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LOCATING THE SALE AGENTS IN SPOKE MODEL THROUGH UNIFORM DISTRIBUTION OF CONSUMERS

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ABSTRACT

Most manufactures sell their products through sale agents and are not directly engaged with consumers. Therefore, determination of optimal location and optimal number of sale agents is highly significant in their planning. The main objective of this paper is theoretical modeling of sale agents and expansion of location models through a method in such a way that the assumptions are closer to reality and could provide the required conditions for selection of optimal location and optimal number of sale agents. To this end, Spoke model of Chen & Riordan (2007) and Lijesen & Reggiani (2013) has been used. In each street *n* consumers have been uniformly located. The results showed under what conditions is the city center the optimal location of sale agents and when the city margin is the optimal location and indicated that the cost of launching sale agents is the main factor in making such decision. Moreover, the results showed that the optimal number of sale agents is a function of the number of streets, the customers' valuation of each unit of product, the price of sale agents, the number of consumers on each street, the earned profit by the sale agents and the cost of launching sale agents.

Keywords: Locating, Sale Agents, Uniform Distribution, Spoke Model.

JEL Classification: L11, L81, C16, C02

INTRODUCTION

In contemporary world, with intensification of the competition between firms and manufacturers, the provision of services in locations intended by the consumers is determining factor in customer attraction and maintenance. The issue of location in economics deals with finding optimal location to achieve the objective defined by the firm. This objective could be earning higher profit, achievement of higher market share, reduction of distribution costs and etc. for manufacturer. The selection of optimal location could guarantee the long-term profitability of the firm such that the survival of the firm or institution would be endangered in case of failure in performing such examinations. Locating has also great effect on the ability of earning and maintenance of competitive advantage (Choo & Mazzrol, 2003). Moreover, if there was a basic method based on scientific trends and specified indices for evaluation of the optimal location and number of sale agents, now there would be no failure of sale agents in most markets and most of them would have not been given permit and license (Unido, 1985).

In contemporary world, the manufacturers mostly do not engage directly with consumers (who are called end users); rather, they sell their products to the agents and distributors who mostly sell their products by retail price. In literature of economics, the agreements between manufacturers and retailers are called vertical restraints. The common agreements between manufacturers and distributors include: exclusive territorial arrangements, exclusive dealership, full-line forcing and resale price maintenance (Shy Oz, 1995)

All these arrangements are along with payment agreements which specify the manner of payment of sold product to the manufacturer. In following, it is assumed that supplying through sale agents is profitable for manufacturers. Although various studies have dealt with non-competitive locating, most of them have been based on geographical methods and this issue has not been taken into account from the economic point of view. The competitive locating models had been developed from Hotelling linear city model in 1929 and have been so far conforming to the real world more and more. By actualization and expansion of this model to circular city model, the location related problems were solved. Following the expansion of these models, Chen & Riordan (2007) and Lijesen & Reggiani (2013) presented spoke model which despite its simplifying assumptions is closer to real world. This model is a natural extension of the classic Hotelling (1929) model to a set of vanes with a center. The difference of spoke model with circular city model is in the junction of streets through center which does not exist in circular city model. The spoke model is an important alternative to the circular city model when the effects of competition are not present (Salop, 1979).

The main aim of this study is theoretical expansion of sale agents locating models. In previous locating models, the city has been considered as linear (one street) with one or two agents. However, in the present study, more real assumptions are considered and a city with S streets, n consumers who are uniformly distributed on each street and K sale agents are included in the research model. Moreover, as far as in real world, the market is not optimally covered by the agents and the number of agents in some areas is high and in some areas is low, finding optimal condition for distribution of agents and the exclusive decision making interval on the number and location of sale agents are the other objectives of this paper. This paper is organized in five parts. After introduction, review of literature will be presented in the second part. The research model is presented in third part and the fourth part includes the selection of location and the number of sale agents. Research conclusion is presented in the fifth and final part.

