Chapter 5

The Store Choice Behavior of Rural and Urban Customers for the Purchase of Staple Goods

5.1 Introduction

Retail store has been one of the growth area in the global economy. The rapid growth of retailing store scenario has been characterized by increasing competition and emergence of increasingly new retailing formats (Popkowski Leszczyc T.L, Sinha and Timmermans, 2000). The study of consumer store choice behavior has been an important area of research for many decades. Consumer decision to shop at a supermarket is in general based on location, assortment and quality of merchandise, service, price image and promotions. The store choice behavior of shoppers has been found to be quite similar to the brand choice behavior of the consumers, with a difference being the incorporation of the spatial dimension in store choice (Sinha and Benerjee, 2004). Though retail stores have been gaining in influence over manufactures of branded grocery products, the way consumers choose between different stores has not been studied as much as brand choice (Fotheringham, 1988). There are two types of choices that consumers regularly make dominates the marketing literature i.e the choice of particular brands and the choice of particular store (Fotheringham, 1988). Cunningham (1961) noted that consumer’s store loyalty was often not exclusive or undivided, but little
quantification or extension of his results has been done. Another view in store choice literature focuses on the store attributes. Price is one of the easily noticeable attributes and considerable work exists (Bell, Ho and Tang, 1998; Freyman, 2002; Arnold, Oum and Tigert, 1983), on how the price of store offerings, affects the store choice. The role of store atmospherics, store ambience and store environment has also been studied as a part of store attributes. A number of studies (Kotler, 1973; Baker, Grewal and Levy, 1992) have studied these and found important relation with consumer store choice. Then there are studies which look at how store environment cues influence consumer’s store choice decision criteria, such as perceived merchandise value and shopping experience (Baker, Parasuraman, Grewal and Voss, 2002). There are another view of store choice, gives more importance to the consumer side, and has looked at the consumer attributes, as well as the situational and tasks associated with the shopping. So the store choice has been seen in the context of the risk reduction strategies of the shoppers (Mitchel and McGoldrick, 1996; Mitchell and Harris, 2005). The work on store choice has also been done on the role of situational factors (Wu, Petroshius and Newell, 2004; Mattson, 1982) and the task-store attribute relationship (Kenhove, Wule, and Waterschoot, 1999). It has also been seen that interpurchase time of shopping trips is one of the significant character of the store choice (Kahn and Schmittlein, 1989). It has also been seen that there exists a logical relationship between a house hold shopping behavior and store preference (Bell and Lattin, 1998). Most of the studies analyze the relationships between consumer store-choice behavior and a set of variables assumed to
influence their shopping choice behavior (Popkowski Leszczyc and Timmermans, 1997). There are some studies relate to aspects of consumer choice behavior to store attributes (Jain and Mahajan, 1979; Gautschi, 1981; Ghosh, 1984; Guy, 1987; Borgers and Timmermans, 1987; Fotheringham, 1988).

In market research, it is necessary to study the queue of customer in stores of rural and urban area because the different grocery stores differ in their sizes, capacity of services etc, so the different sizes of queues are formed in different grocery stores. Queuing theory has been applied in many research investigations by the researchers. The grocery stores of rural and urban area are private and it is operated by the owner itself. There are small numbers of employees in the stores. The flow of customers in the different stores should decide the influence that the service providers have over the customers. This study compares the idiosyncratic nature of the queues formed in the measure of rural and urban stores and the comparison is made between the different grocery stores of rural and urban area.

Various numbers of studies are referred in review of literature section of the present study in the context of customer impatience. Palm (1953) studied queuing systems with impatient customers by using M/M/C model. He assumed that each customer in the queue follow the exponential distribution. Daley (1965) analyzed an integral equation for the limiting waiting-time distribution function that gives the solution for the cases of deterministic and distributed impatience. He considered GI/G/1 queue in which if the customers entering the system has to wait for long time, he/she may leave the system before starting or completing
his/her service. Halfin and Whitt (1981) observe that heavy traffic in multi-server
queues in which there are number of servers is allowed to increase along with the
traffic intensity but the steady state probability that all the servers are busy is held
fixed. Baccelli et al (1984) noticed the GI/G/1 queue and he find that each
‘aware’ customer, upon arrival and leaves the queue immediately if he knows that
his total waiting time is beyond the threshold. Altman and Borovkov (1997)
observed that a customer leaves the system for impatience of customers in a
retrial queue if its cumulative break time exceeds some random threshold. Hasija
et al (2005) studies a service system with gatekeepers who diagnose a customer
problem and then either refer the customer to an expert or attempt by
determining the staffing levels and referral rates that minimize the sum of
stuffing, customer waiting, and mistreatment costs. They also compare the
optimal gatekeeper system with a system staffed with only experts. Jongbloed et
al (2001) observe a queuing model with Poisson arrivals having an unknown
varying arrival rate and compute the prediction intervals for the arrival rate and
compute the waiting time of the consequences for the occupancy level of the call
center. Tiritiroglu et al (2008) studied a consumer’s purchase behavior who
admires a cognitive framework in such a way as to select queuing model which
can be used to assess the credibility of a consumer expression of purchase
intention to proceed into purchase action.
5.2 Grocery Stores as Small Business

