Journal of Harbin Engineering University
ISSN: 1006-7043
Vol 44 No. 9
September 2023

Decision-Making Model for Service Franchising by Applying Game Theory Under Risk Analysis

Maryam Khalili Araghi[1*], Abolfazl Kaviani[2]

[1*] Academic degree: Ph.D. in Business Administration, Member of faculty of Research Sciences, Major specialization in business management with a minor in financial management, Academic rank: Assistant Professor, Email: m.khaliliaraghi@srbiau.ac.ir, Full-time cooperation with the science and research branch, Corresponding Author

[2] Master's degree in Business Management, Department of Business Management, Major: supply chain, faculty of management and economics, Postal address: Management and Economics Department, Tehran Science and Research Branch, Islamic Azad University, Tehran, Iran, Tehran, Iran, Email: abolfazl.kaviani.ac@gmail.com

Abstract- Both the evolutionary stable strategy (ESS) and the General Bass model have been combined to analyze the franchising process to develop a model for decision-making simulation that includes the risk factors of this field. This simulation has been done using Vanta software as well as the financial statements of 148 chain businesses (Yaran Deryan store) in the intervals of 2013 to 2018. This model simulates the decision-makers' behavior when the risks change. The simulation results reveal that when decreasing the probability of the survival of a chain business, franchising will increase. To contrast, the investment in franchising would be decreased for both franchisers and franchisees by the increase in the probability of survival of independent businesses. The increase in the possibility of franchise agreement extension has a downward proportional effect on franchisees' behavior. To continue, the limitations and suggestions were inserted.

Keywords- Franchising, Risk analysis, Evolutionary Stable Strategy, General Bass Model, Game Theory.

1. Introduction

Product branding and franchising is a conventional distribution channel created by the franchisor. The business has been attributed as the most popular form of franchising. A well-known service or product owner (franchisor) licenses another party (franchisee) to sell the product or provide service using the label of the parent company. Accordingly, this method provides economies of scale to benefit the collective power of a brand's trademark as well as the national and international marketing, advertising, purchasing, and training activities. The key elements of a franchise agreement include the products to be sold, quality standards, price, working hours, start-up date, agreement period, renewal periods, and termination conditions. [1- Ali Mohammadzadeh and Naser Sanobar, 2016] Companies consider franchise agreements as a mechanism for facilitating financial and managerial restrictions throughout the development process. Further, it is regarded as a mechanism used to improve the alliance between the enterprise goals and output level. [1- Ali Ahmadzadeh and Nasser Sanobar, 2016] Franchising is one of the most common forms of strategic alliances throughout the world. Franchising is one of the safest and fastest strategic methods for business development. Franchising is an entrepreneurial form of business relationship expanding rapidly throughout the world and helps the franchiser company to grow using the resources of others and also allows new people who start the businesses to work and grow with the support of a well-known brand and reduce the risk before entering a new market. [2- Adams Adzia et al., 2017] There were 801,000 franchised establishments in business format and product distribution franchise systems in the United States in 2016. 2.3 percent of all nonfarm business establishments in the United States are franchised. Franchised businesses directly provided nearly 9.0 million jobs. [3-Economics, 2016] Ignoring the competitors in the market leads to decreased revenue forecast accuracy. Accurate policy-making and decisions on the enterprise can provide considerable income and benefit for the enterprises in line with the realization of their marketing goals in addition to influencing the target market. [4- Sahr Parsanifar, 2018] In this competitive market, predicting the franchising process and providing a mathematical model can assist both the prospective franchisors and the franchisees to understand their financial decisions and adopt a precise and accurate decision by clearly understanding their income and effort as well as regarding their competitors' behavior. [5- Ivan Ketliarov, 2008] deciding to start

the franchise requires considerable attention. It is necessary to analyze the decision-making process in service franchising quantitatively considering the franchising risks to understand the effects of risks on the decision-making process as well as the behavior and reaction of the people involved in this industry. The decision-making process has been investigated in this research due to its significance in this issue. A model has been proposed for decision-making throughout the franchise grant process. An evolutionary game simulation system has been developed to understand the acts applied in the decision-making process and that the risks vary in an environment. The effect of these changes on the decision-making process is analyzed quantitatively.

