ANALYSIS OF BRAND LOYALTY WITH MARKOV CHAINS

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ABSTRACT

Markov chains, applied in marketing problems, are principally used for Brand Loyalty studies. Especially, Markov chains are strong techniques for forecasting long term market shares in oligopolistic markets. The concepts of marketing studies are thought as discrete from the time and place viewpoint and so finite Markov chains are applicable for this kind of process.

The purpose of this study is to examine the consumer Brand Loyalty of sportshoes with markov chains method. In this study, the data to examine the Brand Loyalty have been obtained from 531 undergraduate students in Istanbul, Turkey.

INTRODUCTION

The basic concepts of Markov Chains Method has been introduced by the Russian mathematician, Andrey Andreyevich Markov, in 1970. After this date many mathematicians have conducted research on Markov Matrix and has helped it to develop. Markov Chains Method is used intensively for research conducted on such social topics as the brand selection of customers, income distribution, immigration as a geographic structure, and the occupational mobility (for examples and references please see Frydman 1984; Geweke , Marshall and Zarkin 1986; Singer and Spilerman 1976, 1977). In marketing, Markov Chains Model is frequently used for topics such as “brand loyalty” and “brand switching dynamics”. Although it is very complicated to transform marketing problems in to mathematical equations, Markov Chains Method comes out as the primary and most powerful technique in predicting the market share a product will achieve in the long term especially in an oligopolistic environment and in finding out the brand loyalty for a product.

MARKOV CHAINS METHOD

The stochastic process is defined as a set of random variables $\{X_t\}$ where the unit time parameter **t** is taken from a given set T. All the special values the random variables take on are named as a state. Therefore, a state variable name is given to the X_t random variable. The set that accepts each X_t random variable is called an "example space" or a "state space". If the S state space includes whole number discontinuous values then it is called a stochastic process that is separate stated and these separate stated spaces may be countable and finite or countable and infinite. If X_t is defined in the $t \in (-\infty,\infty)$ interval it is classified as a stochastic process that is real valued. Being a special type of stochastic process, the Markov Chain,

$$P(X_{t+1} = x_t \setminus X_0 = x_0, X_1 = x_1,\ldots, X_t = x_t) = P(X_{t+1} = x_{t+1} \setminus X_t=x_t); \qquad (t=0, 1, ...)$$

is a chain that has Markovian property and the Markovian property stresses that given the present (or preceding) state, the conditional probability of the next state is independent of the preceding states. $P(X_{t+1} = x_{t+1} \setminus X_t = x_t)$ are conditional probabilities and are named as transitional probabilities.

If the relationship

$$P(X_{t+1} = x_{t+1} \setminus X_t = x_t) = p(X_1 = x_{t+1} \setminus X_0 = x_t); \qquad (t=0, 1, 2, \ldots)$$

exists, the one step transitional probabilities are usually shown as P_{ij} and named as stationary and the transitional probabilities that have this property do not change in time and the relationship

$$P(X_{t+1} = x_{t+1} \setminus X_t = x_t) = P(X_n = x_{t+1} \setminus X_0 = x_t); \; t = 0, 1, 2, \ldots; n=0, 1, 2, \ldots$$

becomes valid. These conditional probabilities are named as n-step transitional probabilities and are shown as $P_{ij}^{(n)}$. $P_{ij}^{(n)}$ explains that the process that is in the **i** state, will be in the **j** state **n** steps later. This is because $P_{ij}^{(n)}$ are conditional probabilities and must be non-negative and also the relationship given below is valid.

$$\sum_{j=0}^{m} P_{ij}^{(n)} = 1; \qquad i = 1, 2, \ldots; n = 0, 1, \ldots$$

At this point n-step transitional probabilities matrix, $S = \{S_n, S_1,\ldots,S_m\}$ state space may be shown as

$$P^{(n)} = \begin{array}{c} \\ S_0 \\ S_1 \\ \vdots \\ S_m \end{array} \begin{array}{c} \begin{array}{cccc} S_0 & S_1 & \cdots & S_m \end{array} \\ \begin{bmatrix} P_{00}^{(n)} & P_{01}^{(n)} & \cdots & P_{0m}^{(n)} \\ P_{10}^{(n)} & P_{11}^{(n)} & \cdots & P_{1m}^{(n)} \\ \vdots & \vdots & \ddots & \vdots \\ P_{m0}^{(n)} & P_{m1}^{(n)} & \cdots & P_{mm}^{(n)} \end{bmatrix} \end{array}$$

If n = 1 is taken, then a stochastic process is a Markov Chain that has Markovian propertys. In this research, only the Markov Chains that are finite and have stationary transitional probabilities will be considered.

Chapman – Kolmogorov Equations

The $P_{ij}^{(n)}$ n-stepped transitional probabilities stress the probability of transition from the i state to the j state at the n (>1) step.