A grocery store is a store which is established primarily for the retailing food. The owner of the grocery store stocks different kinds of foods from various places and cultures, and sells the goods to the customers. Large grocery stores stock products other than food, such as household items. The grocery store mainly sells fast moving consumer goods (FMCG). Traditionally, grocery stores have offered credit to their customers, a system of payment that works on trust. According to Deakins et al (2009) a small business is a business that is privately owned and operated with small number of employees and relatively low volume of sells. They characterized as a small business the owner himself/herself is a manager also. Since, they are managed in a personalized fashion and have knowledge of what is actual going on in the business. He/she take effective participation in all matter of business decision taking. The grocery stores are operated by the owner himself/herself. Generally, grocery stores have the quality of small business. Again grocery stores are basically provides services to local and regional demand.

5.3 Conceptual Frame Work

The studies on store choice have mostly dealt with individual choices and the studies have investigated the drivers of store choice. Researchers have found that store choice and shopping trip decisions tend to differ for individuals and households as a result of personal result of personal differences household composition and activity patterns (Popkowski Leszczyc and Timmeremans, 1997;
Kim and Park, 1997). It is also realized that most of the store visits are not the visit by an individual family members, but accompanied by spouse/children. Evidence already exists that most of the shopping takes place on weekends (Kahn and Schmitten, 1989) and also that at times it is aggregated with other tasks and takes place as a multipurpose trip. In Indian context, it is observed that shopping is mostly a family activity, but any shopping activity needs to be preceded by store choice.

With the growing influence of the retail in influencing the consumer choice, the retail strategy is very important from the manufacturer’s point of view and thus the store choice becomes a matter of concern to the manufacturer. In addition with the high growth in the organized retail in the recent times, as well as increasing competition for a retailer the store choice becomes an area of concern. If the family has an influence in deciding the store choice, the loyalty and the patronage it is very relevant that the perspective of the family be taken in any future research in this area.

The main objective of this chapter is to compare the store choice behavior of rural and urban using nested logit model. The reason of using nested logit model is that there are two category of consumer choice of store, when they purchased products from the store. First one consumer switch store from one to another i.e a consumer currently purchased product from that store which is not visited by the consumer in the store previous purchase occasion. This one categorized as “Store Switch”. Again another category “Same Store” this
indicates that consumer purchase the products from that store which he visited earlier. These two categories are considered as a second level. Again the different alternatives are considered as first level. It is more depicted from the following figure.

Figure 5.1 A Two Level decision Tree
Again, this study focuses the different properties of the queues that formed in the grocery stores of rural and urban area. The reason is that, One of the important criteria of every businessman is to satisfy his/her customers. When a customer comes to a store, then the service providers offer the necessary service to them. The flow of customers comes to the store in rush manner than a queue form. Now questions arises here is

i) How much time a customer has to be waiting in the queue?

ii) Is the rural waiting time of a customer different to the urban one?

iii) Are the rural stores more ideal than the urban stores?

iv) Is there any sitting arrangement in rural and urban stores?

v) Does the storekeeper satisfy the customer?

This paper emphasizes the above questions. If the storekeeper is unable to minimize the waiting and there is no sitting arrangement in the stores than customers have most chance to switch the stores to other stores.

This study compares the gap between the customer patience and servers service rate between rural and urban customers. The customer is faced with quite dilemma when he/she has to wait for a long time. If a customer wait for a long time, he/she might be loose his/her patience and switch to another shop. Our approach might be to compare the different queues which are in the different stores of rural and urban area.
Figure 5.2 Switching Customer or Impatience Customer Model.
Queuing theory has been applied in many research investigations by the researchers. There are a large number of queue of customer formed in the several stores. This study gives the appropriate idiosyncratic measure of rural and urban stores. These stores are different in their sizes, capacity of services etc. So their satisfaction levels to the customers are also different. Some of them gives more satisfaction with best service facility, minimized the waiting time of the customers, sitting facility is available in the stores. So there is more chance to keep on the customer in the particular shop. This study looks into the comparison of the characteristics of queues which is formed in different stores of rural and urban area.

5.4 Objective of this Chapter

The main objective of this chapter is to explore the store choice behavior of rural and urban consumer. The objectives can be placed as follows:

(i) Compare the store choice behavior of rural and urban.

(ii) The different factors which influence the store choice behavior are also evaluated.

(iii) Compare the selected properties of the queues that are formed in the grocery stores of rural and urban area.
5.5 Hypotheses of this chapter

In the study, we are comparing the customer of rural and urban in south Assam. Based on the objectives the major hypotheses are as follows:

H0: There is no significant difference between the attributes of rural and urban consumer in store choice behavior.

Nested logit model is used to compare the store choice behavior of rural and urban consumer.

