INVESTIGATING OPTIMUM LENGTH OF PHYSICAL QUEUES AT BUSINESSES AND ITS IMPACT ON CUSTOMERS TO JOIN SUCH QUEUES

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Abstract

Queue is regarded as the central aspect of service organisations. Effective queue management in businesses has a high impact on customer behaviour and service operations. Understanding the behaviour of people when they look at the length of the physical queue is vital for the managers of service organisations on how to keep the queue at the optimum length to attract customers. It also helps the operations managers to determine the number of servers and staff in each period by minimising costs and making more profit. This thesis empirically investigates the impact of physical queue on the customer and the optimum length of the physical queue in service organisations to send a positive signal for customers to join the queue. In doing so, this research aims to understand the effect of queue on service variables and the optimum length of the queue in restaurants.

The focus of past research studies was on minimising the queue through mathematical calculations; it fails to identify the advantages of the queue and find empirically determine the right length of queues in service organisations. This research contributes to the queueing literature in several ways; first, understanding the impact of physical queue length on the service attributes like quality of services to attract customers in the business. It also provides the service operations managers with specific guidelines on how to manage the length of physical queues in their businesses.

To fill these gaps in the literature, the optimum length of physical queues is examined and analysed in different service industries. For this purpose, firstly, the questionnaire-based survey is carried out to test the theoretical framework to understand the interaction of the physical queue length, type of customers and business locations on the quality, offers and intention to switch to alternatives as service variables. Self-completion questionnaire is distributed to collect data online and hardcopy from a random sample of 1515 service consumers in the UK. Factorial MANOVA is adopted to analyse data and examine the relationship between variables. The findings show that under different queue lengths, customers evaluate the service variables differently. Secondly, to find the optimum length of physical queues for restaurants in the UK, this thesis used the mathematical approach of queueing theory to calculates the efficiency parameters of the right model. Based on the queueing model (M/M/1) in the restaurants, data are collected empirically through observation of four restaurants in urban and suburban areas for seven days in each restaurant. Data analysed according to queuing theory formulas and principles to find the optimum length of the physical queue at different times and days for each restaurant. Our findings

from quantitative analyses of survey and observations show the effect and optimum length of physical queue on customers in different areas.

A comparison of three service industries demonstrates the relationship and interaction of variables. It shows that in the entertainments industry, quality is statistically significant based on the type of customer ($p = .047$) Queue length has just interaction in the foods service industry with the *quality* and *offer* variables. In all three service industries, *availability-of-alternatives* are statistically significant, when a different type of customer, business locations and length of the queue have interaction together.

In addressing the research aim, the results of observations show that in the suburban areas there are not any difference-by by adding more server to the system in the length of queue on Weekdays, as in all models there are maximum one customer on average in the queue. In Weekends, it shows that on the busy times when the length of the queue is more than expected times, by running one server to the system the length of the queue would be in the limited optimum length. The analysis of queueing models in the urban locations shows the length of queue on Weekdays reduced from 2.151 in a single server to 0.119 in two serves. It demonstrates that in all conditions one server is enough to run customers in the queue as it does not change customers' perception and also helps to keep the physical queue in the optimum length.

Keywords: Queue length, Customer behaviour, Service industry, Operations management, Queueing theory

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Acronyms and Symbols

OM: Operations management

OR: Operations research

FCFS: First-come, first-served

LCFS: Last-come, first-served

RS: Random selection for service

SPT: Shortest processing time

SPF: Shortest processed first

FIFO: First in first out

SQ: Single queue

DV: Dependent variable

IV: Independent variable

AoA: Intention to switch to alternatives

SPSS: Statistical package for the social sciences

MANOVA: Multivariate analysis of variance

ABS: Abstract

KEY: Keywords

M/M/1: Represents the queue length in a system having a single server, where arrivals are determined by a Poisson process and job service times have an exponential distribution

λ: Mean arrival rate (number of arrivals per unit of time)

μ: Mean service rate per server

P: The average utilization of the system

L: Average number of units/customers in the system

Lq: Average number of customers in the queue (waiting to be served)

W: Average waiting time in the system

Wq: Average waiting time in the queue (service time not included)

M: Markovian (or Poisson) arrivals and exponential service time

C: Number of servers

∞: Infinite system limit; Infinite source limit

Brief Contents

Table of Contents

List of Tables

List of Figures

PART A: INTRODUCTION

Chapter A1: Introduction, Aims and Scope of the Thesis

The purpose of this chapter is to provide an overview of the present research, and thus, a foundation for the rest of the thesis. It introduces the construct of interest and queueing theory, and presents a brief discussion on the background and scope of extant research on the subject matter. The rationale for conducting this research in the services context is also presented. The discussion is followed by a brief account of the issues that pervade the literature, and then identifies the focal issue of concern to this research. The aim and objectives are then articulated, proceeding to an account of the adopted research design. The managerial and theoretical contributions of this study are also delineated. The chapter concludes by presenting the limitations of the study, and finally, outlines the organisation of the thesis.

A1.1: Background and Domain of The Research

Queue or "waiting line" is a widespread phenomenon among people worldwide. Each of us has had the experience of queueing multiple times. People wait to receive services or purchase goods in restaurants, supermarkets, retails, entertainments, and different organisations. Queuing may also happen when customers are waiting to receive services over the phone (Jones and Dent, 1994). Customers expect to receive services in a short time without waiting in an uncomfortable environment or crowded check-outs (East et al., 1994). It is the concern of managers and business owners to satisfy their customers in the waiting line and reduce customer perception of over waiting (Grewal et al., 2003).

Due to the versatile nature of the queue for different purposes, queueing theory was introduced by Erlang in 1909 to manage the queues in call centres. After that, it was developed by other researchers to improve customers' satisfaction level in the queue. Queuing theory applies models and mathematical analyses to identify optimum waiting time a customer spends in the line. Studies demonstrate that queueing research focuses on all aspects of operations in the organisations such as call centres and retails (Bertrand and Fransoo, 2002; Gorney, 1981; Bunday, 1996; Nosek and Wilson, 2001).

The elements of queueing system are arrivals, queue, service, departure and customers. The length of the queue can be infinite or finite. Finite population is when specific number of customers can stay in the queue, and when it is not any limitation on the number of customers in the queue, it is infinite queue length. The sequence in which customers are

processed or served are named queue discipline. The most common discipline is first come, first served (FCFS). Other disciplines include last come, first served (LCFS) and service in random order (SIRO). Customers or patients in the hospitals may also be selected from the queue based on some order of priority (Taha, 2005; Gross and Harris,1998).

The status of a queue may shift based on the customer behaviour waiting in a line. As Gross and Harris (1998), expressed there are three types of customer behaviour for changing a queue including, balking, reneging, and jockeying. Balking refers to the situation that a customer decides not to join a queue when arriving. Reneging addresses the circumstances that a customer chooses to leave a line for some reason after joining a queue. Jockeying encompasses the impatient behaviour of a customer, which causes the customer to switch between the different lines (e.g. parallel lines) to be served earlier.

Studies have identified a high demand for a specific service or product as the primary reason for staying in the queue. In this case, the request for services or goods is higher than the available product or staff to serve the waiting customers in the queue. However, increasing the product or members of the team to serve customers in a shorter time, as a solution, is not economically beneficial for businesses and organisations. Therefore, introducing a system to be financially beneficial and, also improving the quality of service to increase customer satisfaction are both important.

Customers selection of services is not always based on their independent knowledge or experience of a specific product or service. Most of the time, due to the lack of adequate experience about a specific product, customers decide to choose a service based on external sources like the length of a queue (number of people in a waiting line) which is a proxy for other people's choices. In this case, customers may not have made the same decision independently based on their own information. In this case, when customers decide whether to choose a service and join the relevant queue, either of two situations may happen: (1) on one hand, some may decide to choose a service provider with a shorter line to be served earlier with less waiting time (Obamiro, 2003; Scotland, 1991; Babes and Sarma, 1991); (2) on the other hand, some choose a service provider with a long queue since it may give the sense of a better quality of the product when more people are waiting to receive it (Davis et al., 2003).

The literature shows that studies in the area of queuing theory mostly have used approaches to find a better solution for the queuing system ignoring the operational

behaviour of customers and the environment of the businesses. In recent years, some scholars tried to run the operational part of businesses convincingly by looking at the behaviour of customers in this area so-called behavioural operations management (Loch and Wu, 2008).

Research in the field of queueing theory has mostly focused on investigating the behaviour of customers in a waiting line, primarily the time that customers stay in the queue. Scholars have identified some factors that help satisfy customers while they are in the waiting line. While researchers like Veeraraghavan and Debo (2010) mathematically found that the length of a queue has a significant impact on customers' choices for the use of a service, there is a lack of empirical research to demonstrate the advantage of the queue and how it is beneficial for business and organisations to engage more customers and reduce their operational costs. There are two types of waiting in the queue as "physical waiting and abstract waiting. This study concentrates on service organisations where customers physically stay in the queue to receive services.

There are different factors that influence the queue such as capacity, layout and service process (Luo et al., 2004; Nie, 2000). Studies on behavioural aspects of the queue show that the length of the queue will affect customers evaluation and their satisfaction on the services (Davis and Maggard, 1990; Houston et al., 1998; Taylor, 1994), the perceived value of products and services (Debo et al., 2012; Koo and Fishbach, 2010; Kremer and Debo, 2015), and customer loyalty (Bielen and Demoulin, 2007; Dube et al., 1994). Collecting data empirically in the physical queue is not easy, comparing in the high-tech service organisations like call-centres (Koole and Mandelbaum, 2002). Researchers mostly use survey for the purpose of collecting data in the physical queue as it does not record the actual behaviour of customers (Munichor and Rafaeli, 2007; Rafaeli et al., 2002; Chandon et al., 2005).

Studies on queueing length are mostly based on the assumptions that they do not have high impact on the service organisations and its practical settings are challenging (Hwang et al., 2010; Roy et al., 2016). These types of studies are accurate, and it might be work in the short time, but its assumptions does not stay for the longer term. For example, a customer can be unsatisfaction when he stays in the long queue and suddenly decide to renege. Ittig (2002) and Umesh et al. (1989) looked at the effect of relationship between waiting time and arrival rate on the revenue in the companies.

The study by Wu et al. (2018), confirm that waiting time may affect customer service needs and duration. In addition, service personnel have the authority to determine the completion time. They might be more productive and reduce service time in response to a higher workload, but they cannot cope in a high workload situation (Hopp et al., 2007; Tan and Netessine, 2014). This means that waiting line affects the customer behaviour during the observation. Therefore, the focus of operations managers in the service organisations should be on the revenue rather than decreasing the number of customers in the queue (Gavirneni and Kulkarni, 2016). To truly understand the operational implications of these dynamics, an empirical model is combined to investigate the optimal length of the physical queue in a service organisation with a survey incorporating the combined effects of length of queue on service variables. This combination of empirical analyses and surveys enables us to experimentally investigate the optimal length of queue and its impact in the context of restaurant policies and provides results that are more generalisable and meaningful to practice.

A1.2: Scope of The Research

This research investigates the length of the physical queue in food businesses and its impact on the ability of the service provider to attract more customers. The current study has focused on the physical queue (i.e. the customer stays physically in the waiting line). Online queueing and advance booking are not within the scope of this research.

In general, there are multiple categories of service industries which use physical queuing to serve customers, including food and hospitality, retail, health services, entertainment, finance, and transportation industries. In some organisations and businesses like hospitals and transportation, it is crucial to deliver quick services to deliver comfort to the customer and accelerate service delivery. However, the length of the physical queue in these industries can vary based on multiple factors including the nature of the business, its location and type of customers.

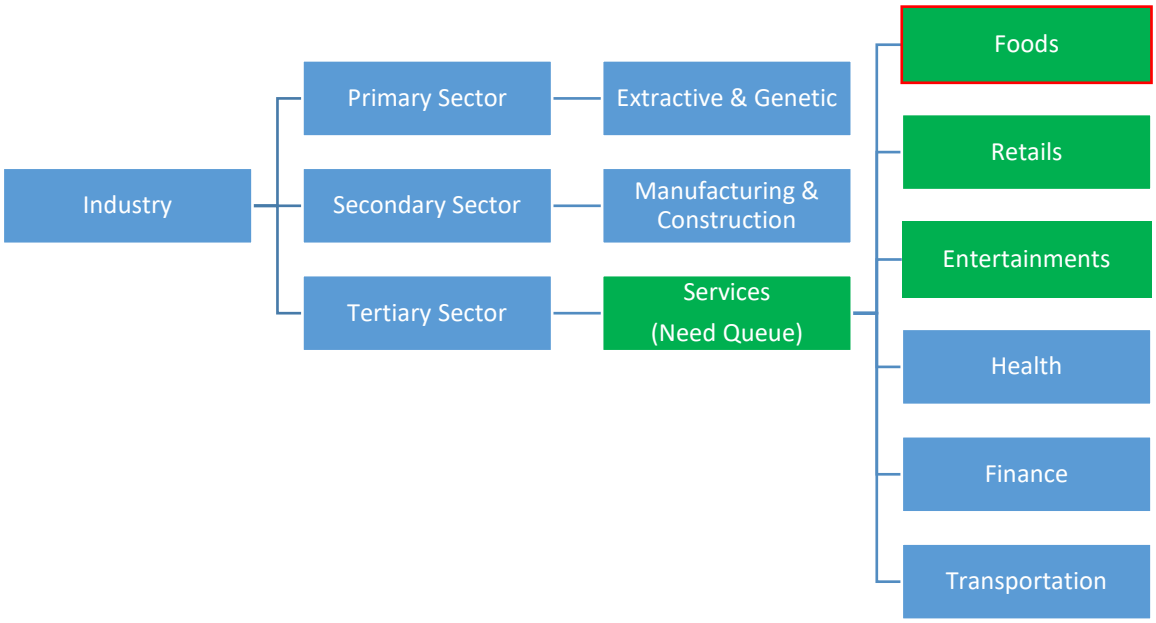


Figure A1.1: Scope of the survey
Source: Compiled based on Prosser, L., (2007) UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) Office for National Statistics, Macmillan

This research examines queueing theory in foods, retails, and entertainments service industries in two broad and interrelated areas of research: (a) the impact of the length of the physical queue on the service-related outcomes (i.e. quality, offers and intention to switch to alternatives) based on the type of customers and location of businesses; (b) the optimal length of the physical queue in the foods service organisations.

A fully comprehensive coverage of all service organisations is practically impossible therefore in the study, only the restaurants in the foods service industry in the UK are considered in this observation.

A1.3: Problem Statement

In 2018, there were 4.2 million businesses in the services industries in the UK, three quarters of all businesses in the nation (Rhodes, 2018). While these service organisations have been supported by the government to grow, it has been observed that they are increasing in numbers but few of them are growing. Apart from common challenges, many of these firms lack basic planning in service design and delivery; an area of focus that is also not significantly covered in the literature.

Statistics show that the rate of failure is very high, as roughly 80% of UK companies fail within their first year (Hussain et al., 2010). According to the latest figures from the

Office for National Statistics (2011-2016), just about half of businesses in the UK survive their fourth year with only 44.1% of them surviving for five years or more. Therefore, any efforts made to learn customer behaviour and consequently help business owners to improve their operations can contribute to increased rate of success for these service organisations. Therefore, this study wishes to empirically test and observe how the service organisations in the UK attend to basic business principles for the queueing process concerning the management of physical queues and the impact of service variables to attract customers.

The literature agrees, for the most part, that the existence of long queues is a disadvantage to businesses since it has a negative effect on the customers. It shows that researchers try to find an analytical solution to minimise queue length and customer waiting time. It has found that not only is the length of the queue critical in any business, but the behaviour and reaction of customers within a line also plays a vital role. To the best of our knowledge, no existing research study has looked at the optimal length of physical queue empirically in service industries.

One of the key advantages of the businesses to make more profit and grow faster are to keep their loyal customers. Growth of businesses depends on two choices. One option is to sell the services to new customers and the next one is to give more offers to existing customers that the company has. The long-term value of existing customers is often the focus of business owners. These customers are usually not properly and practically ignored when performing service operations. In contrast, a great deal of time, effort and money is spent on marketing to try to attract new customers.

Referring to queues, it has been seen that people may be discharged after joining the queue without providing services. It has a negative effect on the growth of company and it's profit when customers leave the queue this way. Therefore, operations managers should plan the service delivery to attract more customers in the queue and keep them happy until they have been served. Customers may search for better and faster places for the same service. Therefore, the value of existing customers is so important.

Physical visits were conducted to get a better understanding of the performance of a business (Kim and Kim 2004) It demonstrates the fidelity of customers and their willingness to use a product from a specific brand (Clark and Wood 1998) In this situation, the quality of product is the main assessment criterion. For example, this type of customers is usually observed at the restaurant where the quality of the food, including the ingredients and the

quality of the place are crucial to them (Johnson and Mathews, 1997) It is assumed that the level of expectation from service quality in repeated customers are higher compared to infrequent customers. Random customers usually evaluate service conditions in the process of their visit (Bornstein, 1989) In this case, customers make the decision based on either internal or external information. Repeated customers rely on internal information like their experience and prior knowledge, while infrequent or random customers rely on external sources like the length of the queue (Foulkes, 1984) Although it is difficult to estimate the rate of repeated and infrequent customers, in aggressive and competitive businesses, usually the random customers exceed. This study investigates the interpretation of various customers of the quality of service. Furthermore, it scrutinizes the reasons for customers' proposal and shifts to a different business. In the literature, little effort has been put into explaining frequent visits in the area of service providers. Initially, this study focuses on distinction between repeated customers from infrequent ones.

There are some studies that look at the effect of waiting line on the customers choices (Raz and Ert, 2008; Veeraraghavan and Debo, 2009). Raz and Ert (2008) found that in the tourist areas customers are mostly interested to join the longer queue. Understanding the behaviour of customers base on the queue length has been done by Veeraraghavan and Debo (2009). They evaluate the perception of customers and their reactions through analytical models. Dharmawirya, Oktadiana and Adi (2012), analysed the expected waiting time for the customer that wait in the queue at lunch time in the university.

After reviewing the literature, it comes to consideration that over the years, queuing theory techniques have been the only solution to managing customers effectively and efficiently in service organisations although most services fail to properly implement this application. Customers do not like to stay in the queue for the long time as it is inconvenience and frustrate their daily lives. In some cases, long delays changed the mind of the customers from pursuing valuable services. It also causes delays for an important event like theatres. Therefore, analysing behavioural operations base on the type of customers in different locations is important.

This study intends to find two main gaps in the queueing literature: The first concern focuses on how different business locations and type of customers interact to determine the impact of queue length on the service variables; and secondly, the optimal length of the physical queue to engage more customers rather than reducing the length of queue. It should

be the concern of operations managers in service organisations to both identify the behaviour of customers in a line, and accordingly, define the optimal length of the physical queue.

Research question

The following research questions are addressed in this study:

1) Does the interaction between customer type and location of businesses affect service variables upon the length of the physical queue?
2) Does the type of customers and the location of businesses influence the impact of queue length on service variables in different service industries?
3) What is the optimal length of the physical queue based on queuing models for restaurants to attract customers in the UK?

A1.4: Research Aim and Objectives

From the aforementioned discussion pertaining to the scope of this research in the context of the extant literature, the following research aim, and objectives are set.

Research aim

The aim of this research is to empirically investigate the impact of the physical queue on the customer and the optimum length of the physical queue in service organisations to send a positive signal for customers to join the queue.

Research objectives

Objectives of the study are as follow:

- To investigate the impact of physical queue length on the behaviour of customers from the perspective of businesses;
- To identify the optimum queue length in order to advise operations managers in businesses on how to best attract customers;
- To investigate the influence that type of customer and location of business have on service variables in terms of the length of physical queues.

A1.5: The Research Process and Design

The process of the research to address the aim and objectives of this study starts with a systematic literature review (Part B). This helps to identify the research gaps and appropriate conceptualisation of the research constructs. This also helps to examine a variety

of existing scales in the literature which facilitated the researcher in an appropriate operationalisation of the research constructs. Importantly, a review of the literature enabled the researcher to develop a theoretical framework for the study (Part C).

This study employs a survey research strategy to test the theoretical framework. Questionnaire and observation are considered an appropriate research strategy for collecting data to answer the research questions. The researcher did a pilot study to assess the theoretical framework and to revise any research component of the study as necessary. Finally, the data was collected for the main study. The formulated hypotheses were tested via Factorial MANOVA in SPSS. For the purpose of observations, data collected are collected from four restaurants situated in two different areas in the UK for seven days (Part D). Part E presents the data analysis and findings, and discussion and conclusions are presented in Part F.

A1.6: Theoretical Contributions

This study makes several significant contributions to extant knowledge on the length of physical queues and understanding the impact of queuing on customers in the service organisations. The most important contributions as follows: (i) advances current understanding of the impact of physical queue on service attributes such as quality of services to attract customers; (ii) furthers current knowledge on service operation management with specific guidelines for optimise the length of physical queues.

A1.7: Structure of The Thesis

This thesis contains six main parts, with further divisions into chapters. The nominated parts are as follow:

Part A: The Introduction presents the background and domain of the research in section A1.1 and explains the scope of the research and the problem statement. The aim and objectives of the research are described in section A1.4, followed by the research process, design and theoretical contribution of the thesis.

Part B: Literature review systematically reviews the empirical research studies in queuing theory and behavioural operations management. The knowledge gaps have been identified through an extensive critical review of operations management sources with a special focus on peer-reviewed journals. In particular, the descriptive findings of the

literature are explained in chapter B3 and discussion of empirical research in queueing theory in chapter B5.

Part C: Research methodology justifies the conceptual and methodological aspects of the research; and provides an account of the methods applied to address the underlying aim of the research. It includes three chapters that provide a comprehensive discussion about the theoretical framework, research philosophy and approaches, and the research design to answer the research questions.

Part D: The Data gathering section contains three main chapters that explain the data collection method. It starts by looking at the sample design on how to target the right population and businesses to reach the aim of the study. After identifying appropriate sampling designs, data collection methods are discussed in detail.

Part E: Data analysis and findings section includes two main chapters and related sub-sections. It contains in-depth discussion of the collected data and analysis of findings for the preliminary and main studies of questionnaires and observation. In particular, in chapter E2, the discussion of main questionnaire analysis and testing the hypotheses through Factorial MANOVA is presented. The analysis of the queueing model for the observed restaurants presented in chapter E3.

Part F: The Discussion and Conclusion section contains one main chapter that includes five sub-sections. It starts by providing the results of a systematic literature review and presenting the research aims and objectives. Thereafter, the academic contributions, descriptive insights and prescriptive insights of the study to operations management knowledge have been explained. In this section, the thesis concludes with a discussion on the limitations of the study and gives direction for future research.

PART B: REVIEW OF LITERATURE

Chapter B1: Introduction to the Literature Review

The aim of this chapter is to explain the structure of the literature review on queueing theory and to present the current and existing reviews on the optimum length of the physical queue in the service organisations. This part helps to build on the knowledge of the current optimum length of the physical queue and contributes to behavioural operations management by testing and developing the impact of quality, service offer and intention to switch to alternatives choices of service variables in the organisation to customers. There are five main chapters to address these issues and reach the objective of the research as follow: Chapter (B2) methodology of systematic literature review, (B3) descriptive findings of literature review in queueing theory, (B4) fundamentals of queueing theory, (B5) empirical research in queuing theory, (B6) customer behaviour in queues and the last chapter (B7) is a summary and conclusion of the section.

Chapter B2: Fundamentals of Queueing Theory

Queueing theory was introduced by Erlang, a Danish in the early 20th century. He was a mathematician who studied telephone traffic congestion. Queueing theory is beneficial in many practical applications in areas such as “telephone exchange, traffic control, manufacture systems, inventory systems and communication systems, telephone exchange, supermarket, at a petrol station, and at computer systems” - this marked the beginning of queuing theory.

Studies have shown that queueing theory is “a set of mathematical tools, which is used for the analysis of probabilistic systems of customers and servers”. In operational research, It is known as the “theory of overcrowding” that investigates the correlation between the calls and the inconvenient delays to respond within the system Gross and Harris (1998). The reason for considering the queueing theory as a branch of operations research is due to the use of the results to identify the resources needed to provide services in business decision making. Queueing theory has been applied in so many areas in the literature like probability, operations research, management science, and industrial engineering (e.g. Gorney, 1981; Bunday,1996; Nosek and Wilson 2001). Traffic flow (vehicles, aircraft, people, communications), scheduling (patients in hospitals, jobs on machines, programs on a computer), and facility design (banks, post offices, amusement parks, fast-food restaurants) are the examples of its application in the real world.

B2.1: Preliminaries of Queuing Theory

Gross and Harris (1998) found queuing theory aims to improve customers' satisfaction by developing the services and the quality of queues. This has been achieved by the implication of different models and mathematical approaches specifically focused on scrutinizing the length of time (Gorney, 1981; Bunday,1996; Nosek and Wilson 2001). Queuing system is the central part of operations in every department, and so has been applied by many pieces of research, especially in the area of call centres and computer networks. In 1909 the telephone network engineer called Erlang worked on the telephone queuing problem and wrote his article about this issue. Later on, he was named as the inventor of queuing theory by publishing his paper (Gross and Harris, 1998). As Kendall (1951) mentioned in his work, most of the research and practices on queuing theory intend to make a model to improve the performance of a queue, based on the equilibrium theory. In this case, Ackere and Larsen (2009) found that, despite general assumptions, the intention of the queuing approach is not merely just to reduce the length of the queue, but to improve the design and implementation of the system. To make the length of lines shorter, some authors suggest the idea of paying for services by those who want to use the system (Naor,1969; Yechiali, 1971). These models are based on statistical circumstances, external customers, and service quality.

Studies have shown that Naor (1969) is the pioneer in discussing and analysing the behaviour of customers in the queue. In his paper, he investigates the effect of a queue length on customer decision making, whether to stay in the queue or balk from the line. Per his debate, customers care about the facility and services provided, compared to the expenses and value of time spent in the a queue. His work was reviewed by Hassin and Haviv (2003) to find a solution for the effect of delay on service value and the costs of staying in a line. They concluded that management should focus on queuing arrangements before the arrival of customers, as this plays a pivotal role in retaining customers. In this case, as observed by Hassin (1986), managers and businesses should inform customers about the waiting time for the services or goods beforehand to avoid balking after encountering the queue system.

M/M/1 queueing system has been studied through Naor (1969) research to analyse the effect of a queue length on customer decision about whether to join the queue or not. As a result, his solution was to control the number of people involved in the system. Based on Naor's article and the idea of limiting people, Yechiali (1971) suggests people pay for coming to the system and staying in the queue. Many researchers such as Stidham (1985;

1992; 1989), Mendelson and Yechiali (1981), Dewan and Mendelson (1990), Ackere (1995), Rump & Stidham (1998), Zohar et al. (2002), Haxholdt et al. (2003), Ackere et al. (2006; 2009) worked on the idea of Naor and Yechiali to get a better understanding of the queuing system and also improving the concept. In this case, Ackere and Lersen (2007) focused on identifying if customers and services are external or internal; as well as if customers decisively joined the queue or if they selected it randomly.

Another significant study builds further on the work of Naor and Yechiali; and includes the study of Edelson and Hildebrand (1975). Introducing M/M/1 queuing model consists of a distinct category of clients who have 'a heterogeneous structure' of desire to wait. This study was successful in restricting capacity and the optimal queue system, and in its consideration of the number of customers waiting in line.

In addition to the studies focused on the number of customers in the queue, Dewan and Mendelson (1990) focused their research on the size and the essential factor in decision policy, the idea that wasting time wastes money. On the other hand, spending time, cost! They established a mathematical model that assumes a non-linear delay cost structure to find a trade-off between the domestic price for acceptance of services and capacity decision. Based on this model, the amount is variable according to the number of customers in each period, and the cost of delay has to be considered for each demand. Their work has been reviewed by Ha (2001) with an emphasis on the price problems. Ha (2001) points out that customers have a choice for their service encounters.

Stidham (1992) followed the research that was done by Dewan and Mendelson (1992); this was later developed by Stidham and Rump (1998), who found that customers decided to spend time in a queue based on their previous experiences of using the service.

Further studies focused on balking, including research by Boots and Tijms (1999). They focused on the multi-server scenario when due to delay in providing the services, customers leave the system. The result shows that in most of the cases, customers leave the queue in call centre after 20 seconds of being on hold. Moreover, Agnew (1976) demonstrates the relation between the different aspects of the queue (queue length and service rate) in dynamic behaviour. This process takes place through analysis of differential equations. While Ackere and Larsen (2004) introduce the Cellular Automata model to show the customer selection of services based on their experiences.

In the past decades, most researchers chose an experimental method to analyse queuing systems. Some of these studies (Seale, 2005; Rapoport et al., 2004; Stein et al., 2007) that analyse the queue resulted in the same queue patterns, even if some people balk or renege from the line. Besides, Rapoport et al. (2010) initiated a project, including different scenarios to test the behaviour of customers with different service capacity.

B2.2: Queueing Models

Elements of Queue

A waiting line usually occurs in the situation that available service does not adequately serve the number of customer demands. In this context, customers are defined as humans or objects. “Machine waiting for repair, a customer order waiting to be processed, sub-assemblies in a manufacturing plant, electronic messages on the Internet, and ships waiting for unloading” are the example of the objects.

In a waiting line system, a challenge for a manager’s decision making is to determine the level of service to offer in terms of quality. If they provide low quality services to the customers, they can save costs in the short term but may incur high costs of customer dissatisfaction, such as loss of future business and actual processing costs of complaints. In spite of the higher cost momentarily for providing a high level of service, it increases satisfaction costs. Because of this trade-off, management must consider that which is the optimal level of service provision. For example, fast-food restaurants illustrate the transient nature of waiting line systems. Usually, within a fast-food restaurant, meal-times see peak waiting lines which is due to the limited available capacity which could be complicated by the waiting line needing to be handled quickly. As a solution, to speed up delivery of the service, some restaurants use an extra window to receive the customer; the first window for receiving the payment, and the second window for picking up the food. However, for the rest of the day, only a single window may be used since there is no waiting line or significantly less waiting at the drive-through windows.

Based on the above discussions, the challenge is creating service systems with adequate capacity that are also economically viable for organisations. A fast-food restaurant experiences variable demand and variable service times. Usually, for fast-food restaurants, it is difficult to anticipate the number of customers’ request and the identity of the orders by each customer. It means each order can be unique and require a different service time. Therefore, it is essential to understand the various elements of a waiting line system. This

includes the customer population (finite or infinite) source, the service system, the arrival and service patterns (the arrival rate specifies the average number of customers per time period and the service rate is the capacity of the service system), and the priorities used for controlling the line.

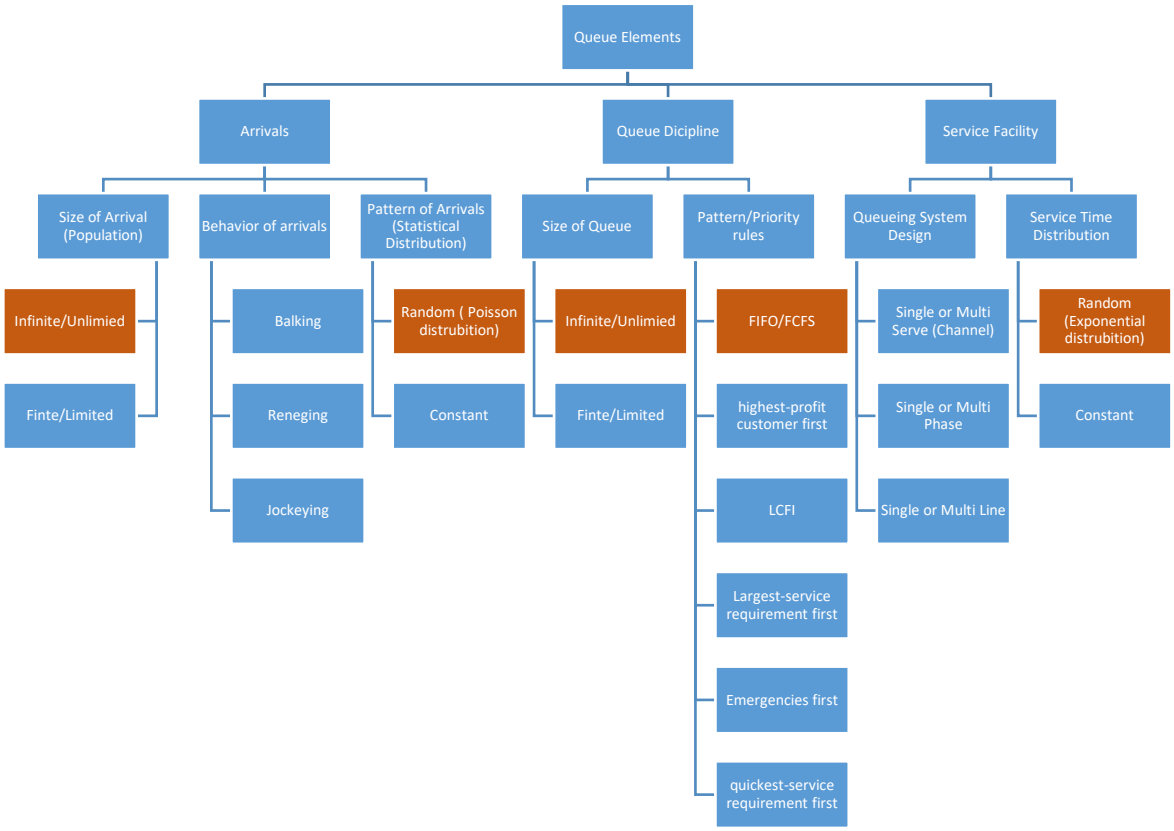


Figure B2.1: Elements of Queue

Balking, reneging or jockeying are different types of customers behaviour in the queue. When customer jump from one queue to another one to make his stay shorter is jockeying. When the customer decides not to enter the waiting line is balking and reneging happens when the customer enters the waiting line but leaves before being served. The models used in this research is based on the queueing system of service organisations that customers come from an infinite population.