The Chapman –Kolmogorov equations,

$$P_{ij}^{(n)} = \sum_{k=0}^{m} P_{ik} P_{ki}^{(n-1)} ; \qquad \forall \text{ i, j and } 0 \le m \le n$$

help in forming a method for calculating the a-step transitional probabilities. In the special occasions where m = 1 and m = n - 1, the equations

$$P_{ij}^{(n)} = \sum_{k=0}^{m} P_{ik} P_{kj}^{(n-1)} ; (\forall \text{ i, j and n}) \qquad \text{and} \qquad P_{ij}^{(n)} = \sum_{k=0}^{m} P_{ik}^{(n-1)} P_{kj}$$

are obtained.

These equations stress the fact that the n-step transitional probabilities may be calculated from the one step transitional probabilities. For example, for n=2

$$P_{ij}^{(2)} = \sum_{k=0}^{m} P_{ik} P_{kj}$$

is obtained and a $P_{ij}^{(2)}$ are the elements of the p^2 matrix. p^2 is obtained from the multiplication of P by P. Therefore, the n-step probabilities matrix may be calculated from the

$$p^n = p^* \cdot p^{n-1} = p^{n-1^*} \cdot p$$

relationship.

The long-term behavior of the Markov Chain

The ergodic chain (matrix) is defined as a chain where from one state it is possible to transform into all other states and where it contains no zero element that is at the powers of the P regular chain (matrix). Therefore it can be concluded that a regular matrix is ergodic but the opposite is not true. For the case where a T matrix is obtained by P having sufficiently big powers, if all of the line vectors of this T matrix are the same, it could be said that the P transitional matrix reaches a balance and there exists a balancing vector. A regular Markov Chain contains a single balance vector.

If $v = [v_1, v_2, \ldots v_m]$ is a probability vector, then the relationship vp = v is valid and v is named as a balance vector.

BRAND LOYALTY

Customer loyalty has been a major focus of strategic marketing planning and offers an important basis for developing a sustainable competitive advantage – an advantage that can be realized through marketing efforts (Dick and Basu 1994). It is reported that academic research on loyalty has largely focused on measurement issues (Kahn et al., 1986) and correlations of loyalty with consumer property in a segmentation context.

Many studies have been conducted on brand loyalty. However, in all of these studies brand loyalty (e.g. repeat purchase) has been measured from the behavioral aspect without considering the cognitive aspects.

However, brand loyalty is not a simple uni-dimensional concept, but a very complex multi-dimensional concept. Wilkie (1994) defines brand loyalty as a "favorable attitude toward, and consistent purchase of a particular brand". But such a definition is too simple for understanding brand loyalty in the context of consumer behavior. This definition implies that consumers are brand loyal only when both attitudes and behaviors are favorable. However, it does not clarify the intensity of brand loyalty, because it excludes the possibility that a consumer's attitude may be unfavorable, even if he/she is making repeat purchases. In such a case, the consumer's brand loyalty would be superficial and shallow – rooted.

Another definition of brand loyalty that compensates for the incompleteness of Wilkie's definition (1994) was offered by Jacobs and Chestnut (1978). They provided a conceptual definition where brand loyalty is (1) biased (i.e. non random), (2) behavioral response (i.e. purchase), (3) expressed over time, (4) by some decision making unit, (5) with respect to one or more brands out of a set of such brands, and is a function of psychological (decision-making, evaluative) processes.

Based on the behavioral element of brand loyalty, Lyong (1998) provides an operational definition that "brand loyalty is a function of a brands' relative frequency of purchase in both time-independent and time dependent situations".

Brand loyalty represents a favorable attitude toward a brand resulting in consistent purchase of the brand over time (Asseal, 1992). Two approaches to the study of brand loyalty have dominated marketing literature. The first is an instrumental conditioning approach, that views consistent purchasing of one brand over time as an indication of brand loyalty. Repeat purchasing behavior is assumed to reflect reinforcement and a strong stimulus-to-response link. The research that takes this approach uses probabilistic models of consumer learning to estimate the probability of a consumer buying the same brand again, given a number of past purchases of that brand. This is a stochastic model rather than a deterministic model of consumer behavior, as it does not predict one specific course of action. Rather, the prediction is always in probability terms.

The second approach to the study of brand loyalty is based on cognitive theories. Some researchers believe that behavior alone does not reflect brand loyalty. Loyalty implies a commitment to a brand that may not be reflected by just measuring continuous behavior.

Several authors have made distinctions between brand loyalty (in terms of repeat purchasing), and brand commitment (implying some degree of high involvement). The brand loyalty that is defined here is the observed behavior of repeat purchasing of the same bran.