5.6 Data Collection

For this study the data collection is done for store switch behavior and the study of queue that form in the grocery stores of rural and urban. For the study of store choice behavior the sampling scheme and method of data collection is provided in the section 1.9 of chapter 1.

Again, for the study of different properties of queue, the data is collected from Cachar district which is situated in south Assam, India. This study emphasizes the comparison of both rural and urban grocery stores. A sample of 25 grocery stores from urban area and 14 grocery stores from rural area are selected by judgment sampling. The sampling is performed separately for rural and urban area. For rural area, the village Duarbondh, Irongmara, Chottojelenga and Durgakona is selected by judgment sampling. For urban area, ward no 16 and 17 was selected by judgment sampling.
5.7 Methodology

Logit model and Multinomial Logit frame work has been quite popular in marketing literature. Even for household the probability of store choice has been modeled within the multinomial frame work in a number of studies is done by the researchers on store choice (Arnold, Oum and Tigert, 1983; Bucklin and Lattin, 1992; Grover and Srinivasan, 1992). Nested Logit (NL) models have been used to analyze travel and transportation modes (Hensher, 1991; Sobel, 1990), welfare effects of changes in environmental quality. (Morey, Rowe and Watson, 1993), migration models (Falaris, 1987) and also in the valuation of environmental amenities (Kling and Thomson, 1996).

An assumption of the multinomial, the conditional logit models and nested logit model is that the choices are independent of one another. The independence from irrelevant alternatives (IIA) derives from the assumption that the stochastic disturbance terms are independent and identically distributed. The NL model was developed to deal with the restrictive assumption of independence between all the alternatives. The nested logit model allow us to maintaining the IIA selectively i.e. within nests (Greene, 1997).

5.7.1 Nested Logit Models

Nested logit models are a generalization of the multinomial logit model. In a two level nesting structure, suppose there are \( j=1,2,\ldots,J \) alternatives. Now, if these \( J \) alternatives can be partitioned into \( K \) groups say \( G_k, k=1,2,\ldots,K \).
If \( y \in \{1, 2, \ldots, J\} \) is the indicator for the realized outcome and \( j \) is an element of group \( G_k \), then the probability of \( y=j \) can be decomposed into

\[
P(y = j) = P(y \in G_k).P(y = j \mid y \in G_k)
\]

### 5.7.2 Model Formulation

Suppose a consumer is choice a store at \( t^{th} \) purchase occasion. At \((t+1)^{th}\) purchase occasion the consumer may switch to another store or active at the same store. So, two categories can be done

(i) Store Switching ;

(ii) Same store

Which is indexed by \( i, i=1, 2 \) (upper level) and switching behavior of different store is considered as lower level.

Our formal model of the two-level logit model as demonstrated by Greene (2003) and modified to our

\[
P[\text{Switching Behavior } j, \text{Branch } i] = p_{j|i} \times p_i
\]

Where \( i \) refer to type of category – store switching and store loyal and \( j \) refers to the store switching behavior of a customer.

The conditional probability \( p_{j|i} \) can be defined as
\[ P_{j|i} = \frac{\exp(\beta X_{j|i})}{\sum_{j=1}^{J} \exp(\beta X_{j|i})} \]

and the marginal probability as,
\[ P_i = \frac{\exp(\gamma Z_{i} + \tau_i I)}{\sum_{i=1}^{I} \exp(\gamma Z_{i} + \tau_i I)} \]

Thus, we have
\[ P[\text{switching Behavior } j, \text{Branch } i] = \frac{\exp(\beta X_{j|i})}{\sum_{j=1}^{J} \exp(\beta X_{j|i})} \times \frac{\exp(\gamma Z_{i} + \tau_i I)}{\sum_{i=1}^{I} \exp(\gamma Z_{i} + \tau_i I)} \]

Where \( X_{j|i} \) refers to the variables to the \( j^{th} \) switching behavior of the \( i^{th} \) category and \( Z_i \) refers to the variables of the \( i^{th} \) category. The term \( I_i \) is the inclusive value (link function between the two levels) for the \( i^{th} \) branch. It is calculated as the log of the denominator of the second level i.e
\[ I_i = \ln \sum_{j=1}^{J} \exp(\beta X_{j|i}) \]

The inclusive value links the two levels of the nested logit model by bringing information from the bottom level into the upper level. The parameter \( \tau_i \) is a measure of the correlation among the random error terms due to unobserved attribute of store switching behavior of consumer and is used as a test for random utility maximization in nested logit model. The expression \( \tau_i \) captures the feedback between the lower level and upper level of the model.
The coefficient \( \tau_i \) of \( I_i \) is called log sum co-efficient. It is important that the inclusive value enters as an independent variable in the first level.

The parameters \( \alpha, \beta, \gamma \) are then estimated using full information maximum likelihood (FIML) simultaneously information. The model is consistent with utility maximization if the condition \( 0 \leq \tau_i \leq 1 \) is satisfied. If \( \tau_i = 1 \), the nested collapses to the Multinomial Conditional Nested Logit model.