EXPERIMENTAL RESEARCH BACKGROUND

The oldest location model dates back to Saffle in 1878. Thinkers such as Lanhart in 1882 and Alfred Veber in 1909 completed and proposed new location models by World War II. Competitive positioning models with a game theory approach were first introduced by Hotelling in 1929. Subsequent research is needed to improve one or more of the assumptions of the Hotelling model and to make it more general (such as Salop 1979, Chen & Riordan 2007 and etc). The most important point in these generalizations is that competitive location models are inherently unstable, In other words, with the slightest change in an assumption or a parameter, completely different results will be obtained. It should be noted that the number of theoretical studies in the field of modeling of location models of firms is very limited (mentioned above) and therefore in the following part, some of the studies focusing on the locating of sale agents will be reviewed.

Barahona & Jensen (1998) solved the issue of locating distribution centers along with fixed storage cost with the aim of reducing the costs through integer linear programming (ILP) and Santzig-Wolfe method. Weber (2001) investigated the cooperation with sale representatives in business market and asserted that the cooperation between suppliers and sale agents is rarely taken into account. The main aim of this study was to introduce the relation between supplier and sale agent with tracking of evolution path of supplier and sale agent with introducing an emerging set of design solutions for more efficient cooperation of supplier and sale agent. Chen et al. (2007) in their study solved fuzzy-location multi-criteria optimization of distribution centers with the aim of cost minimization of supply chain, increasing on time decision making power in probable demand and decreasing transportation cost through linear multi-objective planning and two-stage fuzzy decision making.

Osmonbekov et al. (2009) studied the effect of electronic business on coordination of channel, conflict and function of sale agents. Their results were achieved from the questionnaires filled a sample of 216 sale agents of computer products in supply and chain areas. The results indicated that the coordination of the relation between manufacturer and sale agent leads to increase of supply in electronic trade; whole, it might lead to failure of e-trade and negative yield of investment on technology in demand side.

Glynn (2010) studied the moderating effect of trade mark on the manufacturer and sale agent relations. The results indicated that when the sale agents are the agents of small trademarks, the customer's expectation is important; however, the sale agents of small trademarks have higher commitments and trust the manufacturers of small trademarks with higher probability.

Yao et al.(2010) performed the locating of several distribution-allocation centers and solved the issue of inventory with the aim of minimizing the total expected cost, determination of the number and location of storehouses and demand allocation of them through mixed integer nonlinear planning, approximation, conversion methods and repetitive innovative method. They showed that this proposed method functions well in small scale. Awasthi et al. (2011) studied the location of urban distribution centers with the aim of selection of evaluation criteria of each location and at the end, selection of the best location for implementation of a distribution center from the existing potential points and solved this issue using fuzzy TOPSIS method. Barth (2014) evaluated the effect of government's programs on the automobile market in automobile sale agents in Germany. The main data of this study was a classified sample in annual financial statements of 69 sale agents in Germany. In this study, the qualitative and quantitative financial data were simultaneously used and the results showed that the combined analysis of qualitative and quantitative data in samples will yield better results. Moreover, the results showed that reduction of interest costs has been a completely effective factor on the operation of automobile sale agents industry in Germany. Xiao & Ju (2016) studied the effective factors on the structure of automobile agents in China. The experimental results of their study showed that the decisions of manufacturer in retail network depend on the number of sellers. Moreover, they specified under what condition the manufacturers will select just one sale agent or several sale agents for their brands. Gupta et al. (2016) investigated the issue of local trademark agent in sale agents networks and showed that four features of being native, entrepreneurship, consultant and compatibility are the main effective factors on the preferences of trademarks of sale agents. Moreover, these findings indicated that there is a relation between preferring trademark of sale agent and loyalty to trademark of sale agent which is beneficial for business market management and could effectively improve this relation.

