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The Optimal level of variation of Nike and Adidas Sporting Brands in Mashhad Sporting Stores

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Abstract--- *The product variation of every sporting brand plays an important role in the final choice of customers. This issue is important because the optimal level of the variation of sporting brands can lead to decision making in designing sporting product lines for managers. The data required for conducting this research collected from 140 sporting stores in Mashhad in 2019. In this research it has been tried to determine the optimal level of the variation of the sporting brands using the seemingly unrelated system of equation and optimization algorithm of particle swarm. The results of the optimization algorithm of the particle swarm showed that based on the optimal level of brand variation and the findings of this study, overall Nike brand should reduce 5, 2, and 10 types of their sporting shoes in large, medium and small stores, respectively. Adidas brand also should remove 11, 5, and 4 types of its sporting shoes in large, medium and small stores of Mashhad market, respectively. Also the finding of this study suggest that the reduction of the level of Nile variation in large and medium stores should be less than Adidas brand, and the reduction of Adidas brand must be more in large stores, which this is reverse for small stores*.

Keywords--- *sport brand variation, PSO algorithm, brand share, seemingly unrelated equations system.*

I. INTRODUCTION

In the current competitive environment, most scholars believe that brand constitutes an important part of a business and assets of a firm, and many businesses are interested in learning how to make a successful brand. Kotler and Armstrong (2012), in the book of The Principles of Marketing, stated that a brand is a name, phrase, term, logo, symbol or a combination of them to introduce the products and services of sellers or a group of sellers and to distinguish them from the competing products and corporations. In fact, the brand is one of the most valuable assets of any corporation. One of the requirements for creating a strong brand is the recognition of any factor affecting the share of brands. One of the largest fields of the brands in the world is in the sportswear market, which sporting shoes and sporting clothing are the most active product groups with the most frequent brand fields in the world clothing market. It is estimated that more than three fourth of the entire sportswear market is active and near to 12% of the creditable shoes are branded. Only three sporting brands of Nike, Adidas and Reebok had occupied 11% of the active market of sporting shoes and clothes in the world in 2007 (Newbery, 2008).

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The success of many sporting brands such as Nike and Adidas essentially depends on their capacity to recognize their communicational symbols. To achieve this, the executives of firms know how to use the media, advertising and power of images, special signs and symbols which quickly identified by consumers. From the customer's viewpoint, this power is related with the commitment to brands to provide the guaranteed products and services with a certain level of quality and technology. But additionally, brands are commercial signs to do both the identification role and recognition of the origins of the products and services and their differentiating role, the brand position comparing to providers of other products and services (Bouchet et al., 2013: Dadrasmoghadam et al., 2020).

In order to create a good image of commodities and products, sport marketing should try to introduce the brand by highlighting the main elements of goods and products. These features and elements can include product quality, service cost, distribution channel and other elements of marketing mix (Kotler and Armstrong, 2012). Historically, the shoes industry is unique, so that the clothing industry has been discussed in its broadest sense. The industry has always had its distribution channels to market (Newbery, 2008). Due to different factors such as competition and diversity of consumers' interests, it is very difficult for manufacturers of sporting shoes to maintain their customers.

Tong and Hawley (2009) in a research on sport clothing brands showed that there was an internal correlation between the perceived quality and the relation with and loyalty to sporting brand. Also, there was a positive and significant correlation among awareness of sporting brand, the relation with and loyalty to it. Yee and Sidek (2008) also stated that there was a positive and significant relationship among the factors of the loyalty to brand name, product quality, price, promotion, and service quality and store environment with the sport clothing brands. Today, companies must be pioneer in the issue of product diversification in order to increase profitability according to competition issues, globalization of markets, shortening product life cycle and rapid technological development (Srinivasan et al., 2008).

A sensible achievement in the field of operational research to solve the design problems of the product may seem complex for managers, because it requires specialized expertise in marketing and engineering. In this context, it's very important for a brand to obtain an optimal solution to customer preferences. The fact is that optimization is done to increase market share and profit in product design lines. It is very important for managers to provide an appropriate variation by presenting the right image from a wide range of customers. The design of an inappropriate production line may not cause a change in its expected share of the brand. Therefore, considering different factors for diversification may lead to a general optimal solution to the market share (Alexouda, G. and Paparrizos, 2001).