The Service System

There are five elements of the service system in the organisations as follow: Queues, Server numbers, Arrangement of the servers, Arrival and service patterns, Priority rules.

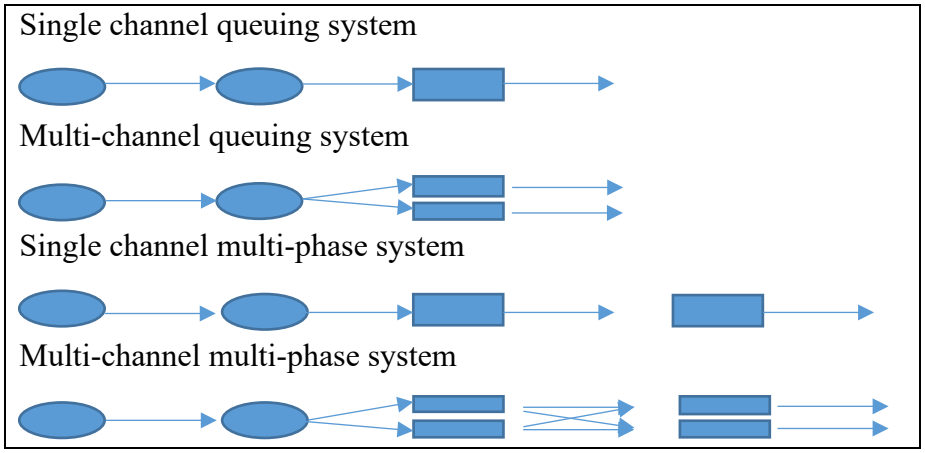


Figure B2.2: Queueing structure

In this section, we discuss the different structure of queue as it shows in Figure B4.2.

- SPF (Shortest processed first)
- FIFO (First In First Out)
- SQ (Single Queue)
- Multiple Queues
- Diffuse Queue
- Head of Queue

SPF (Shortest treated first): As it shows in the name Shortest Processed First (SPF) is a queueing model that the shortest line or the customers with the most concise request will be served first. This kind of model issued in systems like fast food restaurants and supermarket branches. In some cases, it is challenging as some customers may complain about it is not fair to stay longer than others just because of their request. Therefore, it is vital to explain to the customers about the reason, concept, and logic of this model in order to keep them satisfied.

FIFO (First In First Out): In this model, the customers have been served based on their arrival time. This one is the most usual queue models to help customers equally to assure them there is no discrimination or bias.

SQ (Single Queue): Single queue (SQ) is another model of a queue that businesses ask customers to stay in one line to be served. Mainly because there is only one service operator, it usually happens in small businesses. This is the fair model that serves customers in turn, and like the FIFO model, there is not any complaint from them.

Multiple Queues: As the name shows, there is more than one queue in this model, and customers can decide to join any of their preferred lines. For example, some might choose to join the shortest queue.

Diffuse Queue: Diffuse queue is the model that customers should take a ticket from the machine until their turn arrives. In this model, some machines have multiple buttons for different queues and based on their customer requirements they get a ticket for that queue.

Head of Queue: This model has multi-checkout systems that call customers from a single queue. The most use of this is in the post office or big supermarkets.

Priority Queue: Priority queue is the model that serves customers based on the priority as they divide them into different classes or positions. For example in the airline industry first-class customer, business class and economy class will serve from different queues.

Waiting Line Performance Measures

Performance measures are used to gain useful information about waiting line systems. These measures include:

(a) The average number of customers in the queue.

(b) The average time customers spend waiting and the average time a customer pays in the system - Customers often assume long waiting times result in receiving poor-quality service. That is, the company can offer discounts or better service at less busy times of the day or week, for example, a restaurant provides early-bird diners at discount rates and serving the customer is a higher level. The cut moves some demand from prime-time dining hours to the less desired dining hours. In this case, it is crucial to consider the time spent in the system, because if too much time is spent, customers might perceive the competency of the service provider as inferior.

(c) The system utilization rate - Measuring capacity utilization shows the percentage of the time servers are busy. Of course, each management's goal is to provide adequate servers to ensure the waiting time is not excessive, however, many servers may be cost-inefficient to the organisation. We calculate these measures for two different waiting line models: the single-server model and the multi-server model.

M/M/1 Queue Model

The simplest waiting line model involves a single server, single line and single-phase system. The following assumptions are made when we model this environment:

- The customers from a population that can be considered infinite.
- Customer arrivals are described by a Poisson distribution with a mean arrival rate of (lambda)
- The customer service rate is described by a Poisson distribution with a mean service rate of (mu)
- The waiting line priority rule used is FIFO.

Table B2.1, shows the formula to calculate the operating characteristics of the queue.

Table B2.1: M/M/1 Queueing model formula

Parameters	Definition	Formula
$\boldsymbol{\lambda}$	mean arrival rate (number of arrivals per unit of time)	-
$\boldsymbol{\mu}$	mean service rate per server	-
$\boldsymbol{P}$	the average utilization of the system	$\frac{\boldsymbol{\lambda}}{\mu}$
$\boldsymbol{L}$	Average number of units (customers) in the system (includes both the customers waiting for service and those being served)	$\frac{\boldsymbol{\lambda}}{\mu - \boldsymbol{\lambda}}$
$\boldsymbol{Lq}$	average number of customers in the queue (waiting to be served)	$\frac{\boldsymbol{\lambda}^2}{\mu(\mu - \boldsymbol{\lambda})}$
$\boldsymbol{W}$	average waiting time in the system	$\frac{\mathbf{1}}{\mu - \boldsymbol{\lambda}}$
$\boldsymbol{Wq}$	average waiting time in the queue (service time not included)	$\frac{\boldsymbol{\lambda}}{\mu(\mu - \boldsymbol{\lambda})}$

B2.3: Types of Waiting

Research indicates waiting can be divided into multiple categories, generally into three types; as Tylor (1994) observed, these include before, during, and after the services or shopping. In other research, it is defined as 'pre-process', 'in-process', and 'post-process'. For example, at a football match, the pre-process refers to the viewer in the queue to buy the ticket; the in-process is the time the viewer is sitting in the stadium; and the post-process is the time when the viewer is waiting in the queue to leave the event. According to Dube et al., 1988; Venkatesan & Anderson, 1985, organizing the pre-process waiting is more important compared to the other two categories of waiting, since at the pre-processing stage, customers are more likely to become easily dissatisfied if the service is provided at a low level. A long wait in the queue may be associated with a low-level of service.

Consequently, it is crucial for organisations to have a better understanding of the pre-process waiting due to its impact on customers. The pre-process waiting can be divided into sub-classification as pre-schedule, post-schedule, and queue (Tylor, 1994). Pre-schedule is the time when the client arrives earlier than start time so the customer should wait for the services. Post-schedule or delay is the time when the start time passes, and services are not ready for customers because of some problems. The last one, queue, refers to the situations with no schedule or appointment provided for the services and customers. Therefore, they should stay in a line for an unknown amount of time to be served. Imagine, you are hungry and decide to have food in a restaurant or fast food. You make a reservation for your seat at 13:00, but if you arrive at the restaurant at 12:30 you have to wait 30 minutes to be served. This is pre-schedule waiting. However, if your seat is not ready by 13:00, and you are required to wait beyond that time (e.g. up to 13:20), that extra 20 minutes is post-schedule waiting.

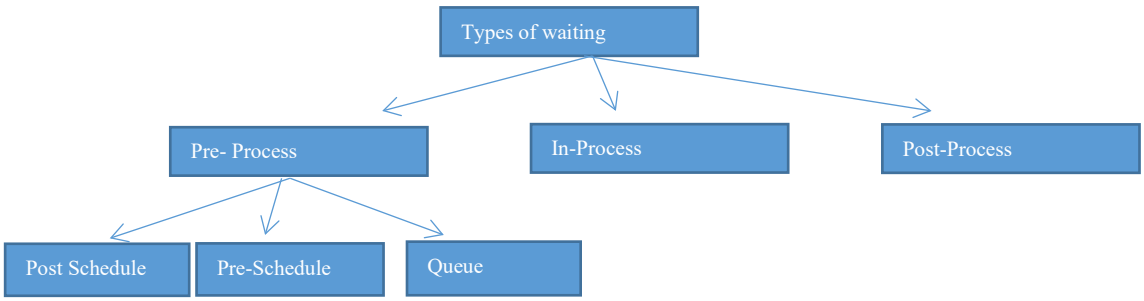


Figure B2.3: Types of Queue

B2.4: Queuing Structure (Physical or abstract)

Scholars defined waiting in two different types: 1. physical waiting, that is if the customer stands in the queue to be served. 2. abstract waiting or waiting elsewhere, that is if the customer is waiting on the phone at home or waiting at home to receive a delivery (Tylor, 1994)

Physical waiting

According to studies, customers in physical waiting usually became angry, irritate, and unsatisfied (Larson, 1987; Hui & Tse, 1996; Taylor, 1994; Zhou & Soman, 2003). Studies show that if the customers realize the queueing time is longer than what they expected, they became more dissatisfied even from the actual service received. This could also be the effect of a longer perceived waiting time even if service was received on time. Therefore, long waiting or perceived long waiting can negatively impact customers' point of view of the service provided and the organisation itself. (Hui & Tse, 1996). Koo and

Fishbach (2010) maintain that customers stay in the queue to achieve a goal, plus as the line grows there is more pressure on customers to achieve their goal and receive that which they are awaiting. This can cause a low ranking of services for the business (Taylor, 1994).

Zhou & Soman (2003) argued that customers have other options in some cases when they think queues and waiting times are longer than usual. In these scenarios, they can balk or renege from the queue and return later or move on to other shops that provide the same services. Studies show that the most frequent reason for balking from queues are shifts to other shops, waiting for costs and low ranking of services.

However, there are reasons customers choose to stay in queues as long as it takes to achieve their goal. Scholars found that when customers notice that the number of people behind them is large, they prefer to stay in the queue instead of reneging or leaving it. Among the main reasons customers choose to stay include: a perception that the value of services that they are waiting for is higher than their expectation and if they balk from queue, they could not benefit from it. Scholars also found that customers stay because they worry about if they leave the queue and want to come back another time, the queue may be just as long or even longer (Koo & Fishbach, 2010; Zhou & Soman, 2003; Cialdini, 1985). When the customers compare themselves to the people behind them, they feel more satisfied with the social view of staying in the queue and it causes the positive point of social comparison. Studies show that when customers are not sure about their behaviour, they compare themselves to other people and social comparison happens for them to see the differences and perceive the advantage of being ahead (Gibbons & Buunk, 1999; Zhou & Soman, 2003; Koo and Fishbach, 2003).

Abstract waiting (Waiting elsewhere)

Abstract waiting or waiting elsewhere refers to the situation that the physical presence of the customer in the queue to receive a service is not necessary. In this waiting type customers can assign their time to do their preferred activity until it is their turn to be served. As Taylor (1994) found in his research, customers became angrier and dissatisfied about services in physical waiting but not so in abstract waiting since they do not feel the waiting time the same way, as their busy with their own activities. For example, when waiting on the phone at home, even if queues are long customers are often also busy with household chores, reading or watching tv, etc, and do not feel the waiting time as much compared to a physical waiting.

Lete and Park (2008) discovered as these kinds of customers do not have the experience of looking at these products or services physically, and they may become confused when receiving information. Consequently, they seek help from customers with more experience and may assess products and services based on the queue length, busyness and their perception of the amount of demand there is for an organisation's services.

B2.5: Queue Management System

In both private and public departments, there is a need to manage people in queues. Private organisations like retail shops, fast food, and restaurants and public facilities like bus stops and hospitals all require the management of people wishing to achieve their goal. Managing queuing in these queuing systems is called the Queue Management System (QSM). There are two kinds of queue management systems: reactive or responsive and proactive. In response, the system tries to improve the service by managing the current queue. The proactive management of queuing is dynamic improvement applied based on collecting data about the system and using those statistics to find the problems and improve the system by analysing data information. The QMS allows managers to observe behaviours of people trying to achieve their goals of receiving the service and enables managers to make decisions for organising, adjusting and improving the system in the future. The style of queues in this system includes the people who are physically present in line to take a ticket that enables the customer to select their position and stand or sit wherever they like. It facilitates a more friendly and relaxed atmosphere for customers, as well as decreases the pressure on the system and servers doing their job. Solving the problem of clients waiting in the queue depends on the place and the environment. Improving the atmosphere of the environment, improves the efficiency of the system and the perception of customers.

Chapter B3: The Methodology of Systematic Literature Review

In this chapter, the detailed information and the methodology that is needed to conduct the literature review are explained. A systematic literature review has been applied to review the optimum length of the physical queue in service organisations. The central phenomenon of interest is the optimum length of the physical queue in service organisations. Instead of a traditional literature review, a systematic literature review is chosen for the purpose of reducing bias by adopting a scientific, replicable and transparent process of reviewing the literature (Tranfield, Denyer and Smart, 2003).

B3.1: Time Horizon

As Tranfield et al (2003) mentioned, the systematic review of literature should be in detail to ensure that the search can be replicated. The data for the purpose of this literature review was gathered from 1977 to the end of 2018.

B3.2: Journal Selection

The articles included in the search are all ABS Ranking Journals (Operations and Technology Management, 3, 4, 4*; Operations Research and Management Science, 3, 4, 4*), The UTD DALLAS 24 Journal Ranking and Financial Times Top 50 Journals.

B3.3: Selection of Articles

To evaluate the relevant empirical studies to answer the research questions, the systematic literature review methodology is adopted by looking at the review papers in the "Scopus" database of articles. This type of process of reviewing the literature decreases bias in the case of reviewing papers and promotes replicability and reliability of the findings to make it transparent (Denyer and Tranfield, 2009; Tranfield et al., 2003). Table B3.1 demonstrates the five different stages of reviewing the literature of empirical queueing theory systematically.

Table B3.1: Process of literature review

Stage one	Stage two	Stage three	Stage four	Stage five
Keywords Search 343 articles →	Duplicates eliminated 249 articles →	Short-Listing of articles 131 articles →	 83 articles →	Full paper review and analysis →
Journals and database selection			Abstract Review and Analysis	Microsoft Excel database created
Title, Abstract and Keyword of peer reviewed Selected scholarly journals searched Period: From 1977 before end 2018				Classification of articles

B3.4: Article Classification

As it shows in the table B3.1, the first part of reviewing the literature is a search for "title, abstract and keyword" in the Scopus database for the following combination of keywords:

TITLE-ABS-KEY ("queu*" OR "waiting time*" OR "waiting line*") **AND TITLE-ABS-KEY** ("behavioral" OR "behavioural" OR "behavior" OR "behaviour" OR "culture" OR "cultural" OR "perception*" OR "satisfaction*" OR "customer satisfaction*" OR "customer decision*" OR "psycholog*") **AND ABS** ("customer*" OR "consumer*" OR "people" OR "patient" OR "human" OR "person" OR "arrival" OR "shopper")

The next step is to eliminate the duplicate findings from the results. This reduces the number of articles from 343 to 249 articles.

The third step was to read in detail the designated abstracts of the 249 papers to select the ones that included empirical data in their research on queue behaviour. Many articles dealing exclusively with non-empirical research or with statistical analysis were excluded. After reviewing abstracts, 131 articles are selected to move on to the next step.

In step four, the relevant and important articles that are cited in the reviewing papers are added to the list. As expressed by Denyer and Tranfield (2009), this procedure makes a comprehensive list of articles that helped to find the appropriate articles. The organic addition of further papers thus sought to ensure that we included all papers relevant to our search and provided a further eight papers, bringing the final total to 83.

In the last step, Microsoft excel document was created to analyse the final 83 articles in-depth for the relevant information like the measures in Table B3.2.

Table B3.2: Process of analysing the literature

Step	Description
1	Establishing a theoretical foundation by theory building and theory verification.
2	Research design classification; i.e. single or multiple case study, panel study, focus group study and survey
3	Data collection method, where articles are classified under historical archive analysis, type of observation\s, interviews and questionnaire survey.
4	Implementation stage; i.e. sample industry, sample size, qualitative/quantitative/triangulated data, cross-sectional or longitudinal data collection and type of respondents.
5	Data analysis method; i.e. descriptive statistics, tests of differences/similarities, measures of dimensionalities and statistical interpretation of parameters.
6	Summary of findings

B3.5: Analysis and Coding Articles

Each article was subject to content analysis by visually scanning the entire document for discussions of theory and conceptual frameworks. A Microsoft excel database was created where the articles were classified into different headings and sub-headings for the purpose of analysing the trends and gaps. Finally, data were extracted from the 83 selected articles by employing a data extraction instrument as advocated by Tranfield et al. (2003) to reduce human error and bias. The data extraction instrument included details such as journal name, title, the context of the study, methodology and findings. As Ritchie and Spencer (1994) suggested, the selected literature was analysed in an inductive way employing the thematic framework approach.

Chapter B4: Descriptive Findings of Literature Review in queueing theory

The descriptive findings of the literature review are presented in the general characteristics, methodological characteristics, conceptual characteristics and the services context (Tranfield et al., 2003)

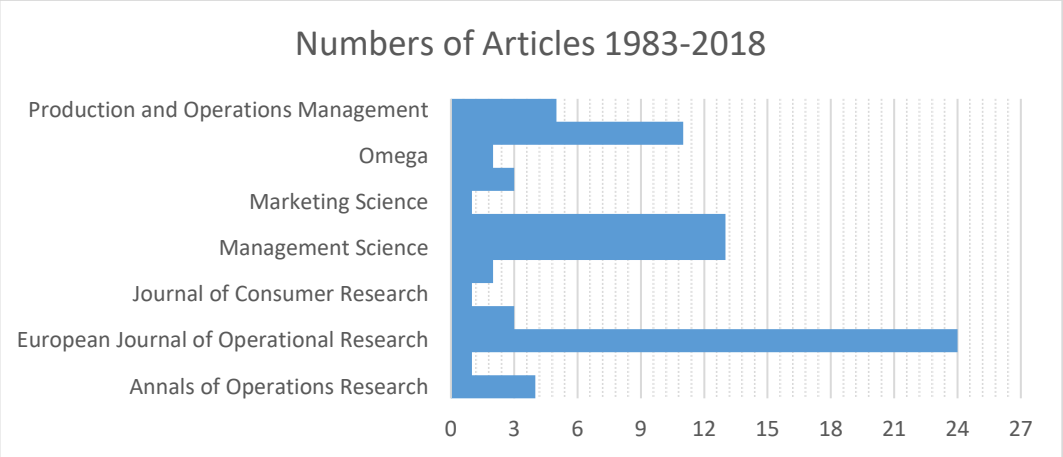
B4.1: Growth of Empirical research in Queueing Theory

It was observed that an empirical research article in queueing theory appeared in Operations Research in the years 1983 and 1987 (Odoni Amendeo, Emily, 1983; Larson,

1987) The article reported an observation and the interviews that have been done with managers “in examining customer reaction to the waiting involved in queues”. The frequency distribution of empirical articles in journals since 1983 is given in Table B4.1.

Over the last three decades, there has been minimal growth in the number of empirical research articles published in queueing theory. The number of empirical research articles are 0.03 percent of total articles (343 queueing theory articles) published since 1977. During the course of this research, it has been observed that the empirical research articles have been published in multiple journals including Annals of Operations Research, Decision Sciences, European Journal of Operational Research, International Journal of Production Research, Journal of Consumer Research, Journal of Operations Management, Management Science, Manufacturing and Service Operations Management, Marketing Science, Naval Research Logistics, Omega, Operations Research, Production and Operations Management. The highest number of articles is published in the European Journal of Operational Research with 24 articles in each one. The frequency of empirical articles published in queueing theory is shown in Table B4.2.

Table B4.1: Number of empirical research articles in journals



The distribution of empirical research articles in queueing theory according to year of publication is from 1983. The selected articles cover a time span of 34 years from 1983 to 2018. This wide time span provides an opportunity for the readers to understand the evolution of the thought process in the field of queueing theory. The majority of the incorporated articles (n=60) are less than 10 years old, demonstrating the rising academic interest in empirical research in recent years.

Table B4.2: Classification of articles by year

Journal Name	1983-1995	1996-2005	2006-2010	2011-2018
Annals of Operations Research	0	0	0	4
Decision Sciences	1	0	0	0
European Journal of Operational Research	1	4	5	14
International Journal of Production Research	0	0	0	3
Journal of Consumer Research	0	1	0	0
Journal of Operations Management	1	1	0	0
Management Science	1	2	3	7
Manufacturing and Service Operations Management	0	1	5	7
Marketing Science	0	1	0	0
Naval Research Logistics	0	0	1	2
Omega	0	2	0	0
Operations Research	2	2	2	5
Production and Operations Management	0	0	1	4
Total	6	14	17	46

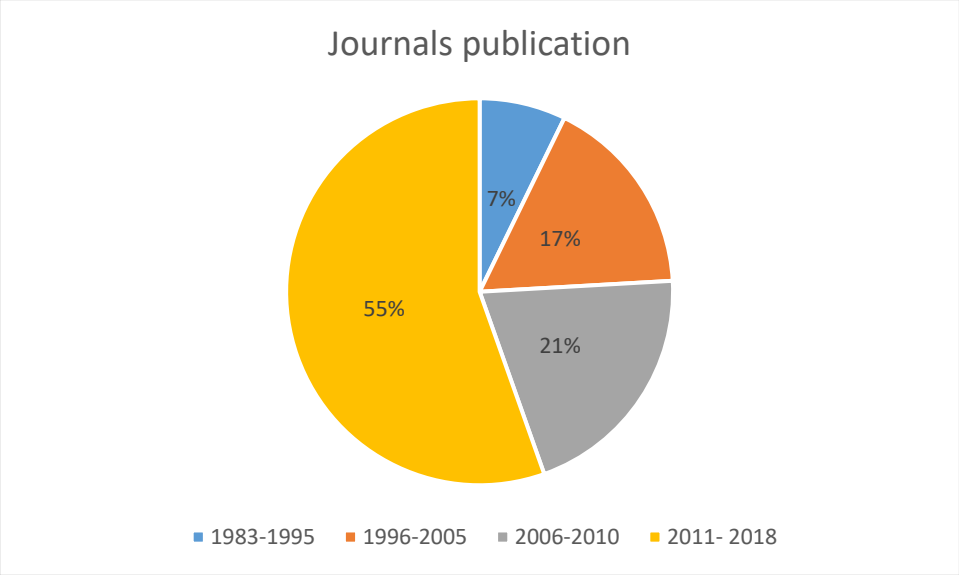


Figure B4.1: Percentages of journals publication by year

B4.2: The intention of empirical research

Generally, the purpose of any investigation in the field of empirical research should serve either theory building or theory verification. Research suggests the theory-building develops new concepts by using existing theories and practices (Glaser and Strauss, 1967; Flynn et al., 1990; Lynham, 2000). While the idea of theory verification is to verify the existing theory by thorough testing of the generated hypotheses within specific conditions, the same concept has been used in the present study to classify the articles. Most articles

published serve theory verification which shows that researchers have been more interested in theory verification rather than theory building.

B4.3: Research design method

Multiple research design methods are used to perform empirical research, including a single case study, multiple case study, panel study, focus research, and surveys. But the most widely used approach which is used in operations management is the survey research method (Flynn et al., 1990). Observation, survey and experiments are the most widely employed research strategies in the studies. Survey was employed by 54% of studies and 41% of studies used a single case study (Bryman and Bell, 2011). The remainder of the studies used the field study design. In the present study, observation and survey research strategies have both been used.

B4.4: Performance and Implementation

The implementation phase of any research design starts with the selection to identify the data collection method. It is essential to determine the range of industries from which to collect the data. In the present research, the concept of queueing theory is not only restricted to one type of service industry but applies to all service organisations. In this case, the UK Standard Industrial Classification of Economic Activities (SIC) is the selected method for this purpose. The investigations and analysis of the data collected in each different sector revealed that the call centres and hospitals contained more than 67% of businesses. In the rest of the articles, data was collected from multiple industries including the fast food industry, bike shop, restaurant, supermarket, and banks.

B4.5: Data analysis techniques

In the opinion of Flynn et al. (1990), empirical data analysis requires generalisation, to frame a new hypothesis or to validate an existing theory. According to Montoya-Weiss and Calantone (1994), the total data analysis method is classified into the groups, as shown in Table B4.3.

Table B4.3: Data analysis techniques with methods in empirical research

Group	Data Analysis Technique	Methods
1	Descriptive statistics	Means, frequencies and proportions
2	Tests of differences/ similarities	t-test, binominal test, analysis of variance (ANOVA), multiple ANOVA (MANOVA), and X^2 test
3	Measures of dimensionalities	Factor analysis, cluster analysis and discriminate analysis
4	Statistical interpretation of parameters	Correlation analysis, canonical correlation analysis, regression analysis, path analysis and structural equation models (SEMs)

Descriptive statistics are applied to show the highest number of published articles (67%). While the statistical interpretation of parameters only includes 26%, the remaining 4% used a mixture of various other techniques.

B4.6: Data Collection Method

As expressed by Wittink (2005), Data collection is a significant phase of any empirical research. The are several methods of data collection. The most well-known include participant's observations, outside observations, interviews, historical archive analysis, and questionnaire surveys. These methods could be used in various combinations to achieve an appropriate data. Among the methods mentioned for data collection and analysis, research suggests that the historical archive analysis is a trustworthy methodology. It is generally used in alignment with another method, including interviews either for multiple or single case studies. Considering the argument of Flynn et al. (1990), the significant advantage of historical archive analysis is its unbiased nature. As he discussed, the most widely used method is the questionnaire survey method. It applies to all single and multiple case studies, panel, and focus groups. But there is a restriction with the significant bottleneck of this design since it is determining the reliability, validity, and generalization of the questionnaire approach. Table B4.4 demonstrates the distribution of empirical research articles in the queue base on the year and research methods. It shows that time of articles from 1987 to 2015 in different journal articles. The researchers used different methods of collecting primary data such as questionnaires, observation, interviews, video recording and historical archives. The statistics show that observation and questionnaires are the most frequent research methods. Studies demonstrate that historical archives and observation are the most applied methods in data collections, used in more than 75% of the articles; while the mix of

video recording and questionnaire were used in 3% and video recording used in 5%. In this case, the remaining reports did not state the data collection methods used.

Table B4.4: Frequency distribution of empirical research articles in Queue

Author	Title	Year	Source Title	Primary Research Method				
				Questionnaire	Observation	Interview	Video Recording	Historical archive
Batt R.J., Terwiesch C.	Waiting patiently: An empirical study of queue abandonment in an emergency department	2015	Management Science		Yes			Yes
Lu Y., Musalem A., Olivares M., Schilkrut A.	Measuring the effect of queues on customer purchases	2013	Management Science				Yes	
Allon G., Federgruen A., Pierson M.	How much is a reduction of your customers' wait worth? An empirical study of the fast-food drive-thru industry based on structural estimation methods	2011	Manufacturing and Service Operations Management					Yes
Seawright K.K., Sampson S.E.	A video method for empirically studying wait-perception bias	2007	Journal of Operations Management	Yes			Yes	
Luo W., Liberatore M.J., Nydick R.L., Chung Q.B., Sloane E.	Impact of process change on customer perception of waiting time: A field study	2004	Omega	Yes	Yes			
Zhou R., Soman D.	Looking back: Exploring the psychology of queuing and the effect of the number of people behind	2002	Journal of Consumer Research		Yes			
Davis M.M.	How Long Should a Customer Wait for Service?	1991	Decision Sciences	Yes	Yes			
Davis M.M., Maggard M.J.	An analysis of customer satisfaction with waiting times in a two-stage service process	1990	Journal of Operations Management	Yes	Yes			
Larson Richard C.	Perspectives on queues: social justice and the psychology of queueing.	1987	Operations Research	Yes		Yes		

Table B4.5 shows the summary of objectives and key findings of the empirical research in queueing theory. It highlights the most issues raised in waiting lines in front of the service organisations are “customer satisfaction, customers’ decision to stay or leave the

queue, studying the behaviour of customers in the queue and the layout of the waiting environment". The findings demonstrate the relationship between the customers and the service organisation depends on different factors, like the number of customers in front of the environment of the waiting line that affects the behaviour of the customer.

Table B4.5: Article's objective and key findings

Author\Year	Article	Objective/Issue raised	Key Findings
Davis M.M. (1991)	How Long Should a Customer Wait for Service?	Fill the gap between the marketing and operations through the development of the model that links customers satisfaction with waiting time.	"The relationship between customer satisfaction and waiting time is apt to be different for each service operation because the relationship is dependent on many factors, some firm-related and others customer-related. However, once that relationship has been determined for a given firm, it can be assumed to remain constant across all of that firm's locations. Recognizing it can provide a service firm with a competitive advantage."
Zhou R., Soman D. (2002)	Looking back: Exploring the psychology of queuing and the effect of the number of people behind	This research investigates consumers' affective experiences in a queue and their decisions to leave the queue after having spent some time in it (reneging)	"The results show the number of people behind increases, the consumer is in a relatively more positive affective state and the likelihood of reneging is lower. While a number of explanations may account for this effect, the role of social comparisons would be the focus."
Seawright K.K., Sampson S.E. (2007)	A video method for empirically studying wait-perception bias	a video-based data collection methodology for studying wait-perception bias. To look at Maister's principle about the impact of wait explanation on wait-perception bias	"Results show that there is a significant difference in wait-perception bias due to the presence or absence of an explanation, but that whether the explanation focuses on customer cause or server cause makes little difference. The findings provide needed empirical support for one of Maister's principles, with the additional contribution being the development of a video-based research methodology that is able to enrich queuing research by enabling the study of wait-perception bias"
Davis M.M., Maggard M.J. (1990)	An analysis of customer satisfaction with waiting times in a two-stage service process	A purely operational approach to providing customer service measures the speed of the service in terms of how long the customer actually waits prior to being served. the goal of the service manager is to provide an acceptable level of customer satisfaction in lieu of a maximum acceptable average waiting time. This new approach to defining customer service raises several interesting managerial issues in the design and staffing of a two-stage (or, for that matter, a multi-stage) process.	"A customer's wait prior to entering the first stage of the system impacts on customer satisfaction much more than the wait prior to entering stage two. The conclusion from this analysis is that in a sequential, multi-stage process, management should design and staff the system so that the shortest wait for the customer occurs prior to the first stage."
Batt R.J., Terwiesch C. (2015)	Waiting patiently: An empirical study of queue abandonment in an emergency department	This study contributes to the understanding of customer waiting behavior by examining the queue abandonment behavior of patients waiting for treatment at a hospital emergency department.	"It shows that the queue length (in our study, waiting room census) impacts behavior separate from wait time. This shows that in queues that are at least partially visible, Erlang-A-type models do not fully capture abandonment behavior. Beyond just the queue length, it replicates that patients respond to other visual aspects of the queue in very sophisticated ways. For example, patients increase abandonment in response to observing arrivals, presumably because waiting patients recognize that the queue is not FCFS and that new arrivals may be served first. Furthermore, waiting patients infer the relative priority status of those around them and respond differently to those sicker and less sick."
Lu Y., Musalem A., Olivares M.,	Measuring the effect of queues on customer purchases	to analyze how waiting in queue in the context of a retail store affects	"Results indicate that waiting in the queue has a nonlinear impact on purchase incidence and that customers appear to focus mostly on the length of the queue, without adjusting enough for the speed at which the line moves. An implication of this finding

Schilkrut A. (2013)		customers' purchasing behavior	is that pooling multiple queues into a single queue may increase the length of the queue observed by customers and thereby lead to lower revenues. Findings show that customers' sensitivity to waiting is heterogeneous and negatively correlated with price sensitivity, which has important implications for pricing in a multiproduct category subject to congestion effects."
Allon G., Federgruen A., Pierson M. (2011)	How much is a reduction of your customers' wait worth? An empirical study of the fast-food drive-thru industry based on structural estimation methods	objective of this paper is to conduct an empirical study of an important industry to measure to what extent waiting time performance impacts different firms' market shares and price decisions	"Our results confirm the belief expressed by industry experts, that in the fast-food drive-thru industry customers trade off price and waiting time. More interestingly, our estimates indicate that consumers attribute a very high cost to the time they spend waiting. Recommendation is an approach to estimate how sales volumes for a service organization depend on all prices and waiting times of the various service providers in the region, along with other relevant attributes."
Luo W., Liberatore M.J., Nydick R.L., Chung Q.B., Sloane E. (2004)	Impact of process change on customer perception of waiting time: A field study	examine how process changes affect customer perceptions on waiting and customer satisfaction	"That process changes can have a significant impact on customer perception of waiting time as well as the actual waiting time, but surprisingly customer satisfaction did not change."
Larson Richard C. (1987)	Perspectives on queues: social justice and the psychology of queueing.	Social injustice, queueing environment, feedback	"Waiting relates to social justice, slips and skips concept. In examining customer reaction to the waiting involved in queues, it becomes obvious that factors other than the actual time spent waiting greatly influence customer satisfaction. A major factor in customer perception of queues is fear of social injustice. Social injustice occurs when a person arriving later to the queue skips ahead of a customer who arrived earlier and who has been waiting longer. While the people who skip feel a certain satisfaction for their good fortune, those who arrived earlier feel victimized. A very effective solution to this problem is to arrange a single queue. Even in the absence of social injustice, waiting can be perceived as frustrating, and many companies have lost business due to queue-related customer dissatisfaction. Innovative and successful solutions include 1. providing live entertainment in the lobby of a bank, 2. installing television sets near the queue, and 3. using the presence of a captive audience to advertise goods and services."