Despite various studies on non-competitive locating, a great part of studies have been based on geographical methods and this issue has been rarely studied from economics and the theoretical expansion of locating models of agents has been rarely considered in studies. Moreover, the existing locating models have been planned based on simplification assumptions such as linear city (one street) and the presence of one or two agents. Therefore, this paper intends to propose a theoretical modeling with assumptions that are closer to reality and could provide the ground for selection of optimum number of agents and optimum distribution of their locations.

PRESENTATION OF MODEL

Assume a city consisting of *s* streets where *n* consumers are uniformly distributed. All the streets of this city are connected just through center, i.e. in order to go to another street, the consumer is inevitable to pass the city center to reach the intended street which means that if the consumer intends to purchase from the firm located in another street, there is no way except to directly pass the street where he is located to the street where the firm is located (Lijesen & Reggiani, 2013). This city could be the same as the cities located in mountainous areas that are distributed around a center (Shy, 1995). To simplify, we assume that the exclusive firm attracts the highest incline to consumers' payment through sale agents. Moreover, assume that the number of consumers on each street is equal to each other, shown by *n*, which are uniformly distributed in the length of each street (Figure 1). The maximum number of sale agents is *s+1* (there is at most one sale agent on each street and there could be one sale agent at the center).

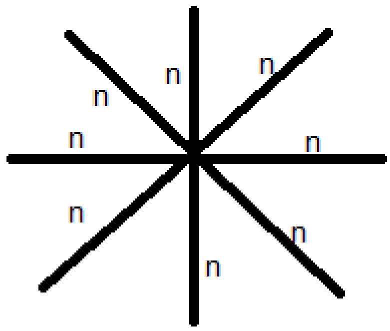

Figure1. One city with 8 streets and *n* consumers on each street
Source: research calculations

Every radius of the above figure to the city center is taken as a street. The length of each street from center to the end equals to $\frac{1}{2}$. The total number of consumers in the city (located on all streets) could be considered as N (N= n .s). For simplification, production costs is considered as equal to zero (c= 0). The manufacturer sells each unit of product by p^M price to each agent that is determined by the manufacturer.

Each sale agent is inevitable to invest F > 0 to create sale agents. At the end, it is assumed that transportation cost per unit of distance is *t=1*.
In this condition, the issue for monopolist is determination of optimal location for sale agent (when he wants to have a sale agent or several sale agents) and the decision making interval on the number of sale agents. In addition, assume that *B* indicates the main value considered for product by each consumer and $B > \frac{1}{2} + x_j + p^D$ is the desirability function of each *i* consumer, i= 1, 2, …, N defined as follow:

$$U^i \begin{cases} B - x_c - p^D & \textit{In case of purchase from center agency} \\ B - (\frac{1}{2} - x_i) - p^D & \textit{In case of purcase from the agency at its street} \\ B - \left(\frac{1}{2} + x_j\right) - p^D & \textit{In case of purchase from agencies of other streets} \\ 0 & \textit{In case of failure in purchase} \end{cases} \qquad (1)$$

Such that p^D , is the received price by sale agent from final consumer. Moreover, these relations indicate that if the consumers purchase from the sale agent located at the center or any other street, all will pay the same p^Dprice.

The above desirability function is extracted such that:
If the consumer is located in one of the streets and the sale agent at city center, in order to purchase from sale agent at the center, he should pay the product price in addition to transportation costs (in respect to distance from city center).

If the consumer is located in one of the streets and the sale agent is also on the same street, in order to purchase from sale agent in its street, he should pay the product price in addition to transportation costs (in respect to distance from sale agent on the same street).

If the consumer is located in one of the streets and the sale agent on another street, in order to purchase from sale agent in other street, he should pay the product price in addition to transportation costs (first transportation cost to city center and then transportation cost to sale agent).

In case of lack of purchase, he will achieve desirability equal to zero.
The monopolist confronts with the following states in deciding on the location and the number of sale agents: 1. launching a sale agent at city center or margin areas; 2. launching a sale agent at city center or several sale agents in suburb areas or margins; 3. launching an agent at city center or a sale agent at city center and several sale agents in suburb areas.