FIML method of nested logit model estimates all parameters simultaneously maximization the unconditional likelihood

\[
\log L = \sum \log p(j \mid i) + \log p(i)
\]

\( Z \) and \( p|z| \) are the test statistic respectively. Here the null hypotheses is as follows

\( H_0 : \) An individual predictor’s regression coefficient is zero given that the rest of the predictors are in the model.

The test statistics \( z \) is defined as the ratio of the coefficient to the corresponding standard error of the predictor. The test statistic follows the standard normal distribution which is used to test against a two-sided alternative hypothesis that the coefficient is not equal to zero.
5.7.3 Methodology for Comparing the Characteristics of Queue form in Rural and Urban Store

Again to compare some of the selected properties of queues that formed in the grocery stores of rural and urban area, the following methodology is adopted:

The methodology of the study adopted for comparing the different characteristics of queue which are formed the different grocery stores of rural and urban are as follows

(a) The investigator waited for 15 minutes in the grocery stores.

(b) The investigator notes down that how many numbers of customers arrive in the store within 15 minutes.

(c) Similarly, the investigator notes down that how many number of customers served completely by the server within 15 minutes.

(d) The investigator also note down the number of server in each store.

(e) The investigator also notes down the availability of the sitting arrangement in each store.

The above process is repeated for each grocery stores of rural and urban.
5.7.4 Queuing System

Queues (or waiting lines) are an unavoidable component of modern life. The customers are required to stand physically in queues in grocery stores, banks, department stores, amusement parks, movie theaters etc. The term queuing theory is introduced in the year 1909, when a Danish Engineer A.K.Erlang (1878-1929) published paper relating to the study of jamming in telephone traffic (Medhi, 1982). The word queuing system comes when there is a queue i.e. when customers come in random manner at a service facility in need of some kind of service. The term queue means waiting line. Queuing system is also referred as the flow of customers or units for service facility forming the queue if service is not immediately available and leaving the system after being served. There are certain characteristics of the queuing system are given (a) Inter arrival time; (b) Service time; (c) Queue Discipline; (d) The number of service channels, (e) System capacity and (f) Size of the calling population.

5.7.5 Assumption for the Model Specification

The customers come to the grocery stores and formed queue. Assume that the inter arrival time of the customer follows exponential distribution with parameter $(\lambda)$. Because the inter arrival time of customer in the system does not affect next inter arrival time of customer i.e. the consecutive inter arrival time of customer are independent and identical with each other. Similarly, the service times of the servers to the customers are also independent and identical. So, assuming that the service time follows exponential distribution with parameter
Again, this study gives that average servers in urban grocery stores are found 3 and the average customer in rural grocery stores are found 2. Assume that the servers $c = [3\text{ (urban); } 2\text{ (rural)}]$ work parallel and independently of each. Further there efficiencies are also same. So, service time of these servers distributed accordingly exponential $\mu$. Assuming that there is no restriction in system capacity and queue discipline is first in first out (FIFO). Assuming that the size of the calling population is infinite. It is also important to note that only one queue build and the customer in front of the queue and nearest to the service facility will proceed to that storekeeper who becomes free at the earliest.

From the above assumption it is clear that $M/M/C$ model are followed by the queue of the customer when they goes to the grocery stores. A comparison is done by using $M/M/C$ model between rural and urban customers.

Let, the random variable $x_i, i=1, 2, \ldots, n$ denoted the service time of the grocery stores. The random variables are $x_i$’s are independently and identically distributed. The random variable $x_i$’s follows the exponential distribution with mean $\mu$. Let, $\mu_n$ denote the service rate of the system when the system is in state $n$. Then the assumption of the model gives that,

$$
\mu_n = \begin{cases} 
  n\mu & \text{if } n \leq c \\
  c\mu & \text{if } n > c 
\end{cases}
$$
Figure 5.3 State transition-rate diagram for an $M/M/C$ Model

(Medhi, 1982)

From the state transient rate diagram gives the steady state equations of the system are given below:

**Table 5.1 Steady State Equation Table**

<table>
<thead>
<tr>
<th>State</th>
<th>Steady state equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$\lambda p_0 = \mu p_1$</td>
</tr>
<tr>
<td>1</td>
<td>$\lambda p_0 + 2 \mu p_2 = \lambda p_1 + \mu p_1$</td>
</tr>
<tr>
<td>2</td>
<td>$\lambda p_1 + 3 \mu p_3 = \lambda p_2 + 2 \mu p_2$</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>c-1</td>
<td>$\lambda p_{c-2} + (c+1)\mu p_c = \lambda p_{c-1} + (c-1)\mu p_{c-1}$</td>
</tr>
<tr>
<td>c</td>
<td>$\lambda p_{c-1} + c\mu p_{c+1} = \lambda p_{c} + c\mu p_{c}$</td>
</tr>
<tr>
<td>c+1</td>
<td>$\lambda p_{c} + c\mu p_{c+2} = \lambda p_{c+1} + c\mu p_{c+1}$</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>n</td>
<td>$\lambda p_{n-1} + c\mu p_{n+1} = \lambda p_{n} + c\mu p_{n}$</td>
</tr>
</tbody>
</table>
When the system is in the state 0 then steady state equation is given below

\[ \lambda p_0 = \mu p_1 \]

\[ \Rightarrow p_1 = \frac{\lambda}{\mu} p_0 \]