Chapter B5: Empirical Research in Queuing Theory

B5.1: Empirical Research in Operations Management

To have a better understanding of this topic, a clear definition of the terms "Operations management (OM)" and "empirical research"; is required. Operations management is generally associated with topics linked to the management of resources. As Chase and Aquilano (1992) described, operations management is "required to produce the goods and services provided by the organization". On the other hand, empirical research, as Flynn et al. (1990) notes, refers to research that uses data that derive from natural field-based observations from an industry. This contrasts with a studies that are conducted in laboratory settings by mathematical modelling or using simulation models.

Chase (1980) founds, "there is a need for more high-risk research in terms of analytic rigor in operations management. Chase's article, presented in the first issue of the Journal of Operations Management, defined high-risk research as the movement from mathematical

proofs to simulation runs, laboratory studies to field studies, time-independent studies to longitudinal studies, and single variable to multivariate problems. At the time this article was written", despite the long history of using this type of research in the areas of science and management, it was an entirely new type of research in the OM area. Wood and Britney (1988) noted that there were pressures for change in the path of OM research. External demands placed on managers in operations related to the rapid advancement and change occurred in the field. According to the author, this resulted in exerting pressure on academics to operations managers to become more integrative and broader in the scope of both research methods and research topics. Meredith et al. (1989) detailed the state of the research methodologies used both historically and concurrently in the OM research. In the paper by Amoako-Gyampah and Meredith (1989), strong reasons provided that critical review in the direction of OM research is required. These reasons usually presented by researchers and academics, in the late 1970s and early 1980s, for the reassessment of the OM field mentioned below. The first reason refers to the functional area of OM, which excludes the professional status in comparison to the other functional areas of business that include a professional situation. Besides, research directions and techniques in OM have not improved according to the critical paths in the industry. The conclusion of this 1989 study demonstrates some progress in the research of applied topics that are of interest to the industry. In this case, a critique of the survey refers to a low level of development in research methodologies associated with empirical research, specifically in the comparison between published and pipeline research.

On the other hand, this evidenced by OM researchers depending entirely on mathematical modelling and laboratory simulation experiments, and the non-existence of integrative and cooperative research has been almost proven. Minor et al. (1994) provide variable suggestions regarding the future of empirical research.

B5.2: Empirical Research in Queueing Theory

Many studies agree that queueing is not a pleasant time for customers. As Kandemir-Cavas and Cavas, (2007) point out, "waiting in queues for a service is annoying" for many customers specifically when the demand for a service exceeds its supply (Obamiro, 2003). In other words, as expressed by Scotland, (1991) it is a "negative experience." The unpleasant experience of waiting in line often has a negative effect on other clients' experiences at a particular organization. In the opinion of Davis et al., (2003), the method applied by a manager to address the issue of waiting time is critical to the long-term success

of the organization. In this case, waiting causes not only an inconvenience but also frustration to people's daily lives which can lead to customers foregoing valuable services as a result of the length of the waiting line or their perception of the time wasted waiting. Waiting may also result in customers being significantly delayed or foregoing other essential events in order to achieve this goal. As a result, the efficiency of waiting systems is a key factor that influences customers' perceptions of service quality. The waiting time problem is considered inevitable in cases of random requests, mainly because of the capacity to provide satisfactory, yet random service involves high costs. This is the premise from which the queuing theory started to design service systems (Alecu, 2004).

Another study carried out by Bolanle (2011), stressed the usability of queuing theory for the problem of port congestion, to enhance sustainable development of Nigeria ports. Nigeria ports were characterizing with incessant congestion problems in the recent past, which resulted in the diversion of ships scheduled for Nigeria ports to other neighbouring country ports. Consequently, the country lost a lot of revenue. The effectiveness and efficiency of a port is contingent upon loading and unloading of ships. The traffic movement through a port is a complex phenomenon because of the random nature of the arrival time and the duration of service time for ships. Thereby, a systematic approach in port planning, queuing and management is required. The queuing model was applied to the arrival and services pattern, to help with the problems of congestion and proffer solutions to the problematic areas. It was also used to predict the average arrival rate of ships to Tin Can Island Port and the average service rate per ship in a month. The study found that the number of berths in Nigeria port is adequate for the traffic intensity of vessels, but that there are other factors leading to port congestion. These were identified through a content analysis of the interview conducted with stakeholders at the port.

The work of Chin (2007) investigated the submittal review/approval process using queuing theory to determine the major causes of long lead times. Under his study, he explored the underlying causes of waiting in a process flow results in the improvement of methods from the queuing perspective. In an article by Joel Zhang Laifu (2000), the performance of single-channelled and multiple channels queues using the discrete-event simulation technique was evaluated. The input to the simulators is based on live data. A customer is allowed to swap to a shorter line which expects to have a shorter wait. But the service time needed by some customers in the queue may be longer; therefore, despite their expectation, they may still have a long wait, possibly even longer.

On the other hand, Opara-Nadi (2005) insisted that customers want fast checkout systems, which is always a concern in improving store checkout systems. The study was initiated with a pilot project that observed ten shoppers and compared the cashier checkout with electronic self-checkout systems. Data for the survey were collected by observations of checkout processes at Wal-Mart Super Centres in Jackson, Mississippi. In this case, formulated research questions statistically tested by employing the independent samples t-tests and the chi-square test for independence. The results of these analyses demonstrated that consumers preferred the cashier checkout system compared to the electronic self-checkout system, although shoppers also intended to learn about the use of a new self-checkout technology. For this study, a random sampling technique was used for two weeks in three stores and selected 90 customers from each of the two checkout systems.

Most of the businesses turned into the service organisations in the modern societies. It makes a competitive environment for the organisations. Customer satisfaction and service operation capabilities provide a competitive advantage for organizations in the marketplace. This has consequently led to increasing importance in service operations management. As a result, queues and waiting times have gained considerable attention to all business operation management specialists. (Bonga, Wellington, Garikai, 2014)

Table B5.1: Past research findings

Author	Place	Research method	Outcome
Obamiro (2010)	A teaching hospital in Nigeria	observation technique for the first three days of each week, Monday to Wednesday because they were the busiest	concluded that the "knowledge of queuing theory can help service managers to make decisions that increase the satisfaction of all concerned parties (customers, employees and management)"
Dais, Famula (2010)	Intercontinental Bank, Osun State, Nigeria	Observation for 21 working days from 08:00am to 4:00pm	"The traffic intensity obtained is 0.8378 which indicates the probability of a customer queueing or waiting for service on arrival."
Gosha (2007)	A barber shop	Survey of 25 participants	concluded that customers are patient to wait only if they have the information of the waiting list and are able to calculate their turn of being served.

B5.3: Behavioural Operations Management

Queuing theory is a sub-category of one OM discipline which applies the results of a behavioural approach to developing more realistic intention assumptions; for example, a

static characteristic of the customer in queuing systems traditionally modelled by patience and abandonment (e.g., Riordan, 1962; Brandt and Brandt, 2000). However, there is empirical evidence that patience is often a characteristic of the system state (Taylor, 1994; Leclerc et al., 1995; Hui and Tse, 1996; Carmon and Hanneman, 1988). This relationship has been explored in the behavioural literature by Maister (1985), Levine (1997), Thieery (1994), Zakay and Hornik (1996), and others. In this case, Zohar et al. (2002) explored the equilibrium conditions by incorporating customer patience into a queuing model based on expectations and anticipated waiting times. In this queuing context, the model-generated theory inspired the need for experimental validation, which in turn developed more accurate intention related assumptions for use in subsequent models.

Chapter B6: Customer Behaviour in Queues

B6.1: Effect of Externalities on Queue Selection

There is a wealth of literature that discusses the decision process of choosing between queues. Hassin and Haviv (2003) provide a comprehensive survey of the research on the equilibrium behaviour of customers and service providers in queuing systems. Also, the effect of negative externalities on the choice between two queues has been well studied (Whinston 1977, Whitt 1986). Although the study focuses on joining shorter lines, it should consider that those simple characterizations of the probability distributions do not exist even for join-the-shortest queue discipline. On the other hand, unfortunately, the steady-state probabilities generated by joining the long queues have not been studied, perhaps because of a perceived lack of applicability.

Consequently, the number of papers that model positive externalities in multiple queues is limited. In a working paper by Debo et al. (2007), customers arriving in the market choose whether to join a single line or not. In this case, when there are no waiting costs, researchers find a threshold length below which customers with pessimistic information do not join, and above which they do participate. However, when waiting costs, that is prices are overtly attached to waiting queues as well as the time it takes to served by the organisation, research shows that a non-threshold strategy may determine the equilibrium. In contrast, using a more productive two-queue model, we can demonstrate that both positive and negative externalities in queues have the potential to arise; due to queue-length information alone.

The report by Su and Zenios (2004, 2005) focused on patient choice in kidney allocation in a queueing context. On the other hand, Gans (2002) studied customers who select a service from a variable service available, with uncertain quality. Customers learn the actual condition of every service provider through (expensive) repeated service sampling. There are no congestion externalities in the model. Lariviere and van Mieghem (2004) "model a system in which customers find congestion costly, and therefore plan to arrive when the order is underutilized". They show that when customers choose arrival times strategically, the equilibrium arrival pattern approaches a Poisson process as the number of customers increase.

B6.2: Herding Theory

As discussed by Baddeley (2010), herding is the behaviour of a person who follows an individual or a group randomly. These actors make the same decision by looking at the action of other people without thinking independently (Loewenstein, 2000; Shiller, 1995; Banerjee, 1992). The theory of herding goes back to Keynes (1930) who emphasized this in his research on the people who imitate others in an ambiguous situation. He assumed herding as a reaction to uncertainty for the people who do not listen to their signals. Because they are uncertain about their information and unable to make a decision based on their knowledge. Also, they trust other people's decisions because they think other people might have more information (Scharfstein and Stein, 1990; Baddeley, 2010; Kahneman, 2003). There are many surveys about herding in psychology, economics, and management. In economics, Chamley (2004) did a review of all previous herding surveys. In queuing theory, researchers refer to the impact of external information on the choices of customers who are unable to decide independently and do not wait for the costs (Callander and Horner, 2009; Veeraraghavan and Debo, 2009).

There are a few pieces of research on behaviour herding based on partial information like the work of Smith and Sorensen (1998). In their model, people make a decision just by looking at one or two previous customers. The focus of their work was on the likelihood of truth based on convergence. Banerjee and Fudenberg (2004) studied a group of people that decide at the same time by looking at an exact number of customers. The emphasis of their work was on the convergence of public opinion.

B6.3: Majority Effect and Conformity

The social influence of a group on an individual is called conformity (Allen, 1965; Burnkrant and Cousineau, 1975; Lee and Park, 2008). Burnkrant and Cousineau (1975) defined conformity as "the tendency of opinions to establish a group norm as well as the tendency of individuals to comply with the group norm." According to Asch (1956), the majority effect is the base of conformity, as people follow the majority without thinking about the reasons which in some cases results in a wrong decision. Banerjee (1992) noted this continuously in circumstances when customers do not have enough information or are unsure of how to react and make a decision. They follow the group without making their own decision even if the group is wrong. As people live together, their behaviour impresses each other to learn from him or her (Lee and park, 2008).

In the view of psychologists, conformity is the pressure of the group on a single person which causes the person to follow the group. This pressure and influence of the group wins the will of individuals in decision making (Kiesler & Kiesler, 1969). Researchers found that conformity has a significant impact on consumer behaviour, especially in the services sector and buying products. In purchasing goods, customers make decisions based on the best seller or popular products. For example, customers follow others to identify what they choose and, consequently, they follow the customer decision. (Lascu and Zinkhan, 1999; Bikhchandani et al., 1998; Calder and Burnkrant, 1977; Lee and Park, 2008).

Table B6.1: Types of Conformity

Informative	the influence to accept information from others to evince the truth to reality
Normative	the influence to conform to the expectation of others

Based on the advantage of different methods within conformity and, which fit with the aim of the study, informative compliance is the focus of the researcher. In the places that customers do not have enough information about the quality of services, they mostly join the popular queue to gain more knowledge.

When the customer ahead in the queue is aware of other customers behind him or her, people with high informative conformity perceive the quality of services or products as exceeding than their expectations. Then, this customer becomes more confident about his or her choice. This is also applicable when the number of customers in front of them is more

than they realised, as the number of people already having chosen influences and confirms their ideas, so they think the product is of high quality. There is a direct link between several people in the queue and the assumption of the customer from the quality of service. The result of Cialdini (1985) survey online as a social comparison demonstrate how socially valuable products attract customers to stay in a long queue.

The research of Debo et al. (2007) on people who decided to join the queuing system on arrivals investigated two different scenarios. The first scenario excluded waiting for cost, while the second scenario included waiting at an overt price. With no waiting cost, people with negative conformity join the queue, especially when it is above the threshold length. However, with waiting cost, the non-threshold plan may control the balance. The result of Gans (2002) was observed on customers who were ambiguous about the services or product and made selections based on previous experience. His model was based on experience rather than conformity or observation. The result of the study by Lariviere and Mieghem (2004) points out that customers would like to arrive when the queue is short, which means fewer people are waiting for services.

Studies in social psychology show that when people compare themselves to others, they like to improve their skills and learn to be on top of others (Festinger 1954; Gilbert et al., 1995; Taylor et al., 1995). Social comparison mostly happens when people are uncertain, or they want to evaluate themselves against others (Gibbons and Brunk, 1999; Zhou and Soman, 2003; Schachter, 1959). In the study of Koo and Fishbach (2003), the number of customers in line shows the importance of their goal and validates their decision.

B6.4: Waiting as a Business Issue

Maister (1985) developed a framework that identified the "factors affecting customer satisfaction with waiting. His framework identified situations in which waits were perceived either more positively or more negatively as a result of the circumstances of the wait. Maister's model has been widely accepted because of its strong face validity". The fundamental premise of the Maister model is that it is the perception of the wait that determines satisfaction rather than the actual waiting time. "Much of the research on waiting has focused on strategies to reduce or avoid waits through the use of operations management techniques or altering the perceived wait through perceptions management" (Katz et al., 1991; Maister, 1985).

Maister, (1985) developed a theory of queue psychology that focuses on a combination of perception and expectation management. There are eight principles which organisation can use to influence customer satisfaction with waiting times.

1. Unoccupied waits seem longer than occupied waits.
2. Pre-process waits seem longer than in-process waits.
3. Anxiety makes waits seem longer.
4. Uncertain waits seem longer than waits of a known duration.
5. Unexplained waits seem longer than explained waits.
6. Unfair waits seem longer than equitable waits.
7. The more valuable the service, the longer people will be willing to wait.
8. Waiting alone seems longer than waiting with a group.

Katz (1991) "did an empirical study about bank customers, examining how a service firm might improve customer satisfaction with waiting in line. They collected customer opinion data shortly after customers had completed their bank transactions and found that customers tended to overestimate how long they had waited in line".

B6.5: Effect of Queue on Customer Behaviour

Operations and perception management are two methods of organising queues (Katz et al., 1991). Managing customers in the queue and their relations to the server is the main purpose of the operations aspect to make the wait useful.

Actual waiting time and perceive waiting time are two types of measuring service quality in this sector. According to Davis and Vollman (1990) the time that customers stay waiting for their services has an influence on their satisfaction towards that service. Taylor (1994) in his research shows that actual time for waiting is not the only reason of keeping customers happy, besides that perceive waiting time i.e. how to make customers happy in the queue and how to keep services more convenient based on their expectations is very important to make them satisfied (Davis and Heineke,1994). Another research that was done by Katz and Larson (1994) shows that improving customer satisfaction is dependent on improving their waiting experience and minimizing their wait time in the queue.

The aim of many different research studies that have been done on queue management and models was to increase the efficiency of the system (Gross & Harris, 1985; Newell, 1982). Today most of the work in this area is based on mathematical models to find

better structural algorithms to develop the queue operations of the business. As queues and waiting times are the main points of relation between customers and businesses, the satisfaction of customers from their experiences in this area is the goal of management in all departments like marketing and finance (Taylor, 1994; Zhou & Soman, 2003; Hui & Tse, 1996).

Taylor (1994) mentioned that to have a better experience of waiting and queuing we should know why people stay in the queue for the services. He describes it as "the time from which a customer is ready to receive the service until the time the service commences." Besides the operation management of queue One way of keeping customers happier about the queue and having better experiences while waiting for their services is customer perception management. In this way instead of reducing the waiting time and make the queues shorter, which may not be economically viable for the organisation, managers can make customers more contented with better experiences while waiting in queues.

There is lots of research on the behaviour of customers in the queue and research-based suggestions on how to manage and make better and more convenient queues. Most of those researchers collected their data through methods such as experiments and observations.

One research was done by Brown et al. (2005) on the effect of waiting time for the customers in call centres who leave the system found that in this system, customers have no clue about the queue and waiting times. Because they are unable to observe the number of people ahead so the only information that they have is the approximate delay time that they hear by the server (Ibrahim and Whitt (2011). Compared to the systems where the queue line is visible to customers like fast-foods, restaurants and the business where customers stand in line, people can estimate how long they should stay in the queue and make their decision to join it or not. The length of the queue is one of the important factors that determine whether customers join the queue or not. Erlang did not mention this in his research before. However, according to Gross et al (2008) this model is the Poisson process that customers may leave the system based on the queue length.

Another study that has been done in the retail industry is by Png and Reitman (1994) who did their research in gas stations found that compared to other factors, waiting time is the main one that attracts customers in this system. In this research, they used aggregate data to find waiting times. The study that was done by Allon et al. (2011) in the fast-food industry

shows waiting time affects the demand within the industry. Allon used structural estimation methods to find price competition between stores.

Based on research done on the effect of queue length and waiting time on the customer behaviour, the effect is non-linear. The anecdotal data from non-linear customers in different situations have been studied by Larson (1987). Larson shows perception waiting time for customers is the important factor for satisfaction, and comparing to actual waiting time it has different elements and essentials for them that has a non-linear outline (Larson, 1987; Davis and Vollmann, 1993; Berry et al., 2002; Antonides et al., 2002; Mandelbaum and Zeltyn, 2004; Hasija et al., 2008).

Another non-linear method used in this area of research was used by Mandelbaum and Zeltyn (2004). They showed that between queue length and balking i.e. customers leave the queue, there is a non-linear relation. There are some factors that change the view of customers while in the queue (Larson, 1987):

- whether the waiting is perceived as socially fair
- whether the wait occurs before or after the actual service begins
- feedback provided to the customer on waiting estimates and the root causes generating the wait

Berry et al. (2002) is among the researchers that test these factors through the use of empirical study. He conducted controlled laboratory experiments in some cases to test elements of perceptions of waiting. Some results showed that the effect of the length of the queue on service rating in the waiting scenarios is less is the queue when it takes less time to be served than in the queue where they stay longer to be served (Hui and Tse, 1996). The experiment that tests the customer balking from the queue was been done by Janakiraman et al. (2011). These research studies suggested two reasons why balking or reneging happens in queue i.e. after the customer joins the queue and stays for a while then they decide to leave the queue. Other researchers studied work on the elements of satisfaction in the queue like music or television that create a better environment for customers and their perception of the waiting time (Hui et al., 1997; Katz et al., 1994).

Table B6.2: Queue Survey

Researcher	Year	Method	Industry	Finding
Taylor	1994	Survey	Airline	delay decreases service evaluations by invoking uncertainty and anger affective reactions
Deacon and Sonstelie	1985	Survey	gasoline purchases	evaluate customers' time value of waiting
Chandon et al.	2005	Survey		customer purchase intentions do not always match actual purchasing behaviour

Forbes	2008	Observation	Airline	customer expectations play an important role in mediating this effect
Campbell and Frei	2010	Empirical study	Bank	That teller waiting times affect customer satisfaction and retention. Their empirical study reveals significant heterogeneity in customer sensitivity to waiting time, some of which can be explained through demographics and the intensity of competition faced by the branch
Aksin-Karaesmen et al.	2011		Call centre	Heterogeneity in caller's waiting behaviour. Our study also looks at customer heterogeneity in waiting sensitivity but in addition, we relate this sensitivity to customers' price sensitivity
Afeche and Mendelson	2004, 2010		Call Centre	association between price and waiting sensitivity has an important role for setting priorities in queue and it affects the level of competition among service providers
Dube et al.	1988		Theatre	pre-process waiting is more uncomfortable for consumers than in-process waiting

B6.6: Effect of Delay Announcements

There are so many literatures in the queue that talks about the effect of information for new consumers (Aksin et al., 2007; Armony and Maglaras, 2004a,b; Jouini et al., 2011). Most of this literature studied the behaviour of customers in the queue in call-centers. Some studies that have been done on the queue show that in some cases managers hide the information about the delay and the queue to reduce balking and to block customers for more benefit (Hassin, 1986; Whitt, 1999). Guo and Zipkin (2007, 2009) considered the effect of different types of information about the queue on customer choices. In their study, they worked on three levels of information (no information, partial information and full information) provided to customers to see how they decide to proceed to queue based on the information. Debo and Veeraraghavan (2014) studied customer behaviour with partial information about the service rate.

Unreasonable delays make the customer unhappy from the services. "The problem of waiting time gets complicated by a lack of facilities and justification for the rationale of such waiting" (Duggirala et al., 2008). Bielen and Demoulin (2007) founds in their study that "customers' perceptions of waiting time influence their satisfaction with the service that they receive".

B6.7: Economics View of Purchasing Decision

Studies demonstrate the economic cost of waiting in line for individuals and businesses. All businesses and companies try to reduce the cost of waiting in their departments. To reduce waiting cost, managers try to run their queues in a more efficient way and provide faster services for customers (Katz et al. 1991). Davis et al. (2003) indicated that the aim of managers in care units like hospitals is to minimize the waiting time until it became zero customers in the line. Based on his study, he found that the reasons managers wish to make a zero waiting time for their customers are; (a) in developed countries, time is

very important for customers who are often rushing back to job or other commitments, (b) as the customers stay shorter in the queue they feel more comfortable and satisfied by the process and more likely to become loyal customers and (c) using new technologies allow customers to compare the speed of service and this influences their satisfaction. These managers believe that the shortest time possible for customers to stay in line reduces the costs for both sides and has a positive impact both on customers and the organisation.

The famous saying that "Time is Money" demonstrates the value of time loss while waiting and indicates how important it is for costumers to get services faster. In developed countries, there is high competition between businesses to attract and keep their customers satisfied. In order to do so, they try to serve them as soon as possible, as organisations are aware that customers can shift to service providers in hopes of quicker service and consequently greater satisfaction.

Becker (1991), a researcher in the field of Economics compared the number of customers in two famous restaurants in which one of them was very busy with a long queue and the other one is empty. The aim of Becker was the monopoly pricing and the right information that the restaurants provide to customers. Becker explains why consumer demand is very "fickle" and why the "shift of restaurants between 'in' and 'out' categories occurs" using a pair of equilibria that are unstable under large demand changes. Bikhchandani et al. (1992) have studied the behaviour of customers when they buy a product about which they have no information on its quality. Their study found that the decisions of other customers and the information that they provide during their shopping affects indecisive individuals just by looking and influences their decisions without thinking about own preferences.

In the current study, people subjects make decisions about joining the queue just by looking at the length of the queue without having any information about the people in the queue or the customers who have already been served and how they had made their decision.

Chapter B7: Under Research Domains and Gaps Identified

Most studies on queuing show that waiting times and long queues have negative impacts on the point of views of customers and lead to negative reviews and reputations for organisations (Hassin and Haviv, 2003; Debo et al., 2007; Baddeley, 2010; Kahneman, 2003). A review of the literature demonstrated the focus of traditional research to solve the problems of queuing statistically by making queues shorter. However, in recent years

researchers found that the design of the queue is not entire problem, but understanding the behaviour of customers in queue is also very important. Examining the literature shows the importance of analysing behavioural operations in businesses (Callander and Horner, 2009; Veeraraghavan and Debo, 2009).

Most of the research in waiting time indicates that the negative evaluation of waiting in line has both economic and psychological cost (Koo & Fishbach, 2010; Bateson & Hui, 1992; Larson, 1987; Osuna, 1985; Baker & Cameron, 1996; Houston, et al., 1999; Hui and Tse, 1996; Katz et al., 1991; Taylor, 1994; Tom & Lucey, 1997).

Koo and Fishbach (2010) worked on the waiting line and the behaviour of people in the line on how they evaluate the value of service base on the number of customers behind or in front of him/her. Research shows that more customers ahead of queue have a negative effect on him/her. However, for the new customers that has a first experience of using the services, the length of the queue is a signal on the quality of the product. Past researches just look at the link between the information on waiting line and value of the services or products and just look at the type of waiting's in the waiting area. These studies indicate the lack of understanding about the charactristics of the customers in the queue (Hui & Tse, 1996; Koo & Fishbach, 2010; Clark and Goldsmith, 2006).

Some research on queuing in the field of psychology show that in some cases longer queues attract some customers who believe the number of people in the queue shows the value of product, and the number of people behind them validates their decision of product or service (Loewenstein, 2000; Shiller, 1995; Banerjee, 1992). The herding theory explains how customers without sufficient information to make personal decisions about product or services piggyback on the choice of others and they prefer to join the longer queue to compensate for their inability to decide on their own (Callander and Horner, 2009; Banerjee and Fudenberg, 2004).

To fill the above gaps, the researcher aims is to support management's understanding of customer behaviour by studying queue length and deciding the optimum length of a queue to attract and retain customers and how it influences the expected product value, intention to switch to alternatives and offers base on the different type of customers in the different locations. Understanding this phenomenon will complement the quest for a solution to reduce queue length even at peak times. Secondly, the researcher focuses on the physical

queue to determine characteristics associated with this visual information which acts as a positive signal and leads to customers deciding to join the queue as a result.

Chapter B8: Summary and Conclusion

As a result, the methodology of a systematic literature review for the purpose of this thesis has been examined. This section provided an overview of the extant literature with respect to behavioural aspect of physical queues at businesses. The researcher is pursuing this thesis in order to identify the key research gaps in the literature and understand the relationship between variables which helped in the development of the theoretical framework. Fundamentals and preliminaries of queueing theory in operations management have been discussed. The different types of queuing models and structures which service organisations use in their day-to-day activities to deliver services to the customers have also been presented.

PART C: RESEARCH METHODOLOGY

Chapter C1: Introduction to The Research Methodology

This part of the thesis is concerned with the adopted research methodology that has been designed to explain the philosophical view of the researcher and the best method of data collection, aimed at exploring the optimum length of the physical queue in service businesses, to send a positive signal for customers to join the queue. The research methodology part consists of five chapters as follow:

1) Introduction to the research methodology
2) Theoretical framework
3) Research philosophy and approaches
4) Formulating the research design
5) Summary and conclusion

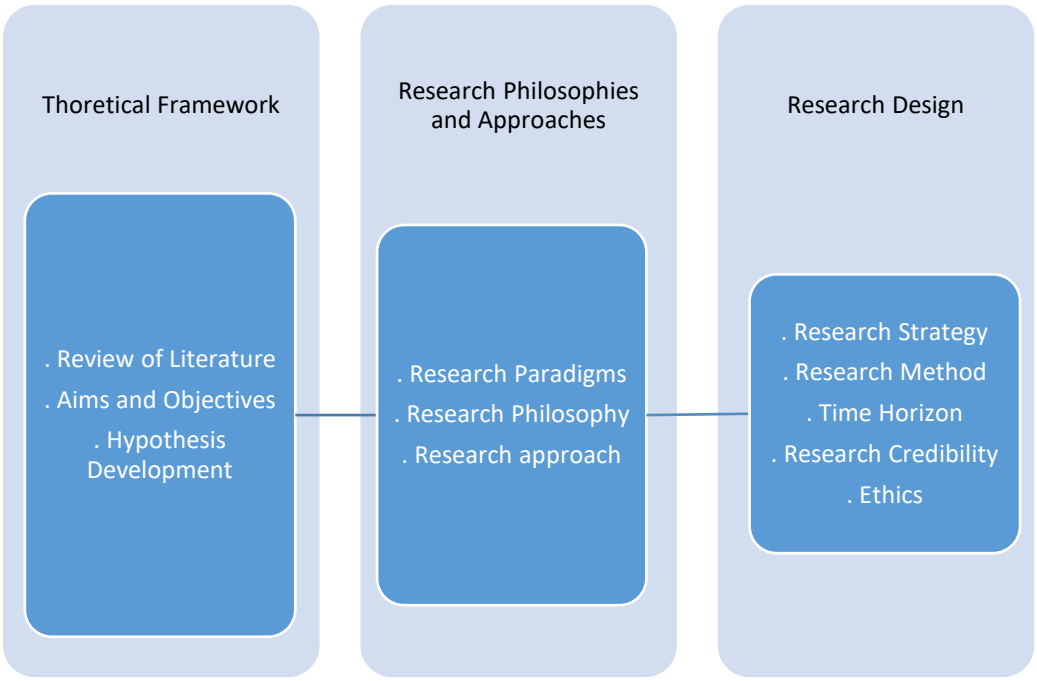


Figure C1.1: Process of research methodology

Chapter C2: Theoretical Framework

This chapter outlines the aim of this research and presents the theoretical rationale underpinning the research hypotheses and observation study. Furthermore, research hypotheses are presented and the theoretical framework of this research is illustrated. The chapter concludes with a discussion pertaining to the philosophical stance of the researcher.

C2.1: Research Framework

Central to any research undertaking is its design (Bryman and Bell, 2011), an operational framework that guides the systematic collection and analysis of data and ensures that the research is undertaken in a manner consistent with the philosophical orientation, aim, and purpose of the research (Malhotra and Birks, 2007; Sekaran and Bougie, 2012) Thus, research design ensures that the study undertaken is relevant to the problem (Iacobucci and Churchill, 2010) This research follows the research design framework suggested by Saunders et al. (2009) depicted in Figure C2.1.

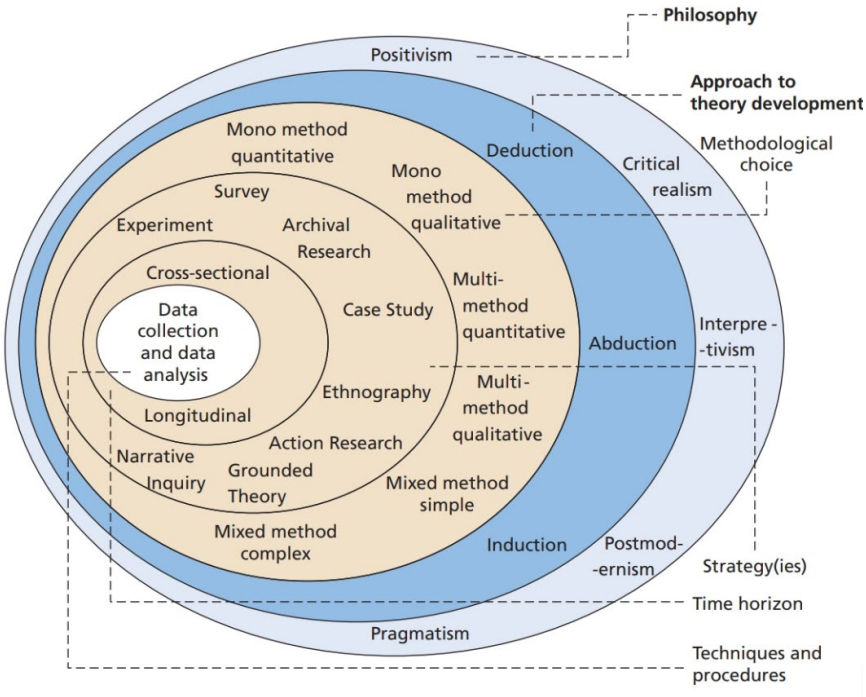


Figure C2.1: The "Research Onion"

Source: Saunders, et al., 2019, p. 130, Figure 4.1

Each layer in Figure C2.1 represents a discrete though interrelated set of activities that must be considered in designing a robust and coherent research design. Importantly, each component of the research design offers alternatives that need to be taken into consideration given their benefits and relevance to the study (Saunders et al., 2009) The interrelated nature of the research process means that most of the research design components had to be considered simultaneously. To ensure lucidity, each of these research components are discussed in subsequent sections, wherein the research framework will be depicted at the start of each section, highlighting the research components being discussed.

C2.2: Research Aims and Objectives

The literature shows that most of the studies on queueing in businesses have been on brand and large size businesses in health service, transportation and call centres. The focus of most papers has been on how to manage and run queues faster (Part 2: Literature Review) Carbone and Haeckel (1994) and Raz and Ert (2008) studied the herding behaviour of customers in the queue and concluded how herding theory affects the choice of customers to stay or balk from the queue. None of these research studies makes a clear suggestion for managers on how to run physical aspects of queueing to a specific length in businesses to persuade customers to join the queue.

The aim of this research is to empirically investigate the impact of physical queueing on the customer and the optimum length of physical queues in service organisations to send a positive signal for customers to join the queue. To achieve this, the following three objectives have to be considered:

1) To investigate the impact of physical queue length on the behaviour of customers from the perspective of businesses;
2) To identify the optimum queue length in order to advise operations managers in businesses on how to best attract customers;
3) To investigate the influence of the type of customer and location of businesses on the service variables in terms of the length of physical queues.

C2.3: Theoretical Consideration

The researcher considered queueing theory (Erlang, 1909) as possible theoretical explanations of the relationship between the length of the physical queue and the outcome variables. In the field of operations research, researchers develop efficient policies through

queue structure and management. Queueing structure in operations research is based on mathematical models to improve it more accurately (Gross and Harris, 1985; Newell, 1982). Recently, scholars have been interested in customers behaviour in queues to understand their action. It helps to increase their satisfaction and make more profit (Taylor, 1994; Zhou and Soman, 2003; Hui and Tse, 1996)

Some service organisation like restaurants can lose their customers easily if they could not satisfy them during the process. For these customers, quality of the service is the most important aspect of their needs (Devaraj et al., 2001; Stank et al., 1999). Relational and operational elements are two main elements of service quality. "Relational elements refer to activities focused on understanding the needs and expectations of customers such as customer loyalty" (e.g. Bell et al., 2005; Crosby et al., 1990; Payne and Frow, 2005). Operational elements are the "activities service providers perform to achieve consistent high level of productivity, quality, and efficiency that are essential determinants of service quality as well" (Stank et al., 1999; Harvey, 1998). Queue management is such an important operational element of service quality. Moreover, Frazier et al. (2004) contends that a specific theory or prior research should underpin the choice of moderators. Consequently, this study employs queueing theory to support the inclusion of the type of customers and the location of the business as a potential moderator of the effect of length of queue on the outcome variables.