Concerning the above conditions, some questions will arise including, where is the optimal location of sale agent in this city? Will the sale agent be launched at city center or in another street? In what condition is it better to launch sale agent at city center than margins?

In what condition is the sale agent at city center more profitable for monopolist than several agents in margin areas? In what condition will the monopolist agree with launching a sale agent at city center and several sale agents in suburb areas instead of just one sale agent at city center? At the end, how will the monopolist decide on the number and location of sale agents? In following, these questions will be studied and the results will be analyzed.

SELECTION OF LOCATION AND NUMBER OF SALE AGENTS

The aim of monopolist is to specify first where to select the location of sale agents in which part of city, and secondly, how many sale agents to launch. To this end, in follow, the monopolist's options will be studied in various conditions.

First state: Launching a sale agent at city center or suburb area

First this question will be studied that if the monopolist intends just to have one sale agent, where is the optimal location, at city center or city margin? The answer to this question is presented in theorem 1:

Theorem 1:

If the monopolist wants to launch just one sale agent and the following condition is established,

$$F \geq \frac{2\,(p^D)^2 + p^D\left(1 - \frac{S}{2} - 2B\right) - (n-1)\gamma}{n-1}$$

Then the optimal location of sale agent will be at city center rather than city margin.

Proof:

First we will obtain the situation of indifferent consumer in respect to purchase from sale agent at city center or his failure in purchase. Concerning the same length of streets and therefore the same situation of indifferent consumer on each street, in order to achieve the indifferent consumer in this state, we have:

$$\mathrm{B} - x_c - \mathrm{p}^{\mathrm{D}} = 0 \;\Rightarrow \hat{x}_c = B - p^D$$

If the sale agent is located at city center, based on the assumptions of the model, all consumers with non-negative surplus ($\mathrm{B} - x_c - \mathrm{p}^{\mathrm{D}} \geq 0$) will purchase the intended good. Concerning the constraint related to achievement of non-negative profit γ by the sale agents, the maximum price that the monopolist could demand from sale agent will be achieved from the following equation:

$$\pi^{D} = \frac{s}{n}\ \hat{x}_c\ (p^D - p^{M}) - F = \gamma \Rightarrow \frac{s}{n}\ (B - p^D)\ (p^D - p^{M}) - F = \gamma$$

Where there are s streets on which the consumers are uniformly distributed $(\frac{1}{n})$; therefore, the following equation will be achieved:

$$\Rightarrow p^{M} = \frac{n\ (s\ B\ p^D - s\ (p^D)^2 - F - \gamma)}{s\ (B - p^D)} \qquad (2)$$

The monopolist profit in this state equals to:

$$\pi^{M} = \frac{s}{n}\ (B - p^D)\ p^{M} = sBp^D - s\ (p^D)^2 - F - \gamma \qquad (3)$$

Now, we assume that the sale agent is located on one of these streets, in this state, n consumer located on the same street where the sale agent is located (in case of purchase) will have a surplus of $p^{D} + \frac{1}{2} - B$ (purchase from the sale agent on its street), other consumers (in case of purchase) will also have a surplus of $B - \frac{1}{2} - p^{D}$ (these consumers are inevitable to pass city center and refer to another street where the sale agent is located due to lack of sale agent on their own street or center). The maximum price that the monopolist could demand from sale agent will be achieved from the following equation:

$$\pi^{D} = \left[\frac{1}{n}\ \hat{x}_i\ (p^D - p^M) + \frac{(s-1)}{n}\ \hat{x}_j\ (p^D - p^M)\right] - F = \gamma$$

$$\Rightarrow [\frac{1}{n}\ (p^D + \frac{1}{2} - B)\ (p^D - p^M) + \frac{(s-1)}{n}\ (B - \frac{1}{2} - p^D)\ (p^D - p^M)]\ - F = \gamma \qquad (4)$$