2- Theoretical foundations and research literature

2-1. Decision-making in franchising

The effective factors in service franchising have been the subject of much research accomplished outside of Iran. Factors such as trust, commitment, effectiveness, nearness, and satisfaction have been discussed in many studies carried out in terms of service franchising. The possibility of the franchise agreement extension indirectly relates to the issue of staying in the franchising relationship. The more satisfied the branches are, the more they recommend the franchise to others. This facilitates the development of franchising. The intention to stay in franchising also can have a positive or negative effect on the franchising system.

The degree of satisfaction has a direct relationship with the intention to stay in the system. [2- Adams Adzia et al., 2017] [6- Carlijn et al., 2014] [7- Ali Pourani, Mahmoud Ahmadpour Dariani, 2009] [8- Ying et al., 2016] [9- Malih Medanoglu et al., 2011] [1- Ali Mohammadzadeh and Naser Sanobar, 2016] [10- Hoso et al., 2009] [11- Muriel Fadairo et al., 2016] [12- Ali Pourani et al.] What influence do risks have on the decision-making process for franchising? And how do capital owners and chain business owners react to these changes? To answer these research questions, a model has been developed for decision-making throughout the franchise grant process. An evolutionary game simulation system has been developed to understand the acts applied in the decision-making process and that the risks vary in an environment. The effect of these changes on the decision-making process is quantitatively analyzed to fill the gap between theoretical research carried out concerning risks and franchising.

2-2. General bass model

This method is used to analyze the diffusion of high-tech as well as new products in the market. In General Bass Model, the available parameters can provide a reasonable baseline forecast, regardless of decision-making changes. The Bass Model has been widely used in empirical studies done in the case of marketing and technology diffusion. The bass model proposes models for increasing knowledge and skills, technology management for optimal allocation of resources, and feasibility studies of various technologies. In studying decision-making, it is proposed to combine this model with another appropriate model (games theory). It has a unique capability to interpret the power of innovation and imitation. Therefore, the bass model has become popular due to its apparent power and clarity. The Bass model assumes that two factors-the coefficient of innovation (p) and the coefficient of imitation (q)-affect the rate of a new product diffusion pattern. The coefficient of innovation refers to the influence of mass media or magazines. The coefficient of imitation mainly accounts for "word of mouth". The 750 publications have been presented based on the Bass model. [13-Long Chen, 2018] [14- http://www.bassbasement.org]

2-3. Game theory

Evolutionary stable strategy is considered a basic concept in evolutionary game theory that originates from biological evolution. However, today, it is used in praxeology and economics. This concept considers a population of boundedly rational players playing a game repeatedly over time. Players use each other's experience to improve their strategy.

The Evolutionary Stable Strategy (ESS) is widely used in various sciences such as investment security structure analysis, trust-based decisions, wireless networks, and modeling user behavior. Compared to classical game theory, evolutionary games are appropriate for studying phenomena in the digital era. An Evolutionary Stable Strategy can refer to a specific group's decision-making with less limitation in access to information. However, this strategy does not provide any effective method for solving the mutation problem in decision-making games. [15-Kamran Kianfar et al., 2019] [13-Long Chen, 2018] [16-Zahra Mojaver et al., 2019] [17-Marzieh Khakestari et al., 2018]

2-4. Franchising process and risk analysis

Investors sometimes use the net present value measurement to decide to choose from among several options. Net present value only refers to the amount

of income and does not consider the probability of its availability in risky and dynamic conditions. According to the resource scarcity theory, companies may withdraw part of the assigned concessions, not extend the franchising agreement, and purchase and manage the shop themselves to obtain financial and human resources as well as to increase their profitability. Agency theory is used to explain the balance between two costs common in franchising. Horizontal and vertical costs affect the decision-making for the development of franchised or independent businesses, and the probability of independent and franchised businesses' survival are intrinsically related to each other, and systemically depends on financial potential. Further, the probability of agreement extension relates to staying in a franchising agreement, and the more satisfied the branches with the franchising relationship, the more they would recommend franchising to others (word-of-mouth effect). This facilitates the franchising market growth. The intention to stay in franchising can affect the franchising positively or negatively. The accomplished studies emphasize that further research is required on relationship quality. The level of satisfaction with the relationship has a direct relation with the intention to stay in franchising. [13-Long Chen, 2018] [2- Adams Adzia et al., 2017] [10-Hoso et al., 2009] [9- Malih Madanoglu et al., 2018]

3- Analysis of the franchising process decision-making model

In franchising, chain business owners and capital owners are two groups that make decisions in a repetitive game. Each member of the group can make decisions and exchange information with each other through communication tools. Each member can use his/her or others' experiences to form his decision. Figure 1 represents the relationship between the variables (obtained using mathematical relations) that influence the decisions adopted by these two groups.