C2.4: Theoretical Framework and Research Hypothesis

A theoretical framework evolves from the reviewed literature and helps the researcher to see clearly the main variables and the relationships between the focal variables in a given study (lmenda, 2014) Importantly, it guides the researcher in the collection. interpretation and explanation of the data (lmenda, 2014). This study develops a theoretical framework illustrated in figure C2.2 by integrating the literature on queueing theory. The theoretical framework is tested empirically to understand how the model performs based on the length of the physical queue. Specifically, this framework captures

- The impact of length of physical queue on quality, intention to switch to alternatives and offers;
- How the location of business and type of customers impact the customer's choice in different service organisations.

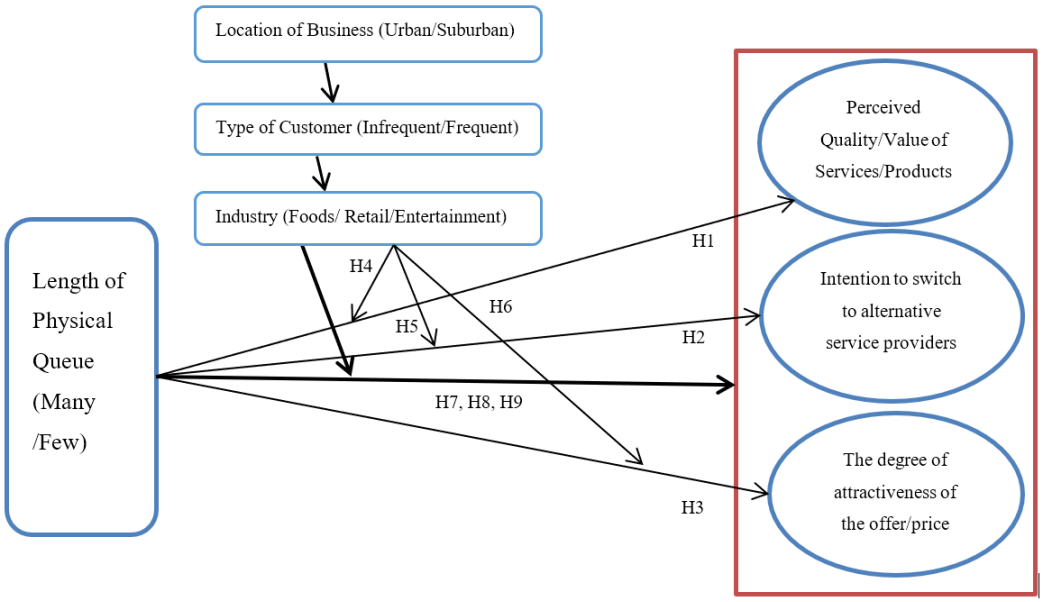


Figure C2.2: Research Framework

Hypothesis Development

In this section, the research hypothesis and its theoretical rational is explained. First, we clarify the theories behind the selected variables; then, the hypotheses are presented. Queueing theory is the main theory that is considered in this study to investigate the impact of the physical queue length on the customers.

The first point of interaction between customers and a service provider is the queue. Understanding customers and managing a queue to attract and satisfy them are challenging tasks for operations managers. Naor (1969) explained the effect of queue length on the customer to stay or balk from the queue. Customers make their choice for selection of services that they need based on the information that they receive from the length of queue such as quality of service provider, promotional offers or intention to switch to alternatives. Therefore, the focus of this study is on the length of the physical queue in different locations with different type of customers and its impact on the quality, offers and alternatives choices to the customers.

Length of Physical Queue

Larson (1987), Hui & Tse (1996), Taylor (1994) and Zhou & Soman (2003) found that waiting in a queue causes frustration, anger and anxiousness. Hui & Tse (1996) argue that the perception of a long time waiting in a queue has a direct link to negative feedback given by a customer. Consequently, positive service evaluation more often happens in the case of a short time waiting.

Koo and Fishbach (2010) introduce the concept of goal-based analysis which is the time a customer has to wait in a line based on the number of customers ahead to determine the amount of effort a customer has to put in to achieve the goal. On the other hand, it implies that an increase in waiting time for receiving the expected service, results in negative responses. Taylor (1994) points out the proper evaluation of a product reduces negative perception caused by the long waiting time. Therefore, lower product evaluation emerges if the quantity of people in front is high.

Extended queue, which means customers have to wait a long time in a line, might result in leaving the queue or choosing an alternative for multiple reasons (Zhou & Soman, 2003) Customers may prefer to return at another time when accessibility of services is quicker. The reasons for quitting include high cost for waiting, lack of time, joining an alternative option, or unfavourable response. This situation usually happens when there is a high number of customers in front. On the other hand, if the number of customers behind is also high, reneging is less likely. There are multiple reasons for this fact. First, it gives the perception of a high-quality service or product when many people are waiting in a line; therefore, it is valuable to spend more time to receive it (Koo & Fishbach, 2010; Zhou & Soman, 2003; Cialdini, 1985). Second, a customer assumes that if she or he decides to join the same queue later on, they may have to stay just as long or longer to receive the same service. The customer is likely to feel that they should persevere having already invested time and effort and already in position to receive the service. (Koo & Fishbach, 2010; Zhou & Soman, 2003) Finally, when there are many people waiting behind a customer, social comparison with the those behind occurs and reduces the negative effect (Zhou & Soman, 2003) Studies agreed that social comparison is an automated phenomenon which is unplanned and effortless (Gibbons & Brunk, 1999; Zhou & Soman, 2003) This phenomenon is more observed with unsettled customers. Besides, the report by Koo and Fishbach (2003) makes it clear that the value of achieving the goal for which one is queuing can be estimated via the physical presence of customers in a queue.

Types of Customer

Physical visits were conducted to get a better understanding of the performance of a business (Kim and Kim 2004) It demonstrates the fidelity of customers and their willingness to use a product from a specific brand (Clark and Wood 1998) In this situation, the quality of the product is the main assessment criterion. For example, this type of customers is usually observed at the restaurant where the quality of the food, including the ingredients and the quality of the place, are crucial to them (Johnson and Mathews, 1997) It is assumed that the level of expectation from service quality in repeated customers are higher compared to infrequent customers. Random customers usually evaluate service conditions in the process of their visit (Bornstein, 1989) In this case, customers make the decision based on either internal or external information. Repeated customers rely on internal information like their experience and prior knowledge, while infrequent or random customers rely on external sources like the length of the queue (Foulkes, 1984) Although it is difficult to estimate the rate of repeated and infrequent customers, in aggressive and competitive businesses, usually the random customers exceed. This study investigates the interpretation of various customers of the quality of service. Furthermore, it scrutinizes the reasons for customers' proposals and shifts to a different business. In the literature, little effort has been put into explaining frequent visits in the area of service providers. Initially, this study focuses on the distinction between repeated customers from infrequent ones.

Perceived Quality/Value of Services/Products

The quality and value of services in an organisation have high impact on the behaviour of its customers to join queue to use their services (Hwang and Kandampully, 2015; Alex and Thomas, 2011; Asmayadi and Hartini, 2015) Parasuraman et al. (1985) defined quality as an error-free product, and service quality as a difference between the services that customers request and their expectation. The research by Chathoth et al. (2014) shows customers consider the quality of service as a component to make them happy and continue to attract them to the business. Another study by Yu and Fang (2013) presents the quality of service has a direct effect on the customers' happiness and their behaviours to use the services.

The assessment of service quality usually is evaluated based on the level of differences between the assumption and expectation of a customer from a specific service, and what they really receive (Gronroos 1983; Lau et al. 2013) Therefore, according to the

level of a contract between the customer's expectations and what they earn, service quality is defined as a comprehension that customers get based on the service experience (Ryu et al. 2012) The service performance or the service deliverance plays an essential role in perceived service quality. It means the behaviour and characteristics of employees who deliver the service impact the purchase behaviour (Abebe 2014), which establishes a vital distinctive and driving weapon for achieving efficiency and high-quality performance within businesses (Bharadwaj et al. 2015). Structured and managed transaction operations that process a customer purchase since receiving until fulfilment, has a massive impact on customer satisfaction and business performance. In this case, there are multiple different types of services, in situations where the service is instantly consumed after being provided, the level of customers' satisfaction is higher (Kotler and Keller 2007)

The process of economic value and the relation between the capacity of the service provider and behaviour of customer has been evaluated by Pine and Gilmore (2000) They demonstrate that the quality of offering services is important in the view of customers based on their expectations. For the service organisations, it is interesting to know the behaviour of different types of customers toward service quality in service organisation based on the queue length. Therefore, we investigate the quality of services in organisations.

H1: In the physical waiting line, longer queue length infers higher quality of services in different service industries.

H4: In the physical waiting line, types of customers depend on the location of business infer higher service quality from longer queue length in different service industries.

Intention to Switch to Alternative Service Providers

Waiting in a queue is not always an optional issue; in special occasion like payment of bills or purchasing urgent products, queueing becomes an inevitable phenomenon (Barzel, 1974; Cameron et al., 2003; Davis and Heineke, 1994; Lysonski and Durvasula, 2013; Katz et al., 1991). The inclination of a customer to wait when there are available alternatives is undetermined. This phenomenon authorises further studies on marketing because of the potential interest of customers to improve sales profits for companies. Therefore, some organisations provide promotional activities to encourage queueing. Some researchers investigate customers' willingness to queue if an alternative is available. Within promotional activities, few methods have been applied to improve a customer's willingness to wait in a line (Solomon and Surprenant, 1985) Scholars like Friman (2010) and Lotrakul et al. (2008)

study methods providing discount based on the amount of waiting time, providing information for special brand and product at the queue, releasing news reports, reducing the number of available products for sale after queueing, restricting the promotional offers, and attracting the public to join the queue.

We conclude that promotional activities refer to manipulated methods of advertising within an organisation to encourage customers to wait in a line to receive a service. Investigating the impact of queue length on the offers and intention to switch to alternatives based on the type of customers and the location of the business is a practical gap that will be bridged in this research.

H2: In the physical waiting line, longer queue length infers less intention to switch alternatives in different service industries.

H5: In the physical waiting line, types of customers depend on the location of business infer less intention to alternatives from longer queue length in different service industries.

The degree of attractiveness of the offer/price

Each organisation operates its own process of sales and promotional activities. Companies should consider the negative impact of long queues by responding to the long waiting times. Spending a long time in a waiting line is the primary fact for causing an adverse effect; but this problem could be solved by engaging customers with an exciting event. It could even encourage more customers to join the queue. For example, offering music, beverages, and snacks provides an enjoyable experience for the waiting customers. Besides, the formation of the queue line and the reduction in the number of customers waiting within a line are two other significant factors for managers to reduce the negative perception of waiting customers.

H3: In the physical waiting line, longer queue length infers more degree of attractiveness of the offer/price from service organisation in different service industries.

H6: In the physical waiting line, types of customers depend on the location of business infer more degree of attractiveness of the offer/price from longer queue length in different service industries.

Therefore, after reviewing the literature and the theories therein, the following hypotheses are developed to test the interactions between queue length, business location and customer types on how they affect the service characteristics including quality of services, intention to switch to alternatives and the degree of attractiveness of the offer/price to attract customers into the queue in different service industries:

H7: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in foods service industries (here, restaurants)

H8: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in retails service industries.

H9: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in entertainment service industries.

Chapter C3: Research Philosophies and Approaches

C3.1: Research Paradigms

To find the right map of the research and make a correct plan to reach the objective of the research, researchers should have a good understanding of the world and the social environment and hold a correct understanding of their research assumptions (Saunders et al., 2009) Research assumptions concern the view of the researcher about society's and his beliefs and values about facts and knowledge (Saunders et al., 2009; Bryman and Bell, 2011) A combination of research philosophy and research methodology is the factor that guides the researcher to find the road map of the project. Selecting the appropriate assumptions helps the researcher to control the elements that may affect the results of the study. Distinguishing the limitations and boundaries of assumptions is not easy, as it becomes a dilemma for researchers to define their research plan based on one (Bryman and Bell, 2011) The three main research assumptions in social science are: ontology, epistemology and axiology.

Ontology is related to the nature of social objects. It refers to the concepts of objectivism and constructionism. In the view of objectivism, social phenomena and social entities are independent of each other but, in the position of conservatism, social phenomena

and social actors are dependent (Lincoln et al., 2011; Bryman and Bell, 2011) The ontological position of this research is objectivism. An assumption of this kind decides how one sees the world of business and management and one's choice of what to examine for research (Saunders et al., 2009)

Epistemology has been defined as acceptable knowledge in a system. It concerns assumptions about learning, what constitutes the adequate, substantial and true, and how information can be passed to others (Bryman and Bell, 2011)

The multidisciplinary setting of business and administration implies that distinctive sorts of learning – going from numerical information to printed and visual information, from actualities to understandings, and including stories and even anecdotal records – can all be viewed as true. Thus, diverse business and administration scientists embrace distinctive epistemologies in their examinations (Saunders et al., 2009)

Axiology is about the role of qualities and morals inside the research. This fuses questions about how we, as scientists, manage both our own particular qualities and those of our exploration members. Bryman and Bell (2011) contend that our qualities are the managing explanation behind all human activity. They contend that scientists show an axiological attitude by having the capacity to verbalise their qualities, as a premise for making judgments about what research they direct and how they do it. Picking one subject instead of another recommends that an individual think one point is more vital than another. One's decision of his or her philosophy is an impression of their qualities, just like their decision of data collection strategies.

In this study, the researcher has taken the epistemological position of positivism as this study intends to use quantifiable measures of variables and hypotheses testing and thus the principal nature of relationship between theory and research is based on the principle of deductive.

C3.2: Research Philosophy

Research philosophy helps to show the process of collecting and analysing data to find the truth about world events based on our ideas and beliefs. It helps the researcher to better understand how to get data that best fit the research questions. It also specifies the border areas of research for collecting data (Saunders et. al., 2009; Remenyi, 1998; Bryman

and Bell, 2011) In this research, philosophy helps in analysing the optimum length of a queue in service delivery businesses, the effect of queueing on potential customers and the benefits of a longer queue. There are different ideas and beliefs about the existence of knowledge and reality in the world and based on these beliefs, several philosophies have been invented such as Positivism, Interpretivism, Realism and Pragmatism (Saunders et. al., 2009) Based on the aim and objective of this research – which is to find the optimum length of a physical queue in service businesses to send a positive signal for customers to join the queue – two main types of research philosophies, namely Positivism and Interpretivism will be discussed, which match this study. Table C3.1 compares these two philosophies.

Table C3.1: Research Philosophy

Positivism	Interpretivism
Large samples	Small samples
Hypothesis testing	Generating theories
Objective	Subjective
Quantitative	Qualitative

Source: Saunders et al. (2019)

Positivism is a philosophical approach that develops hypotheses based on current theories and existing knowledge (Saunders et al. 2009) In this process, data have been collected by the researcher through observing queues in service businesses and asking customers to fill questionnaires, with the help of natural science. As positivism depends on scientific evidence, like statistics or social operations, it has strong evidence on the data collection process used by the researcher. In positivism, the data collected have been analysed through statistical approach and techniques. Moreover, positivism can also be considered as a technique of evaluating knowledge in the scientific way (Remenyi et al., 1998) As the data should be analysed in a statistical way, it needs a researcher with mathematical knowledge, who can analyse data thoroughly to answer the objective of the research (Saunders et al., 2009)

Interpretivism is the philosophy that reality is different for each person or group. Interpretivism explains that the understanding of facts and knowledge and what happens around humans is different for each person and people accept reality based on their beliefs and assumptions (Saunders et al., 2009; Bryman and Bell, 2011) In this philosophy, the facts surrounding a business are different for each other and this is impossible to explain them in just one theory. As Rowlands (2005) also mentioned, one solution is not suitable for all times; and for each problem, different research is needed to find the reality. Factors like

culture, life-style and personality influence the individual's acceptance of reality and their way of thinking in search of the truth. The researchers of this philosophy interpret their data to understand the sense of the world rather than just analysing those data (Saunders et al., 2009)

Table C3.2: Philosophies comparison in social science

	Positivism	**Realism**	**Interpretivism**
Ontology (nature of reality or being)	Real, external, independent One true reality (universalism) Granular (things)Ordered	Stratified/layered (the empirical, the actual and the real)External, independent Intransient Objective structures Causal mechanisms	Complex, rich Socially constructed through culture and language Multiple meanings, interpretations, realities Flux of processes, experiences, practices
Epistemology (what constitutes acceptable knowledge)	Scientific method observable and measurable facts. Law-like generalisations. Numbers Causal explanation and prediction as contribution	Epistemological relativism Knowledge historically situated and transient Facts are social constructions Historical causal explanation as contribution	Theories and concepts too simplistic Focus on narratives, stories, perceptions and interpretations New understandings and worldviews as contribution
Axiology (role of values)	Value-free research Researcher is detached, neutral and independent of what is researched Researcher maintains an objective stance	Value-laden research Researcher acknowledges bias by world views, cultural experience and upbringing Researcher tries to minimise bias and errors Researcher is as objective as possible	Value-bound research Researchers are part of what is researched, subjective Researcher interpretations key to contribution Researcher reflexive
Typical Method	Typically deductive, highly structured, large samples, measurement, typically quantitative methods of analysis, but a range of data can be analysed	Reproductive, in-depth historically situated analysis of pre-existing structures and emerging agency. Range of methods and data types to fit subject matter	Typically, inductive. Small samples, in-depth investigations, qualitative methods of analysis, but a range of data can be interpreted

Source: Saunders et al. (2019)

As a result of the above discussion and a comparison of the different philosophies in Table C3.2, and based on the aim and objective of this research - that is to explore the optimum length of the physical queue in the businesses and to send a positive signal for customers to join the queue - positivism has been selected as the right philosophy to answer the research questions for completing this research.

C3.3: Research Approach

Saunders et al. (2009) defined the deductive and inductive research approaches in social science. A deductive approach is a top-down approach that analyses the area of study

from broad topic into detail. Because the theory exists, the deductive approach will test the idea and hypothesis in the theory to find specific details based on the collected data (Bryman and Bell, 2011). The plan of this approach is to develop a hypothesis based on the theory and to analyse the data to find reality. It is responsible for testing theory rather than building theory (Saunders et al., 2009).

The inductive approach involves making a theory based on findings. In this approach, after collecting data and analysing them, the new theory will be developed and generated (Saunders et al., 2011) An inductive approach is a bottom-up approach that makes a conclusion based on the analysed data and observations; as it works from details to a general idea, it can develop and make a theory (Bryman and Bell, 2011)

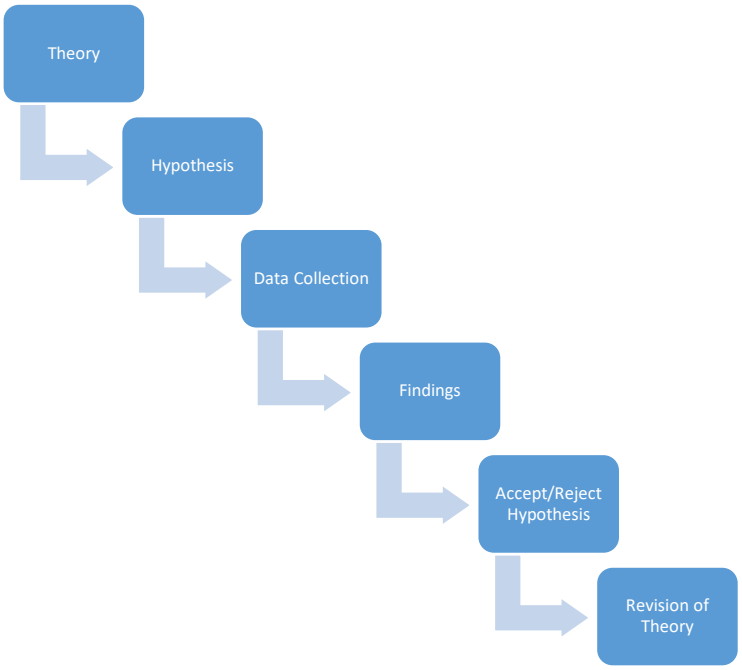


Figure C3.1: Deductive process

As the objective of this research is to identify the optimum queue length in businesses, it needs to test the theory and analyse data in detail to find the facts about the impact of queue length on customer choices. There are already efforts on investigating the behavioural issues of service queue that have been discussed in the literature review (B6) therefore the dissertation can build on those studies to develop a research model. The deductive approach was used as research objective establishes by using existing theory which was acquired from the research framework to test the research hypothesis. The

deductive approach is the best one that matches this objective to find the reality (Bryman and Bell, 2011; Saunders et al. 2009)

In this study, the researcher has taken the epistemological position of positivism as this study intends to use quantifiable measures of variables and hypotheses testing and thus the principal nature of relationship between theory and research is based on the principle of deductivism. Thus, the researcher on the basis of what is known about a particular domain (i.e. Queueing Theory) deduces hypotheses, which are then subjected to empirical scrutiny (Bryman and Bell, 2011) as illustrated in Figure C3.1. Positivistic studies tend to be driven by theory and assume that reality is objectively given and the measurable constructs are independent of the researcher and associated research instruments (Tronvoll et al., 2011).

Chapter C4: Formulating the Research Design

C4.1: Research Purpose

The purpose of research can be classified into three broad categories according to the state of current knowledge of the topic under investigation: exploratory, descriptive, and explanatory research (Iacobucci and Churchill, 2010; Chisnall, 2005) Each category and its relevance to this research is discussed in the following sections.

Exploratory Research

Exploratory research is undertaken when some facts are known about an issue or a topic. But more information is needed to develop a viable theoretical framework (Sekaran and Bougie, 2013) Thus, exploratory research allows the researcher to become familiar with the research problem and then enables the development of propositions and hypotheses for future research (McGivern, 2009) Furthermore, exploratory research often relies on secondary research such as review of the literature and/ or qualitative approaches to data gathering such as focus groups, interviews and case studies (Sekaran and Bougie, 2013) However, the results of exploratory studies are not generalisable to the population (Sekaran and Bougie, 2013)

In this study, exploratory research was undertaken by conducting an extensive review of the queueing theory literature (see Part B) This enabled the researcher to identify the research gaps in the extant literature and define the need for further research. Besides, at the

initial stage of this study, the researcher participated in the annual conferences and doctoral colloquiums. Participation in the aforementioned doctoral colloquia enabled the author to receive feedback from academic experts in the field, clarifying issues related to the study's theoretical framework and the context.

Descriptive Research

The objective of descriptive research is to describe the characteristics of the variable(s) of interest, whether they are persons, events or situations (Sekaran and Bougie, 2013) However, descriptive research is not relevant to this study as the principal focus of this research lies in investigating the relationships between constructs in a theoretical framework and testing a set of related hypotheses rather than giving a description of the phenomena of interest.

Explanatory Research

As mentioned by Lacobucci and Churchill (2010), a hypothesis is a statement that specifies *"how two or more measurable variables are related"*. Thus, the objective of hypothesis testing is to elucidate the nature of possible relationships between two or more variables as specified by the theoretical framework (Malhotra, Birks and Wills, 2013) Furthermore, Malhotra *et al.* (2013) point out that whilst research questions are interrogative, hypotheses are declarative and can be tested empirically and thus the latter can provide an answer to the former. The purpose of this study can be described as hypothesis testing as the central focus of this research is to test a set of hypotheses related to the relationships between constructs in a theoretical framework as illustrated in Part C2.4.

The Extent of the Researcher's Interference

Sekaran and Bougie (2013) insist that the extent of a researcher's interference has a direct bearing on whether the study undertaken is correlational or causal in nature. Correlational studies are conducted in a natural environment with minimal interference by the researcher, resulting in normal flow of events (Sekaran and Bougie, 2013) They are undertaken to identify the associations between research constructs (Bryman and Bell, 2011; Sekaran and Bougie, 2013) By comparison, causal studies are undertaken when the researcher aims to establish a cause and effect relationship (Bryman and Bell, 2011; Sekaran and Bougie, 2013)

Establishing causal relationships is problematic since it is difficult to observe one variable causing a change in another; so causal relationships are usually *inferred* but not observed (de Vaus, 2001) Furthermore, in a causal study, a researcher tries to manipulate certain variables so as to study the effects of such manipulations on the dependent variable of interest (Sekaran and Bougie, 2013) Thus, there can be varying degrees of interference in the manipulation and control of variables, ranging from minimal to excessive.

Sekaran and Bougie (2013) suggest that a researcher should determine whether a causal or correlational study is appropriate to answer formulated research questions. As this study wants to infer if the length of the physical queue influences the customers about the quality, offer or alternative choices, correlational study would have been appropriate in this context.

Study Setting: Contrived or Non-Contrived

According to Sekaran and Bougie (2013), research may be conducted in a contrived or a non-contrived setting, depending on whether the study is causal or correlational. In an artificial, contrived setting, the variables of interest are strictly controlled by the researcher in order to assess the cause and effect relationships (Malhotra el al., 2013) In a non-contrived setting, a research takes place in a natural environment where the subjects under investigation proceed normally and data are collected without the undue influence of the researcher (Sekaran and Bougie, 2013) In this study, data collection takes place in a natural environment and thus the study setting is non-contrived.

C4.2: Research Strategy

In this section, the focus of the researcher is to find a structured strategy based on the research philosophy and approach that are selected to answer the research questions. Research strategy is about selecting the best skill for collecting data (Bryman and Bell, 2011; Creswell, 2013) Most prevalent research strategies to do research design are survey, case study, action research, experiment, archival research and ground theory (Goodman and Kruger, 1988; Yin, 1994; Gill and Johnson, 1997; Bell, 1999, Saunders et al. 2009).

The important factors in the selection of a research strategy are the research questions. The two questions answered by research are ‘what, where, how many and how

much' as opposed to 'how and why' (Yin, 1994: 6) 'How and why' questions are more explanatory and lead to the use of case studies, histories and experiments. Experiments are introduced when an investigator can manipulate behaviour directly, precisely and systematically, which reflect the fact that they tend to occur in a laboratory or in a field setting, as social experiments. Whereas case study and history designs are more suitable when the researcher is unable to control behavioural events. The research presented in this thesis focuses on contemporary events and does not require control over the behavioural proceedings being investigated, with a relatively full understanding of the nature and complexity of the phenomenon being studied (Benbasat et al., 1987; Eisenhardt, 1989; Meredith, 1998; Voss et al., 2002; Yin, 1994)

Table C4.1: Research Strategies

Strategy	Form of Research question	Requires control over behavioural event?	Focuses on contemporary events?
Experiment	How, Why	Yes	Yes
Survey	Who, What, Where, How many, How much	No	Yes
Archival analyses	Who, What, Where, How many, How much	No	Yes/No
History	How, Why	No	No
Case study	How, Why	No	Yes

Source: Yin (2014)

Although each design supports post-positivistic research, the relative merits must first be discussed. The main research strategies that have been employed in the literature to investigate queueing theory are discussed in Table C4.2, which leads to an understanding of which methodology to adopt.

Table C4.2: Different types of research strategy

Research design	Brief description
Surveys (Questionnaire, Observation)	Surveys involve the collection of information from individuals. This can be achieved through various methods, including questionnaires, telephone conversations and face to face interviews. Once an appropriate level of information has been collected, "it can be analysed, patterns extracted and comparisons made across the sample group" (Bell, 1999: 13) It is common for a sample group that represents a proportion or segment of the population to be selected. However, consistency is required between epistemological and methodological positions (Blanche and Durrheim, 1999) In the literature, there is a school of thought that considers retrospective surveys as a more appropriate research design to understand length of physical queue compared to experiments (East and Uncles, 2008; East, Uncles, Romaniuk and Hand, 2013) This argument is based on the fact that queue length is a naturally occurring phenomenon which is likely to be informal, impromptu and unpredictable. Thus, East and Uncles (2008) argue that retrospective surveys are a practical method for understanding queue length as it is difficult for researchers to generalise everyday behaviour such as it in an experimental setting.
Action research	Action research involves creating knowledge from a specific action and is supported by Cohen (1977) and Coughlan and Coghlan (2002), who describe it as "a procedure designed to deal with a concrete problem located in an inadequate situation" (2002; 25) Action research uses a variety of mechanisms including questionnaires, diaries, interviews and case studies to ensure that research feedback is translated into modifications, adjustments, directional changes and redefinitions (Hill, 2004) Cohen (1977) argues this is necessary to ensure prolonged benefits of the process itself, rather than a future occasion. However, consistency is required between epistemological and methodological positions (Blanche and Durrheim, 1999), hence this methodology is not suitable.

After reviewing different strategies and considering the goal of the researcher and, given the deductive approach of this research approach, the research questions and the objective of the study, survey (questionnaire and observation) are the appropriate strategy to reach the researcher's goal.

C4.3: Research Method

According to Saunders et al. (2009), the research method is the technique of analysing data on a statistical or non-statistical method. Dependent on the research questions, the philosophy and strategy of the study, the appropriate research method will be selected. The methods that have been used in social science are quantitative, qualitative or mix-method (Bryman and Bell, 2011; Saunders et al., 2009; Babbie, 2013) The quantitative method is focused on the numbers and statistical data, especially for large data and surveys where data should be analysed mathematically. On the other hand, the qualitative method puts the emphasis on explanations and the interpretation of context that has been collected through interviewer observation.

According to some social scientists, these methods are two different ways of doing research that depend on the aim of the project (Bryman, 1984) Other researchers believe that

these approaches are incompatible and depend on their various epistemologies (Ghauri and Gronhaug, 2002) The qualitative method can be defined as an interpretive technique which makes a theory from collecting broad descriptive information in a natural setting. According to Ghauri and Gronhaug (2002), the qualitative method is epistemologically originated in the interpretivist philosophy. The notion of this method says that reality is based on the work of researchers. It is more trustworthy and contains in-depth information because of its relationship with the respondents and its structure (Ghauri and Gronhaug, 2002) The focus of qualitative research based on social inquiry is on the interpretation of humans and their experiences in the world that they live in. Quantitative research is based on the idea of positivism and identified as a scientific way of doing research. From the view of positivists, the social world is external and assets are measured through an objective way (Bryman and Bell, 2011) The ontological attitude of this method is based on the numerical form of information that can be measured in an objective reality that exists free from the opinion of people.

The quantitative method is a mathematical analysis of numerical data to get statistical results (Basset and Basset, 2003; Bryman and Bell, 2011) This method is the approach that has been used mostly with the survey strategy to test a hypothesis. Based on the attributes of this method, the outcome can be generalised (Creswell, 2012; Yimaz, 2013; Bryman and Bell, 2011) The qualitative approach is the method of analysing non-statistical data. In this method, data is analysed in words and no numbers are shown as a result of the analysis (Bryman and Bell, 2011; Saunders et al., 2009) It is mostly used in surveys for interpreting and explaining events, data and theories in social science (Bryman and Bell, 2011) In epistemological and ontological paradigms, each of these methods has a different strategy.

Both quantitative and qualitative methods have their advantages and disadvantages. The more suitable method depends on the type of research in order to yield the most valuable information in that area. One of the advantages of the quantitative method is that because the outcome is mostly based on the statistics and these numerical data will be analysed by mathematical procedures, it is more reliable than the qualitative approach, which depends on the expertise of the researcher in the collection and analysis of data. The quantitative method is easier to understand and interpret as the result shows in a statistical structure, but this numerical structure has its disadvantages, as it is unable to show the emotions of people. The next advantage of the quantitative method is the cost-effectiveness of the research. Compared to the qualitative method, it is much cheaper for the mass collection of data. Also

compared to the qualitative method, this method for gathering data is quicker and less time-consuming. In recent years, researchers in social sciences have used a mix of both methods in their studies to get the best results depending on the aim and objective of the research, one method or a mix of both should be used (Bryman and Bell, 2011)

Thus, it can be concluded that each method has its characteristics, advantages and disadvantages, both give reliable and useful information in different ways and choice of one or the other or even a combination depends on the goal of the research. Researchers use different forms of methods for evaluating and analysing projects. The use of each method depends on the research question, the period for completion of the project and the resources available for the evaluation of that mission. The strength of these methods shows that researchers can use both in a project to get more reliable and robust information. From this evaluation, we can understand that there is more than one method to evaluate social research.

The review of the literature shows that most of the studies used quantitative research method to analyse the queue length. Around 60% of the papers used descriptive statistic. While around 25% of them includes the statistical interpretation of and less than 15% used a mixed method. Observation and Surveys are the two most widely employed research strategies in the incorporated studies, where the focus of the research approach is quantitative. These findings suggest a need for more quantitative research empirically in calculating the optimum length of queue in service organisations. Empirical research may provide rich data on understanding the behaviour of customers (Bryman and Bell, 2011). Because the aim of this research is to empirically investigate the impact of the physical queue on the customer and the optimum length of the physical queue in service organisations to send a positive signal for customers to join the queue, analysis of qualitative data is outside the scope of this study.

In the present study, the researcher has adopted the epistemological position of positivism. The objectives and research questions of this study dictate the use of quantitative methods to investigate the relationships between the research constructs which provides better and wider view of the situations in a fast and more efficient manner (Bryman and Bell, 2011). It would seem that the researcher should use the deductive approach according to the nature of the project. On the other hand, quantitative data leads to the testing and validation of data, more generalised research findings, higher credibility and a constructive situation. Moreover, quantitative data take significantly less time to collect and is useful for studying

a large number of customers. As a result, quantitative approach has been selected as a right research method for the current research project.