In studies, optimization algorithms have been used to find the optimal level of variation (Balakrishnan et al., 2004: Camm et al., 2006). In the field of calculating the optimal level of brand diversification, Foster et al., (2014) used the discrete-genetic algorithm optimization method to maximize the production variety. The benefits of the method are that it has resulted in savings in calculations and the increased share of the brand in the market. Wang and Yeh (2014) used the modified particle swarm algorithm (MPSO) to design the product line. In their study, they compared the performance of MPSO with the standard PSO (SPSO) and the genetic algorithm (GA). The results showed that MPSO is better than SPSO and GA in terms of reliability and convergence speed. Wu and Chen (2014) designed the product line and pricing for smart phones (with high diversity of product) in a competitive market. In their study, a discrete selection model and genetic algorithm were used to optimize the price of the smart phones. Saridakis et al., (2015) introduced the new car models in a production line proportionate with customer's needs. In their study, the swarm intelligence mechanism was used to optimize the degree of product differentiation in automobile models; and sampling was taken of 1164 passenger car that the results showed that the variation among the models of car production lines increased customer's satisfaction. Dadrasmoghadam et al., (2016) studied the factors affecting the share of cheese products for Kaleh, Pegah and Sabah brands in food stores with emphasis on variation. Using the seemingly unrelated regression model and particle

optimization algorithm, they showed that the variation of Kaleh cheese was more than other brands and Kaleh brand should remove tin cheese from the markets. UF variation is more welcomed in the market. Guo et al., (2016) studied the optimal design modeling of cell phone by taking into account the needs of product design and customers' needs. Genetic algorithm was used with BP neural network to optimize cell phone design. Zhang et al., (2017) evaluated the design of new product engineering that took place in the ranking of design options using experts' subjective judgments. The particle swarm optimization based on support vector machine (PSO-SVM) was used to predict data-based performance. Shieh et al., (2017) designed the products based on the needs of their customers and used the genetic algorithm and multi-objective evolutionary algorithm (MOEA) to solve the customer's decision-making model and through this, they extracted the Pareto optimized solutions. Finally, they obtained the fuzzy analytical hierarchy process (FAHP) to achieve an optimal design of Pareto solutions. A case study of the design of a car model was presented to illustrate the proposed approach. The results showed that this approach was feasible and effective for obtaining the optimal designs and could provide an excellent insight into the product form design.

Shang et al (2018) enhanced the production efficiency and product quality by hybrid algorithm. The combination of genetic algorithm and particle swarm optimization algorithm have been a certain reference value for the production scheduling.

Goli et al (2019) investigated the optimization of the product portfolio problem under return uncertainty. The contribution of this research is founded on the application of a hybrid improved artificial intelligence and robust optimization and offering a novel method for calculating the risk of a product portfolio. Results of this study showed that by the statistical tests designate that the two newly proposed robust models are of similar performance in the finding the maximum return solutions so this study showed that this technique decreases the execution time by an average of 3%, indicative of proposed method effectiveness.

Reviewing the literature on factors affecting the share of brands including sporting brands shows that still there is no sufficient research in this area and the results of some studies done are contradictory. Therefore, the present study seeks to identify the factors influencing the share of brand by considering a comprehensive model. As previous research has shown, maintaining the customers will lead to the survival of the company and if a company loses its customers, it should not be hopeful to continue its activity. One of the most important factors to attract customers is the brand variation. If the company fails to be in a position to diversify the brand, it is not able to compete with its competitors in its current competitive environment and will lose the market share. This issue is especially important for sporting brands. In this study, the optimal level of diversification of Adidas and Nike brands for sporting shoes in Mashhad was determined using the optimized algorithm of particle swarm (PSO). The fundamental question of research in this field is that whether is there an optimal level of brand diversification and if so, what is the optimal level?