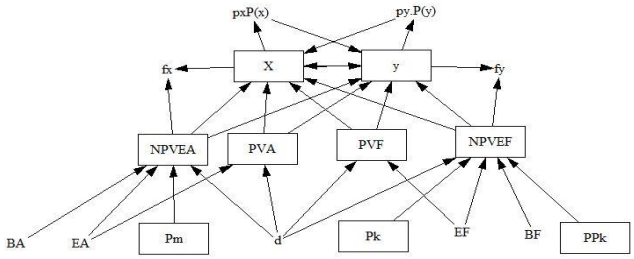


Figure 1: the relationship between the variables

3-1. Combination of the general bass model and evolutionary stable strategy

The franchising game is a multivariate issue. The two parties (chain business owners and capital owners) take into account the effect they have on each other. The General Bass Model is a proper method for modeling decision-making behavior in groups. [13-Long Chen, 2018] But it cannot directly pave the way to consider the group of chain business owners or analyze the effect of the two groups on each other. As mentioned earlier, franchising is an iterative process. Compared to other methods, the Evolutionary stable strategy takes into account the behavior of the population with bounded rationality, which can provide a solution for the multivariate process. Therefore, a model is constructed for multivariate decision-making by the use of the General Bass model. Further, an evolutionary game is added to it to develop the model by using Evolutionary Stable Strategy. Relation 1 represents the general equation used for interpreting the new product or service adaptation (evolution) process in the population. According to the Evolutionary Stable Strategy, there are two movements (strategy) to buy or not to buy the product or service, s_1 (to buy a specific product) and s_2 (not to buy a specific product). x is the proportion that chooses the first strategy in the capital owners' population; y is the proportion that chooses the first strategy in the chain business owners' population. Regarding the Evolutionary Stable Strategy, the dynamic iterative equation is represented as follows [13-Long Chen, 2018]

$$\frac{f(t)}{1-F(t)} = p + \mathrm{qF}(t) \quad (1)$$

$$\frac{dx}{dt} = x(E - E') = x(1-x)(u_1 - u_2) \quad (2)$$

x: Proportion of buyers who chose the purchase movement (S1), E: Expected income earning from purchase movement (S1), E': Average income, $u1$: Amount of income earning from purchase movement (S1), $u2$: Minimum income. It is perceivable that X and F(t) have the same meaning. Then, the second relation is presented as follows.

(3) $$\frac{dx}{dt} = F'(t) = f(t) = F(t)\big(1 - F(t)\big)(u_1 - u_2)$$

The equation number one, the purchase penetration change rate will be shown as follows:

(4) $$f(t) = F(t)\big(1 - F(t)\big)q + \big(1 - F(t)\big)p$$

If

$q = (u_1 - u_2)$

Then, equations 3 and 4 would have the same meaning. q is the imitation coefficient in the General Bass model for buying a new product and accounts for the external factors for buying a product. On the other hand ($u_1 - u_2$), it is the income differentials obtained from the purchase that somehow refers to the same imitation with this meaning that the purchase strategy creates this benefit and is effective in attracting more purchases. q has the same meaning, too. It can be said that equation 3 would be the same as equation 4 if merely the income as an external factor is effective in the purchase decision. In other words, equation 3 is the imitation of the birds from each other's decision, where learning is done only through earning experience. The difference in income leads to an increase in decision-making changes. Since equation 3 only considers the population with bounded rationality, and the rate of imitation depends on the difference in income, it is necessary to consider the mutation for improvement if the individual ignores their income in decision-making. In economics, decisions that ignore income as an effective variable are called irrational. In equation 4, p is considered the coefficient of innovation and is a factor that expresses internal factors. Income is ignored in these internal factors due to every individual's reasons. It is perceivable that section (1-F (t)) p in equation 4, is regarded as the effect of internal and non-rational factors in the buying decision process in the economy. As a dynamic game, this coefficient should not be considered constant. According to the Evolutionary strategy, however, it should vary by changing the strategy. The relationship between irrational decision-making and the franchising strategy selection is represented by ρ. p (F (t)), where ρ is the level of each individual's risk to make an irrational decision. p (F(t)), is a relation containing F(t). ρ. p (F(t)) represents the mutation that was not included in equations 2 and 3. P has an inverse relationship with stability in strategies. It means that if individuals choose a strategy permanently, irrational behavior would decrease and ultimately everyone's decision will be more effective and profitable. Regarding the above-mentioned descriptions, the relation function is represented as follows: [13-Long Chen, 2018]