C4.4: Time Horizon

In terms of temporal dimensions of research. two types of studies may be undertaken: (1) cross-sectional or one-shot in which data are collected at a single point in time and (2) longitudinal, whereby data are collected at two or more points in time (Malhotra et al., 2013; Sekaran and Bougie, 2013) Longitudinal studies take more time, effort and cost more than cross-sectional studies (Sekaran and Bougie. 2013) However, longitudinal designs are considered superior to cross-sectional designs in reducing common method bias (Rindfleisch, et al., 2008) Due to financial and time constraints, data in this study were collected at a single point in time.

C4.5: Research Credibility

To consider the success of the research and to be certain about the outcome of the study, two main criteria in the quantitative approach should be reviewed. Reliability and validity are two issues that should be examined in any research for the assurance of that study and reduction of errors (Bryman and Bell, 2011; Saunders et al., 2009) Different research methods have their own criteria and elements for checking their stability.

Reliability

In the quantitative method, reliability is measured by the trustworthiness of data to check the degree of consistency among multiple measurements of a variable. According to Bryman and Bell (2011), reliability is how the study can be replicated. In our research, in all the selected businesses, data will be collected, and we will record all information in the same way. Also, by calculating Cronbach's alpha, we will assess the consistency of the entire scale. This measures the degree of the inter-correlations among items. In the observation, we make sure that the categories for recording data are clear and observers are consistent across time. For this reason, each observer has the record sheet and digital watch to take the exact data for the measurement.

Generalisability

Lovelock (1983) and McColl-Kennedy and Fetter Jr (2001) suggest that research in service organisations should encompass multiple services settings to produce insights that would transcend specific services and thus provide more generalised results. Moreover, East et al. (2007) argue that the findings based on the examination of a single category may relate

to features of that category. Thus, to establish generalisations, scholars need to study several categories (East et al. 2007) Therefore, in an attempt to augment the generalisability of the findings of this study, this research is conducted in three service industries as (1) food, (2) retail and (3) entertainment.

Validity

In quantitative research methods, validity checks the connection between different parts of the research from research questions, research approaches and methodology (Saunders et al. 2009) The more consistent and connected the different parts are, the more the research and the results of analysis are shown to be trustworthy and valid and of use for future purposes. Bryman and Bell (2011) explained validity as to how to describe research objectives from the analysis of data. Typically, four types of validity can be distinguished (Table C4.3)

Table C4.3: Types of Validity

Types of validity	Definition
Internal validity	It is related to the issue of causality. Cross-sectional retrospective surveys can produce associations between variables, but it is difficult to establish causal direction or inference from the resulting data
External validity	It is concerned with the question of whether the results of the study can be generalised beyond the specific research contexts. External validity is strong in cross-sectional retrospective surveys especially when the sample has been randomly selected
Measurement validity	It is the extent to which a scale of items measures the instruments that is supposed to measure.
Ecological validity	It is concerned with the question of whether or not social scientific findings are applicable to everyday natural social settings

Source: Data adopted from Bryman and Bell (2011); Hair et al. (2006); Saunders, Lewis and Thornhill (2019)

Internal Validity: According to Aronson et al. (1990) internal validity is about "the extent to which a valid causal statement can be made about the effects of the independent variable on the dependent variable in a particular context". For observations, observers sit in different positions without any contact with the customers and participants. In this way, participants behave as usual without any interference that might impact or cause changes in their behaviour.

External Validity: In the current study, the samples for the survey and observation have been selected randomly. This shows strong external validity (Bryman and Bell, 2011, p. 43)

Measurement Validity: In the current study, the measuring instruments for the survey are based on past research that tested the scales (Section D3.2) and confirmed that they are reliable and valid for use in future studies like this one. For observation, as well, the measuring instruments were tested before along with the recording sheet to record the variables that should measure the scales based on the previously collected data in other studies.

Ecological Validity: This refers to the extent to which the results can be generalised in future studies or other groups. In the case of observations, it is mostly a threat to the participants' observation study, but in our study, the type of observation is non-participant observation that verified the study with no errors (Saunders, Lewis and Thronhill, 2009)

C4.6: Ethical Concerns

Ethical issues are an important aspect of any research, especially where humans are involved. Bryman and Bell (2011) defined ethics as the rules and policies that the researcher should follow in the area of his/her work based on the research centre or organisation. It defines differences between standard and unusual behaviours in the study for people that participate in the research, to protect their privacy (Saunders et al., 2009) For the purpose of this study, the ethical rules of the institution (UK Ethical Guidelines: Data Protection Act 1998 and Kingston University Ethical Guidelines) will be followed and the participants will be informed of any issues that may occur. Any potential ethical concerns arising from the research have been addressed. All data and information that are collected from customers will be kept safe from unauthorised people. We can confirm that the data will not be used for commercial purposes and all collected data will be treated as confidential and kept safe from unauthorised people. The researcher ensured that: (a) informed consent is taken from all the respondents; (b) the identity of all the respondents is kept anonymous; (c) participation is voluntary and (d) that the data is used for research purposes only. Importantly, the researcher received ethical approval from the Faculty Research Ethics Committee of Kingston Business School to conduct this research.

Chapter C5: Summary and Conclusion

In conclusion, after reviewing the different parts of the research methodology in social sciences, the researcher has selected the best methods that match the objective of the study. Positivism has been selected as the philosophy to conduct this research. As the objective of the research is to identify the optimum queue length in business, it is necessary to test the hypothesis and analyse the data in detail to find the facts about the impact of queue length on customer choices. Because of the statistical base of the study and after reviewing different methods of conducting research, the quantitative method has been chosen. The chapter concludes with a discussion of the data analysis techniques employed in this research. Factorial MANOVA will be used to test the hypotheses. The next part discusses the data gathering methods of this study.

Table C5.1: Summary of research methodology

Theoretical Framework	**Research Philosophies and Approaches**	**Research Design**
Review of Literature	**Research Paradigms:** *Epistemological position* of positivism as this study intends to use quantifiable measures of variables and hypotheses testing is selected.	**Research Strategy**: a survey (questionnaire and observation) are the appropriate strategy to reach our goal
Aims and Objectives	**Research Philosophy:** *Positivism* has been selected as the right philosophy to answer the research questions.	**Research Method**: quantitative approach has been selected as a right research method, Factorial MANOVA
Hypothesis Development	**Research approach:** *Deductive approach* is the best one that matches this objective	**Time Horizon**: cross-sectional, data in this study were collected at a single point in time
		Research Credibility: Internal validity, External validity, Measurement validity, Ecological validity are confirmed
		Ethics: For the purpose of this study, the ethical rules of the institution (UK Ethical Guidelines: Data Protection Act 1998 and Kingston University Ethical Guidelines) will be followed

PART D: DATA GATHERING AND ANALYSIS

Chapter D1: Introduction to Data Gathering

This part of the thesis presents an account of the techniques used for data collection. The researcher sets out to collect appropriate, accurate and valid data to answer the research questions. This is organised into five chapters, detailing the methods and procedures applied for gathering data as follows:

Chapter D1: Introduction to data gathering

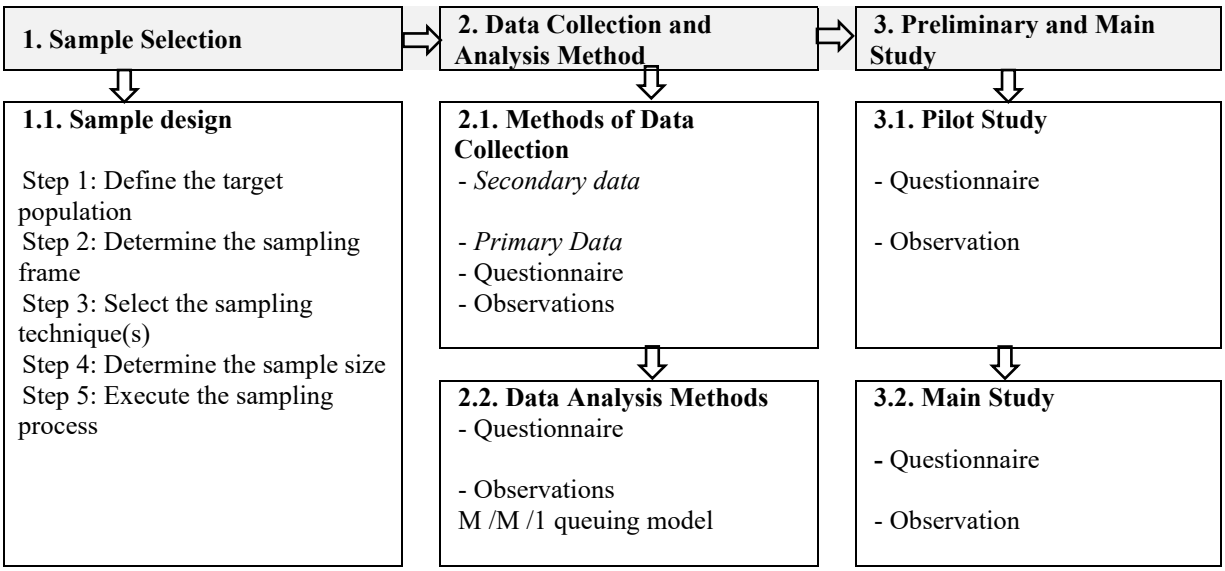
Chapter D2: Sample selection for the questionnaire and observation

Chapter D3: Primary and secondary data collection

Chapter D4: Preliminary studies and pilot testing

Chapter D5: Summary and conclusion of data gathering

Table D1.1: Process of data gathering and analysis



Chapter D2: Sample Selection

The focus of this chapter is on the sampling design adopted in this study.

D2.1: Sampling Design

Sampling involves the systematic selection of participants and data for answering the research questions (Saunders et al., 2009). An important consideration is thus identifying and targeting an appropriate research population from which to draw samples that fit the parameters of the research and the available resources (Saunders et al., 2009). The two overarching sampling strategies applied to survey research are probability (representative) and non-probability (judgmental) sampling (Bryman and Bell, 2011; Saunders et al., 2009). In this research, an accepted practice recommended by Iacobucci and Churchill (2010) is adopted for the sampling design as illustrated in Figure D2.1.

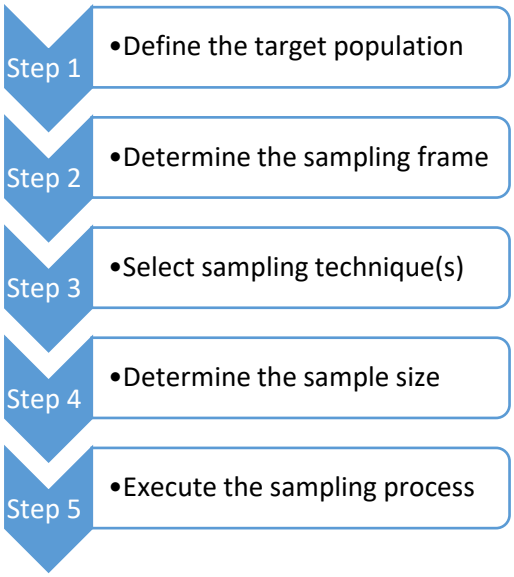


Figure D2.1: Sampling steps

Source: Iacobucci and Churchill (2010, p. 283)

Step 1: Determine the Target Population

The first step in this process is to define the target population. The target population constitutes the totality of cases that conform to some designated parameters (Iacobucci and Churchill and, 2010); the sample is a subset of this population (Sekaran and Bougie, 2013). The rationale for using a representative sample to collect data, instead of the entire population, stems from the fact that it is practically impossible to collect data from every element especially in the B2C contexts due to time, financial and human resource constraints (Sekaran and Bougie, 2013). Importantly, studying a sample rather than the entire population

is likely to produce more reliable results for several reasons, including avoiding researcher fatigue and systematic errors (Sekaran and Bougie, 2013).

In the context of survey research, attention should be given to ensuring that a chosen sample is representative of the population of interest, enabling the researcher to generalise the results obtained from the sample to the targeted population (Sekaran and Bougie, 2013). In other words, conclusions drawn from the sample can be inferred to the population (Sekaran and Bougie, 2013).

The study adopts the use of two methods for primary data collection: survey and observation. For the survey, the target population is defined as adult residents in the United Kingdom who are familiar with and/or have experienced the service categories under investigation. Other considerations and constraints such as cost and ease-of-access to potential respondents, support the use of this target population. Data are collected during the period of August 2017 - May 2018. For the observation, the target population is defined as businesses, particular restaurants, selected based on location, in both urban and suburban areas, and similarity with respect to size, price, and product and service offerings. The observation of restaurants was conducted in May 2018. Figure D2.2 presents an overview of the sample of restaurants for the study.

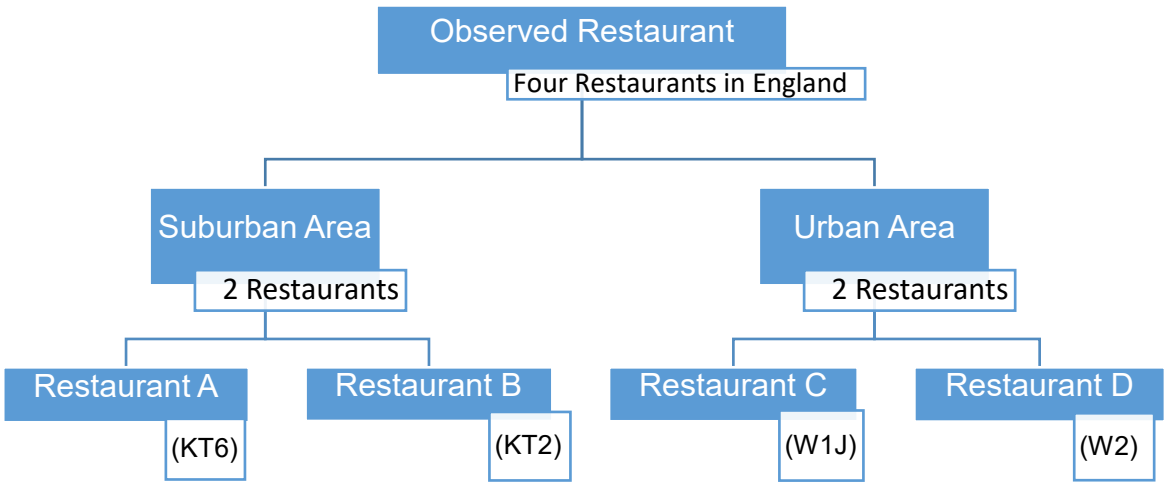


Figure D2.2: Selection of Observed Businesses

Step 2: Determine the Sampling Frame

The sampling frame is a representation of all the elements in a target population from which the sample is drawn (Sekaran and Bougie, 2013). In the absence of a pre-defined and readily-available sampling frame, survey respondents were recruited via the personal and

professional network of the researcher, social media, and face-to-face invitations to potential respondents encountered at various locations including university and public libraries.

For observation, two sets of businesses located in central areas of London and two sets of businesses in the London suburban areas are selected. We have selected these areas because they are touristic areas, where individuals are likely to be infrequent customers, having limited prior knowledge about the businesses. In local areas some customers have experience of the services of that business; therefore, we may have frequent and infrequent customers (see Figure D2.2).

Step 3: Select Sampling Technique(s)

Decisions regarding sampling techniques relate to whether the study adopts the use of probability and/or non-probability samples (Iacobucci and Churchill, 20I0). In probability sampling, elements in the population have a known and equal chance of being included in the sample. Probability samples are most often used for survey research (Saunders et al., 2009). In non-probability or judgmental sampling elements are selected based on pre-determined characteristics that align with the aim and purpose of the research. As opposed to probability techniques, non-probability sampling is based on the subjective judgment of the researcher. Figure D2.3 presents an overview of the common sampling techniques applied in business research.

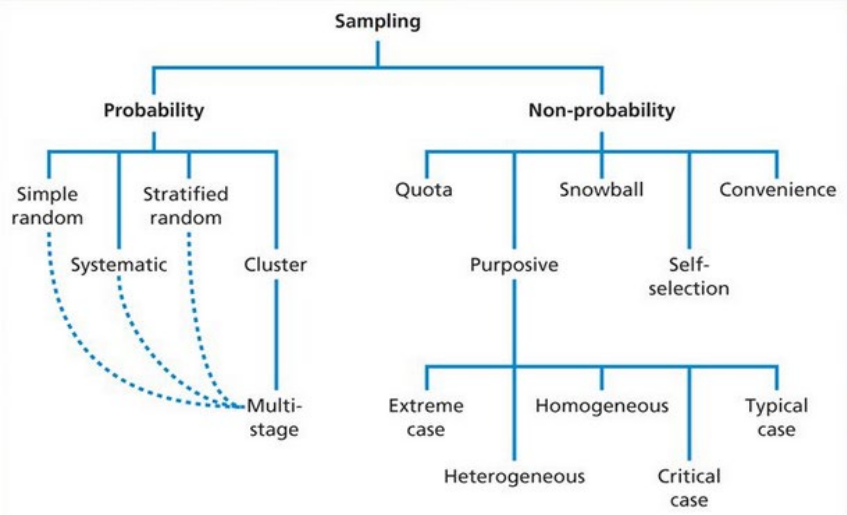


Figure D2.3: Sampling Techniques

Source: Saunders et al. **(**2009)

Simple random sampling is applied for the survey; this enables the researcher to recruit individuals who have had queueing encounters at services organisations in the London urban and suburban. All individuals in these areas have an equal opportunity for

selection in the survey sample; therefore, the researcher is able to collect data from various standpoints. For observation, the focus is on family-dining restaurants. The application of cluster sampling enables the researcher to select appropriate restaurants in this category.

Step 4: Determine the Sample Size

Sample size refers to the number of elements included in the study (Malhotra et aI., 2013). Appropriate sample size is necessary to ensure sufficiently reliable and valid results are derived from the study (Malhotra et al., 2013). Several factors influence sample size: (a) nature of research, (b) sample size used in similar studies, (c) resource constraints, (d) extent of precision required, and (e) size of population (Saunders, Lewis and Thornhill, 2009; Malhotra et al., 2013; Sekaran and Bougie, 2013). Importantly, careful consideration is giving to ensure that the study has adequate statistical power to avoid type II errors (Saunders, Lewis and Thornhill, 2009; Sullivan and Feinn, 2012).

The sample size is determined by power analysis using G*Power (Cohen, 1988; Faul, Erdfelder, Lang and Buchner, 2007). In G*Power, statistical power set is specified as 0.80 (3 = 0.20), significance α = .05, population effect size r =0.25, in turn ensuring the study has acceptable power to support the related null hypothesis. By calculating the population of London as 68 million in 2018, the procedure estimates a minimum sample size of n= 384 (n = 384 x 3 phases = 1152). However, taking a conservative approach and caution for potential incomplete and unusable survey responses, an additional 30% is added to the suggested sample size. One of the studies involved in the research uses a sample of 1515 respondents. The sample size for the observation is calculated based on an estimate of the population and restaurants in the urban and suburban areas at the time of data collection. Other sampling parameters include time of day (within the hours of 11:00 am and 8:00 pm) within the allocated period for data collection. The observation is conducted over seven days with two cases (i.e. restaurants) in the identified areas (Normand and Zou, 2002; Curin et al., 3005; Office for national statistics, UK, 2019).

Step 5: Execute the Sampling Process

The sample participants for the survey are the individual users of service organisations. Following good practice from Laczniak et al. (2001) different respondents are drawn from the same target population for the pilot study and the main study involved in the research. This procedure was undertaken to avoid contaminating the results of the main study and to eliminate potential measurement and confounding effects (Feldman and Lynch, 1988;

Laczniak et aI., 2001). The observations are conducted on restaurants classified as having accommodation for family-dining.

Table D2.1: Observation sample selection

Case	Location	Type	Area	Data collection	Day and time
A	Suburban	Brand	Competitive, touristic, many infrequent customers	Questionnaire /Observation	Weekdays and weekend, 11:00 – 20:00
B	Suburban	Non-brand (4.5+> customer review	Competitive, touristic, many infrequent customers	Questionnaire /Observation	Weekday and weekend, 11:00 – 20:00
C	Urban	Brand	Not competitive, touristic, regular customers	Questionnaire /Questionnaire	Weekday and weekend, 11:00 – 20:00
D	Urban	Non-brand (4.5+> customer review	Not competitive, touristic, regular customers	Questionnaire /Questionnaire	Weekday and weekend, 11:00 – 20:00

Chapter D3: Data Collection and Analysis Methods

Some research studies are straight-forward and thus data are easily collected; others are more complicated and require relatively long time periods and complex research strategies (Bryman and Bell, 2011; Saunders et al., 2009). A research project may adopt the use of primary and/or secondary data collection towards answering the research questions. The related decisions are informed by the research aim, objectives and research questions.

D3.1: Secondary Data Collection

By definition, secondary data are gathered from sources that are readily available in the public or private domain, such as from books, research and trade journals, as well as industry and market reports. Secondary data allow researchers to understand the study domain and develop initial hypotheses and propositions for the issues under investigation. Secondary data also enable the researcher to explore new methods and approaches to address the research questions (Saunders et al., 2009; Bryman and Bell, 2011). For the purpose of this study, secondary data is used to help the researcher to understand theories that underpin customers' attitudes to queueing and waiting time, and to identify appropriate research strategies.

D3.2: Primary Data Collection

Primary data involves the researcher collecting data first hand from original sources; i.e. data that have been collected for the first time (Collis and Hussey, 2003). The most

common techniques used for primary data collection are survey (interviews, questionnaires) and observations (Bryman and Bell, 2011; Saunders et al., 2009).

Collecting data through questionnaires

Informed by the underlying questions and objectives of the research, the decision is taken to employ the use of both secondary and primary data methods. As already discussed, a survey (questionnaire) is deemed appropriate for collecting primary data. Using this technique, the researcher can collect statistical data from the selected samples and solve the research problem through a quantitative method. Different types of surveys (e.g. face-to-face, telephone, postal, electronic) are evaluated on a number of related criteria, particularly, the limited time, cost, and resources available for collecting data, and the ease of data collection (Bachmann, Elfrink and Vazzana, 1996). Having considered the advantages of alternative modes of administration, an electronic, face-to-face mode is employed for the study.

Structure of the questionnaire

The layout and structure of the questionnaire is designed following good practice as recommended by Oppenheim (2000) and Fowler (2013) In terms of standardisation, the questionnaire adopts a highly structured design. Whilst not considered a substantively long questionnaire (Table C6.1), the following procedures are taken to avoid the incidence of respondent fatigue:

(i) situating no more than two questions in on a single page; and

(ii) locating a progress bar on each page of the questionnaire to give respondents a visual monitor of their progress at any point whilst completing the questionnaire. Attention turns to outlining the different parts of the questions in turn.

Table D3.1: Structure of Questionnaire

Block and Parameters	Question Number	Source
B1: Introduction and Instruction	-	-
B2: Type of service organisation	Q2.1 _ Q2.2	-
B3: Type of Customer and Location of business	Q3.1 _ Q3.3	-
B4: Intention to switch to alternatives	Q4.1 _ Q4.3	Parasuraman et al. (1994), Bansal and Taylor (1999), Usunier and Valette-Florence (2007)

B5: General Attractiveness	Q5.1 _ Q5.3	Seo and Yun (2015), Highhouse, Lievens and Sinar (2003), Fuwaheer (2004)
B6: Quality aspects of the Service Organisation	Q6.1 _ Q6.6	Parasuraman et al. (1994), Rauch et al (2015), Frangos et al. (2012)
B7: Offers/Promotions aspects of the Service Organisation	Q7.1 _ Q7.5	Friman (2010), Lotrakul et al. (2008), Solomon and Surprenant (1985)
B8: Length of physical queue in the business	Q8.1 _ Q8.4	-
B9: Demographic information of the respondents	Q9.1 _ Q9.8	-

The questionnaire begins with a short paragraph, conveying the purpose of the study and discloses relevant information regarding the anonymity and confidentiality of the collected data. It provides an indication of the approximate time for completing the questionnaire 'no more than 10 minutes of your time'. The survey also adheres to good ethical research practice, for instance informing respondents of the anonymity and voluntary nature of the survey. The main body of the questionnaire is organised into nine blocks (Table D3.1). The measures, as outlined in Table D3.1, are ordered to mimic the natural flow of a conversation (Groves et al., 2009). The questionnaire concludes by thanking respondents for their participation in the study.

Measurement Scales

All dependent variables employed in the research are derived from scales in the relevant existing literature. The wording of the scales is adapted to reflect the services context. These scales were chosen based on their tested and proven psychometric properties in extant research. The constructs are measured using a seven-point scale. This is deemed appropriate as it constitutes a clear middle point, and only two choices between middle and endpoints (Oppenheim, 2000). A seven-point scale also enables the researcher to capture meaningful variations in opinions without presenting too many or too few scale points (Basheer, 2014). Table D3.2 provides an overview of the scales employed in the questionnaire.

Table D3.2: Questionnaire variables scale

Variable	Item	Source/s of measure
Quality of Services	1. Trustworthy staff 2. Polite staff 3. Knowledge and skills of staff 4. Professionalism and credibility of the staff 5. Accurate bill 6. Managing complaints efficiently	Parasuraman et al. (1994), Rauch et al (2015), Frangos et al. (2012)
Intention to switch to alternatives	1. How likely are you to switch your service provider to an alternative based on the length of the physical queue? Very unlikely-Very likely 2. How likely are you to switch your service provider to an alternative based on the length of the physical queue? Very improbable-Very probable 3. How likely are you to switch your service provider to an alternative based on the length of the physical queue? No chance-Very certain	Parasuraman et al. (1994), Bansal and Taylor (1999), , Usunier and Valette-Florence (2007)
Offers/Promotions	1. I am not willing to go to extra effort to find lower prices. 2. I will visit more than one restaurant to take the advantages of offers and low prices. 3. The money saved by findings low prices is usually not worth the time and effort. 4. I would never visit more than one restaurant to find low prices. 5. The time it takes to find low prices is usually not worth the effort.	Friman (2010), Lotrakul et al. (2008), Solomon and Surprenant (1985)
Length of Physical Queue	**Short** =1. Less than 5 customers in the queue, 2. Between 6 to 9 customer in the queue **Long** = 3. Between 10 to 15 customers in the queue, 4. More than 15 customers in the queue	
Location of Business	1. **Urban** (i.e. in central locations where the majority of shops and businesses are) 2. **Suburban** (i.e. in a more residential area)	
Type of Customer	**Frequent** = 1. Daily, 2. 2-3 times a week, 3. Once a week **Infrequent** = 4. Once a month, 5. Rarely, 6. Other…….	

Collecting data through observation

Observational methods such as participant observation and ethnography, are used to directly capture behavioural response to an object, event or phenomenon (Creswell, 2014). Observations are widely employed in social and business research (TulI and Hawkins, 1993; Malhotra and Birks, 2012; Crano, Brewer and Lac, 2014). A core advantage of observational methods is that it enables the researcher to acquire in-depth insights into phenomena that

participants may not be willing to disclose or articulate using surveys and alternative methods (Creswell, 2014).

Observations for the present research are conducted on food services organisations - restaurants. Observing behavioural patterns of restaurant customers enables the researcher to evaluate, among other concerns, the relationship between queue length and customers decisions to join or abort waiting in queues. The research is mainly focused on family-dining restaurants that offer simple menus and provide service for the family market segment. The observations are undertaken without direct contact and interaction with restaurant patrons.

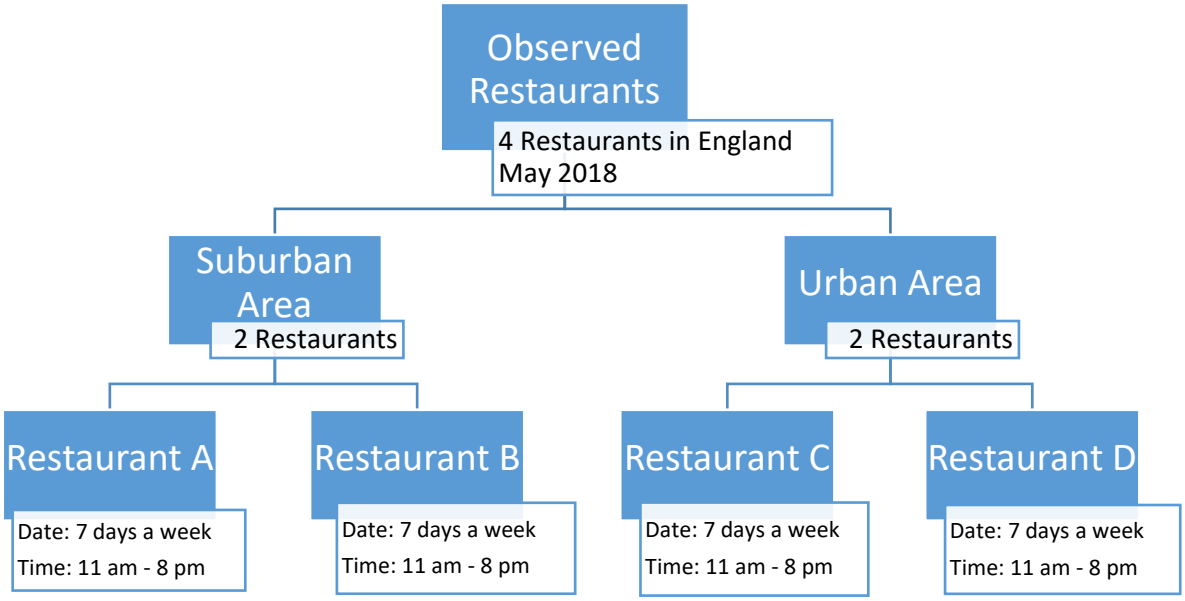


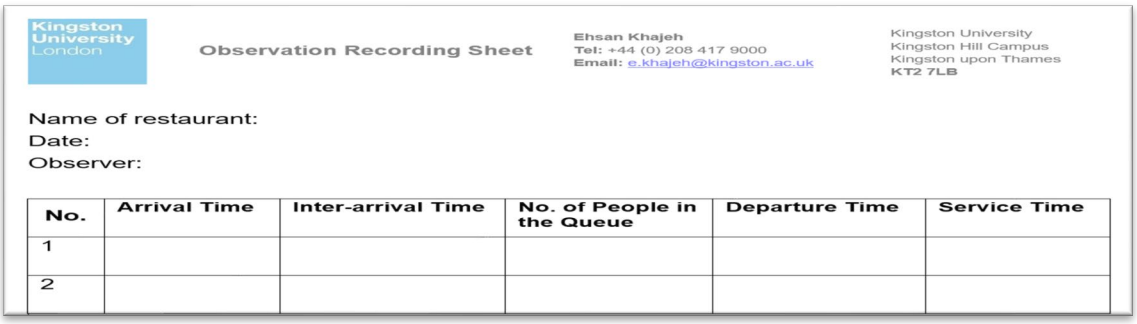
Figure D3.1: Structure of Observation

Structure of Observation

Structured observations are undertaken on restaurants located in two geographic areas. The selection is made using a cluster sampling technique. Two sets of businesses located in the urban areas of London and two sets in the London suburbs are selected (Figure D3.1). As previously mentioned, the rationale for this decision is that the selected areas are particularly touristic where customers are likely to have limited prior knowledge about surrounding restaurants; in local areas, customers are likely to have service experience surrounding restaurants. The selection is made based on the similarities among restaurants with respect to pricing, and the nature of product and service offerings.

Acknowledging that days of the week can influence restaurant patronage (Walker, 2011), observations are conducted to capture potential differences throughout the week. Days of a week can be divided into two categories for restaurants and food-service organisations – weekdays and weekends (Walker, 2011). Consequently, and in line with the aim of the research, the decision is taken to collect data during the normal operating hours, across the seven operating days of the week, and more specifically, one week for each of the four selected restaurants during the month of May 2018.

In undertaking the observations, consideration is also given to the time of day – a factor that potentially affects restaurant patronage. In this context, time of day can be divided into (i) peak, and (ii) off-peak times. The observations are for approximately nine hours at each restaurant, between 11:00 am and 8:00 pm. The observations are conducted by three trained observers at each restaurant, the observations are conducted independently to later confirm inter-observer reliability. Each observer manually records relevant data using a structured record sheet, as per the excerpt in Figure D3.2. A digital stopwatch is used to record the arrival, inter-arrival, departure and service times. Observers also record queue length at the start of each observation, and the total number of customers who join queues at various times (Figure D3.2). To minimise potential biases and errors, the collected data are recorded in MS Excel sheet at the end of each observation session.



Kingston University London

Observation Recording Sheet

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Kingston Hill Campus
Kingston upon Thames
KT2 7LB

Name of restaurant:
Date:
Observer:

No.	Arrival Time	Inter-arrival Time	No. of People in the Queue	Departure Time	Service Time
1					
2					

Figure D3.2: Observation recording sheet

D3.3: Data Analysis Methods

This section provides an account of the analytical techniques applied to the data collected from the survey and observation procedures, towards addressing the research hypotheses.

Questionnaire Analysis Method

Upon careful evaluation of a number of analytical procedures, factorial multivariate analysis of variance (MANOVA) is deemed most appropriate to empirically test the

hypotheses. The analysis is conducted using the latest version of SPSS (Statistical Package Social Science). The statistical procedures are conducted, following good practice recommended by Field (2009). Adhering to good practice in social and business research, $p < 0.05$ is adopted as an appropriate level of significance. In addition to MANOVA, a number of preliminary and supporting analyses, including regression and means comparisons of the dependent variables are conducted.

Observation Model Specification

The regression model is first specified with the constituting research constructs and dependent variables. Field (2009) warns that if the estimated model is mis-specified, this may lead to biased and inconsistent results and findings. As derived from existing literature, a Queuing Model in the form of 'M/M /C: FCFS /∞/∞' is specified following the parameters outlined in Table D3.3 and Figure D3.3.