II. RESEARCH METHODOLOGY

The main objective of this study is to optimize the variation of sporting brands in Mashhad. For this end, the system of the seemingly unrelated equations was first used to examine the factors affecting the share of the branded sporting shoes. The dependent variables were the shares of Adidas and Nike sporting brands and the competitors' brands of sporting shoes in Mashhad market (S^*_{1i}, S^*_{2i}, S^*_{3i}) respectively, and the independent variables were the variation of sporting shoes in Mashhad sporting stores (n_{1i}, n_{2i}, n_{3i}) which shown by the system of the following equations (Horrace et al., 2016; Horrace et al 2009):

$$S^*_{1i} = f(n_{1i}, n_{2i}, n_{3i}, p_{1i}, p_{2i}, p_{3i}) + u_{1it} \quad (1)$$

$$S^*_{2i} = f(n_{1i}, n_{2i}, n_{3i}, p_{1i}, p_{2i}, p_{3i}) + u_{2i} \quad (2)$$

$$S_{3i}^{*} = f(n_{1i}, n_{2i}, n_{3i}, p_{1i}, p_{2i}, p_{3i}) + u_{3it} \quad (3)$$

The system of equations proposed in the framework of the SURE model can be estimated. The seemingly unrelated regression equations (SURE) were proposed by Zellner in 1962. The SURE model can be considered as a simple mode of the general linear model where for some vector members, the coefficients are considered to be zero. In this system, each of the equations has its own dependent variable and potentially can have a different set of explanatory variables. Each equation, in turn, is a linear regression that can be estimated individually and due to this reason, this set of equations is called "seemingly unrelated" (Green, 2002).

This model can be estimated as a single equation by the conventional least squares of OLS. Estimations were obtained for the above equations using the STATA 15 software.

Particle swarm optimization

Particle optimization algorithm is one of the most important algorithms in the field of the collective intelligence and has been designed by simulating the birds' behavior to find food sources. In the PSO algorithm, a number of organisms (particles) exist in the searching space of a function that the purpose is to optimize it. Each particle calculates the value of the target function in the space position in which located. Then, using the combination of its current location information and the best location where it existed before, as well as the information of one or more particle(s) of the best existed particles, it selects a direction to move. After doing this movement, one step of the algorithm is finished. This step is repeated several times to get the intended answer. In fact, the mass of particles that search for the optimal value of a function are similar to the flocks of birds that seek food (Poli, 2007).

Generally, in PSO algorithm, each bird searches a possible answer in the search space of the problem. At first, the algorithm is given a value by gathering a group of birds (particles) that are randomly generated in the problem space and then the search is started to reach the best answer. Each particle in PSO algorithm is composed of three d-dimension vectors. At each step of the algorithm repetition, the bird moves to a better position. The next position for each bird is obtained based on two values: the first value is the best situation that the bird has ever had (pbest), the second value is the best position that all birds ever received so far (gbest). In other words, gbest can be considered as the best pbest in the community of whole bird. This process will continue until it reaches the stopping condition. The stopping condition in this research is when it reaches to the number of the considered repetitions. According to the values of pbest and gbest, each bird uses the following relations to determine the next position (Engelbrecht, 2007).

$$v_j^i[t+1] = wv_j^i[t] + c_1 r_1\left(x_j^{ibest}[t] - x_j^i[t]\right) + c_2 r_2\left(x_j^{gbest}[t] - x_j^i[t]\right) \quad (4)$$

$$x_j^i[t+1] = x_j^i[t] + v_j^i(t+1) \quad (5)$$

In equations (4) and (5), the constants c1 and c2 determine the learning coefficients (the effect rate) for variables of gbest and pbest. r1 and r2 are random numbers in the range of [0, 1]. $x_j^i[t]$ is the current position of each bird; $v_j^i(t+1)$ is the birds' velocity in that stage and w is the inertia coefficient controller of particle motion. At the beginning, the implementation of the PSO algorithm is of higher speed and as after a while it closes to the response, the velocity decreases. The functions used for this purpose usually cause a linear reduction after each repetition (Shi & Eberhart, 1998).

We can modify the equation (4) by adding the W parameter. The right side of the equation (4) consists of three terms, which the first term is the current velocity of the particle; the second and third terms are the velocity of particle and its rotation toward the best personal experience and the best experience of the group. If the first term is not considered in this

equation, then the particle velocity is determined only with respect to the current position and the best experience of the particle and the best swarm experience. Therefore, the best swarm particle stays in place and the others move toward that particle. In fact, the swarm movement of particles without the first term of equation (4) will be a process in which the search space gradually becomes smaller and a local search is made around the best particle (Banks et al, 2008).