(5) $$p\big(F(t)\big) = (1 - |1 - 2F(t)|)$$

(6) $$k - * f(t) = F(t)\big(1 - F(t)\big)(u_1 - u_2) + \big(1 - F(t)\big)\rho.\, p(F(t))$$

The following equation is obtained by the placement of equations 5 and 6. Equation 7 is an overall equation for rational and non-rational decision-making that is used for simulating the franchise game:

(7) $$f(t) = F(t)\big(1 - F(t)\big)(u_1 - u_2) + \big(1 - F(t)\big)(1 - |1 - 2F(t)|)$$

3-2. Simulating the decision-making model for franchising

Regarding the compatibility of being classic of the lemons, the evolutionary stable strategy (ESS) will change over time in the case of the possibilities and the buying process of franchising. This means that the probability of choosing S_{F2} increases over time, that is if attracting investors and granting franchises lasts for a long period, the franchisers would decide to create shops for themselves to prevent losing their market. This causes an increase in the franchiser enterprise's costs in the long term. If the mentioned enterprise intends to compensate for these costs, the income earned from the franchising would be decreased. The franchising rate (X) also decreases, and as a result, the total amount of the franchiser's revenue downwards from the ideal level. If the franchisor obtains a higher level of profitability and benefit, it would select the S_{F1} strategy. Otherwise, it would choose the S_{F2} strategy. By the increase of selection of S_{F2} strategy by franchisers, the income expected by the franchisees is decreased and, accordingly, the rate of penetration (x) decreases. Those who want to invest in franchising do not have enough knowledge about the possibility of strategies being selected by franchisers. Every time, since franchisers and franchisees look at their past, they consider their past experiences in decision-making. Equation 10 is used for modeling. The sequence of events in the game is as follows.

1) Investors decide to grant a franchise.

2) The investor and the company negotiate to conclude a contract.
3) The franchiser makes its decision regarding franchising.
4) The investor receives the adopted decision and shares his experience with others.

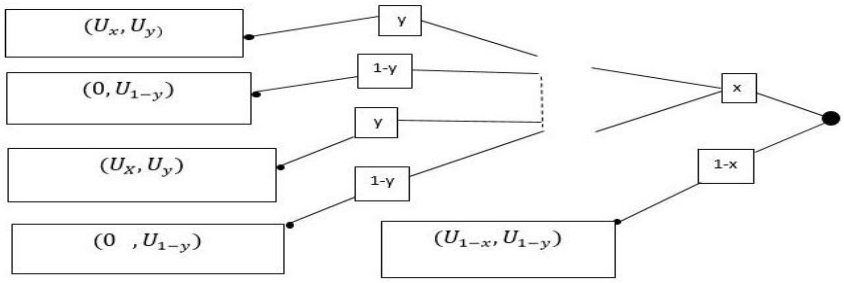


Diagram 3-1. Decision-making tree in the franchising process

The degree of utility (fitness function) resulting from franchising or independent business is measured by the net present value. The net present value shows the amount of income, but it ignores the possibility of its availability in conditions where there are dynamic risks. Therefore, the modified formula of net present value is used to take the risk into account. [5- Ivan Ketliarov, 2008] where PK is the probability of survival of the franchised business, Pm is the probability of the independent business survival, and PPK is the probability of the franchise agreement extension. BA and BF are the income obtained from independent and franchised businesses. EF and EA are the costs of a franchised and independent business. All the intervals were regarded as equal for the calculations' easiness. Regarding the evolutionary stable strategy (ESS), the following relation is inserted instead of (q):