Table D3.3: Observation Model Specification

Symbol	Definition
M	Markovian (or Poisson) arrivals and exponential service time
C	number of servers
FCFS	First come, first served
∞	Infinite system limit; Infinite source limit

For the analysis of the M/M/1 queuing model, the following variables are specified in the analysis;

Figure D3.3: Queueing Model Parameters

Parameters	Definition	Formula
λ	mean arrival rate (number of arrivals per unit of time)	-
M	mean service rate per server	-
P	the average utilization of the system	$\frac{\lambda}{\mu}$
L	The average number of units (customers) in the system (includes both the customers waiting for service and those being served)	$\frac{\lambda}{\mu - \lambda}$
Lq	the average number of customers in the queue (waiting to be served)	$\frac{\lambda^2}{\mu(\mu - \lambda)}$
W	average waiting time in the system	$\frac{1}{\mu - \lambda}$
Wq	average waiting time in the queue (service time not included)	$\frac{\lambda}{\mu(\mu - \lambda)}$

Note: The service rate must be greater than the arrival rate.

Chapter D4: Preliminary Studies and Pilot Testing

In an effort to ensure optimal validity of the research, content and face validity is confirmed using data gathered from a pilot study.

D4.1: Content and Face Validity

Hardesty and Bearden (2004) point out that validity checks are important to assess and confirm that adopted measures accurately reflect the intended meaning of the constructs. In this light, to confirm face validity, the survey instrument is thus critically evaluated by an independent expert in the field of survey and research design. Particular attention is given to assess the content and representativeness of the various survey questions and to critique the adequacy of the measures. Necessary changes are made following the expert advice. The survey was further scrutinised via several rounds of consultations with academic colleagues and experts in the area of questionnaire design. Furthermore, feedback from subject experts at academic conferences prove useful to further refine the study design and research instrument. Content validity was confirmed through a comprehensive review of the extant literature on the subject matter, enabling careful conceptualisation the constructs adopted in the research (Part B).

Following recommendations from Hardesty and Bearden (2004) a further test was conducted to assess the meaning, logical flow and clarity of the revised survey. Adhering to Netemeyer et al. (2003), 10 postgraduate students at Kingston University London are asked to complete the revised questionnaire, and to provide comments on the representativeness and flow of the survey. One participant agreed to take part in a follow-up interview to provide more in-depth insights into the survey and overall survey experience. The participant was also probed with respect to their understanding of what the researcher was trying to find out (Beatty and Willis, 2007). After receiving feedback and comments, further modifications were undertaken to optimise the reliability and validity of the study.

D4.2: Pilot Study

A pilot study was conducted to identify potential areas of concern or errors that might hinder the implementation of the observational and survey designs. There were two underlying objectives for conducting the pilot study. The first objective was to evaluate the adequacy of the modifications incorporated throughout the preceding stages of developing the instruments used for the survey and observational studies. The second objective was to detect possible sources of bias and/or errors (Saunders, et al., 2009). The pilot study was

conducted in February 2018, administering the survey using an Internet-based survey platform, Qualtrics. A sample of 165 adult (18+) UK residents, chosen from the target population, is used. No major problem found in the pilot study (Table D4.2) other than minimal and final modifications were made to the wording of particular questions to improve the readability of the survey instrument. Furthermore, appropriate modifications are made to the survey and tests and assumptions worked as expected.

Table D4.1: Pilot Study-Sample Size

Industry	Queue Length	Customer Type	Urban	Suburban	Total
Industry	Short	Frequent	21	21	42
		Infrequent	20	21	41
	Long	Frequent	22	20	42
		Infrequent	20	20	40

Table D4.2: Pilot Study-Reliability Analysis

Industry	Variables	No. of Items	Cronbach's Alpha	Average Corrected Item-Total
Industry	Offer	5	0.845	0.598
	Alternatives	3	0.798	0.561
	Quality	6	0.838	0.578

The results of Cronbach's alpha for pilot study in Table D4.2 shows that all the scales demonstrate adequate internal consistency with Cronbach' s alpha values exceeding the benchmark value of 0.70 (Field, 2013).

After the initial pilot study of observation, observers inter-observer reliability (Field, 2009), and also critically evaluated the observation procedure. An emerging need was to enhance accuracy in the arrival, departure and service times of restaurant patrons, resulting in the decision to use the digital stopwatch adopted in the main study. Moreover, modifications were made to the static position of each observer to ensure a minimal encounter with consumers and their decisions to join or abort queues they might have encountered.

Chapter D5: Summary and Conclusion

In the foregoing part of the thesis, the procedures employed for sampling design, data collection and pilot tests, and validity have been presented. The researcher provides a comprehensive discussion of the adopted sampling design and outlays an account of the units of analysis of interest to the research.

The target population for the survey is defined as adults (18+) residents of the United Kingdom who are familiar with and/or have experienced the restaurant service category under investigation. The sample size was calculated via G*Power, to minimise errors and potential related bias. Primary data were collected using two methods: a survey using a web-based questionnaire, and structured observations undertaken by three trained and independent observers. For observations, the target population is defined as food service establishments (family-dining restaurants) located in urban and suburban areas in London. We selected these areas because, in tourist areas, customers have limited prior knowledge about restaurants; whilst in local areas, customers tend to have experience surrounding restaurants. The selection of each set of businesses is based on the similarity of pricing, number of seats and food type.

The questionnaire is carefully designed and developed, following recommended good practice (e.g. (Bryman and Bell, 2011; Saunders et al., 2009). Structured observations were undertaken across similar restaurant establishments. These enabled to researcher to systematically examine consumer behaviour and the potential links between queue length and the number of customers to join or abort queues. The section ends with a discussion of the statistical methods adopted to empirically test the research hypotheses, and in turn, address the underlying aim and objectives of the study. Random and systematic errors are discussed, alongside the potential for common method bias.

Table D5.1: Summary of data gathering and analysis

1. Sample Selection	2. Data Collection and Analysis Method	3. Preliminary and Main Study
1.1. Sample design - Any adult individual resident of the United Kingdom, who are familiar and experienced any of the service categories. - For observation, the target business has been selected based on their location in urban and suburban areas and selection of each set of business is based on the similarity of size, pricing, goods and service type - probability, simple-random sampling - sample elements for the questionnaire are the individual users of the services organisation. Observation is used for restaurants that are under family-dining restaurants.	**2.1. Methods of Data Collection** **- *Secondary data*** Books, Articles, Journals and Internet **- *Primary Data*** **- Questionnaire** • Electronic and face-to-face mode • Scales measured using previously employed scales **- Observations** Four sets of businesses located in urban and suburban areas in London	**3.1. Pilot Study** **- Questionnaire** • *1st draft*: between 10 postgraduate students at KBS to fill the draft of the questionnaire and put comments on the representativeness and flow of the survey. One interview • 2nd draft: Done in February 2017 in Qualtrics with the sample size of 165 participants **- Observation** In one set of restaurants, observers sat together to check the records sheet and discuss any issues that they had faced
	2.2. Data Analysis Methods **- Questionnaire** Factorial MANOVA through SPSS (Statistical Package Social Science) **- Observations** M /M /1 queuing model (M /M /1: FCFS /∞/∞) $Lq = \frac{\lambda^2}{\mu(\mu-\lambda)}$	**3.2. Main Study** **- Questionnaire** Data are collected during the period August 2017 – May 2018 and sample size of 1515 respondents in total **- Observation** London Urban areas (two restaurants) London Suburban areas (two restaurants) • Date and Time: 7 days of a week in the period of one week for each restaurant in May 2018 from 11:00 – 20:00

PART E: DATA ANALYSIS AND FINDINGS

Chapter E1: Introduction to The Data Analysis and Findings

The findings presented in this part have significant implications for service organisations trying to improve operational performance. The findings presented here can begin to help service organisations to better understand how to manage their queues to attract customers and make them happy. These findings are now explored in the following chapters:

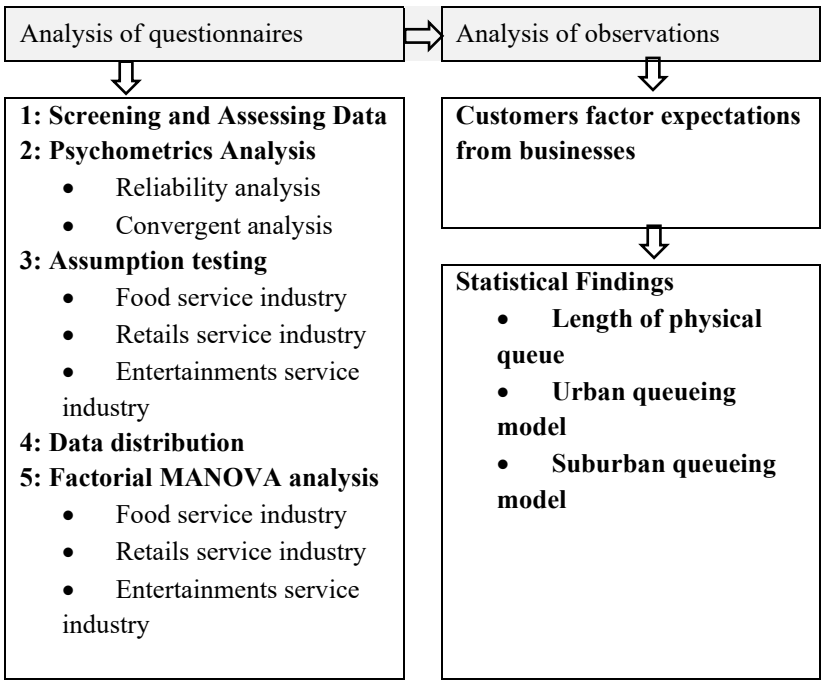
Chapter E1: Introduction to the data analysis and findings

Chapter E2: Analysis of questionnaires

Chapter E3: Analysis of observations

Chapter E4: Summary and conclusion on the key points from data analysis and finding part

Table E1.1: Process of data analysis and findings



Chapter E2: Analysis of Questionnaires

In this chapter, the results and findings of the study are presented. The theoretical framework was tested through the Factorial MANOVA as a main analytical procedure.

E2.1: Screening and Assessing Data

Before starting the main analysis, as the pilot test, we examined the data sets for any error and suspicious answers or records in the survey and observation. A series of preliminary procedures are taken to ensure the quality of data and following appropriate practice (Field, 2009; Oppenheimer, et al., 2009) Firstly, respondents failing to meet the completion time are removed from the data set. Secondly, an instructional manipulation check is used to identify instances where respondents failed to follow survey instructions. Thirdly, the researcher visually examined all data sets for evidence of straight-lining, leading to all those indulging in the practice being discarded (Hair et al., 2014) Fourth, incomplete questionnaires are also removed from the data. Whilst being stringent evidently reduces the actual sample size used for analysis, such quality checks are applied to reduce noise in the data and in turn increases the statistical power of the analysis (Oppenheimer et al., 2009; Muller et al., 2014) The researcher incorporated the instructional manipulation check at the end of the survey to ensure that disengaged participants (influenced by fatigue and boredom) were removed from the study. The final sample size is adequate to ensure that the study undertaken has enough statistical power to avoid a type II error (Sullivan and Feinn, 2012) as discussed in Chapter D2.

Table E2.1: Sample size _Survey

Type of Industry	Queue Length	Customer Type	Urban	Suburban	Total
Foods Industry No. 406	Short	Frequent	45	54	99
		Infrequent	51	52	103
	Long	Frequent	49	56	105
		Infrequent	50	49	99
Retails Industry No. 405	Short	Frequent	47	49	96
		Infrequent	47	53	100
	Long	Frequent	56	52	108
		Infrequent	51	50	101
Entertainment Industry No. 401	Short	Frequent	49	56	105
		Infrequent	45	50	95
	Long	Frequent	46	54	100
		Infrequent	48	53	101

Table E2.1 documents the number of respondents in each industry based on its sub-category. It demonstrates that in total 406 valid respondents in the food industry, 405

respondents in the retail service industry and 401 respondents in the entertainment industry participated. In the current study, participants in each group are unique to that group with no participant appearing in more than one group.

E2.2: Psychometric Analysis

Establishing the reliability and validity of the constructs is important accounting for the measurement error. Measurement error is the *"difference between the true value of a variable and the value obtained by measurement"* (Hair *et al.,* 2014, p. 97) The researcher will first discuss the various approaches to examine the reliability of the construct and establish the reliability of the measures, which leads to a discussion on assessing the validity of the measures. The researcher deems this necessary since reliability and validity are related in the sense that validity presumes reliability (Bryman and Bell, 2011) even though reliability and validity are analytically distinguishable. In other words, an unreliable measure can never be valid because systematic error cannot be distinguished from random error. Thus, reliability is the necessary condition for validity (Hair et al., 2014) All the latent constructs are reflective in nature and were measured using previously employed scales from the literature adapted to the study contexts.

Reliability analysis

Before proceeding to test the research propositions, the researcher tested the psychometric properties of the dependent variables (Fuchs and Diamantopoulos, 2010) Internal and consistency reliability is assessed by Cronbach's alpha which provides an estimate of the reliability based on the intercorrelations of the observed indicator variables (Nunnally and Bernstein, 1994; Field, 2009)

Table E2.2 shows the results of Cronbach's alpha that all the scales demonstrate adequate internal consistency with Cronbach' s alpha values exceeding the benchmark value of 0.70. Cronbach's alpha values for all variables of “offer, intention to switch to alternatives and quality” range from 0.701 to 0.811, exceeding the recommended benchmark value of 0.7 (Nunnally and Bernstein, 1994) Results indicate that all the items of the employed scales had corrected item total correlations greater than 0.70 which represents the benchmark suggested by Field (2013).

Table E2.2: Reliability Analysis

Industry	Variables	No. of Items	Cronbach's Alpha	Average Corrected Item-Total
Food	Offer	5	0.745	0.510
	Alternatives	3	0.757	0.593
	Quality	6	0.811	0.581
Retail	Offer	5	0.701	0.458
	Alternatives	3	0.735	0.563
	Quality	6	0.745	0.485
Entertainment	Offer	5	0.736	0.490
	Alternatives	3	0.703	0.525
	Quality	6	0.712	0.483

Convergent Validity

"Convergent validity essentially concerns the extent to which different measures of the same construct converge on the intended construct" (Mathieu and Taylor, 2006) In the extant literature, a common measure to establish convergent validity at the construct level is average variance extracted developed by Fornell and Larcker (1981) The value of 0.50 or higher indicates a sufficient degree of convergent validity implying that the latent variable is able to explain more than half of the variance of its indicators. However, if the average variance extracted is less than 0.50, then due to measurement error, the variance is larger than the variance captured by the construct and the validity of the individual indicators as well as that of latent variable is questionable (Fornell and Larcker, 1981; Henseler, et al., 2009; Hair et al., 2014) Table E2.3 shows that all variables in our samples across all services demonstrate adequate convergent validity with the average variance extracted scores above the recommended threshold of 0.50 (Fornell and Larcker, 1981)

Table E2.3: Convergent validity

Variables	Offer	Intention to switch to alternatives	Quality
Food	0.534	0.556	0.568
Retails	0.596	0.620	0.614
Entertainment	0.578	0.545	0.509

E2.3: Assumptions Testing

The study involves examining the interaction effects of the length of physical queue on the customers' attraction based on quality, offers and intention to switch to alternatives in different locations and different types of businesses. On considering alternative analytical procedures in the light of the aim of the research, analysis of Factorial MANOVA is deemed

to be an appropriate procedure (Field, 2009) Before starting the analysis procedure, the data should meet the Factorial MANOVA assumptions for a valid result (Field, 2009) as follows:

- Continuous dependent variables
- Two or more categorical groups for independent variables
- No relationship between the observations in each group or between the groups themselves
- No univariate or multivariate outliers
- Multivariate normality
- Linear relationship between each pair of dependent variables for all combinations of groups of two independent variables
- Homogeneity of variance-covariance matrices

Food Service Industry

The normality of data for the food industry has been assessed by plotting the Histogram with the Normal Curve. The Skewness and Kurtosis values of each sample have been assessed as well to check the validity of the samples. Table E2.4, shows that there are no concerns concerning the normality of data in the sample. Furthermore, the values of Skewness and Kurtosis depicted in Table E2.5, are within the acceptable range of -2 and +2 and -5 and +5 proposed by Alden and Chen (2009)

Table E2.4: Normality of Food

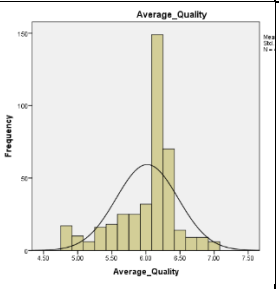
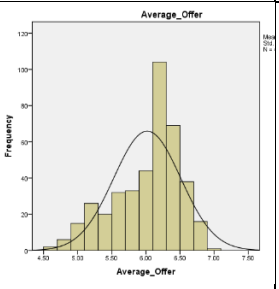
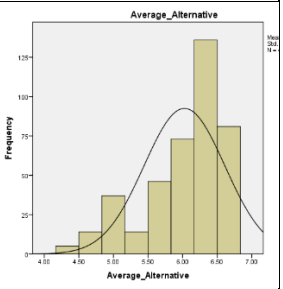
Quality	Offer	Alternative
		

Table E2.5: Skewness and Kurtosis of Food

Construct	No.	Skewness	Kurtosis
Quality	406	-.904	.795
Offers	406	-.707	-.185
Alternatives	406	-1.011	.192

The result of the normality test in the table E2.6 shows that all results are not statistically significant (p values for Kolmogorov-Smirnov test for quality is 0.200, offer is 0.210 and Intention to switch to alternatives is 0.185 and the P-value for Shapiro-Wilk test for quality is 0.467, offer is 0.485 and Intention to switch to alternatives is 0.562) Therefore, we assume that all variables (quality, Offer and Intention to switch to alternatives) are normally distributed.

Table E2.6: Food Tests of Normality

Food Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MQuality	.260	406	.200	.886	406	.467
MOffer	.205	406	.210	.931	406	.485
MAlternative	.235	406	.185	.861	406	.562
a. Lilliefors Significance Correction						

According to Field (2009), in residuals statistics for Mahal. Distance, the maximum value with three dependent variables should be 16.27. The result of the analysis in Table E2.7 shows the value of Mahal. Distance is a maximum 11.794 that confirms we met the assumption.

Table E2.7: Residuals Statistics

Residuals Statistics[a]					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.39	1.58	1.50	.031	406
Std. Predicted Value	-3.573	2.536	.000	1.000	406
Standard Error of Predicted Value	.025	.114	.047	.016	406
Adjusted Predicted Value	1.36	1.59	1.50	.031	406
Residual	-.578	.607	.000	.500	406
Std. Residual	-1.152	1.210	.000	.996	406
Stud. Residual	-1.167	1.242	.000	1.001	406
Deleted Residual	-.593	.640	.000	.505	406
Stud. Deleted Residual	-1.168	1.243	.000	1.001	406
Mahal. Distance	.004	**11.794**	2.993	2.974	406
Cook's Distance	.001	.021	.003	.002	406
Centered Leverage Value	.000	.049	.007	.007	406
a. Dependent Variable: QueueLength					

To check the linear relationship between each pair of dependent variables across each level of independent variables, matrix scatter graph has been used. Figure E2.2 shows the relationship has been met as all shapes are in the right position.

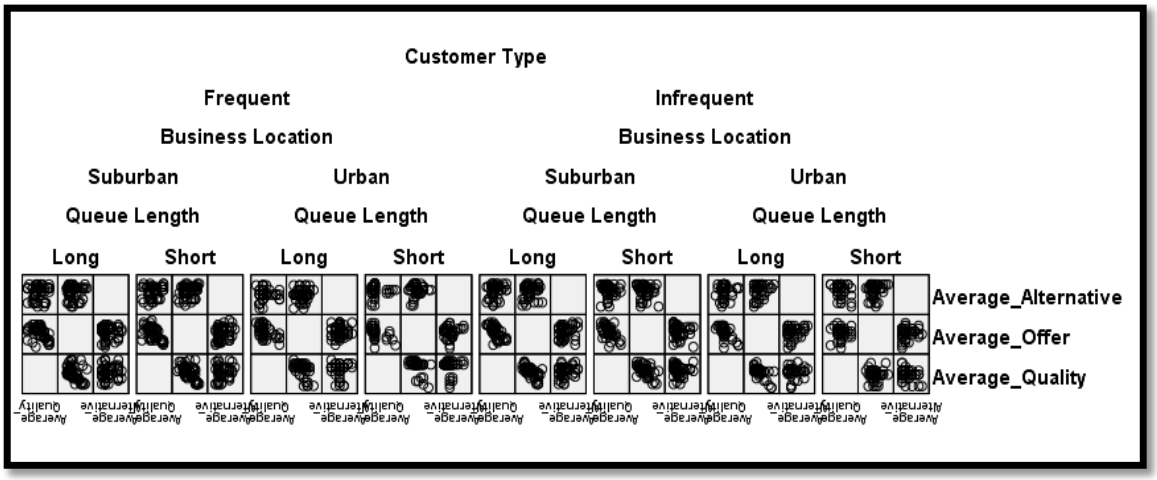


Figure E2.1: Matrix Scatter Graph

Table E2.8 shows the assumption of multicollinearity test. In this test, correlation between the dependent variables should be less than 0.9 to assume that the variables are not multicollinear and higher than 0.2 to make sure that they are correlated (Field, 2009) The results in Table E2.8 illustrate that we met both assumptions.

Table E2.8: Multicollinearity test

Correlations				
		MQuality	MOffer	MAlternative
MQuality	Pearson Correlation	1	.554**	.228
	Sig. (2-tailed)		.000	.008
	N	406	406	406
MOffer	Pearson Correlation	.554**	1	.346
	Sig. (2-tailed)	.000		.006
	N	406	406	406
MAlternative	Pearson Correlation	.228	.346	1
	Sig. (2-tailed)	.008	.006	
	N	406	406	406
**. Correlation is significant at the 0.01 level (2-tailed)				

Retail Service Industry

The normality of data for the retail industry has been assessed by plotting the Histogram with the normal curve. The Skewness and Kurtosis values of each sample have been assessed as well to check the validity of the samples. Table E2.9 shows that there are no concerns with respect to the normality of data in the sample. Furthermore, the values of Skewness and Kurtosis depicted in Table E2.10 are within the acceptable range of -2 and +2 and -5 and +5 proposed by Alden and Chen (2009)

Table E2.9: Normality of Retail

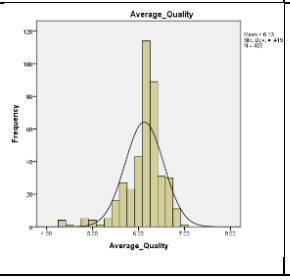
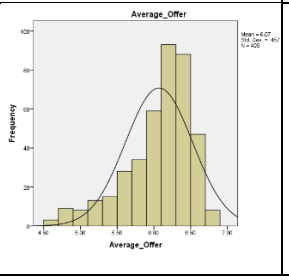
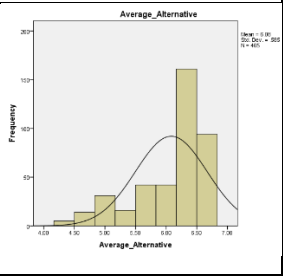
Retail	Offer	Alternatives
		

Table E2.10: Skewness and Kurtosis of Retail

Construct	No.	Skewness	Kurtosis
Quality	405	-1.448	3.661
Offers	405	-1.063	.834
Alternatives	405	-1.173	.482

The result of the normality test in table E2.11 shows that all results are not statistically significant (p values for Kolmogorov-Smirnov test for quality is .185, offer is .200 and intention to switch to alternatives is .215 and the P-value for Shapiro-Wilk test for quality is .546, offer is .452 and intention to switch to alternatives is .466), so we assume that all variables (quality, Offer and Intention to switch to alternatives) are normally distributed.

Table E2.11: Retail Tests of Normality

Retail Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MQuality	.219	405	.185	.882	405	.546
MOffer	.195	405	.200	.903	405	.452
MAlternative	.295	405	.215	.824	405	.466
a. Lilliefors Significance Correction						

According to Field (2009), in residuals statistics for Mahal. Distance, the maximum value with three dependent variables should be 16.27. The result of the analysis in Table E2.12 shows the value of Mahal. Distance is a maximum 12.540 that confirms we met the assumption.

Table E2.12: Residuals Statistics

Residuals Statistics[a]					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.40	1.68	1.52	.041	405
Std. Predicted Value	-2.855	4.000	.000	1.000	405
Standard Error of Predicted Value	.026	.118	.047	.018	405
Adjusted Predicted Value	1.38	1.71	1.52	.042	405
Residual	-.673	.600	.000	.499	405
Std. Residual	-1.345	1.199	.000	.996	405
Stud. Residual	-1.382	1.214	.000	1.001	405
Deleted Residual	-.711	.616	.000	.504	405
Stud. Deleted Residual	-1.383	1.215	.000	1.001	405
Mahal. Distance	.079	**12.540**	2.993	3.433	405
Cook's Distance	.001	.026	.003	.003	405
Centered Leverage Value	.000	.053	.007	.008	405
a. Dependent Variable: QueueLength					

To check the linear relationship between each pair of dependent variables across each level of independent variables, matrix scatter graph has been used. Figure E2.3 shows the relationship has been met as all shapes are in the right position.

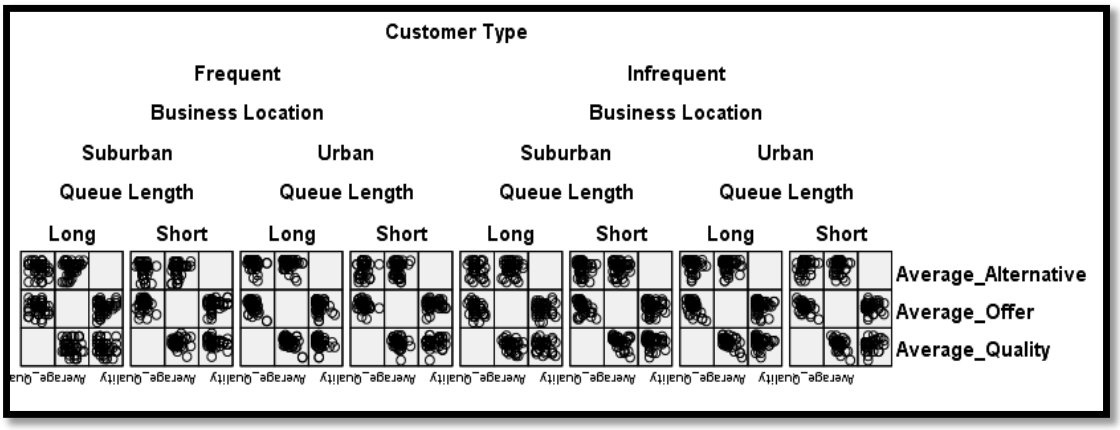


Figure E2.2: Matrix Scatter Graph

Table E2.13 shows the assumption of multicollinearity test. In this test, the correlation between the dependent variables should be less than .9 to assume that the variables are not multicollinear and more than .2 to make sure that they are correlated (Field, 2009) The results in the Table E2.13 illustrates that we met both assumptions.

Table E2.13: Multicollinearity test

Correlations				
		MQuality	MOffer	MAlternative
MQuality	Pearson Correlation	1	.396**	.391
	Sig. (2-tailed)		.000	.006
	N	405	405	405
MOffer	Pearson Correlation	.396**	1	.231
	Sig. (2-tailed)	.000		.028
	N	405	405	405
MAlternative	Pearson Correlation	.391	.231	1
	Sig. (2-tailed)	.006	.028	
	N	405	405	405
**. Correlation is significant at the 0.01 level (2-tailed)				

Entertainment Service Industry

The normality of data for the entertainment industry has been assessed by plotting the Histogram with the normal curve. The Skewness and Kurtosis values of each sample have been assessed as well to check the validity of the samples. Table E2.14 shows that there are no concerns with respect to the normality of data in the sample. Furthermore, the values of Skewness and Kurtosis depicted in Table E2.15 are within the acceptable range of -2 and +2 and -5 and +5 proposed by Alden and Chen (2009)

Table E2.14: Normality of Entertainment

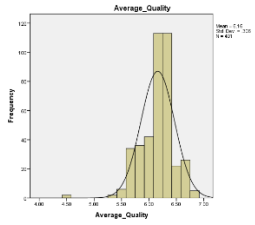
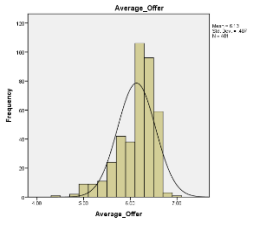
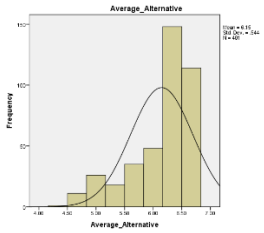
Quality	Offer	Alternatives
		

Table E2.15: Skewness and Kurtosis of Entertainment

Construct	No.	Skewness	Kurtosis
Quality	401	-.978	3.556
Offers	401	-1.143	1.337
Alternatives	401	-1.215	.652

The result of the normality test in the table E2.16 shows that all results are not statistically significant (p values for Kolmogorov-Smirnov test for quality is .145, offer is .175 and intention to switch to alternatives is .195 and the P-value for Shapiro-Wilk test for quality is .475, offer is .535 and intention to switch to alternatives is .515), so we assume

that all variables (quality, Offer and Intention to switch to alternatives) are normally distributed.

Table E2.16: Entertainment Tests of Normality

Entertainment Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MQuality	.204	401	.145	.914	401	.475
MOffer	.226	401	.175	.894	401	.535
MAlternative	.287	401	.195	.819	401	.515
a. Lilliefors Significance Correction						

According to Field (2009), in residuals statistics for Mahal. Distance, the maximum value with three dependent variables should be 16.27. The result of the analysis in Table E2.17 shows the value of Mahal. Distance is a maximum of 14.293 which confirms the assumption was met.

Table E2.17: Residuals Statistics

Residuals Statistics[a]					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.28	1.61	1.50	.048	401
Std. Predicted Value	-4.658	2.238	.000	1.000	401
Standard Error of Predicted Value	.026	.146	.047	.018	401
Adjusted Predicted Value	1.29	1.63	1.50	.048	401
Residual	-.609	.659	.000	.498	401
Std. Residual	-1.218	1.317	.000	.996	401
Stud. Residual	-1.239	1.339	.000	1.001	401
Deleted Residual	-.633	.681	.000	.503	401
Stud. Deleted Residual	-1.240	1.340	.000	1.001	401
Mahal. Distance	.105	**14.293**	2.993	3.696	401
Cook's Distance	.001	.031	.003	.003	401
Centered Leverage Value	.000	.083	.007	.009	401
a. Dependent Variable: Queue Length					

To check the linear relationship between each pair of dependent variables across each level of independent variables, matrix scatter graph has been used. Figure E2.3 shows the relationship has been met as all shapes are in the right position.

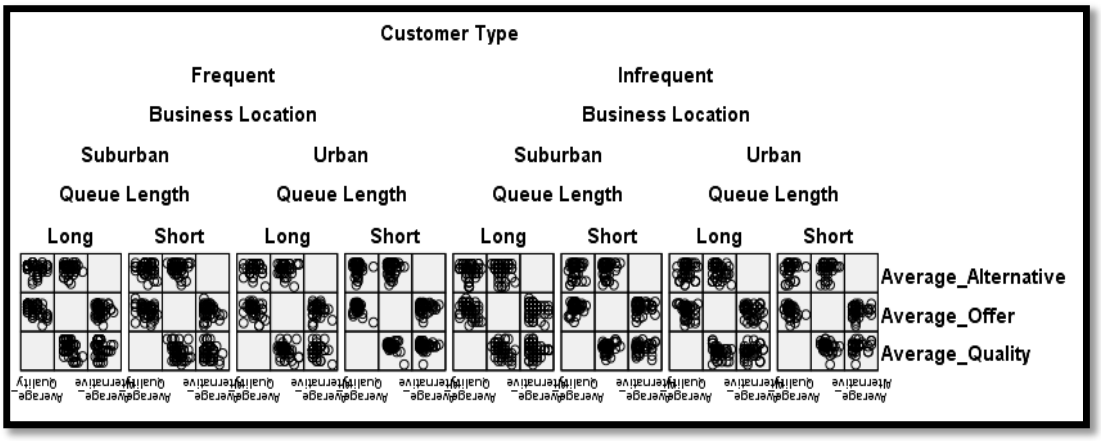


Figure E2.3: Matrix Scatter Graph

Table E2.18 shows the assumption of multicollinearity test. In this test, the correlation between the dependent variables should be less than .9 to assume that the variables are not multicollinear and more than .2 to make sure that they are correlated (Field, 2009) The results in the Table E2.18 illustrates that we met both assumptions.

Table E2.18: Multicollinearity test

Correlations				
		MQuality	MOffer	MAlternative
MQuality	Pearson Correlation	1	.258**	.364
	Sig. (2-tailed)		.000	.003
	N	401	401	401
MOffer	Pearson Correlation	.258**	1	.415
	Sig. (2-tailed)	.000		.017
	N	401	401	401
MAlternative	Pearson Correlation	.364	.415	1
	Sig. (2-tailed)	.003	.017	
	N	401	401	401
**. Correlation is significant at the 0.01 level (2-tailed)				

E2.4: Demographic Information

The demographic profile of the participants in the main study represented a diverse cross-section of UK context, males comprised 53% of the food sample and 54% of the retail sample and 49% of the entertainment industry sample. The gender composition of the sample appears to be near representative of the gender breakup of the UK population, which had 51 % females and 49% males as per 2011 population census (Office of National Statistics, 2012) Table E2.19 presents the category of different variables in the service food, retails and entertainment industries.