Therefore:

$$p^{M} = \frac{2\ B\ p^D + n\ F + n\ \gamma - (2-s)(p^D)^2 - p^D + \frac{1}{2}\,s\ p^D - s\ B\ p^D}{(s-2)\ p^D - 1 + 2\ B - s\ B + \frac{1}{2}\,s} \qquad (5)$$

Therefore, the monopolist profit in this state equals to:

$$\pi^{M} = (2\ -\ s)(p^D)^2 - 2\ B\ p^D +\ p^D -\ \frac{1}{2}\ s\ p^D +\ s\ B\ p^D\ - n\ F -\ n\ \gamma \qquad (6)$$

By comparison of equations 3 and 6, the monopolist will launch sale agent at city center rather than margin when the following relation is established:

$$sBp^D - s\,(p^D)^2 - \mathrm{F} - \gamma \ \geq (2 - s)(p^D)^2 - 2\,B\,p^D + p^D - \tfrac{1}{2}\,\mathrm{s}\,p^D + \mathrm{s}\,\mathrm{B}\,p^D - n\,F - n\,\gamma \qquad (7)$$

By simplification and solving of equation (7) is becomes clear that:

$$F \geq \frac{2\,(p^D)^2 + p^D\left(1 - \frac{s}{2} - 2B\right) - (n-1)\gamma}{n-1}$$

Second state: Launching a sale agent at city center or several agents at margin areas

Now, this question arises that whether the manufacturer gives permit to one sale agent at city center or several sale agents at margins? It seems that the irrecoverable costs should be an important factor in launching sale agents and the following theorem will confirm it.

Theorem 2

The presence of a sale agent at city center for monopolist is more profitable than the presence of several sale agents (K) in margins if:

$$F \geq \frac{2K\,(p^D)^2 + p^D\left(K - \frac{s}{2} - 2KB\right) - (nK-1)\gamma}{nK-1}$$

Proof: Beforehand, we know that if there is just one sale agent at city center, then based on equation (3) the monopolist profit is equal to:

$$\pi^{\mathrm{M}} = \frac{s}{n}\,(B - p^D)\,\mathrm{p}^{\mathrm{M}} = sBp^D - s\,(p^D)^2 - \mathrm{F} - \gamma$$

Now, assume that the monopolist has several sale agents (K) in various streets. Here, as far as K sale agents sell their products to the consumers at the same streets and there are *n* consumers in each street that in case of purchase will have a surplus of $\mathrm{p^D} + \frac{1}{2} - \mathrm{B}$ and the rest S-K streets have no sale agents, the consumers will have a surplus of $\mathrm{B} - \frac{1}{2} - \mathrm{p^D}$ in case of purchase, therefore, the profit of sale agents will be equal to:

$$\Pi^{\mathrm{D}} = \sum_{\mathrm{i=1}}^{\mathrm{K}} \pi_{\mathrm{i}}^{\mathrm{D}} = [\frac{K}{n}\,\hat{x}_i\,(p^D - \mathrm{p^M}) + \frac{s-K}{n}\,\hat{x}_j\,(p^D - \mathrm{p^M})] - \mathrm{KF} = \mathrm{K}\gamma$$

$$\Rightarrow [\tfrac{K}{n}\left(\mathrm{p^D} + \tfrac{1}{2} - \mathrm{B}\right)(p^D - \mathrm{p^M}) + \tfrac{s-K}{n}\,(\mathrm{B} - \tfrac{1}{2} - \mathrm{p^D})\,(p^D - \mathrm{p^M})] - \mathrm{KF} = \mathrm{K}\gamma \qquad (8)$$

Where, $K\gamma$ is the total profit of the whole sale agents (γ unit for each sale agent). By solving and simplification of the above equation, the following result will be achieved:

$$p^{M} = \frac{2K\,B\,p^{D} - (2K-s)(p^{D})^{2} - Kp^{D} + \frac{1}{2}s\,p^{D} - s\,B\,p^{D} + n\,KF + nK\,\gamma}{(s-2K)\,p^{D} - K + 2K\,B - s\,B + \frac{1}{2}s} \quad (9)$$