(8) $$NPVA_P = \sum_{i=1}^{K} \frac{PM_i(BA_i - EA_i)}{(1+d)^i}$$

(9) $$NPVF_P = \sum_{i=1}^{K} \frac{PK_i(BF_i - EF_i)}{(1+d)^i}$$

(10) $$(NPVF_P = \sum PKK_j \sum_{i=1}^{K} \frac{PK_i(BF_i - EF_i)}{(1+d)^i}$$

(11) $$PPK = \frac{K_{k+1}}{K_k}$$

$$f(t)_x = F(t)_x(1 - F(t)_x)(u_x - u_{1-x}) \quad (U_x - U_{1-x})$$
$$+ (1 - F(t)_x).\rho.\mathrm{p}(F(t)_x)$$
$$\mathrm{f(t)_x} = \mathrm{F(t)_x}(1 - \mathrm{F(t)_x})\left((\mathrm{y})\frac{\mathrm{NPVF}}{\mathrm{PVF}} - (1 - \mathrm{y})\frac{\mathrm{NPVA}}{\mathrm{PVA}}\right)$$
$$+ (1 - \mathrm{F(t)_x}).\rho.\mathrm{p(F(t)_x)}$$

If $f(t)_x = 0$, $\mathrm{F(t)_x}$ would be equal to 0 or 1; or:

$$y = \frac{\frac{NPVA}{PVA}}{\frac{NPVA}{PVA} - \frac{NPVF}{PVF}} - \frac{\rho * (1 - |1 - 2F(t)_x|)}{F(t)_x\left(\frac{NPVA}{PVA} - \frac{NPVF}{PVF}\right)} \quad (١٢)$$

If we consider $f(t)_y = 0$, $\mathrm{F(t)_y}$ would be equal to 0 or 1; or:

$$X = \frac{F(t)_y\left(\frac{NPVA}{PVA}\right) - \rho * \mathrm{p}(F(t)_y)}{F(t)_y\left(\frac{NPVF}{PVF}\right)}$$

$$PVA = \sum_{i=1}^{k} \frac{EA_i}{(1+d)^i}$$

$$PVF = \sum_{i=1}^{k} \frac{EF_i}{(1+d)^i}$$

4-2. Simulation and analysis

Regarding the dynamic systems, the present research has proposed an evolutionary game in a dynamic system to simulate the decision-making dynamics in environments where risks are changing [18- Baralas, 1996] This simulation has been done applying Vanta software using the financial statements of 148 chain businesses (Yaran Deryan Store), in the intervals of 2013 to 2018. This model simulates the decision-makers' behavior where risks change.

4-2-1. Simulating the model and valuing the variables

The variables have been summarized in Table (4-1). The initial value of the initial penetration coefficient for both populations has been regarded as 0.5 which is representative of a natural state in the game. Players randomly choose their strategies since none of these groups has enough information about the

opposite group's behavior. Moreover, the factors related to irrational behavior and other risks are randomly determined.

The parameters have been determined based on the rules of the dynamic systems simulation code in Ventana Vensim software, version 7. RANDOM NORMAL (Min, Max, Mean Stdv, Seed) has been used for adjusting the unmeasurable factors as well as the risks with normal distribution. It includes the maximum, minimum, median, standard deviation, and initial value, and is ready for simulation.

Table 4-1. Simulation Values

Variable	Value of variable	Description
P_m	The initial value (0.5)	Probability of independent business survival
P_k	The initial value (0.5)	Probability of chain business survival
PP_k	The initial value (0.5)	Probability of franchise agreement extension
d	The initial value (0.2)	Discount rate
EA	9000	Independent business costs
BA	10000	Independent business incomes
$NPVEA$	Relation 9	Net present value of the independent business
PVA	Relation 14	Present value of independent business costs
EF	12000	Chain business costs
BF	16000	Chain business incomes
$NPVEF$	Relation 10	Net present value of chain business
PVF	Relation 15	Present value of chain business costs
f_x	$f_x\ formula$	Rate of penetration rate changes in the capital owners' group
f_y	$f_y\ formula$	Rate of penetration rate changes in the chain business group

Variable	Value of variable	description
x	Relation 13	Penetration coefficient among capital owners
y	Relation 12	Penetration coefficient among chain business owners
$p_x P(x)$	RANDOM NORMAL (-0.01, 0.01, 0, 0.003, 0.005) *(1-ABS(1-2*x))	Effect of irrational decision-making on capital owners
$p_y P(y)$	RANDOM NORMAL (-0.01, 0.01, 0, 0.003, 0.005) *(1-ABS(1-2*x))	Effect of irrational decision-making on chain business owners
DeltaP_m	Pm*RANDOM UNIFORM (-0.05, 0.05, 0.001)	Changes in the probability of an independent business survival
DeltaP_k	Pk*RANDOM UNIFORM (-0.05, 0.05, 0.001)	Changes in the probability of a chain business survival
DeltaPP_k	PPk*RANDOM UNIFORM (-0.05, 0.05 ,0.001)	Changes in the probability of franchise agreement extension
$NPVEF$	Relation 10	Net present value of chain business
PVF	Relation 15	Present value of chain business costs
f_x	$f_x\ formula$	Rate of penetration rate changes in the capital owners' group
f_y	$f_y\ formula$	Rate of penetration rate changes in the chain business group