Table E2.19: Demographic Data

Variable	Category	Food %	Retails %	Entertainment %
Gender	Male	53.0	54.0	49
	Female	47.0	46.0	51
AgeGroup	Under 18	2.7	3.7	1.7
	18 - 24	28.1	16.3	13.0
	25 - 34	19.2	17.0	20.0
	35- 44	23.9	29.9	30.4
	45 - 55	14.5	23.0	26.7
	Above 55	11.6	10.1	8.2
Income	Less than £18,000	14.0	13.6	18.0
	£18,000 to £32,000	23.6	26.7	20.2
	£33,000 to 48,000	19.0	23.0	23.7
	£49,000 to 57,000	14.5	15.6	16.7
	Above £58000	8.6	6.7	7.7
	Family Support	20.2	14.6	13.7
Ethnicity	White	32.5	28.4	28.9
	Black / African / Caribbean / Black British	22.2	18.8	21.4
	Mixed / Multiple ethnicity	12.6	18.0	14.7
	Asian / Asian British	20.7	19.5	16.7
	Middle East	11.8	14.8	17.2
Employment Status	Employed full time	41.9	41.5	45.9
	Employed part-time	9.9	20.0	19.7
	Unemployed looking for work	4.4	5.2	6.2
	Unemployed not looking for work	1.2	.2	0
	Retired	9.1	9.6	8.2
	Student	33.5	23.2	20.0
Maretial Status	Married	49.0	54.3	56.4
	Divorced	2.0	2.0	1.5
	Separated	0	.2	2.0
	Single	49.0	43.2	40.1
Education	High school graduate	12.6	6.9	4.0
	Some college	24.6	31.9	33.4
	Professional degree	44.1	49.9	53.9
	Doctorate	18.7	11.1	8.7

E2.5: Testing of Factorial MANOVA and Hypotheses

This chapter presents the results of empirically testing the research propositions using Factorial MANOVA. Attention turns to testing the explanatory powers of the three dependent variables. The same order of analysis is used for the three different service industries of the research. As it shows in section E2.3, all assumptions have been met and the pattern of the correlations through the dependent variables suggesting the appropriateness of a Factorial MANOVA.

Food Service Industry

The following tables report the results of hypothesis testing that business location, type of customers and length of physical queue interact to influence service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in food industries like restaurants.

H1: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in foods service industries (here, restaurants)

H0: No interaction occurs between queue length, business location and customer type in effecting service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in foods industries like restaurants.

Table E2.20 presents the descriptive statistics of the food service industry. According to Field (2009), it should be approximately equal sample size in each category, (i.e. "the largest size (N) is not more than 1.5 times larger than the smallest sample size") The table contains the means and standard deviations for each dependent variable.

Table E2.20: Descriptive Statistics

Descriptive Statistics						
	Customer Type	Business Location	Queue Length	Mean	Std. Deviation	N
MQuality	1 Infrequent	1 Urban	1 Short	6.1765	.21451	51
			2 Long	6.1367	.36217	50
			Total	6.1568	.29611	101
		2 Suburban	1 Short	6.0673	.44680	52
			2 Long	5.9592	.48416	49
			Total	6.0149	.46613	101
		Total	1 Short	6.1214	.35409	103
			2 Long	6.0488	.43400	99
			Total	6.0858	.39595	202
	2 Frequent	1 Urban	1 Short	6.0852	.32299	45
			2 Long	6.0782	.29678	49
			Total	6.0816	.30794	94

		2 Suburban	1 Short	5.8395	.60740	54
			2 Long	5.8452	.59277	56
			Total	5.8424	.59724	110
		Total	1 Short	5.9512	.51135	99
			2 Long	5.9540	.49002	105
			Total	5.9526	.49925	204
	Total	1 Urban	1 Short	6.1337	.27319	96
			2 Long	6.1077	.33104	99
			Total	6.1205	.30344	195
		2 Suburban	1 Short	5.9513	.54432	106
			2 Long	5.8984	.54523	105
			Total	5.9250	.54412	211
		Total	1 Short	6.0380	.44541	202
			2 Long	6.0000	.46497	204
			Total	6.0189	.45518	406
MOffer	1 Infrequent	1 Urban	1 Short	6.0980	.37175	51
			2 Long	6.1600	.39383	50
			Total	6.1287	.38219	101
		2 Suburban	1 Short	6.0269	.52098	52
			2 Long	5.9918	.52593	49
			Total	6.0099	.52106	101
		Total	1 Short	6.0621	.45247	103
			2 Long	6.0768	.46922	99
			Total	6.0693	.45967	202
	2 Frequent	1 Urban	1 Short	6.1111	.38271	45
			2 Long	6.0000	.49497	49
			Total	6.0532	.44594	94
		2 Suburban	1 Short	5.8370	.58545	54
			2 Long	5.9571	.54032	56
			Total	5.8982	.56357	110
		Total	1 Short	5.9616	.51956	99
			2 Long	5.9771	.51762	105
			Total	5.9696	.51734	204
	Total	1 Urban	1 Short	6.1042	.37499	96
			2 Long	6.0808	.45168	99
			Total	6.0923	.41479	195
		2 Suburban	1 Short	5.9302	.56030	106
			2 Long	5.9733	.53137	105
			Total	5.9517	.54523	211
		Total	1 Short	6.0129	.48790	202
			2 Long	6.0255	.49603	204
			Total	6.0192	.49143	406
MAlternative	1 Infrequent	1 Urban	1 Short	6.1699	.54721	51
			2 Long	6.1600	.57633	50
			Total	6.1650	.55901	101
		2 Suburban	1 Short	6.1346	.55722	52
			2 Long	5.9320	.67693	49
			Total	6.0363	.62343	101
		Total	1 Short	6.1521	.54986	103
			2 Long	6.0471	.63534	99
			Total	6.1007	.59414	202
	2 Frequent	1 Urban	1 Short	5.9926	.57511	45
			2 Long	5.9932	.41661	49
			Total	5.9929	.49605	94
		2 Suburban	1 Short	5.8395	.63027	54
			2 Long	5.9940	.60132	56
			Total	5.9182	.61776	110
		Total	1 Short	5.9091	.60762	99
			2 Long	5.9937	.52089	105
			Total	5.9526	.56483	204
	Total	1 Urban	1 Short	6.0868	.56454	96
			2 Long	6.0774	.50805	99
			Total	6.0821	.53523	195
		2 Suburban	1 Short	5.9843	.61098	106
			2 Long	5.9651	.63536	105
			Total	5.9747	.62182	211
		Total	1 Short	6.0330	.59014	202
			2 Long	6.0196	.57844	204
			Total	6.0263	.58361	406

Table E2.21 shows "the Box's Test of Equality of Covariance Matrices checks the assumption of homogeneity of covariance across the groups using $p < .001$ as a criterion" (Field, 2009). This statistic tests the null hypothesis that the variance-covariance matrices are the same in all three groups. Therefore, if the matrices are equal, it means the assumption of homogeneity is met. In our study, Box' M is equal 45.113 and p is .101 which is greater than .001 indicating that there are no significant differences between the covariance matrices. Therefore, the assumption is not violated, and Wilk's Lambda is an appropriate test to use.

Table E2.21: Box's Test

Box's Test of Equality of Covariance Matrices[a]	
Box's M	45.113
F	1.370
df1	42
df2	25512.526
Sig.	.101
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength	

Table E2.22 presents the Multivariate tests in Factorial MANOVA. By looking at the Wilk's Lambda test, using an alpha level of .05, we see that p-value of customer type is .072 which shows it is not statistically significant which is more than .05. This indicates that there are no significant differences among the groups on a linear combination of the three dependent variables. The Partial Eta Squared explains the percentage of variance in the combination of the variables is .008 indicates that approximately .8% of the multivariate variance of the dependent variables is associated with the group factor that has a small effect size. Business location, p-value of .210 shows, it is not statistically significant either.

The interaction of customer type and business location and interaction of queue length and business location are not statistically significant. In this case, we fail to reject the null hypothesis. On the other hand, the p-value of length of the physical queue is .013 that shows it is statistically significant. This indicates that there are significant differences among the groups on a linear combination of the three dependent variables. The Partial Eta Squared explains the percentage of variance in the combination of the variables is .053. This indicates that approximately 7.3% of the multivariate variance of the dependent variables is associated

with the group factor that has a medium effect size. The p values of interactions between the customer type, locations of business and length of the queue are statistically significant (p=.24, P<.05) with 16% of the multivariate variance of the dependent variables showing a large effect size.

Table E2.22: Multivariate Tests for Food Service Industries

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
CustomerType	Wilks' Lambda	.962	5.174[b]	3.000	396.000	.072	.008
BusinessLocation	Wilks' Lambda	.943	7.960[b]	3.000	396.000	.210	.007
QueueLength	Wilks' Lambda	.997	.456[b]	3.000	396.000	**.013**	**.073**
CustomerType * BusinessLocation	Wilks' Lambda	.996	.469[b]	3.000	396.000	.074	.004
CustomerType * QueueLength	Wilks' Lambda	.991	1.255[b]	3.000	396.000	**.020**	**.079**
BusinessLocation * QueueLength	Wilks' Lambda	.997	.388[b]	3.000	396.000	.038	.005
CustomerType * BusinessLocation * QueueLength	Wilks' Lambda	.986	1.932[b]	3.000	396.000	**.024**	**.160**
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength							
b. Exact statistic							

Table E2.23 shows a summary table of Levene's test of equality of variances tests for each of the dependent variables. "Levene's test should not be significant for all dependent variables if the assumption of homogeneity of variance has been met" (Field, 2009). The results for these data clearly show that the assumption has been met for all dependent variables.

Table E2.23: Levene's Test Output 4

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
MQuality	11.083	7	398	.412
MOffer	5.313	7	398	.407
MAlternative	2.576	7	398	.208
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.				
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength				

Table E2.24 presents the Tests of Between-Subjects Effects for the dependent variables. It shows the values and their dependent variables and therefore, we can see the interaction and effect size of each dependent variable to the categories. It illustrates that customer type, business location, the interaction of customer type and business location and

interaction of queue length and business location are not statistically significant. Also, all of these constructs have a small effect size.

By looking at the queue length and each dependent variable (quality of service, offer and intention to switch to alternatives), the value of P indicates that there are statistically significant results on the quality and offer (p is less than .05) It means the quality and offer level is different on queue length as an independent variable, but for intention to switch to alternatives, there are no statistically significant findings. It means that it does not differ based on the length of the queue. In terms of effect size by looking at the Partial Eta Squared, for length of queue and quality, the effect size is 8.7% which shows medium effect on the queue length.

For the interaction between queue length, customer type and location of the business in the foods service industry, it shows that all dependent variables are statistically significant. Offer has the highest effect size of 28% comparing to the quality of service with 18% and intention to switch to alternatives 5.4%.

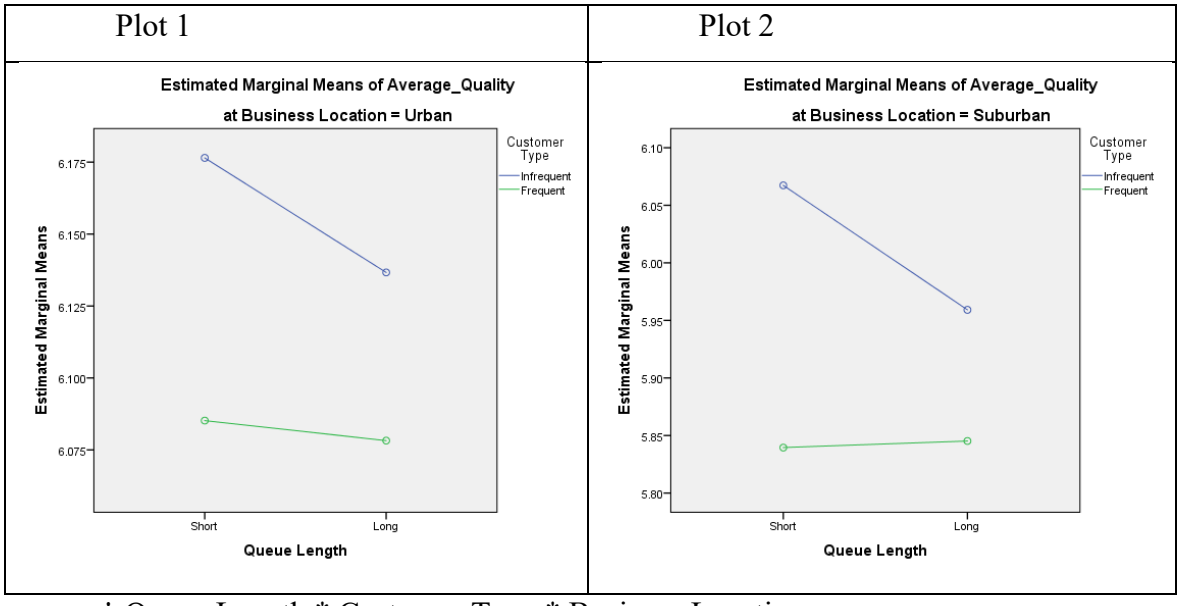
Table E2.24: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects				
Source	Dependent Variable	F	Sig.	Partial Eta Squared
CustomerType	MQuality	7.802	.075	.019
	MOffer	3.690	.165	.009
	MAlternative	6.304	.112	.016
BusinessLocation	MQuality	18.920	.090	.045
	MOffer	8.272	.244	.020
	MAlternative	3.268	.071	.008
QueueLength	**MQuality**	.719	**.047**	**.087**
	MOffer	.034	**.033**	**.110**
	MAlternative	.062	.803	.000
CustomerType * BusinessLocation	MQuality	1.191	.276	.003
	MOffer	.161	.688	.000
	MAlternative	.234	.629	.001
CustomerType * QueueLength	**MQuality**	.695	**.045**	**.094**
	MOffer	.009	**.026**	**.087**
	MAlternative	2.559	.110	.006
BusinessLocation * QueueLength	MQuality	.100	.752	.000
	MOffer	.481	.488	.001
	MAlternative	.028	.436	.000
CustomerType * BusinessLocation * QueueLength	**MQuality**	.212	**.005**	**.180**
	MOffer	2.881	**.030**	**.280**
	MAlternative	2.274	**.042**	**.054**

These differences can be easily visualised by the plots generated by this procedure, as shown in the following illustrations. By looking at the output for the profile plot of quality aspects in food service industries, Figure E2.5 graphically illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with infrequent type of customers represented by the blue line and the frequent type of customers by the green line based on the location of businesses in urban area (Plot 1) Across two queue length levels, the scores for the infrequent customers, decreased from short (6.175) to long (less than 6.150) queue length. On the other hand, the scores for the frequent customers have substantively decreased as well.

In the suburban areas (Figure E2.5-Plot 2), the slip of scores of levels for infrequent customers and frequent customers are mostly the same as urban areas with lower marginal means. It means the infrequent customers in long queue length have much lower scores compare to short queue length.

Figure E2.4: Quality Profile Plot



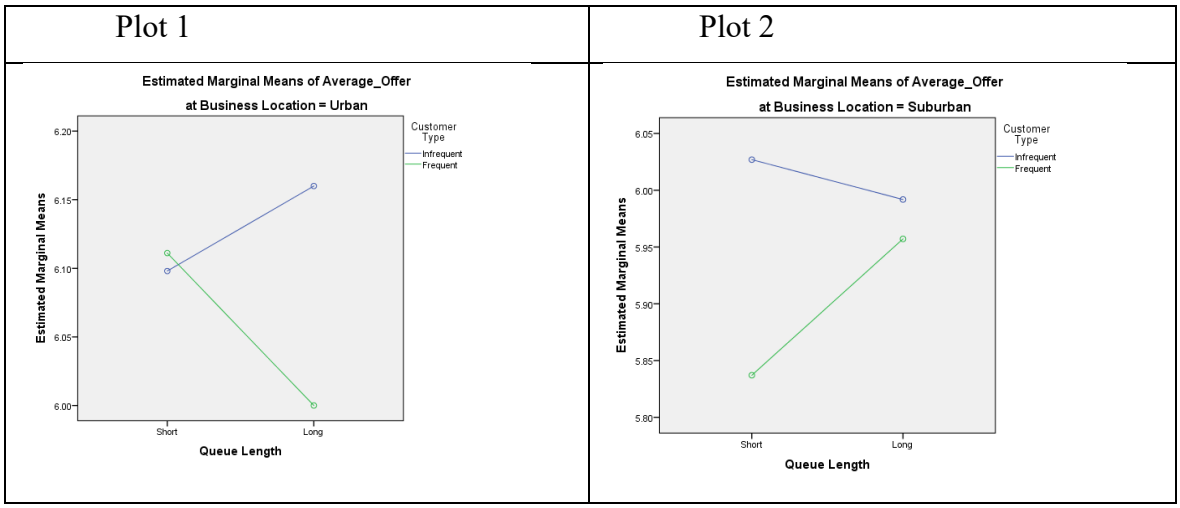
* Queue Length * Customer Type * Business Location

By looking at the output for the profile plot of quality aspects in food service industries (Figure E2.6) graphically illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with infrequent type of customers represent by the blue line and the frequent type of customers by the green line for

the location of business in urban area (Plot 1) Across two queue length levels, the scores for the infrequent customers, increased from short to long queue length. On the other hand, the scores for the frequent customers have substantively decreased from short to long queue length.

In the suburban areas (Figure E2.6-Plot 2), the relationship between infrequent and frequent customers do not have an interaction. The slip of scores of levels for infrequent customers and frequent customers show a significant difference in the short queue length and a lower score differences in the long queue. It means the infrequent and frequent customers in both queue lengths have higher scores compared to short queue lengths.

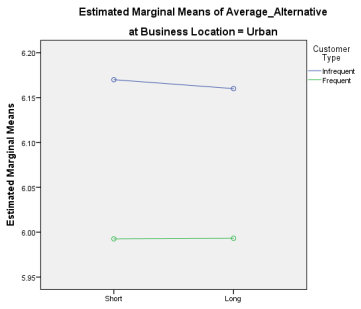
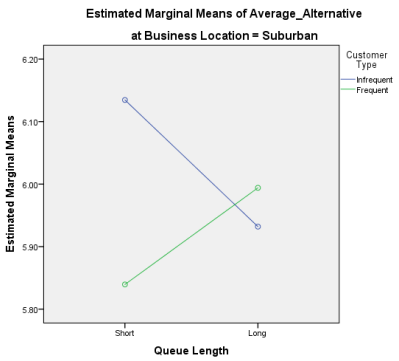
Figure E2.5: Offer Profile Plot



* Queue Length * Customer Type * Business Location

By looking at the output for the profile plot of quality aspects in food service industries Figure E2.7 graphically illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with infrequent type of customers represented by the blue line and the frequent type of customers by the green line for the location of business in urban area (Plot 1) Across two queue length levels, the scores for the infrequent customers are higher than those for the frequent customers. It shows that there is no interaction between frequent and infrequent customers. In the suburban areas (Plot 2), there is an interaction between types of customers with lower marginal means between infrequent customers to frequent customers from short to long queue length.

Figure E2.6: Alternatives Profile Plot

Plot 1	Plot 2
	

* Queue Length * Customer Type * Business Location

Retail Service Industry

The following tables report the results of hypothesis testing that business location, type of customers and length of physical queue interact to influence service characteristics including quality of services, intention to switch to alternatives and offers (3DVs) to attract customers into the queue in retail industries.

H1: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in retails service industries.

H0: No interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in retails service industries.

The descriptive statistics in table E2.25, represent the means and standard deviations for each dependent variable in the retail service industry. The sample size in each category should be equal or no more than 1.5 from the smallest category (Field, 2009) The following table shows the reliable sample size in the groups for the purpose of this research.

Table E2.25: Descriptive Statistics

Descriptive Statistics

	CustomerType	BusinessLocation	QueueLength	Mean	Std. Deviation	N
MQuality	1 Infrequent	1 Urban	1 Short	6.1879	.35204	47
			2 Long	6.0654	.50230	51
			Total	6.1241	.43888	98
		2 Suburban	1 Short	6.1038	.53332	53
			2 Long	6.1067	.35116	50
			Total	6.1052	.45193	103
		Total	1 Short	6.1433	.45691	100
			2 Long	6.0858	.43244	101
			Total	6.1144	.44461	201
	2 Frequent	1 Urban	1 Short	6.1596	.41697	47
			2 Long	6.0625	.47627	56
			Total	6.1068	.45064	103
		2 Suburban	1 Short	6.1599	.35998	49
			2 Long	6.1827	.28822	52
			Total	6.1716	.32357	101
		Total	1 Short	6.1597	.38686	96
			2 Long	6.1204	.39979	108
			Total	6.1389	.39328	204
	Total	1 Urban	1 Short	6.1738	.38406	94
			2 Long	6.0639	.48653	107
			Total	6.1153	.44392	201
		2 Suburban	1 Short	6.1307	.45696	102
			2 Long	6.1454	.32129	102
			Total	6.1381	.39409	204
		Total	1 Short	6.1514	.42304	196
			2 Long	6.1037	.41524	209
			Total	6.1267	.41920	405
MOffer	1 Infrequent	1 Urban	1 Short	6.1489	.31614	47
			2 Long	6.0353	.52567	51
			Total	6.0898	.43942	98
		2 Suburban	1 Short	5.9623	.53358	53
			2 Long	6.0320	.41475	50
			Total	5.9961	.47854	103
		Total	1 Short	6.0500	.45249	100
			2 Long	6.0337	.47165	101
			Total	6.0418	.46113	201
	2 Frequent	1 Urban	1 Short	6.1064	.38865	47
			2 Long	6.0393	.50079	56
			Total	6.0699	.45219	103
		2 Suburban	1 Short	6.1633	.46668	49
			2 Long	6.0846	.43987	52
			Total	6.1228	.45252	101
		Total	1 Short	6.1354	.42895	96
			2 Long	6.0611	.47080	108
			Total	6.0961	.45202	204
	Total	1 Urban	1 Short	6.1277	.35299	94
			2 Long	6.0374	.51037	107
			Total	6.0796	.44501	201
		2 Suburban	1 Short	6.0588	.51016	102
			2 Long	6.0588	.42644	102
			Total	6.0588	.46901	204
		Total	1 Short	6.0918	.44206	196
			2 Long	6.0478	.47028	209
			Total	6.0691	.45681	405
MAlternative	1 Infrequent	1 Urban	1 Short	6.0496	.65563	47
			2 Long	6.0980	.62288	51
			Total	6.0748	.63594	98
		2 Suburban	1 Short	6.0755	.56855	53
			2 Long	6.0467	.57147	50
			Total	6.0615	.56735	103
		Total	1 Short	6.0633	.60802	100
			2 Long	6.0726	.59555	101
			Total	6.0680	.60029	201
	2 Frequent	1 Urban	1 Short	5.9858	.64440	47
			2 Long	6.2738	.49281	56
			Total	6.1424	.58224	103
		2 Suburban	1 Short	6.1020	.51462	49

			2 Long	6.0064	.59953	52
			Total	6.0528	.55923	101
		Total	1 Short	6.0451	.58163	96
			2 Long	6.1451	.56051	108
			Total	6.0980	.57132	204
	Total	1 Urban	1 Short	6.0177	.64733	94
			2 Long	6.1900	.56285	107
			Total	6.1095	.60843	201
		2 Suburban	1 Short	6.0882	.54080	102
			2 Long	6.0261	.58339	102
			Total	6.0572	.56197	204
		Total	1 Short	6.0544	.59378	196
			2 Long	6.1100	.57745	209
			Total	6.0831	.58535	405

Table E2.26 shows "the Box's Test of Equality of Covariance Matrices which checks the assumption of homogeneity of covariance across the groups using $p < .001$ as a criterion" (Field, 2009). These statistics test the null hypothesis that the variance-covariance matrices are the same in all three groups. Therefore, if the matrices are equal, it means the assumption of homogeneity is met. In our study, Box' M is equal 81.103 and p is .072 which is greater than .001 indicating that there are no significant differences between the covariance matrices. Therefore, the assumption is not violated, and Wilk's Lambda is an appropriate test to use (Field, 2009).

Table E2.26: Box's Test

Box's Test of Equality of Covariance Matrices[a]	
Box's M	81.103
F	1.883
df1	42
df2	25525.463
Sig.	.072
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength	

Table E2.27 presents the Multivariate tests in Factorial MANOVA. By looking at the Wilk's Lambda test, using an alpha level of .05, we see that p-value of customer type, business location, queue length and the interaction of customer type and business location are higher than .05 that shows it is not statistically significant. This indicates that there are no significant differences among the groups on a linear combination of the three dependent variables. The Partial Eta Squared explains the percentage of variance in the combination of the variables is less than .06. This indicates that the multivariate variance of the dependent variables is associated with the group factor that has a small effect size.

The interaction of customer type and queue length, business location and queue length, customer type and business location and queue length are statistically significant. This means, their p values are less than .05 showing statistical significance. This indicates that there are significant differences among the groups on a linear combination of the three dependent variables. The Partial Eta Squared explains the percentage of variance in the combination of the variables indicates that multivariate variance of the dependent variables are associated with the group factor that has medium and large effect size.

Table E2.27: Multivariate Tests for retail Service Industries

Multivariate Tests[a]							
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**
CustomerType	Wilks' Lambda	.996	.536[b]	3.000	395.000	.658	.004
BusinessLocation	Wilks' Lambda	.996	.495[b]	3.000	395.000	.686	.004
QueueLength	Wilks' Lambda	.993	.909[b]	3.000	395.000	.437	.057
CustomerType * BusinessLocation	Wilks' Lambda	.992	1.004[b]	3.000	395.000	.391	.008
CustomerType * QueueLength	Wilks' Lambda	.997	.346[b]	3.000	395.000	**.029**	**.140**
BusinessLocation * QueueLength	Wilks' Lambda	.983	2.261[b]	3.000	395.000	**.046**	**.075**
CustomerType * BusinessLocation * QueueLength	Wilks' Lambda	.992	1.100[b]	3.000	395.000	**.039**	**.180**
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength							
b. Exact statistic							

Table E2.28 shows a summary table of "Levene's test of equality of variances tests for each of the dependent variables. Levene's test should not be significant for all dependent variables if the assumption of homogeneity of variance has been met" (Field, 2009). The results for these data clearly show that the assumption has been met for all dependent variables.

Table E2.28: Levene's Test

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
MQuality	1.810	7	397	.084
MOffer	2.335	7	397	.124
MAlternative	2.255	7	397	.329
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.				
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength				

Table E2.29 presents the Tests of Between-Subjects Effects for the dependent variables. It shows the values and its dependent variables we can see the interaction and

effect size of each dependent variable to the categories. It illustrates that customer type, business location, queue length, the interaction of customer type and business location are not statistically significant. Also, all of these constructs have a small effect size.

By looking at the interactions of customer type and queue length, business location and queue length, customer type and business location and queue length and each dependent variable (quality, offer and intention to switch to alternatives), the value of P indicates that there is statistically significant results for the interaction of customer type and queue length on the offer (p=.46, P<.05) It means the offer level is different on customer type and queue length as an independent variable, but for intention to switch to alternatives and quality, the findings were not statistically significant. This means that it does not differ based on the interaction of customer type and queue length. In terms of effect size by looking at the Partial Eta Squared, the effect size is 12% which shows a medium effect.

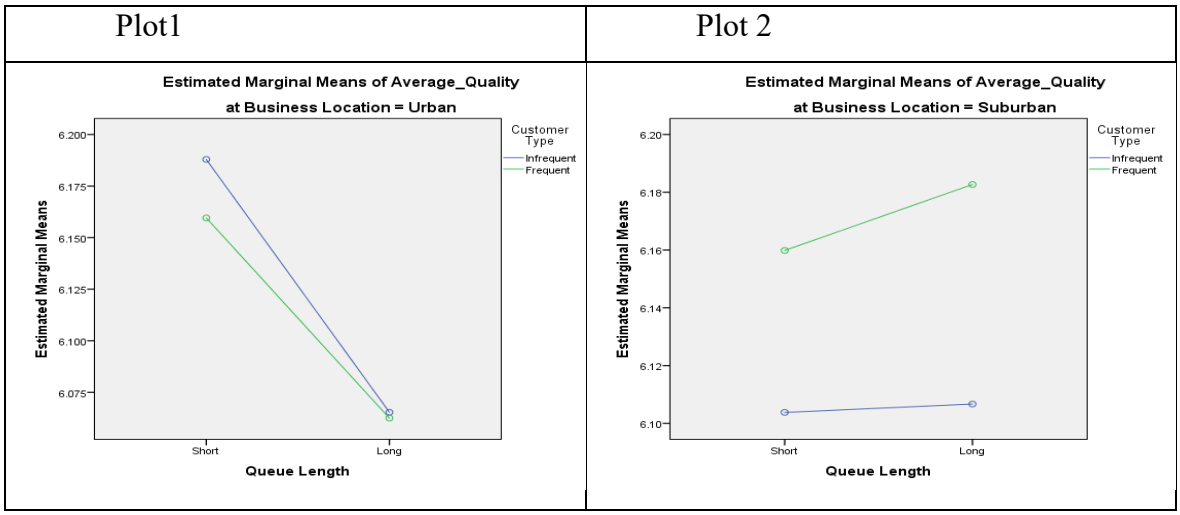
For the interaction between queue length, customer type and location of the business, it shows that offer and intention to switch to alternatives are statistically significant. The intention to switch to alternatives has the highest effect size of 14% compared to that of the variable of offer with an effect size of only 7.7%.

Table E2.29: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects				
Source	**Dependent Variable**	**F**	**Sig.**	**Partial Eta Squared**
CustomerType	MQuality	.364	.547	.001
	MOffer	1.400	.237	.004
	MAlternative	.178	.673	.000
BusinessLocation	MQuality	.215	.643	.001
	MOffer	.233	.629	.001
	MAlternative	.577	.448	.001
QueueLength	MQuality	1.344	.247	.003
	MOffer	1.089	.297	.003
	MAlternative	.830	.363	.002
CustomerType * BusinessLocation	MQuality	.953	.329	.002
	MOffer	2.585	.109	.006
	MAlternative	.292	.589	.001
CustomerType * QueueLength	MQuality	.074	.786	.000
	MOffer	.314	**.046**	**.120**
	MAlternative	.552	.458	.001
BusinessLocation * QueueLength	MQuality	2.152	.143	.005
	MOffer	.894	.345	.002
	MAlternative	3.925	**.038**	**.132**
CustomerType * BusinessLocation * QueueLength	MQuality	.001	.973	.020
	MOffer	1.151	**.024**	**.077**
	MAlternative	1.736	**.018**	**.140**

By looking at the output for the profile plot of quality aspects in retail services Figure E2.8 graphically illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with infrequent type of customers represent by the blue line and the frequent type of customers by the green line for the location of business in urban area (Plot 1) Across two queue length levels, the scores for the infrequent customers, decreased from short to long queue length. Similarly, the scores for the frequent customers substantively decreased as well. But the interaction between two levels of customer types shows the higher differences in the means of short queue length rather than long queue length. In the suburban areas (Plot 2), the slip of scores of levels for infrequent customers is mostly the same between the levels of queue length but frequent customers show a higher score for the long queue rather than a short queue. This means that frequent customers in long queue lengths have higher scores compared to in short queue lengths.

Figure E2.7: Quality Profile Plot

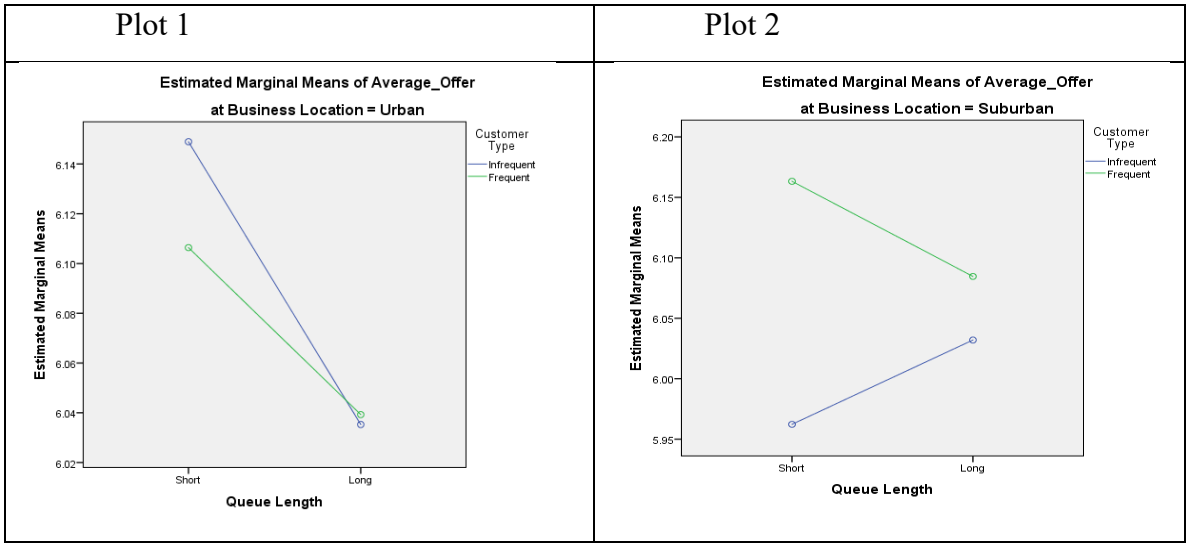


***Queue Length * Customer Type * Business Location**

The quality profile plot of offer aspects in retail industries (Figure E2.9) illustrates an observable pattern of interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with Infrequent type of customers represented by the blue line and the frequent type of customers by green line for the location of business in urban area (Plot 1) Across two queue length levels, the scores for the infrequent customers (blue line), decreased from short to long queue length. On the other hand, the scores for the frequent customers have substantively decreased as well. It shows that the type of customers has an interaction with

long queue length as infrequent customers have lower scores compared to frequent customers. In the suburban areas (Plot 2), the slip of scores of levels for frequent customers is mostly the same as in urban areas but the infrequent customers have a higher score in long queue compare to short queue.