...(5.1)

For the state \( n \), for \( n=1, 2, \ldots c \)

\[ \lambda p_n + n \mu p_n = \lambda p_{n-1} + (n + 1) \mu p_{n+1} \]

...(5.2)

Again, for the state \( n \), for \( n=c, c+1, c+2, \ldots \)

\[ \lambda p_{n-1} + c \mu p_{n+1} = \lambda p_n + c \mu p_n \]

.... (5.3)

Putting \( n=1 \) in equation (5.2) gives,

\[ \lambda p_1 + c \mu p_1 = \lambda p_0 + 2 \mu p_2 \]

\[ \Rightarrow p_2 = \frac{1}{2!} \rho^2 p_0 \]

where , \( \rho = \frac{\lambda}{\mu} \)

Putting \( n=2 \) in equation (5.2) gives,

\[ \lambda p_2 + 2 \mu p_2 = \lambda p_1 + 3 \mu p_3 \]

\[ \Rightarrow p_3 = \frac{1}{3!} \rho^3 p_0 \]
In general,  
\[ p_n = \frac{1}{n!} \rho^n p_0 \quad ; \quad n = 1, 2, \ldots, c-1. \]

Again, putting \( n = c \) in equation (5.3) gives that,

\[ \lambda p_{c-1} + c \mu p_{c} = \lambda p_{c} + c \mu p_{c} \]

\[ \Rightarrow p_{c+1} = \frac{\rho^{c+1}}{c!} p_0 \]

Putting \( n = c+1 \) in equation (5.3) gives that,

\[ \lambda p_{c} + c \mu p_{c+1} = \lambda p_{c+1} + c \mu p_{c+1} \]

\[ \Rightarrow p_{c+2} = \frac{\rho^{c+2}}{c+1!} p_0 \]

In general,

\[ p_n = \frac{\rho^n}{c^{n-c} c!} p_0 \quad ; \quad n = c, c+1, \ldots \]

**Evaluation of \( p_0 \)**

It is defined that, \( \sum_{n=0}^{c} p_0 = 1 \)

\[ \Rightarrow \sum_{n=0}^{c-1} p_n + \sum_{n=c}^{c} p_n = 1 \]

\[ \Rightarrow \sum_{n=0}^{c-1} \frac{\rho^n}{n!} p_0 + \sum_{n=c}^{c} \frac{\rho^n}{c^{n-c} c!} p_0 = 1 \]
\[ p_0 = \left[ \sum_{n=0}^{c-1} \frac{\rho^n}{n!} + \frac{\rho^c}{c!} (1 - \frac{\rho}{c})^{-1} \right]^{-1} \]

### 5.7.6 Distribution of Waiting Time in Queue

Let, the random variable \( T \) denote the waiting time of the queue of an arriving customer. Then the two cases arises

1. The arriving customer will not required waiting in the queue;
2. The arriving customer finds the system is busy.

**Case 1:**

The arriving customer will not require waiting in the queue. In that case the customer finds the system is in state 0, 1, 2, \( \ldots \) \( c-1 \). The probability that the arriving customer will not required to wait in the queuing system denoted by \( P(T=0) \). Therefore,

\[ p(T = 0) = \sum_{n=0}^{c-1} p_n = \sum_{n=0}^{c-1} \frac{\rho^n}{n!} p_0 \quad \ldots \quad (5.4) \]

**Case 2:**

The arriving customer finds that the system is in busy i.e. the arriving customer finds that the system is in state \( c, c+1, \ldots \infty \). The probability that the arriving customer wait in the queuing system is denoted by \( P(T>t) \). Therefore,
Chapter 5 The Store Choice Behavior of Rural and Urban Customers for the Purchase of Staple Goods

\[ P(T > t) = \sum_{n=c}^{\infty} p(\text{number of customer in the system is n})p(T > t/\text{number of customer is n}) \]  \hspace{1cm} \ldots (5.5)

Now,

\[ p(T > t/\text{number of customer in the system is n}) \]

\[ = p(\text{Waiting time in the queue of the arriving customer exceeds t / It finds that n customer in the system on arrival}) \]

\[ = p(X_1 + X_2 + \ldots + X_{n-c+1} > t) \]  \hspace{1cm} \ldots (5.6)

Again from the memory less property of exponential distribution emphasized that

\[ X_i \sim \text{exp}(c\mu); \ i = 1, 2, \ldots n-c+1. \]

Since \( X_i \)'s are independently and identically distributed random variable.