Therefore, the monopolist's profit in this state equals to:

$$\pi^{M} = (2K - s)(p^{D})^{2} - 2\,KB\,p^{D} + Kp^{D} - \frac{1}{2}\,s\,p^{D} + s\,B\,p^{D} - n\,KF - n\,K\gamma \quad 10)$$

The comparison of equations 3 and 10 shows that if the monopolist agrees with launching one sale agent at center instead of several sale agents at margins and the following equation is established:

$$sBp^{D} - s\,(p^{D})^{2} - F - \gamma \geq (2K - s)(p^{D})^{2} - 2\,KB\,p^{D} + Kp^{D} - \frac{1}{2}\,s\,p^{D} + s\,B\,p^{D} - n\,KF - n\,K\gamma$$

Solving this inequality in respect to F will yield the following result:

$$F \geq \frac{2K\,(p^{D})^{2} + p^{D}\left(K - \frac{s}{2} - 2KB\right) - (nK-1)\gamma}{nK-1} \quad (11)$$

This result could have main consequences for monopolist who wants to distribute several sale agents in city.

This theorem confirms the theorem presented by Mathewson & Winter (1986) who claimed that if the irrecoverable costs related to launching sale agent are high, then the manufacturer will launch just one sale agent at city center. Moreover, it is shown that in case of small city, the manufacturer just agrees with launching a sale agent at city center (Shy, 1995). In this state, concerning the monopolist's profit function, the maximum optimal number of sale agents equal to:

$$K \leq \frac{s\,B\,p^{D} - s\,(p^{D})^{2} - \frac{1}{2}\,s\,p^{D}}{2Bp^{D} - 2\,(p^{D})^{2} - p^{D} + nF + n\gamma}$$

Third state: Launching a sale agent at city center and several sale agents at city margins

Now the next question could be proposed in this way that when would the monopolist agree with launching a sale agent at city center and several sale agents at city margins rather than just one sale agent at city center? The answer to this question is presented in theorem 3.

Theorem 3

The monopolist agrees on launching one sale agent at city center and several sale agents at margin instead of just one sale agent at city center, if:

$$F \geq \frac{2K\,(p^D)^2 \;+\; p^D\left(\frac{K}{2} - 2KB\right) - (nK + n - 1)\gamma}{nK + n - 1}$$

Proof: We already know that if there is a sale agent at city center, then, according to equation (3) the monopolist profit equals to:

$$\pi^{\mathrm{M}} = \frac{s}{n}\,(B - p^D)\,\mathrm{p}^{\mathrm{M}} = sBp^D - s\,(p^D)^2 - \mathrm{F} - \gamma$$

Now this issue will be studied that if the monopolist wants to have a sale agent at city center and several (K) sale agents at city margins, here, as far as the consumers are located at the same steers as K sale agents are located and there are *n* consumers in each street which in case of purchase have the surplus of $\mathrm{p^D} + \frac{1}{2} - \mathrm{B}$ and the rest s-K streets without sale agents whose consumers will have a surplus of $B - p^D$ in case of purchase (purchase from central sale agent), therefore, the profit of sale agents will be equal to:

$$\Pi^{\mathrm{D}} = \sum_{\mathrm{i=1}}^{\mathrm{K}} \pi_{\mathrm{i}}^{\mathrm{D}} + \pi_{\mathrm{C}}^{\mathrm{D}} = [\tfrac{K}{n}\,\hat{x}_i\,(p^D - \mathrm{p^M}) + \tfrac{s-K}{n}\,\hat{x}_c\,(p^D - \mathrm{p^M})] - (\mathrm{K}+1)\mathrm{F} = (\mathrm{K}+1)\gamma \qquad (12)$$

where, π_C^D indicates the profit of sale agents located at city center, $(\mathrm{K}+1)\gamma$ is total profit of all sale agents including those located at city center and *K* sale agents located at streets (γ is the profit unit of each sale agent). By solving and simplification of the above equation:

$$\mathrm{p^M} = \frac{2K\,B\,p^D - (2K - s)\left(p^D\right)^2 - \frac{K}{2}p^D - \mathrm{s\,B}\,p^D + n\,(K+1)F + n(K+1)\,\gamma}{2K\,B - (2K-s)\,p^D - \frac{K}{2} - s\,B} \qquad (13)$$