Behavioral measures have defined loyalty by the sequence of purchases (purchased Brand A give times in a row) and/or the proportion of purchases, in the event that the customer is satisfied with the brand purchase and repeats it in a relatively short period of time (Charnatony and Mc Donald 1992).

In order for managers to cope with the forces of disloyalty among consumers, there is a need to have an accurate method to measure and predict brand loyalty. However it was impossible to obtain an objective and general measurement of brand loyalty, because brand loyalty has been defined in many different ways and operationalized by a number of scholars. The diverse definition and operationalization of brand loyalty in the past has been due to the various aspects of brand loyalty (e.g. behavioral and attitudinal brand loyalty).

A transition matrix was used as a forecasting instrument for determining the market environment in the future by Styan and Smith in a research conducted in 1964. This paper shows the potential of using Markov Chains in determining the intensive transitional probabilities for a new product. These probabilities may help marketing management by comparing the intensiveness gained in a certain period of time with product life cycle. Thereby it may be possible to take the situation under control by taking corrective action.

Although the Markov Chains Method is quite successful in forecasting (predicting) brand switching, this model still has some limitations:

1. Customers do not always buy products in certain intervals and they do not always buy the same amount of a certain product. This means that in the future, two or more brands may be bought at the same time.
2. Customers always enter and leave markets, and therefore markets are never stable.
3. The transition probabilities of a customer switching from an i brand to an j brand are not constant for all customers, these probabilities may change from customer to customer and from time to time. These transitional probabilities may change according to the average time between buying situations.
4. The time between different buying situations may be a function of the last brand bought.
5. The other areas of the marketing environment such as sales promotions, advertising, competition etc. were not included in these models.

RESEARCH METHODOLOGY

The purpose of this study is to examine the brand loyalty of consumers for sports shoes using the Markov Chains Method. For this study data has been collected for brand loyalty from 531 undergraduate students in Istanbul, Turkey.

In order to analyze brand loyalty using Markov Chain Method, 11 sport shoes brands having the highest market share have been selected and a survey containing 8 questions has been conducted to 531 undergraduate students in different universities in Istanbul. Two of the questions in the survey are demographic questions, defining sex and income of the students. The next two questions are about the 11 brands that form the foundations of the Markov Matrix where students were asked the present brand of sport shoes they own and to put in order (rank order) the brand preferences they have for their next sport shoes purchase (among the 11 brand selected). The rest of the questions are about the marketing variables that form the basis of the consumers behavior when making a brand selection. These questions that shape the behavior of consumers were designed in the 5 point Likert Scale format (1 = strongly disagree, 5 = strongly agree).

ANALYSIS OF RESULTS

Since there are 12 states in this study, the state space is in the form,

S = {Adidas, Nike, Reebok, Puma, Slazenger, Kappa, Diadora, Ellese, Le coq sportif, Asix, Converse, other}

As a result of the survey conducted on university students, the data collected about the relationship between their existing and next purchase brand preferences were transformed into a Markov Matrix which is shown in Table 1.

Table 1:

	Adidas	**Nike**	**Reebok**	**Puma**	**Slaz-enger**	**Kappa**	**Di-adora**	**Ellese**	**Le coq Sportif**	**Asix**	**Con-verse**	**Other**
Adidas	0,042	0,563	0,204	0,024	0,06	0,006	0,012	0,006	0,012	0,006	0,018	0,047
Nike	0,472	0,016	0,276	0,057	0,041	0,008	0,033	0,008	0	0,008	0,008	0,073
Reebok	0,360	0,488	0,012	0,023	0,047	0	0,012	0	0,012	0,012	0	0,034
Puma	0,438	0,250	0	0	0,123	0	0	0	0,063	0,063	0,063	0
Slazenger	0,395	0,289	0,184	0	0,053	0	0,026	0,053	0	0	0	0
Kappa	0	0,5	0,25	0	0	0,25	0	0	0	0	0	0
Diadora	0,111	0,333	0	0,111	0,111	0,111	0	0	0	0	0,111	0,112
Ellese	0	0,6	0	0	0,2	0,20	0	0	0	0	0	0
Le coq sportif	0	0,571	0,286	0,143	0	0	0	0	0	0	0	0
Six	0,167	0	0,167	0,167	0,167	0,166	0	0	0,166	0	0	0
Converse	0,4	0,2	0	0	0,20	0	0	0	0	0	0,20	0
Other	0,309	0,4	0,055	0	0,036	0	0,036	0,18	0	0	0,018	0,128

This matrix shows only the existing and the next brand preference of the students. In order to show the t time parameter it is necessary to measure the transformation (switching) between brands following a long period of time which forces the usage of sufficiently big forces of P. This brings us to such a T matrix that all line vectors of this matrix become the same. In the study conducted, the balance vector is given in Table 2.