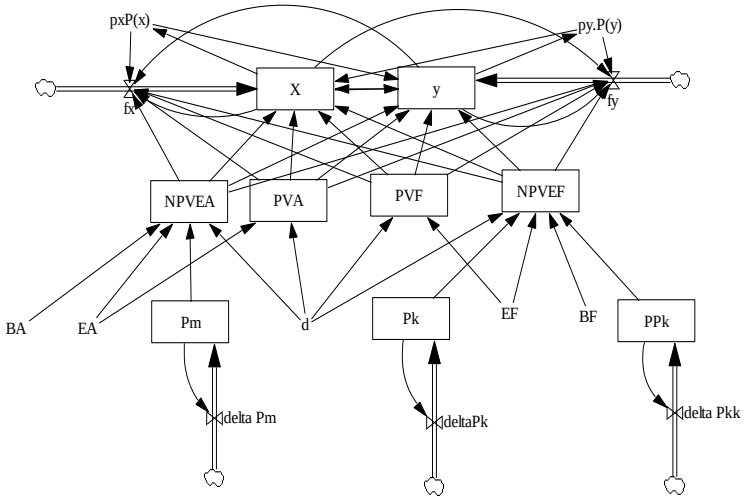
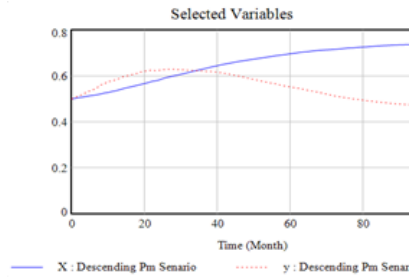


Figure 4-2. Franchising game system

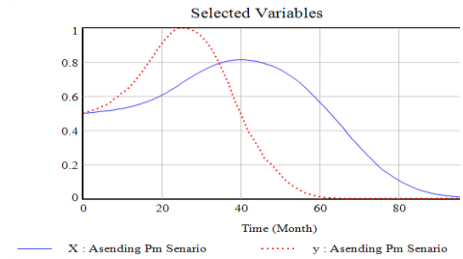
The franchising game system is shown in the figure above. Each arrow indicates which factor affects the other one. X and y represent the probability of choosing a strategy (granting and buying a franchise) in two populations using rate variables. f_x and f_y determine the rate of change in strategies applied by two populations using flow variables. P_m, P_k, and PP_k are risk variables whose values change through cumulative changes during the changing period. Variables, EA, BA, EF, BF, and d are fixed. Furthermore, the effect of every variable on the f_x and f_y can be determined regarding the equations and decision-making tree.

4-2-2. Simulation results and sensitivity analysis

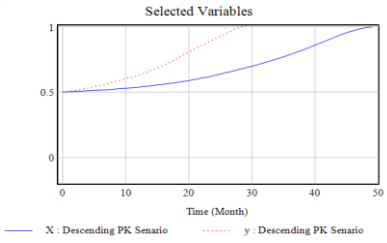
Two hypotheses were expressed to investigate the goals specified in this research. The first hypothesis is that the distribution of branches varies by the influence of risk factors, and the second hypothesis is that the degree of chain business owners' tendency to the franchiser varies by the influence of risk factors. Increasing the probability of the chain business survival leads to an increase in the enterprises' tendency to take franchising and a decrease in their tendency to grant it. Otherwise, these enterprises' tendency to grant franchising increases; but the trend of taking franchising generally would be slower than it's granting. An increase in the probability of independent business survival makes the chain business enterprise companies change their strategy in granting the franchise in comparison to the capital owners and lose their willingness to grant it. If this trend downwards, the capital owners would have more tendency to select and take franchising. However, the chain business owners lose their willingness to grant it. by the increase of the probability of chain contract extension, the chain business owners are more inclined to grant franchising in comparison to the capital owners. With the decrease of this probability, the tendency to take franchising is reduced but the chain business owners considerably change their strategy to grant service franchising. Considering the results of the simulation, which has been done using the financial information of 146 chain businesses of Yaran Daryan store in the intervals of 2013 to 2018, the first and second hypotheses cannot be rejected. Capital owners' and franchised business owners' decision-making in the process of changing the risks has been presented along with the effect of every risky factor on the decision-making. In the given diagrams, the horizontal and vertical lines are representative of the time axis and the strategy selection ratio in the studied populations, respectively. Applying the standardization, the strategy selection ratio was determined at a value between 0 and 1. The value 1 indicates that the population has decided to take franchising, and 0 indicates that none of the capital owners have selected the strategy of granting the franchise royalty. In the case of chain business owners, 1 indicates their willingness to grant franchising, and 0 means that none of the members intend to grant franchising. The dashed line on the graphs is indicative of chain business owners' behavior (y). further, the continuous line is indicative of capital owners' behavior (x).