In this research, the target function is obtained by summing up the share of sporting brands resulted from the seemingly unrelated regression model and is limited to the total share of the brands available in the market that equals to 1. The target function is the sum of market share for Nike brand, Adidas brand and the competitors' brands which are maximized according to equation (6) (Kohli et al., 1990; Tsafarakis et al, 2013).

$$\max \sum_{i=1}^{435} (S_{1i}^{*} + S_{2i}^{*} + S_{3i}^{*}) \qquad (6)$$

And the limitation also equals to the sum of the shares available in the market that is calculated according to formula (7):

$$\sum_{i=1}^{435} (S_{1i}^{*} + S_{2i}^{*} + S_{3i}^{*}) = 1 \qquad (7)$$

The optimum levels of variation of Nike and Adidas brands and the brands of other competitors were obtained using the PSO algorithm and MATLAB software. The parameters used in this study are the population size of 50 and a personal and social learning rate of 2. In this study, a questionnaire was used for collecting data that included 140 sporting stores in Mashhad, which were selected through simple random sampling method. Sporting stores in Mashhad are divided into three categories in terms of their size, including big, medium and small stores and the issue of variation was discussed according to the size of the sporting stores. Variables included the share of sporting brands of Nike and Adidas that have a major contribution in sporting shoes in Mashhad. Classification was done in terms of variation in color and quality in 2019.

III. RESEARCH RESULTS

Before estimating the system of equations using the SUR method, it is necessary to test the concurrent correlation between the intervening terms of the equations. For this purpose, Breush Pagan LM test was used. As shown in table (1), the value of Breush Pagan's estimator is significant at the level of 1%; therefore, the null hypothesis is rejected and we cannot reject the concurrent correlation between the intervening terms of the equations. Thud, the equations must be estimated by the seemingly unrelated regression method.

Table 1. Significance test of model estimation using the system of equations (big stores)

Estimator	First system of equations	Second system of equations	Third system of equations
System significance	100.96***	163.00***	108.56***
Goodness of fit Coefficient for system of equations	0.62***	0.72***	0.64***
Breush Pagan statistics (total system)		129.442***	

* Significant at 10% level, ** significant at the 5% level, *** significant at 1%

Source: Research Findings

The whole systems were significant at level of 1%, indicating the significance of the total systems of the seemingly unrelated equations. The results of market share for two sporting brands are presented in Table 2. The variation of brands has a positive impact on the share of Nike sporting shoes in the big sporting stores, and the coefficient of Nike variation is greater than other variation coefficients, and it is clear that Nike's diversification increases its share in the big sporting stores.

In the second equation for the Adidas share (in big sporting stores), the coefficient of Nike's diversification has been negative. Adidas variation has a positive and significant effect on the purchasing share of Adidas customers, and Adidas' diversification with coefficient of 0.0282 is significant at the level of 0.01, indicating that the more the diversification of Adidas shoes increases in the big sporting stores, the more the share of sporting shoes with Adidas brand will increase, and ultimately the diversification of the brands of the competitors will be insignificant statistically.

One of the factors affecting the share of the sporting shoes of the competitors' brands (in big sporting stores) is Nike's diversification which has a negative effect on the customer's purchasing behavior of competitors' brands. The coefficient of the competitors' diversification has become positive and significant, which indicates that the more the diversification of the competitors' brands of shoes (in big sporting stores) will increase, the more the share of competitors' brand will increase in Mashhad market. This research is consistent with previous studies, which showed that the product diversification of each brand will increase the share of the brand in the market, but increasing the competitors' diversification of the branded shoes will reduce the brand share of the market (Foster et al, 2014 & Shi & Eberhart, 1998).

