,52]	[52,67]
bundle	{ylf, yff, chn, chl, chc, dn, cn, cf, br, bo, it, if, mlf, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, it, if, mlf, mff}
interval	[67,87]	[87,93]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if, mlf, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if, mlf}
interval	[93,98]	[98,107]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, mlf}	{ylf, yff, chn, chl, chc, cn, cf, br, bo}
interval	[107,115]	[115,125]
bundle	{ylf, chn, chl, chc, cn, cf, br, bo}	{ylf, chn, chl, chc, cn, cf, br}
interval	[125,140]	[140,145]
bundle	{ylf, chl, chc, cn, cf, br}	{ylf, chc, cn, cf, br}
interval	[145,153]	[153,167]
bundle	{ylf, chc, cf, br}	{chc, cf, br}
interval	[167,245]	[245,273]
bundle	{chc, br}	{br}
interval	[273, ∞+]	-
bundle	ϕ	-

Based on the algorithm the results of Table 8 were used to reach the root. Because of two nodes in the first level (Kaleh brand and other brands), optimal intervals were calculated based on Table 8 and consumers' preferences about other brands. Results are shown in Table 9.

Since the problem at the root level is equivalent to this paper bundle optimisation problem (equation-6), the collection with the highest profit includes an optimal bundle. The results of the expected profit for the root listed from each bundle is shown in Table 9. The highest expected revenue is highlighted in bold. Therefore, the optimal bundle is {ylf, chc, cf, br} **(low-fat-yoghurt, cream-cheese, flavoured-cream and regular-butter)** with an expected profit of 730 Tomans (0.15 Euro). Comparing the profit of this bundle with the profit of each product in bundle separately (692 Tomans, or 0.14 Euro) revealed that the profit of selling this product as a bundle is higher than selling these products separately. This result is consistent with findings by Merritt (2019) and Chen and Riordan (2013).

Table 9. Calculation optimal interval for Kaleh products node (first level)

bundle	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if, mlf, mff}	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, it, if, mlf, mff }
$V_k(B_k)$	4797	4577
$V_k(B_k)$ $\pi_k(B_k)$	775999	764339
optimal interval	[∞-,53]	[53,73]
bundle	{ylf, yff, chn, chl, chc, dn, cn, cf, br, bo, it, if, mlf, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, it, if, mlf, mff}
$V_k(B_k)$	4360	3817
$V_k(B_k)$ $\pi_k(B_k)$	748430	705416
optimal interval	[73,79]	[79,90]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if, mlf, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if, mlf}
$V_k(B_k)$	3302	3008
$V_k(B_k)$ $\pi_k(B_k)$	658993	628470
optimal interval	[90,104]	[104,108]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, mlf}	{ylf, yff, chn, chl, chc, cn, cf, br, bo}
$V_k(B_k)$	2682	2374
$V_k(B_k)$ $\pi_k(B_k)$	593224	535048
optimal interval	[108,115]	[115,119]
bundle	{ylf, chn, chl, chc, cn, cf, br, bo}	{ylf, chn, chl, chc, cn, cf, br}
$V_k(B_k)$	1204	1178
$V_k(B_k)$ $\pi_k(B_k)$	416740	413373
optimal interval	[119,129]	[129,136]
bundle	{ylf, chl, chc, cn, cf, br}	{ylf, chc, cn, cf, br}
$V_k(B_k)$	908	754
$V_k(B_k)$ $\pi_k(B_k)$	376525	353583
optimal interval	[136,141]	[141,145]
bundle	{ylf, chc, cf, br}	{chc, cf, br}
$V_k(B_k)$	688	146
$V_k(B_k)$ $\pi_k(B_k)$	344001	64386
optimal interval	[145,161]	[161,176]
bundle	{chc, br}	{br}
$V_k(B_k)$	104	6.7
$V_k(B_k)$ $\pi_k(B_k)$	36400	1902
optimal interval	[176,188]	[188,197]
bundle	ϕ	
$V_k(B_k)$	0	
$V_k(B_k)$ $\pi_k(B_k)$	0	
optimal interval	[197, ∞+]	

Table 10. Identifying optimal bundle for root

Interval	[∞-,53]	[53,73]
Bundle	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, is, it, if, mlf, mff}	{ylf, yff, chn, chl, chc, dc, dn, cn, cf, br, bo, it, if, mlf, mff }
expected profit	207	226
interval	[73,79]	[79,90]
bundle	{ylf, yff, chn, chl, chc, dn, cn, cf, br, bo, it, if, mlf, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, it, if, mlf, mff}
expected profit	261	287
interval	[90,104]	[104,108]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if, mlf, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo, if, mlf}
expected profit	328	374
interval	[108,115]	[115,119]
bundle	{ylf, yff, chn, chl, chc, cn, cf, br, bo, mff}	{ylf, yff, chn, chl, chc, cn, cf, br, bo}
expected profit	431	442
interval	[119,129]	[129,136]
bundle	{ylf, chn, chl, chc, cn, cf, br, bo}	{ylf, chn, chl, chc, cn, cf, br}
expected profit	512	562
interval	[136,141]	[141,145]
bundle	{yff, chl, chc, cn, cf, br}	{ylf, chc, cn, cf, br}
expected profit	603	648
interval	**[145,161]**	[161,176]
bundle	**{ylf, chc, cf, br}**	{chc, cf, br}
expected profit	**730**	625
interval	[176,188]	[188,197]
bundle	{chc, br}	{br}
expected profit	486	180
interval	[197, ∞+]	-
bundle	ϕ	-
expected profit	*0*	

CONCLUSIONS

Product bundling has proven to be a very effective and profitable marketing strategy. This strategy could be used to meet the needs of consumers based on their preferences. Given the importance of this promotion strategy, factors affecting consumers' purchase behaviour were estimated by using a nested logit model on data collected from a sample of dairy products consumers in Sari City, Iran in 2018. Building on the model estimations, this paper suggested a dairy product bundle, given the consumer preference and the producer's profits.

The estimation results of affecting factors on consumers' preferences showed that products' price and life cost as disposable income decreased choosing probability, while age, education level, family size, preferences for the specific brand, and the relevance of product 4P variables increased its probability. An algorithm to find the best bundle were run based on these results and the dissimilarity parameter estimated from the nested logit model. The results of this bundle that consider consumers' preferences and producers' maximum expected profit revealed that a specific bundle had the maximum expected profit. We found that the profit of selling this product bundle is higher than the profit that could be obtained by selling these products separately.

Marketing managers, especially in the field of dairy products, can consider affecting factors on preferences to present especial dairy bundle. The content of these bundles can be changed based on a company's purpose. Targeted dairy bundles can be suggested for segments with specific needs and wants, such as "low-fat dairy bundle" for old age consumers or "diet dairy bundle" for athletes or those who want to lose weight. This selling method can improve consumption of more dairy products, especially in developing countries.

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