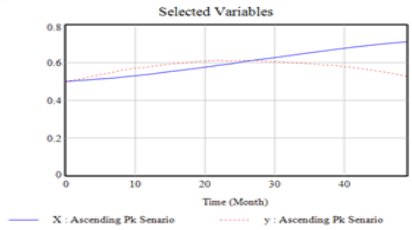
graph 4-2. The behavior of x and y where the probability of an independent business survival has a downward trend.



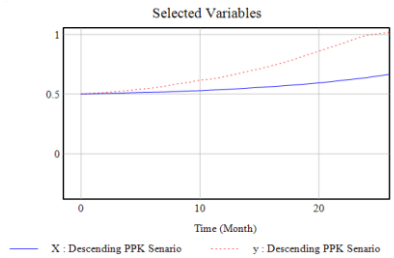
graph 4-1. The behavior of x and y where the probability of an independent business survival has an upward trend.



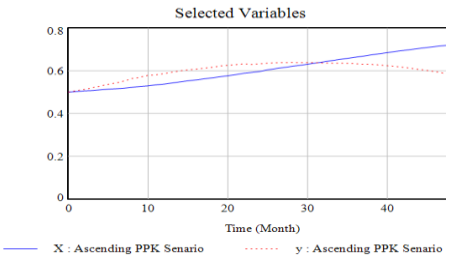
graph 4-4. The behavior of x and y where the probability of franchised business survival has a downward trend.



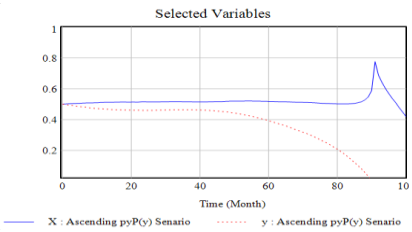
graph 4-3. The behavior of x and y where the probability of franchised business survival has an upward trend.



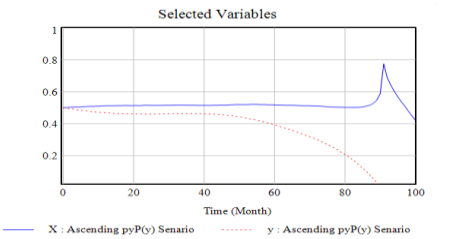
graph 4-6. The behavior of x and y where the probability of franchised business contract extension has a downward trend



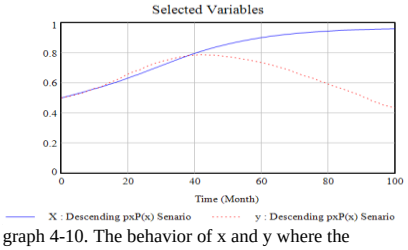
graph 4-5. The behavior of x and y where the probability of franchised business contract extension has an upward trend



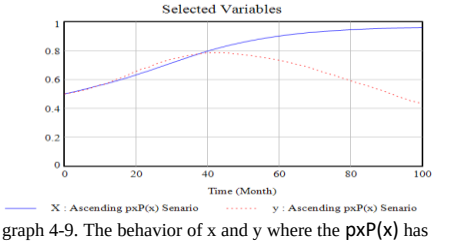
graph 4-8. The behavior of x and y where the pyP(y) has a downward trend