Table 2. Estimation of the demand share model of the brands selected by sporting shoes manufacturer in the big sporting stores (SUR structure)

Variables	Share of Nike brand		Share of Adidas brand		Share of the competitors	
	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient
Nike variation	1.28	0.0096	-1.10	-0.0086	-0.42	-0.0047
Adidas variation	0.86	0.0079	2.95	0.0282***	1.03	0.0141
Variation of the competitors	0.45	0.0008	0.12	0.0002	4.39	0.0128***

* Significant at 10% level, ** significant at the 5% level, *** significant at 1%

Source: Research Findings

Table 3. Significance test of model estimation using the system of equations (medium stores)

Estimator	First system of equations	Second system of equations	Third system of equations
System significance	47.37***	43.06***	53.47***
Goodness of fit Coefficient for system of equations	0.67***	0.65***	0.69***
Breush Pagan statistics (total system)		63.33***	

* Significant at 10% level, ** significant at the 5% level, *** significant at 1%

Source: Research Findings

Also, the whole systems were significant at level of 1%, indicating the significance of the total systems of the seemingly unrelated equations. The results of market share for two sporting brands are presented in Table 4. The variation of brands has a positive impact on the share of Nike sporting shoes in the medium sporting stores, and the coefficient of Nike variation is greater than other variation coefficients, and show that Nike's diversification increases its share in the medium sporting stores.

In the second equation for the Adidas share (in medium sporting stores), the coefficient of Nike's diversification is negative and it is statistically significant. Adidas variation with coefficient of 0.0300 is a positive and significant; in other

words, if the variation of Adidas shoes increases in the medium sporting stores, the share of Adidas will increase. The coefficient of brand diversification of the competitors will be insignificant statistically.

Nike's diversification is one of the factors affecting the share of the competitors' brands of shoes in the medium sporting stores, which reduces the share of the competitors' brands in the Mashhad shoe market. Adidas' diversification coefficient and those of competitors in the medium sporting stores are positive and significant, indicating that the greater the variation of Adidas brands and those of competitors in medium stores, the more the share of competitors' brands will increase in the Mashhad market.

Table 4. Estimation of the demand share model of the brands selected by sporting shoes manufacturer in the medium sporting stores (SUR structure)

Variables	Share of Nike brand		Share of Adidas brand		Share of the competitors	
	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient
Nike variation	1.01	0.0058	-2.02	-0.0106**	-3.47	-0.0198***
Adidas variation	1.53	0.0114	4.42	0.0300***	4.38	0.0322***
Variation of the competitors	0.38	0.0009	0.42	0.0009	4.89	0.0121***

* Significant at 10% level, ** significant at the 5% level, *** significant at 1%

Source: Research Findings

Table 5. Significance test of model estimation using the system of equations (small stores)

Estimator	First system of equations	Second system of equations	Third system of equations
System significance	100.96^{***}	163.00^{***}	108.56^{***}
Goodness of fit Coefficient for system of equations	0.62^{***}	0.72^{***}	0.64^{***}
Brush Pagan statistics (total system)		129.44^{***}	

* Significant at 10% level, ** significant at the 5% level, *** significant at 1%

Source: Research Findings

For the small stores, the entire system of seemingly unrelated equations was significant. The results of market share for two sporting brands are presented in Table 6. The diversification of Nike's brands has a positive effect on the share of Nike's sporting shoes in small sporting stores, is not statistically significant. The Adidas variation coefficient is positive (and statistically significant) and is greater than the other coefficients of brand variation in the small sporting stores, and suggests that Adidas' diversification increases Nike's share in small sporting stores compared to the other brands. In the first equation, the diversification coefficient of competitors in the sporting stores is negative and significant, indicating the more the competitors' brand diversification increases in small sporting stores, the more the share of Nike's brand will be reduced.

In the second equation, Nike's diversification coefficient is negative and statistically significant in the small sporting stores. The Adidas variation coefficient is positive and significant; indicating that the more the diversification of Adidas shoes increases in small sporting stores, the more the share of Adidas' brand will increase. The competitors' diversification coefficient has been estimated equal to -0.0076 that is statistically significant; indicating that the competitors' diversification increases in small sporting stores, the more the share of Adidas' brand will decrease.

In the third equation, Nike's diversification is negative, but not statistically significant. One of the factors influencing the share of sporting shoes of the competitors' brands in the small sporting stores is diversification of Adidas and the

competitors that is positive and significant. The Adidas' diversification coefficient is greater in small stores, suggesting with the increase of Adidas' diversification, the share of the competitors' brands will increase in small stores.