Table 2:

Brand Names	**Probability**
Adidas	0,2895
Nike	0,3232
Reebok	0,1707
Puma	0,0342
Slazenger	0,0562
Kappa	0,0127
Diadora	0,0195
Ellese	0,0082
Le coq sportif	0,0091
Asix	0,0085
Converse	0,0163
Other	0,0518

The balance vector has been analyzed using the QSB computer program. Upon examining the table and interpreting the brand preferences, it can easily be seen that with a value of 0,3232 Nike is the preferred brand compared to others in a long period of time. This means that students show the most brand loyalty towards Nike. Adidas follows Nike with a value of 0,2895. The computer program SPSS/PC (Version 6.0) was used for analyzing the data in this study.

The variables that determine the existing brand preferences are given in Table 3. As can be seen from Table 3, when making a brand preference, quality, image and the availability of the brand in the market are determinants that are the most important.

Table 3:

	Strongly agree	**Strongly disagree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
Quality of the product	44,4	47,5	3,0	1,8	3,4
Brand image	18,7	47,6	14,9	11,7	7,1
Market share of the brand	7,5	36,5	25,4	17,7	12,8
Advertising of the brand	13,8	39	15	20,8	11,5
Satisfaction after buying process	42,0	47,1	3,7	3,9	2,9
Accessibility of the brand	29,7	46,2	10,9	9,0	4,2
Sales price of the brand	10,4	30,0	30,8	19,2	9,6
Marketing of the product in different varieties	18,8	45,7	18,0	12,1	5,5
Availability of the brand in other sport articles	19,5	42,9	14,9	14,1	8,7
Other	32,4	25,4	9,9	21,1	11,3

Table 4:

	Strongly Agree	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
New introduction of the brand in to the market	6,0	12,5	16,0	39,0	26,5
Desire to try the new brand	9,8	35,7	16,4	26,4	11,7
Discount sales of the brand	13,1	34,2	19,0	23,2	9,8
Promotions of the brand	9,8	39,0	18,3	23,2	9,8
Renewing the image of the brand	9,2	34,1	24,9	22,6	9,2
Advertising of the brand	14,3	46,9	15,7	15,2	7,9
Sales campaigns of the brand	14,6	40,7	22,1	14,6	8,0
Other	43,4	22,4	15,8	3,9	14,5

The preference of the second brand that is thought of being used (bought) is determined by the brand advertisements and the desire to try the brand at least once.

The effect of sex on marketing variables given in Table 5 and Table 6 on the existing and future brand preferences has been tested with t-Test.

Table 5: The impact of gender on brand choices

	t-value	Probability	Difference
Quality of the product	-0,21	0,835	Not significant
Brand image	0,11	0,915	Not significant
Market share of the brand	2,34	0,020	Significant
Advertising of the brand	1,14	0,257	Not significant
Satisfaction after buying process	1,11	0,267	Significant
Accessibility of the brand	3,80	0,000	Not significant
Sales price of the brand	0,83	0,409	Not significant
Marketing of the product in different varieties	1,74	0,083	Not significant
Availability of the brand in other sport articles	0,36	0,717	Not significant

Table 6: The impact of gender on alternative brand choices

	t-value	Probability	Difference
New introduction of the brand in to the market	-0,55	0,586	Not Significant
Desire to try the new brand	0,75	0,456	Not Significant
Discount sales of the brand	0,93	0,351	Not Significant
Promotions of the brand	0,05	0,958	Not Significant
Renewing the image of the brand	1,70	0,089	Not Significant
Advertising of the brand	1,92	0,055	Not Significant
Sales campaigns of the brand	-0,67	0,501	Not Significant

According to the test results, a significant difference was not detected. The demographic variables of the students that has joined the survey is given in Table 7.

Table 7: Demographic variables

SEX	VALID PERCENT
Female	48,0
Male	52,0

Table 8:

INCOME	VALID PERCENT
250 million TL and less than 250 million TL	7,0
251-500 Million TL	21,5
501-750 Million TL	26,0
751 and more than 751 Million TL	45,4

CONCLUSION

In this study, a survey was conducted on 531 undergraduate students from different universities in İstanbul and the result were transformed into a Markov Matrix and the switching between brands (brand loyalty) in a long period of time was observed. Due to the fact that the matrix that is formed is a systematic matrix, it was possible to reach a balance

condition. According to the mentioned balance condition, it was observed that the students are brand loyal and the brand preferences intensified on Nike and Adidas Brands. Although there are some disadvantages to the Markov Matrix, it is obvious that the Markov Matrix is a important technique in showing the tendency of a consumer to be brand loyal in a long period of time and in determining the market share of the brands.

In this study it was observed that in forming the tendency of customers on becoming brand loyal, the marketing variables play an important role.

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