Therefore, the monopolist's profit in this state equals to:

$$\pi^{\mathrm{M}} = (2K - s)(p^D)^2 - 2\,KB\,p^D + \frac{K}{2}p^D + \mathrm{s\,B}\,p^D - n\,(K+1)F - n(K+1)\,\gamma \qquad (14)$$

The comparison of equations 3 and 14 shows that the monopolist agrees with launching one sale agent at city center and several sale agents at margins instead of just one sale agent at city center, when the following equation is established:

$$sBp^D - s\,(p^D)^2 - \mathrm{F} - \gamma \le (2K - s)(p^D)^2 - 2\,KB\,p^D + \frac{K}{2}p^D + s\,B\,p^D - n\,(K+1)F - n(K+1)\,\gamma$$

By solving this inequality in respect of F, the following result will be achieved:

$$F \le \frac{2K\,(p^D)^2 + p^D\left(\frac{K}{2} - 2KB\right) - (nK+n-1)\gamma}{nK+n-1} \quad (15)$$

This equation shows that if the recoverable cost related to launching sale agent is sufficiently low, then, the monopolist will agree with launching one sale agent at city center and several sale agents at margins instead of just one sale agent at city center. In this state, concerning the profit function of monopolist, the maximum number sale agents equals to:

$$K \le \frac{s\,B\,p^D - s\,(p^D)^2 - nF - n\gamma}{2Bp^D - 2\,(p^D)^2 - \frac{1}{2}\,p^D + nF + n\gamma}$$

At the end, it should be noted that the results of three theorems 1, 2 and 3 confirms the work of Mathewson & Winter (1986) who showed that in a linear city, if the city is big enough, i.e. if $2\mathrm{T} < \mathrm{F} < 4\mathrm{T}$[1], one unit sale agent will be established at city center and if $\mathrm{F} < 2\mathrm{T}$, then the agents will be established at city margin. Moreover, in a small city ($\mathrm{F} > 4\mathrm{T}$), just one sale agent will be launched at city center (Shy, 1995).

CONCLUSION

One of the main effective factors on decision making of individuals and firms is location which is significantly influential on their profitability and survival. In today's world, it is observed that market is not fully covered in some areas or the number of firms in an area is more than required. The issue of sale agent is one of the main issues in this regard. In this paper, the deficiencies and weaknesses of previous models in simplification of non-competitive location models, especially on the manner of consumers' distribution, the number of streets, location of sale agents and the optimal number of sale agents have been studied and discussed. The results showed that under certain condition, if there is just one sale agent, then, the optimal location of sale agent firm will be at city center rather than margins. Moreover, it is shown that if the irrecoverable costs are sufficiently high, the presence of one sale agent at city center is more profitable than several sale agents at margins for monopolist. In addition, under certain condition, the monopolist agrees with launching one sale agent at city center and several sale agents at city margins rather than just one sale agent at city center.

[1] The intended city is called a big city, if F < T and the intended city is called a small city if F > T

The results also showed that the optimal number of sale agents is a function of the number of streets, the desirability of goods consumption, the price of sale agents, the number of agents on each street, the earned profit by the sale agents and the costs of launching sale agents. Therefore, the importance of these results for manufacturers who intend to license sale agents is determined both in the optimal number and location.

CONFLICT OF INTEREST

We, the authors of this article, declare that in relation to the publication of the presented article, they have completely avoided publishing ethics, including avoiding plagiarism, misbehavior, falsification of data, or double submission and publication, and there are no commercial interests in this regard.

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