Table 6. Estimation of the demand share model of the brands selected by sporting shoes manufacturer in the small sporting stores (SUR structure)

Variables	Share of Nike brand		Share of Adidas brand		Share of the competitors	
	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient
Nike variation	1.48	0.0073	-1.76	-0.0069*	-0.63	-0.0046
Adidas variation	3.77	0.0291***	7.44	0.0453***	2.38	0.0272***
Variation of the competitors	3.47	-0.0069***	4.85	-0.0076***	2.20	0.0065**

* Significant at 10% level, ** significant at the 5% level, *** significant at 1%

Source: Research Findings

Optimization of the diversification of sporting brands (big, medium and small stores)

Based on the results of the PSO algorithm, the optimal level of the brands of Nike, Adidas and the competitors (in big stores) is presented in Table 6. The optimal levels of diversification of sporting shoes in the big stores for the brands of Nike, Adidas and the competitors are 10, 9 and 16, respectively, indicating that the optimum level of Nike's brand products in big stores should be more than Adidas, and since the maximum diversification in big stores for brands of Nike, Adidas and the competitors are 15, 20, and 50 respectively, at least 5 brands of Nike and 11 brands of Adidas and 34 brands of the competitors in the Mashhad market should be reduced in the big sporting stores. The optimal levels of diversification of Nike, Adidas and the competitors' brands in the medium stores have been calculated as 10, 13 and 23, respectively. In this research, the maximum variations of Nike, Adidas and the competitors' brands for the medium sporting stores were 12, 18, and 30 respectively, indicating that the big sporting stores in the Mashhad must eliminate two levels of Nike's brand variation, five levels of Adidas' brand variation and seven levels of the competitors' brand variation. The maximum range of Nike's brand variation in the small stores is 15 that the optimal level of Nike's variation was calculated equal to 5, suggesting that 10 levels of the variation of Nike's brands in the small stores must be reduced. The maximum range of Adidas' variation in small stores is 20 that the optimal level of this brand variation was calculated equal to 16, indicating that 4 levels of the variation of Adidas' brands must be reduced in small stores. This reduction is also true for Adidas' brand and the maximum optimal level is achieved with a variation of 5 in the market. Also, the maximum variation of the competitors' brands in small stores is 30, which according to this study, the optimal level of the competitors' diversification should be reduced to 23. In other words, the level of Nike's variation should be reduced more in the small stores compared to the brands of Adidas and the competitors. Overall, according to the findings of this study, Nike's brand should reduce 5, 2 and 10 types of their sporting shoes from the market in big, medium and small stores, respectively; and Adidas' brands should reduce 11 , 5 and 4 types of their sporting shoes from the Mashhad market in big, medium and small stores, respectively; Also the present study shows that in the big and medium stores, the reduction of Nike's variation should be less than Adidas' brand; and about Adidas' brand, the big stores should have the grater reduction and this issue is reverse for small stores.

Table 7. The optimal level of variation of sporting brands in large, medium and small stores

Component		**Number**
Variation level of big stores	Nike	**10**
	Adidas	**9**

	Competitors	**16**
Variation level of medium stores	Nike	**10**
	Adidas	**13**
	Competitors	**23**
Variation level of small stores	Nike	**5**
	Adidas	**16**
	Competitors	**22**

(Source: Research findings)

IV. DISCUSSION AND CONCLUSION

Based on the results of this study, the factors affecting the share of the brands of the sporting shoes are the variation and quality of the brand, so that Nike's diversification increased the share of Nike in big, medium and small stores. In big stores, Nike's brand variation have greater impact on the share of Nike's brand, but in medium and small stores, Adidas' diversification increases more the share of Nike's sporting brand than other brands. Also, the more the variations of the competitors' brands increase in small sporting stores, the more the share of Nike's brand will be reduced. The more the variations of Adidas sporting shoes increase in big, medium and small sporting stores, the more the share of Adidas brand will increase. In big, medium and small sporting stores, by increasing Nikes diversification, the share of Adidas will reduce in Mashhad market of sporting shoes. In the small stores, by increasing the diversifications of the competitors, the share of Adidas' brand will reduce. It became clear that in the big, medium and small sporting stores, the greater the variation of the brands of the competitors' shoes would increase, the share of customers' purchases from the rival brand would increase. By increasing the variation of Adidas, the share of the competitors' brands will increase in the medium and small stores in Mashhad market of sporting shoes.