Therefore,

\[ \sum_{i=1}^{n-c+1} X_i \sim \text{Gamma} (n-c+1, \mu) \]  \hspace{1cm} \ldots (5.7)

Applying (5.7) to get the probability of the waiting time in the queue of the arriving customer exceeds \( t \) given that the customer finds that there are \( n \) customer in the system on arrival i.e.

\[ p(T > t/\text{number of customer in the system is n}) = \frac{(c\mu)^{n-c+1}}{\Gamma(n-c+1)} \int_{t}^{\infty} e^{-(c\mu)z} z^{n-c} \, dz \]
Using equation (5.8) in (5.5) gives

\[ p(T > t) = \frac{\rho^c}{c!} \left(1 - \frac{\rho}{c}\right)^{-1} e^{-\left(1 - \frac{\rho}{c}\right)c \mu t} p_0 \]  

...(5.9)

Differentiating (5.9) with respect to \( t \) gives the probability distribution function,

\[ f(t) = \frac{p_0}{(c - 1)!} \frac{\rho^c}{\mu} e^{-c \mu t \left(1 - \frac{\rho}{c}\right)} p_0 \]  

...(5.10)

The probability distribution of the waiting time in the queue is given by the equation (5.4) and (5.10).

5.7.7 Expected Waiting time in the queue

Expected waiting time of customer in the queue is given by,

\[ W_q = \frac{\rho^c}{(c - 1)! \mu (c - \rho)^2} p_0 \]

5.7.8 Expected Waiting time in the system

It is observed that,

Waiting time in the system = Waiting time in the queue + Service time.

Therefore,
5.7.9 Expected number of customer in the queue

Little (1961) gives an exact proof of the formula of the equation \( L = \lambda W \) which is known as Little’s formula. Using this formula to find the average number of customer in the queue. According to Little’s formula

\[
L_q = \lambda W_q = \lambda \frac{\rho^c}{(c-1)! \mu (c-\rho)^2} p_0
\]

5.7.10 Expected number of customer in the System

Similarly the expected number of customer in the system is given by

\[
L_s = \lambda \left[ \frac{\rho^c}{(c-1)! \mu (c-\rho)^2} p_0 + \frac{1}{\mu} \right]
\]

5.7.11 Utilization Ratio of the traffic intensity

The utilization ratio of traffic intensity shows that in what extent the server of the grocery store is being utilized i.e. how busy are the store. It is calculated by the following formula

\[
p = \frac{\lambda}{c \mu}
\]

Where, \( P = \text{Utilization Ratio} \). \( \lambda = \text{Arrival Rate} \). \( \mu = \text{Service Rate} \).
5.7.12 The Probability that the Store is Idle

The probability that the store remain idle can be denoted by \( p_0 \) and is calculated by the following formula

\[
p_0 = 1 - \frac{\lambda}{c\mu}
\]

This probability gives that how much time the store remaining idle.

5.8 Findings and Analysis

Based on the above methodology the different parameters are estimated using STATA 10.
### Table 5.2 Factors Affecting the Bottom Levels with the Shopkeeper

| Service is Better | Relation with the Shopkeeper | Quality is Good | Price Minimum | Near House | Home Delivery | Credit Facility | Availability in the Store | Behavior of the Shopkeeper | Coefficient Value of Z | P>|Z| |
|-----------------|-------------------------------|----------------|---------------|------------|--------------|-----------------|--------------------------|---------------------------|--------------------------|-------|
| Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural |
| 0.4157398 | 1.783242 | 0.069105 | 0.55 | 0.0873162 | 0.1264749 | 0.4204801 | 0.1325297 | 0.3069182 | 0.0643677 | 0.07094235 | 0.3209274 |
| 2.41 | 0.17 | 0.34 | 0.40 | 4.28 | 208 | 0.416 | 0.016 | 0.007 | 0.014 | 0.101 | 0.735 |
| 341 | 0.06 | 0.05 | 0.35 | 0.07 | 0.006 | 0.345 | 0.006 | 0.005 | 0.007 | 0.113 | 0.016 |

- If things become bad they can be returned
- Price Minimum
- Quality is Good
- Availability in the Store
- Credit Facility
- Home Delivery
- Relation with the Shopkeeper
- Service is Better
### Table 5.3

| Type of Equation | Store Switching Factors of Store Switching Behavior | Coefficient Value of $Z$ | $P>|Z|$ |
|------------------|-----------------------------------------------------|--------------------------|--------|
| Urban            | 0.0645867                                           | 12.96881                 | 4.783653 |
| Rural            | 0.0008474                                           | 0.760407                 | 0.01557 |

### Table 5.4

<table>
<thead>
<tr>
<th>In-store Purchase Time in Days</th>
<th>Family Members</th>
<th>Income</th>
<th>Switching Behavior</th>
<th>Factors of Store Switching</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>0.038</td>
<td>0.253</td>
<td>3.33</td>
<td>0.0471972</td>
</tr>
<tr>
<td>0.020</td>
<td>0.084</td>
<td>1.64</td>
<td>0.17</td>
<td>0.0453139</td>
</tr>
<tr>
<td>0.000</td>
<td>0.026</td>
<td>4.73</td>
<td>4.73</td>
<td>0.0008474</td>
</tr>
<tr>
<td>Urban</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.0008474</td>
</tr>
<tr>
<td>Rural</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.0008474</td>
</tr>
<tr>
<td></td>
<td>$</td>
<td>Z</td>
<td>&lt;P$</td>
<td>Value of $Z$</td>
</tr>
</tbody>
</table>
The first equation specifies the dependent variable of store choice and the alternative specific variables