graph 4-7. The behavior of x and y where the pyP(y) has an upward trend



graph 4-10. The behavior of x and y where the pxP(x) has a downward trend



graph 4-9. The behavior of x and y where the pxP(x) has an upward trend

5. Discussion and Conclusion

This research has investigated the decision-making process for investment in service franchising and the effect of related risks in investment in this field. Regarding the risks, the Evolutionary Stable Strategy and the General Bass model were used to model the decision-making process in investment in this field. In an environment where the risks are changing, an evolutionary game system has been used to simulate the dynamics of decision-makers' behavior using the information of 146 chain businesses of Yaran Deryan in the intervals of 2013 to 2018. This simulation was done using Vanta system design software, version 7. The simulation results reveal that the probability of service franchise agreement extension, probability of survival of chain business, and independent business influence the behavior of individuals deciding on this field. Increasing the probability of the chain business survival leads to an increase in the enterprises' tendency to take franchising and a decrease in their tendency to grant it. Otherwise, these enterprises' tendency to grant franchising increases; but the trend of taking franchising generally would be slower than it's granting. An increase in the probability of independent business survival makes the chain business enterprise companies change their strategy in granting the franchise in comparison to the capital owners and lose their willingness to grant it. If this trend downwards, the capital owners would have more tendency to select and take franchising. However, the chain business owners lose their willingness to grant it. by the increase of the probability of chain contract extension, the chain business owners are more inclined to grant franchising in comparison to the capital owners. By the reduction of this probability, the tendency to take franchising is reduced but the chain business owners considerably change their strategy to grant service franchising.

5-1. Suggestions

The results of this research can pave the way for chain business directors and capital owners in the franchising process and help them in risk management planning. Accordingly, they would be able to select better paths and methods for investment concerning the risk impacts.

1. the business managers are suggested to evaluate the opposite party's willingness to continue cooperation by estimating the degree of probability of agreement extension and adopting their appropriate strategy.
2. further, they are suggested to evaluate the probability of selection of specific decisions and potential options by accurately estimating the probability of survival of a business, whether franchised or independent, and evaluate the other party regarding the strategy selection changes so that both parties can have a better understanding of each other's behavior and condition.

5-2. Research limitations

The present research has several limitations. It has only analyzed the decision-making for franchising regarding three risks. It is better to evaluate the other actions and factors related to franchising. The decision-makers' personality has been ignored in solving this problem. The multi-factorial simulation might be the proper method for studying this issue.

References

Persian references

1-Ali Mohammadzadeh and Nasser Sanobar, 2016, the importance and role of franchise in business development, 4th National Conference on Economics, Management, and Accounting.
4-Sahar Parsanifar, 2018, pricing in the three-layer competitive supply chain using game theory approach
7- Ali Pourani, Mahmoud Ahmadpour Daryani, 2009, An Investigation of Factors Affecting Franchise Purchase Intentions.
15- Kamran Kianfar, Habibeh Amini, 2019, green supply chain network design by transportation mode selection, considering advertisement effect and the price elasticity of demand.
16- Seyyedah Zahra Mojaver, Ali Shahandeh, Morteza Rasti, 2019, Game theory approach for pricing new and recycled products and determining the guarantee time in the closed-loop supply chain.
17- Marzieh Khakestari, 2018, analysis of OPEC behavior by the Evolutionary Game Theory approach

Latin References

2-Adams Adeiza, Noor Azizi Ismail, Marlin Marissa Malek, an empirical examination of the major relationship factors affecting franchisees' overall satisfaction and intention to stay, 2017
3-The Economic Impactof Franchised Businesses: Volume IV, 2016 September 15, 2016)
5-Ivan Kotliarov,2008, how does a potential franchisee take decision about franchise purchase: a mathematical model
6-Karlijn J. Nijmeijer,1,2 Isabelle N. Fabbricotti1 and Robbert Huijsman1,2014, making franchising work:a framework based on a systematic review
8-Ying, Ying Fan, Kai-Uwe Ku¨,2016, francine lafontaine§ university of michigan financial constraints and moral hazard: the case of franchising

9- Melih Madanoglua, Gary J. Castrogiovannib, Murat Kizildag,2018, franchising and firm risk among restaurants
10-Hsu, L.-T., Jang, S., 2009. Effects of restaurant franchising: Does an optimal franchise proportion exist? Int. J. Hosp. Manag. 28 (2), 204–211.
11-Muriel Fadairo, Cintya Lanchimba, Josef Windsperger,2016, the trade-off between risk and royalties in franchise contracting
13-Long Chen etc,2018, decision making in crowdfunding under risk analysis
14-
http://www.bassbasement.org/BassModel/Default.aspx
18-Barlas Y, "Formal aspects of model validity and validation in system dynamics", System Dynamics Review, 12(3), 1996, pp.183-210.