In general, the results show that the diversification of sporting shoes has a direct relationship with the share of the brands of Nike and Adidas, and a reverse relationship with diversification of the brands of the other competitors, and it can be suggested that in order to increase the share of sporting brands, the special attention should be paid on the variation of sporting shoes in the stores. One of the main reasons that these sporting brands have been able to have a special share in the market is the issue of consumers' behavior variability in the market of sporting shoes. The findings of this study indicate that the big and medium stores need to reduce the optimum level of Nike variation compared to Adidas' brand, and the large stores should further reduce Adidas' brands, which this issue is reverse for small stores.

Applicable remarks

1. Sports brand companies should pay special attention to diversification in order to increase their market share in Mashhad. One of the main reasons for sports brands to have a significant market share has been the particular attention to the variety of sports products marketed in the area.
2. Finally, the optimum profit status of sport stores showed that the optimal amount of brand diversity varies with the size of the store, and the sporting shops have to differentiate the market according to the size scale.

REFERENCES

[1] Alexouda, G., & Paparrizos, K. (2001). A genetic algorithm approach to the product line design problem using the seller's return criterion: An extensive comparative computational study. European Journal of Operational Research, 134(1), 165-178. doi: 10.1016/S0377-2217(00)00246-0

[2] Banks, A., Vincent, J., & Anyakoha, C. (2008). A review of particle swarm optimization. Part II: hybridisation, combinatorial, multicriteria and constrained optimization, and indicative applications. Natural Computing, 7(1), 109-124. doi: 10.1007/s11047-007-9050-z