(i) Availability in the store

(ii) Behavior of the shopkeeper

(iii) Credit facility

(iv) Home delivery

(v) If things become bad they can be returned

(vi) Near house

(vii) Price is minimum

(viii) Quality is good

(ix) Relation with the shopkeeper

(x) Service is better

These above mentioned alternative specific variables vary among the bottom level alternatives. These estimates are listed in the Table 5.2. For the second equation, we specify the variable “Type” this variable identifies the first level alternatives i.e. whether the consumer of rural and urban are interested in store switching or purchase from the same store. The variable of store switching which captures, how the consumer of both the places switching store to store in different purchase occasion.
Chapter 5 The Store Choice Behavior of Rural and Urban Customers for the purchase of Staple Goods

From the Table 5.2 it is observed that in the first level, the following factors

(i) Availability in the store,

(ii) Home delivery,

(iii) Near house

(iv) Relation with the shopkeeper,

(v) Service of the store

is found to be significant. This indicates that urban consumer are more influence that the store whose products are available with different brands. Again, the store gives the facility of home delivery than urban consumer are more interested to choice that particular store. Distance is also another significant factor to choice a particular store i.e. if the store is near to the consumer home than the consumers choose the store. It is also observe that relation of the shopkeeper is one of the most important factors for the urban consumer. Store service quality is also reasonable factor to chose that the store.

In case of the rural store behavior, it is observed that quality of the products in particular store must influence on rural consumer. Credit facility of a particular store one of the most significant determinant for the rural consumer. This indicates that most of the rural consumers choose a store for the credit facility of that store. It is also observed that the as similar as urban consumer the distance from the consumer’s house to the store is one of the significant
determinants for the rural consumer. It is also observed that the rural consumer are most influence by the store who take the minimum price of the product comparison to the another store from the consumer. Table 5.2 revealed that rural consumers are always wishes the good relation with the shopkeeper which is also a significant factor. The rural consumer influenced by the storekeeper service. They want best services from the store keeper.

From the table 5.3, it is obtain a parameter estimate for each variable for each alternative at this level. Except that one set of parameters for one alternative is set to zero. In this case, the variable “Same store” is considered as base line category. Here we obtain that the factor income of the household and the inter purchase time (in days) found to be significant factors. The positive coefficient of the factors on “Store switching behavior” indicates that the consumers of urban place are more likely to switch the store than the same store. Again in case of rural consumer, the brand switching behavior is affected by the factors income of the household, size of the family members and the inter purchase time (in days) they purchase the products. Here the factors family member and inter purchase time (in days) found to be negative coefficient. This indicates those rural consumers are more likely to stay with the same store.

Table 5.4 gives the coefficient of the inclusive value. Both the cases of rural and urban the coefficient of the inclusive function for the category store switching lies between zero and one. This indicates that the model is consistent with the random utility model.
5.8.1 Findings of the characteristics of queue that formed in the rural and urban grocery store

The findings of the different characteristics of queues that formed the grocery store of rural and urban as follows:

One of the important aspects of the study is to perceive whether the data follow the assumption of the M/M/C model or not. More clearly it is to test whether the arrival rate and service rate follow the exponential distribution or not. For that purpose one sample Kolmogorov-Smirnov test is performed under the assumption that arrival rate and service rate are exponentially distributed.

Table 5.5 *p*-value for Arrival Rate and Service Rate for Rural and Urban Grocery Stores.

<table>
<thead>
<tr>
<th>Places</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arrival Rate</td>
</tr>
<tr>
<td>Rural</td>
<td>0.66</td>
</tr>
<tr>
<td>Urban</td>
<td>0.229</td>
</tr>
</tbody>
</table>

Table 5.5 highlighted that corresponding p-value of the arrival rate and service rate for both the places i.e. rural and urban are greater than the 0.05. So, it can be concluded that both the arrival rate and service rate follow the exponential
distribution. Also table 3 highlighted that average servers of the grocery stores for rural and urban places are greater than the 1. Queue discipline is first in first out (FIFO). The calling population is also infinite. So, it is clear from the above discussion that the data follow all the assumption of the M/M/C model.

So, all the characteristics of the M/M/C model can be can be evaluate and shown in table 5.5. The purpose of the study is to compare the different grocery store characteristics of rural and urban area using M/M/C model.