[3] Balakrishnan, P., Gupta, R. & Jacob, V. (2004). Development of hybrid genetic algorithms for product line designs. IEEE Transactions on Systems, Man, and Cybernetics, 34(1): 468−483. doi: 10.1109/TSMCB.2003.817051
[4] Bouchet, P., Hillairet, D., & Bodet, G. (2013). Sport brands. Routledge.
[5] Camm, J. D., Cochran, J. J., Curry, D. J. and Kannan, S. (2006). Conjoint optimization: An exact branch-and-bound algorithm for the share-of-choice problem. Management Science, 52(3): 435−447. doi: 10.1287/mnsc.1050.0461
[6] Dadrasmoghadam, A., Ghorbani, M., Karbasi, A. R., & Kohansal, M. R. (2016). Determining the Optimum Brands Diversity of Cheese Using PSO (Case Study: Mashhad). Industerial Engineering and Mangement Systems, 15(4): 318-323. doi: 10.7232/iems.2016.15.4.318
[7] Dadrasmoghadam, A., Etezad, S.K., Sahebkaran, M.A., Barbaar, A., Ghorbani, M. (2020). Modeling the Factors Affecting the Relative share of Sporting Brands in Mashhad Market. J Adv Pharm Edu Res, 10(S4):63-69.
[8] Engelbrecht, A. P. (2007). Computational intelligence: An introduction. England: John Wiley and Sons.
[9] Foster, G. and Ferguson, S. (2013). August. Enhanced Targeted Initial Populations for Multi objective Product Line Optimization. In ASME 2013 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. American Society of Mechanical Engineers.
[10] Foster, G., Turner, C., Ferguson, S., & Donndelinger, J. (2014). Creating targeted initial populations for genetic product searches in heterogeneous markets. Engineering Optimization, 46(12):1729-1747. doi: 10.1080/0305215X.2013.861458
[11] Goli, A., Zare, H. K., Tavakkoli-Moghaddam, R., & Sadeghieh, A. (2019). Hybrid artificial intelligence and robust optimization for a multi-objective product portfolio problem Case study: The dairy products industry. Computers & Industrial Engineering, 137, 106090. doi:10.1016/j.cie.2019.106090
[12] Green,W. H. (2002). Econometric analysis (5th ed).prentice Hall.
[13] Horrace, R.H., William, C., & Jeffrey, M.P. (2009). Variety: Consumer choice and optimal diversity. Food Marketing Policy, Center Research Report, No. 115. doi: 10.22004/ag.econ.149942.
[14] Horrace, W. C., Huang, R., & Perloff, J. M. (2016). Effects of increased variety on demand, pricing, and welfare. Research in Economics, 70(4): 569-587. doi:10.1016/j.rie.2016.06.006
[15] Guo, F., Qu, Q. X., Chen, P., Ding, Y., & Liu, W. L. (2016). Application of Evolutionary Neural Networks on Optimization Design of Mobile Phone Based on User's Emotional Needs. Human Factors and Ergonomics in Manufacturing & Service Industries, 26(3): 301-315. doi: 10.1002/hfm.20628
[16] Kohli, R. and Sukumar, R. (1990). Heuristics for product line design using conjointanalysis. Management Science, 36(12): 1464−1478. doi:10.1287/mnsc.36.12.1464
[17] Kotler, Phillip, and Gary Armstrong. (2012). Principle of Marketing (ed). New Jersey.
[18] Newbery, M. (2008). Global Market Review of Active Sportswear and Athletic Footwear- Forecasts to 2014: 2008 Edition.
[19] Poli, R., Kennedy, J., & Blackwell, T. (2007). Particle swarm optimization. An overview. Swarm Intelligence, 1(1): 33–57. doi: 10.1007/s11721-007-0002-0
[20] Shi, Y., & Eberhart, R. (1998). A modified particle swarm optimizer. Proceedings of the IEEE World Congress on Computational Intelligence Anchorage, AK, USA: IEEE Press. 69−73. doi: 10.1109/ICEC.1998.699146
[21] Saridakis, C., Tsafarakis, S., Delias, P., Baltas, G., & Matsatsinis, N. (2015). Optimizing differentiation and commonality levels among models in car line-ups: An empirical application of a nature-inspired heuristic mechanism. Expert Systems with Applications, 42(5): 2323-2335. doi: 10.1016/j.eswa.2014.11.008
[22] Shang, J., Tian, Y., Liu, Y., & Liu, R. (2018). Production scheduling optimization method based on hybrid particle swarm optimization algorithm. Journal of Intelligent & Fuzzy Systems, 34(2): 955-964. doi: 10.3233/JIFS-169389
[23] Shieh, M. D., Li, Y., & Yang, C. C. (2017). Product Form Design Model Based on Multiobjective Optimization and Multicriteria Decision-Making. Mathematical Problems in Engineering. doi:10.1155/2017/5187521
[24] Srinivasan, R. Lilien, G. L. and Rangaswamy, A. (2008). Survival of high tech firms: The effects of diversity of product–market portfolios, patents, and trademarks. International Journal of Research in Marketing, 25(2): 119−128. doi: 10.1016/j.ijresmar.2007.12.005
[25] Tong, X., & Hawley, J. M. (2009). Measuring customer-based brand equity: empiricalevidence from the sportswear market in China. Journal of Product & Brand Management, 18(4): 262-271. doi: 10.1108/10610420910972783
[26] Tsafarakis, S., Saridakis, C., Baltas, G., & Matsatsinis, N. (2013). Hybrid particle swarm optimization with mutation for optimizing industrial product lines: An application to a mixed solution space considering both

discrete and continuous design variables. Industrial Marketing Management, 42(4): 496-506. doi: 10.1016/j.indmarman.2013.03.002

[27] Wang, S.C. & Yeh, M.F. (2014). A modified particle swarm optimization for aggregate production planning. Expert Systems with Applications, 41(6): 3069-3077. doi: 10.1016/j.eswa.2013.10.038

[28] Wu, S. & Chen, S. (2014). A Bi-level algorithm for product line design and pricing. In 2014 IEEE International Conference on Industrial Engineering and Engineering Management (pp. 14-18). IEEE. doi: 10.1109/IEEM.2014.7058591

[29] Yee, W. F., & Sidek, Y. (2008). Influence of brand loyalty on consumer sportswear. International Journal of Economics and Management, 2(2):221-236.

[30] Zellner, A. (1962). An efficient method of estimating seemingly unrelated regression and tests of regression bias. Journal of American Statistical Association, 57(298): 348-368.

[31] Zhang, Z. J., Gong, L., Jin, Y., Xie, J., & Hao, J. (2017). A quantitative approach to design alternative evaluation based on data-driven performance prediction. Advanced Engineering Informatics, 32: 52-65. doi: 10.1016/j.aei.2016.12.009.