**Table 5.6 Comparison Table of Store Characteristics**

<table>
<thead>
<tr>
<th><strong>Characteristics of the stores</strong></th>
<th><strong>Rural</strong></th>
<th><strong>Urban</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers</td>
<td>2.1 ≈ 2</td>
<td>2.74 ≈ 3</td>
</tr>
<tr>
<td>Arrival Rate (Per Hour)</td>
<td>33.6 ≈ 34</td>
<td>40.8 ≈ 41</td>
</tr>
<tr>
<td>Service rate (Per hour)</td>
<td>21.6 ≈ 22</td>
<td>21.6 ≈ 22</td>
</tr>
<tr>
<td>Utilization Ratio</td>
<td>37 minutes 52 second</td>
<td>46 minutes 52 second</td>
</tr>
<tr>
<td>Ideal period</td>
<td>22 minutes 8 second</td>
<td>13 minutes 8 second</td>
</tr>
<tr>
<td>Expected number of customer in the system</td>
<td>3.84 ≈ 4</td>
<td>2.29 ≈ 2</td>
</tr>
<tr>
<td>Expected number of customer in the Queue</td>
<td>2.28 ≈ 2</td>
<td>0.40</td>
</tr>
<tr>
<td>Average Waiting time of a customer in the system</td>
<td>6 minutes 8 seconds</td>
<td>3 minute 10 second</td>
</tr>
<tr>
<td>Average Waiting time of a customer in the Queue</td>
<td>4 minute</td>
<td>24 second</td>
</tr>
</tbody>
</table>
Table 5.6 focused the following result:

- Average servers of rural grocery stores is 2 where as average servers of urban grocery stores is 3. This indicates that the mean server of rural grocery store is less than the urban grocery stores.

- It is also observed that the rate of arrival of customer in rural grocery store per hour is 34 whereas the rate of arrival of customer per hour in particular grocery store of urban is 41. So, it is to conclude that arrival rate (per hour) of customer in rural grocery store is less than the rate of arrival (per hour) of customer in urban grocery stores.

- In case of service rate of the servers to the customers in per hour in both the places i.e. rural and urban are same. In more evidently, the efficiency of the servers of both the places i.e. rural and urban grocery stores are same.

- The utilization or the busy period of the rural grocery store in per hour is 37 minutes and 52 second. Similarly, the busy period for the urban grocery stores per hour is 46 minutes 52 seconds. Therefore, the urban grocery stores are busier than the rural grocery stores.

- The ideal periods of rural grocery stores are greater than the urban grocery stores. The urban grocery stores are busier than the rural grocery stores.

- Table 5.6 highlighted that average number of customer in the system in the rural grocery store is 4 where as the average number of customer in
the urban grocery store is 2 which implies that the service is quicker in the urban stores.

- Interestingly it is found that average number of customer in the queue of rural grocery store is 2 where as it is found that average number of customer in the queue of urban grocery store is approximately zero.

- Average waiting time of a customer in the system of rural grocery store is 6 minutes 8 seconds where as average waiting time of customer of urban grocery store is 3 minute 10 seconds. This indicates that the waiting time of customer of a rural grocery store are more than the urban grocery stores.

- It is found that the average waiting time of customer in the queue of a rural grocery store is 4 minute while the average waiting time of customer of urban grocery store is only 24 seconds.

5.9 Conclusion

This study enables us to give the store choice behavior of rural and urban consumer. It also gives the different factors which influence the store choice behavior of rural and urban consumer. Urban stores have the available brand of the different products. The urban consumers are choosing the store which products are available. In case of rural, stores are not so much brand as urban stores. But the rural consumers are interested that store whose have maximum number of brands of the products than the other stores. Interestingly, urban
consumers are more interested the store who gives the facility of home delivery. So, they choose the store near house i.e. minimum distance whose service is better. Urban consumer are interested in maintain the relation with the shopkeeper. Rural consumers are choosing the store whose maintain the quality. This indicates that there might be the store where they got unbranded product. So, the rural consumers choose the store whose store the more branded product. One most important factor of choosing the store by rural consumer is that credit facility. This indicates that more of rural consumers are from low income. So, they must choose the store who gives the credit facility. Rural consumers are also interested in the shop which is very near to the house. In rural area, there are few stores within two kilometer. So, they choose the store with minimum distance. The rural consumers go for the store who took the minimum price with better services.

This study also looks into the comparison of different characteristics of queue of grocery stores located in rural and urban area. The study was performed in a particular geographical area only and the results are true for that located area. The study supports the common believe that rural people are less busy compared to their urban counterpart. An urban grocery shop in order to survive should have more servers so that the customers could be provided necessary service within a short period, while a rural customer keeps waiting for a longer time to get the service. This study is useful when a grosser wish to optimize the number of servers in his store. The study finds that the arrival rate of customers is differing but service rate of the servers in the rural and urban grocery stores are found to be
same. This indicates that efficiency of servers in the areas under consideration does not have any significant difference.

As an extension of the study a researcher may increase the geographical area and perform the same investigation with a bigger sample size. The movement of customers towards a grocery store follows a cyclical pattern throughout the day. The crowd generally is more in the morning and in the evenings. The location of the store also has a role to play. A grocery store near the market is supposed to pull more customers compared to a store located in a residential area. Similar studies can be carried out at different time periods classifying time by the traffic intensity and cross classifying the stores by their location.