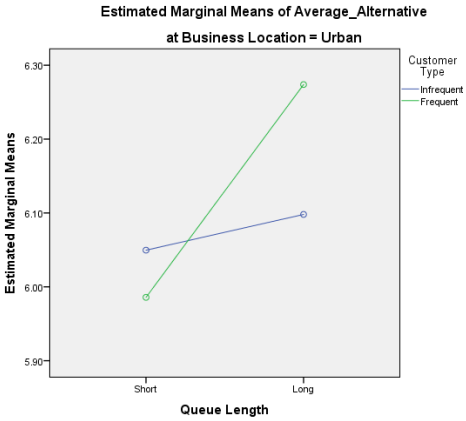
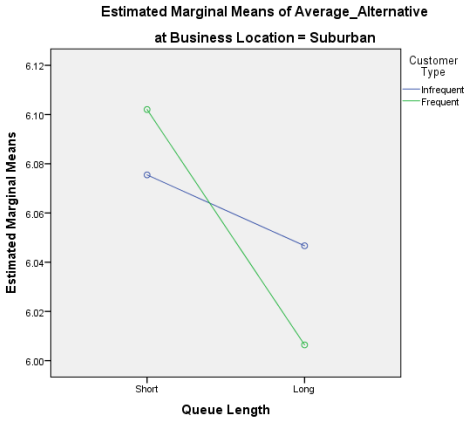
Figure E2.8: Offer Profile Plot



***Queue Length * Customer Type * Business Location**

The alternative profile plot of retail services in Figure E2.10, illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with infrequent type of customers represented by the blue line and the frequent type of customers by the green line for the location of business in urban area (Plot 1) Across two queue length levels, the scores for both level of customers, increased from short to long queue length. The differences between the means of customer levels in short queue length is lower than the differences between the level of customers in the long queue length. In the suburban areas (Plot 2), the slip of scores of levels for both levels of customers is the opposite of the urban areas. It means the long queue length has a lower score for infrequent and frequent customers compare to short queue length.

Figure E2.9: Alternatives Profile Plot

Plot 1	Plot 2
	

* Queue Length * Customer Type * Business Location

Entertainment Service Industry

The following tables report the results of how hypothesis testing that business location, type of customers and length of physical queue interact to influence service characteristics including quality of services, intention to switch to alternatives and offers (3DVs) to attract customers into the queue in the entertainment industry.

H1: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in the entertainment industry.

H0: No interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in the entertainment industry.

Table E2.30 presents the descriptive statistics of the entertainment services of the survey. The number of participants in each category shows approximately equal sample size with the means and standard deviations for each dependent variable (Field, 2009)

Table E2.30: Descriptive Statistics

Descriptive Statistics						
	CustomerType	BusinessLocation	QueueLength	Mean	Std. Deviation	N
MQuality	1 Infrequent	1 Urban	1 Short	6.1556	.40421	45
			2 Long	6.2118	.30118	48
			Total	6.1846	.35395	93
		2 Suburban	1 Short	6.2400	.31073	50
			2 Long	6.1635	.28587	53
			Total	6.2006	.29920	103
		Total	1 Short	6.2000	.35862	95
			2 Long	6.1865	.29277	101
			Total	6.1930	.32557	196
	2 Frequent	1 Urban	1 Short	6.2041	.33379	49
			2 Long	6.1413	.26520	46
			Total	6.1737	.30259	95
		2 Suburban	1 Short	6.0804	.30317	56
			2 Long	6.1019	.21577	54
			Total	6.0909	.26293	110
		Total	1 Short	6.1381	.32230	105
			2 Long	6.1200	.23934	100
			Total	6.1293	.28432	205
	Total	1 Urban	1 Short	6.1809	.36797	94
			2 Long	6.1773	.28483	94
			Total	6.1791	.32816	188
		2 Suburban	1 Short	6.1557	.31562	106
			2 Long	6.1324	.25363	107
			Total	6.1440	.28572	213
		Total	1 Short	6.1675	.34058	200
			2 Long	6.1534	.26893	201
			Total	6.1604	.30646	401
MOffer	1 Infrequent	1 Urban	1 Short	6.0800	.36282	45
			2 Long	6.1000	.43467	48
			Total	6.0903	.39947	93
		2 Suburban	1 Short	6.0680	.51998	50
			2 Long	6.2113	.31235	53
			Total	6.1417	.42989	103
		Total	1 Short	6.0737	.45011	95
			2 Long	6.1584	.37769	101
			Total	6.1173	.41548	196
	2 Frequent	1 Urban	1 Short	6.1469	.38465	49
			2 Long	6.1696	.42785	46
			Total	6.1579	.40412	95
		2 Suburban	1 Short	6.1107	.41239	56
			2 Long	6.1741	.38076	54
			Total	6.1418	.39663	110
		Total	1 Short	6.1276	.39819	105
			2 Long	6.1720	.40103	100
			Total	6.1493	.39922	205
	Total	1 Urban	1 Short	6.1149	.37387	94
			2 Long	6.1340	.43044	94
			Total	6.1245	.40218	188
		2 Suburban	1 Short	6.0906	.46446	106
			2 Long	6.1925	.34742	107
			Total	6.1418	.41207	213
		Total	1 Short	6.1020	.42343	200
			2 Long	6.1652	.38856	201
			Total	6.1337	.40705	401
MAlternative	1 Infrequent	1 Urban	1 Short	6.1407	.57511	45
			2 Long	6.0000	.64869	48
			Total	6.0681	.61495	93
		2 Suburban	1 Short	6.0867	.63464	50
			2 Long	6.1887	.49142	53
			Total	6.1392	.56500	103
		Total	1 Short	6.1123	.60457	95
			2 Long	6.0990	.57647	101
			Total	6.1054	.58878	196
	2 Frequent	1 Urban	1 Short	6.2381	.54433	49
			2 Long	6.3043	.39016	46
			Total	6.2702	.47464	95
		2 Suburban	1 Short	6.1905	.47506	56

			2 Long	6.0432	.53020	54
			Total	6.1182	.50600	110
		Total	1 Short	6.2127	.50663	105
			2 Long	6.1633	.48662	100
			Total	6.1886	.49637	205
	Total	1 Urban	1 Short	6.1915	.55839	94
			2 Long	6.1489	.55652	94
			Total	6.1702	.55638	188
		2 Suburban	1 Short	6.1415	.55577	106
			2 Long	6.1153	.51417	107
			Total	6.1283	.53417	213
		Total	1 Short	6.1650	.55617	200
			2 Long	6.1310	.53331	201
			Total	6.1480	.54441	401

Table E2.31 shows the Box's Test of Equality of Covariance Matrices which checks the assumption of homogeneity of covariance across the groups using $p < .001$ as a criterion. These statistics tests the null hypothesis that the variance-covariance matrices are the same in all three groups. Therefore, if the matrices are equal, it means the assumption of homogeneity is met. In the current study, Box' M is equal 91.348 and p is .092 which is greater than .001 indicating that there are no significant differences between the covariance matrices. Therefore, the assumption is not violated, and Wilk's Lambda is an appropriate test to use.

Table E2.31: Box's Test

Box's Test of Equality of Covariance Matrices[a]	
Box's M	91.348
F	2.120
df1	42
df2	24660.757
Sig.	.092
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength	

The Multivariate tests of Factorial MANOVA for the entertainment service industry ae presented in Table E2.32. The Wilk's Lambda test illustrates the significance of variables and their relationship to the dependent variables. Using an alpha level of .05, we see that p-value of business location, queue length and the interaction of customer type and queue length, business location and queue length are higher than .05 which shows it is not statistically significant. This indicates that there are no significant differences among the groups on a linear combination of the three dependent variables. The Partial Eta Squared explains that the percentage of variance in the combination of the variables is less than .06.

This indicates that the multivariate variance of the dependent variables is associated with the group factor that has a small effect size.

The customer type, interaction of customer type and business location, customer type and business location and queue length are statistically significant. It means the p-value of them is less than .05 that shows it is statistically significant. This indicates that there are significant differences among the groups on a linear combination of the three dependent variables. The Partial Eta Squared explains the percentage of variance in the combination of the variables and indicates that multivariate variance of the dependent variables are associated with the group factor and that have a medium effect size.

Table E2.32: Multivariate Tests for Foods Service Industries

Multivariate Tests[a]							
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**
CustomerType	Wilks' Lambda	.978	2.889[b]	3.000	391.000	**.035**	**.022**
BusinessLocation	Wilks' Lambda	.994	.761[b]	3.000	391.000	.517	.006
QueueLength	Wilks' Lambda	.991	1.198[b]	3.000	391.000	.310	.009
CustomerType * BusinessLocation	Wilks' Lambda	.983	2.304[b]	3.000	391.000	**.037**	**.057**
CustomerType * QueueLength	Wilks' Lambda	.999	.086[b]	3.000	391.000	.968	.001
BusinessLocation * QueueLength	Wilks' Lambda	.996	.498[b]	3.000	391.000	.684	.004
CustomerType * BusinessLocation * QueueLength	Wilks' Lambda	.979	2.819[b]	3.000	391.000	**.039**	**.081**
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength							
b. Exact statistic							

Table E2.33 shows a summary table of "Levene's test of equality of variances which tests for each of the dependent variables. Levene's test should not be significant for all dependent variables if the assumption of homogeneity of variance has been met" (Field, 2009). The results for these data clearly show that the assumption has been met for all dependent variables.

Table E2.33: Levene's Test

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
MQuality	.877	7	393	.525
MOffer	1.514	7	393	.161
MAlternative	3.949	7	393	.347
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.				
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength				

Table E2.34 presents the Tests of Between-Subjects Effects for the dependent variables. It shows the values and its dependent variables we can see the interaction and effect size of each dependent variable to the categories. It illustrates that business location, queue length and the interaction of customer type and queue length, business location and queue length are not statistically significant. Also, all these constructs have a small effect size.

By looking at the customer type, interaction of customer type and business location, customer type and business location and queue length and each dependents variable (quality, offer and intention to switch to alternatives), the value of P indicates that they are statistically significant results. In terms of effect size, the Partial Eta Squared shows that there are medium effect sizes on them.

For the interaction between queue length, customer type and location of the business, it shows that the intention to switch to alternatives is statistically significant (p=.36, p<.05) with a medium effect size of 6.1%.

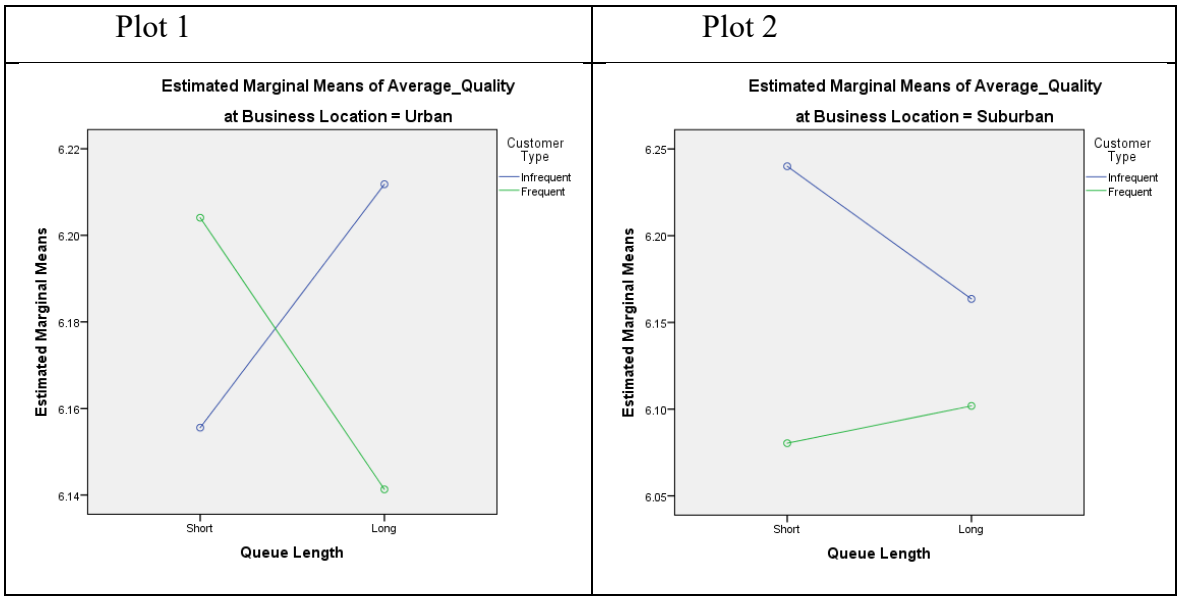
Table E2.34: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects				
Source	Dependent Variable	F	Sig.	Partial Eta Squared
CustomerType	**MQuality**	3.975	**.047**	**.070**
	MOffer	.755	.385	.002
	MAlternative	2.761	.097	.007
BusinessLocation	MQuality	1.084	.299	.003
	MOffer	.171	.679	.000
	MAlternative	.646	.422	.002
QueueLength	MQuality	.254	.614	.001
	MOffer	2.329	.128	.006
	MAlternative	.305	.581	.001
CustomerType * BusinessLocation	MQuality	2.669	.103	.007
	MOffer	.643	.423	.002
	MAlternative	4.186	**.041**	**.041**
CustomerType * QueueLength	MQuality	.030	.863	.000
	MOffer	.224	.636	.001
	MAlternative	.038	.845	.000
BusinessLocation * QueueLength	MQuality	.158	.691	.000
	MOffer	1.008	.316	.003
	MAlternative	.018	.893	.000
CustomerType * BusinessLocation * QueueLength	MQuality	3.163	.076	.008
	MOffer	.256	.613	.001
	MAlternative	4.434	**.036**	**.061**

The profile plots in the next section show these differences visually. Figure E2.11 represents the output for the profile plot of quality aspects in the entertainment industries.

The pattern of the observed interactions between queue length, customer type and business location can be seen visually in the graphs. They show the relationship between two levels of the short and long queue length with infrequent type of customers represent by the blue line and the frequent type of customers by the green line for the location of businesses. In the urban areas (Plot 1), across two queue length levels, the scores for the infrequent customers (blue line), increased from short length to long queue length. Whereas, the scores for the frequent customers shows the opposite. It shows as interaction with high differences between the means of customers in the short and long queue length. In the suburban areas (Plot 2), the scores of levels for infrequent customers are higher in short and long queue lengths compare to frequent customers.

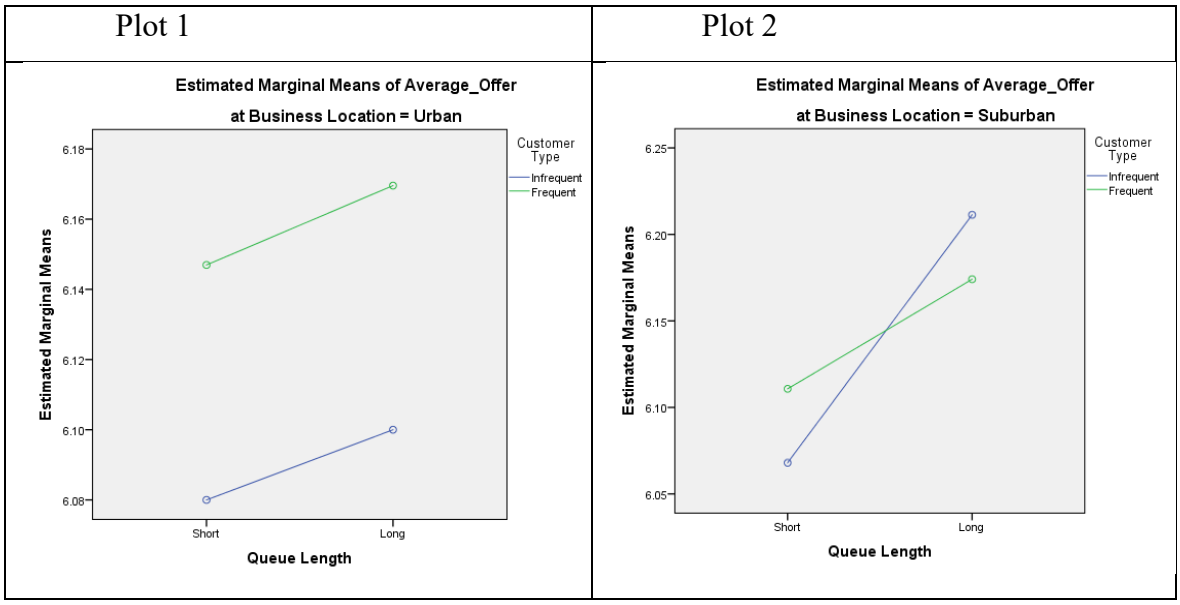
Figure E2.10: Quality Profile Plot



* Queue Length * Customer Type * Business Location

The output of offer in the profile plot in entertainment service industries (Figure E2.12) illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs show the relationship between two levels of the short and long queue length with Infrequent type of customers represent by the blue line and the frequent type of customers by the green line for the location of businesses. It presents parallel interaction between infrequent and frequent customers in the urban areas. In short queue length, both types of customers have lower scores than long queue lengths. In contrast, infrequent and frequent type of customers in suburban areas have an interaction.

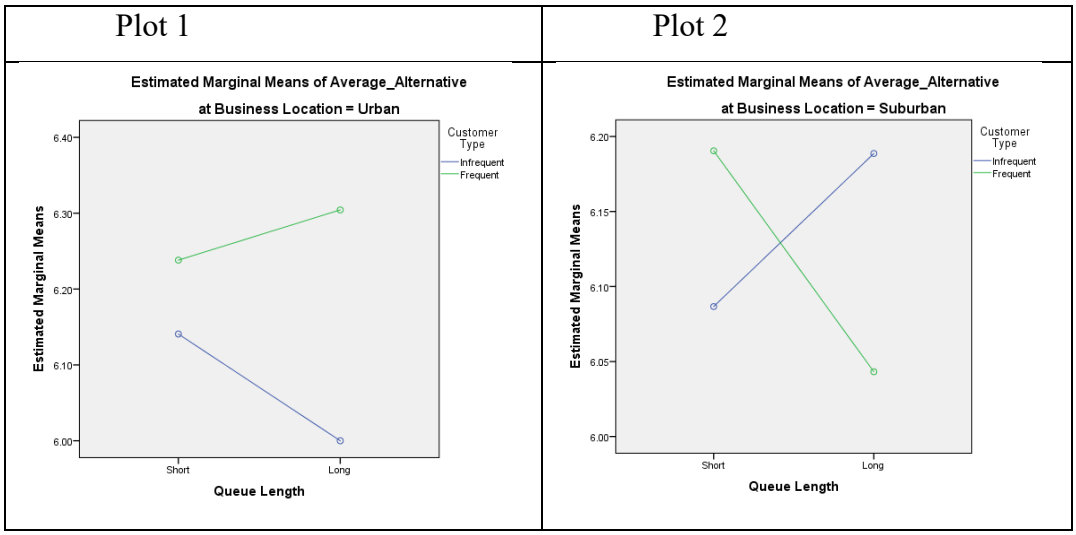
Figure E2.11: Offer Profile Plot



* Queue Length * Customer Type * Business Location

The output of alternative profile plots in entertainment industries illustrates the pattern of the observed interactions between queue length, customer type and business location. The graphs in Figure E2.13 show the relationship between two levels of the short and long queue length with infrequent type of customers represented by the blue line and the frequent type of customers by the green line for the location of businesses. In urban area (Plot 1), across two queue length levels, the scores for the infrequent customers (blue line) is lower than the score of frequent customers in both long and short queue length. It indicates the differences in marginal means of long queue length is much higher than differences in the short queue length. In the suburban areas (Plot 2), there is an interaction between customer types in the queue levels. It means the infrequent customers in long queue length have much higher scores compared to frequent customers but in the short queue length, the frequent customer has higher scores compare to the infrequent customers.

Figure E2.12: Alternatives Profile Plot



* Queue Length * Customer Type * Business Location

Chapter E3: Analysis of Observations

In this chapter, the analysis of the four observed restaurants is explained. It represents the statistical findings for the restaurants in the urban and suburban areas. In the first part of the chapter the customer factor expectations from the business are explained and after that numerical findings, graphs and statistical bars of the observations are shown. Figure E3.1 shows the distributions of the restaurants in different locations. Restaurants A and B are allocated in the suburban areas and restaurants C and D are in the urban areas.

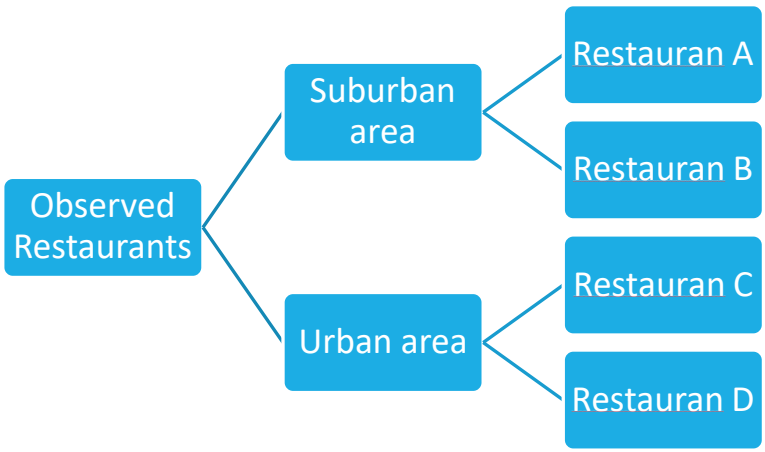


Figure E3.1: Location of Restaurant

E3.1: Customer Factor Expectations at Businesses

The top factor for the selection of food services in our questionnaire is quality attributes. The quality factor is selected by respondents as one of the most important factors. Table E3.1 represents the percentages of the main variables when customers decide to select a service organisation like restaurants.

Table E3.1: Customer Expectations

Factor	Percentage
Quality	78 %
Offer or promotions	22%

E3.2: Statistical Findings of Observations

Table E3.2 shows the weekly customer counts from the observations at the restaurants. Weekends are the busiest days of the week.

Table E3.2: Total Observed Customers

	Mon	Tue	Wen	Thurs	Fri	Sat	Sun	Total
Res A	110	118	105	123	130	247	236	1069
Res B	115	110	127	107	128	249	237	1073
Res C	273	281	278	272	311	330	318	2063
Res D	266	270	265	284	307	345	309	2046

To answer the research question for recommendation to the manager of businesses, we should determine the average number of in (λ) and out (μ) customers in the restaurants. It helps to determine the arrival rate and service rate of the observed restaurants (Table E3.3) From the findings, it can be seen that in the suburban areas (restaurant A and restaurant B), the average number of in and out customers on weekdays are 23 and 45, and for Weekends is 53 and 62 every hour. For the restaurants in the urban areas (restaurants C and restaurant D), the average number of customers that come into the restaurant is 55 and 74 customers leave the restaurant every hour, on weekdays. On weekends, 67 customers come into the restaurants and 75 customers leave it in every hour.

Table E3.3: Average Customers (in and out per hour)

		Mon	Tue	Wen	Thurs	Fri	Sat	Sun	Weekdays	Weekends	Week
Res A	In	22	24	21	24	26	54	51	23	53	32
	Out	44	45	42	43	54	62	61	46	62	50
Res B	In	23	22	26	21	25	55	51	23	53	32
	Out	41	40	46	44	51	63	60	44	62	49
Res C	In	54	57	52	55	57	69	64	55	67	58
	Out	71	75	68	72	78	76	74	73	75	73
Res D	In	52	51	55	53	59	65	66	54	66	57
	Out	72	73	69	76	79	78	72	74	75	74

Length of Physical Queue at Businesses

To study the pattern of the physical queue in the business, we calculate the total number of customers in the queue for every thirty minutes from the start of the observation at 11 am until the end of observation at 8 pm for each restaurant (Tables E3.4, E3.5, E3.6, E3.7)

Table E3.4, represents the queue length of customers in restaurant A. It shows that the noon and late evening are the times that there are queues in the restaurant. It indicates that the length of the queue is variable from time to time and day to day. From the observation, it can be seen that on Fridays and weekends the restaurant has the longest queues.

Table E3.4: Restaurant A Queue length (every 30 minutes)

	11-12pm		12-13		13-14		14-15		15-16		16-17		17-18		18-19		19-20	
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half
Mon	0	0	2	2	1	0	0	0	0	0	0	0	0	1	1	2	1	1
Tue	0	0	1	1	2	1	1	0	0	0	0	0	1	0	2	1	0	1
Wen	0	0	1	0	2	1	1	0	0	0	0	0	1	1	1	1	1	0
Thurs	0	0	0	1	1	1	1	0	0	0	0	0	0	2	6	6	5	2
Fri	0	0	2	2	3	2	1	1	0	0	0	0	1	2	4	7	8	6
Sat	0	0	3	2	3	1	1	0	0	0	1	0	2	4	7	8	9	7
Sun	0	0	2	4	3	2	0	0	0	0	0	0	1	3	4	4	5	3

The queue length of customers in the restaurant B (Table E3.5) shows the times between 12 pm – 2 pm and 5 pm – 8 pm customers stay in the queue to be served. The longest queues to manage the customers are on Friday evenings and weekends, but other times of the day and week, there is not any pressure of the servers as just a few customers stay to be served.

Table E3.5: Restaurant B Queue length (every 30 minutes)

	11-12pm		12-13		13-14		14-15		15-16		16-17		17-18		18-19		19-20	
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half
Mon	0	0	1	2	1	0	1	0	0	0	0	0	0	1	1	1	2	2
Tue	0	0	2	1	1	1	0	0	0	0	0	1	2	1	2	1	2	1
Wen	0	1	1	2	2	1	0	1	0	0	0	0	1	2	2	1	2	1
Thurs	0	0	1	2	1	1	0	0	0	0	0	0	1	1	3	2	3	2
Fri	0	2	2	1	2	2	1	1	0	0	0	1	1	3	5	5	7	7
Sat	0	1	2	3	3	2	0	0	0	1	0	2	4	6	8	9	8	8
Sun	0	1	2	2	1	1	2	0	0	0	0	1	3	4	5	4	3	2

Table E3.6, shows the queue length of the restaurant C in the urban area. The longest length of the queue in this restaurant is on weekends and Friday afternoons. From the observation, it can be seen the maximum length of the queue is about nine customers in the waiting line.

Table E3.6: Restaurant C Queue length (every 30 minutes)

	11-12pm		12-13		13-14		14-15		15-16		16-17		17-18		18-19		19-20	
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half
Mon	0	1	3	2	3	1	2	1	0	0	0	0	2	4	3	5	2	4
Tue	0	0	2	2	4	2	1	0	0	0	0	0	2	5	2	4	6	2
Wen	0	0	2	2	3	3	1	0	0	0	0	0	0	3	5	3	5	4
Thurs	0	2	1	2	4	1	2	1	0	0	0	0	1	4	6	4	5	5
Fri	0	0	2	3	2	1	2	1	0	0	0	0	2	4	6	3	5	2
Sat	2	3	7	7	6	8	4	4	2	1	0	3	5	5	8	8	9	6
Sun	3	3	8	7	7	6	4	1	1	0	0	0	4	8	6	8	6	7

The observation of queue length in restaurant D (Table E3.7), demonstrates the average busiest times are lunchtime between 11:30 to 2 pm and dinner time from 5 pm until late evening. The observations show the longest length of queue is on Saturday and it is up to ten customers in the waiting line. It may indicate some customers arrive in groups which makes it longer.

Table E3.7: Restaurant D Queue length (every 30 minutes)

	11-12pm		12-13		13-14		14-15		15-16		16-17		17-18		18-19		19-20	
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half
Mon	0	2	2	4	3	2	1	2	0	0	0	0	2	2	3	3	1	3
Tue	0	1	2	3	3	2	2	1	1	0	0	0	1	2	4	3	2	3
Wen	0	0	3	4	3	2	1	1	0	0	0	1	1	2	3	3	1	3
Thurs	0	1	2	4	4	2	1	2	1	0	0	0	0	3	4	3	4	5
Fri	0	2	4	2	4	2	1	0	0	0	0	1	1	3	4	6	6	5
Sat	1	3	5	7	5	4	4	2	2	0	0	2	3	8	10	9	7	6
Sun	3	3	7	5	7	7	4	5	1	0	0	1	2	7	8	7	8	6

Figure E3.2, shows that 57.13% of customers consider the long queue between 10 to 15 customers in the line and 29.36% of them consider 6 to 9 customers in the queue as a long queue. The results show that restaurant A and B serve more than 90% of customers faster than expected by customers and no customer stay in a long queue. On the other hand, analysis of the observation for restaurants C and D shows that on average 50% of customers stay in the short queue length and just 8% of them are in the long queue.

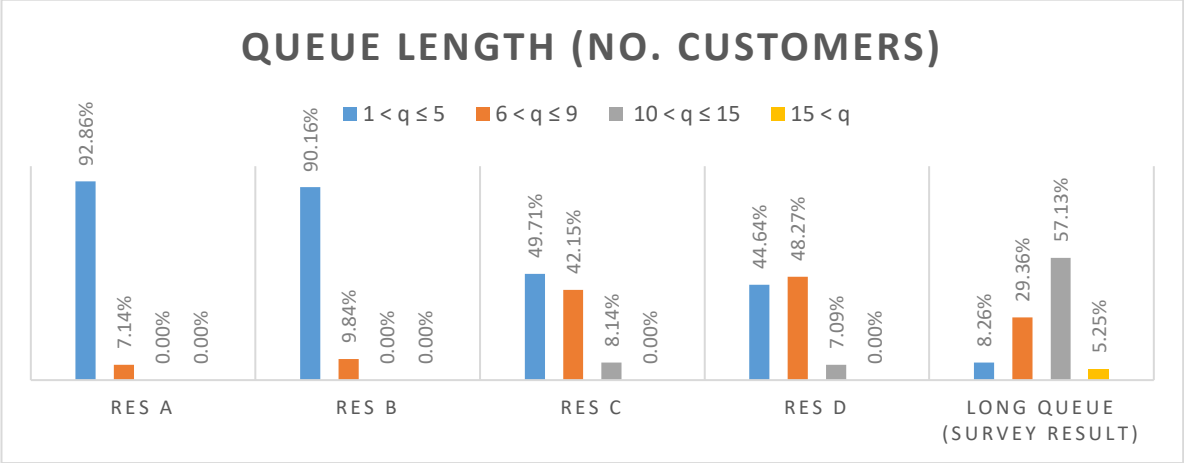


Figure E3.2: Observed length of the queue in the restaurants

Figure E3.3, represents the time that customers stay in the queue. The results of the survey demonstrate that 21.67% of customers expected to stay in the queue for up to three minutes and 56.74% of them are happy to stay in the line up to 5 minutes. The data from observations show that restaurant A and B run the queue much faster than customers' expectations (i.e. on average 80% of customers stay in the queue less than 2 minutes) but in restaurants C and D, on average 60% of customers stay in the queue up to 3 minutes. In restaurant D, more than 15% of customers stay longer than expected in the waiting line to be served.

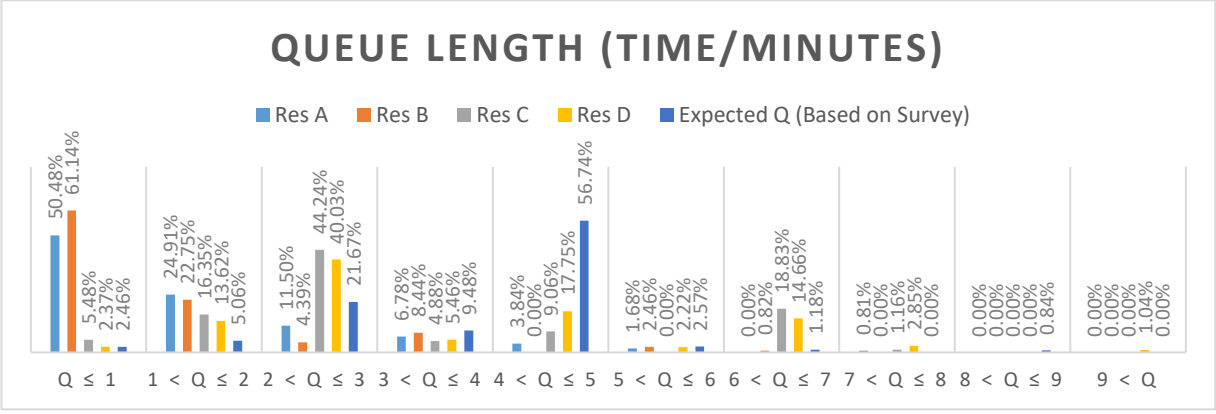


Figure E3.3: Observed queue length per minutes

Results of Queueing Model in Suburban Areas

The result of findings from the observation of queues of restaurants in suburban areas show that based on their queueing model (M/M/1), assuming system in steady-state condition, on average each customer stay in queue for 1.39 minutes on weekdays, 5.699 minutes on weekends and 2.133 minutes for the whole week (Table E3.8)

Table E3.8: Suburban Queueing Analysis

Suburban Queueing Option (Weekends)	
PARAMETERS	(M/M/1)
λ	53
μ	62
ρ	0.855
L	5.889
Lq	5.034
W	0.111 (6.667 min)
Wq	0.095 (5.699 min)
P (n=0)	0.145
P(t<0)	0.145

Suburban Queueing Option (Weekdays)	
PARAMETERS	(M/M/1)
λ	23
μ	45
ρ	0.511
L	1.045
Lq	0.534
W	0.045 (2.727 min)
Wq	0.023 (1.394 min)
P (n=0)	0.489
P(t<0)	0.489

Suburban Queueing Option (Week)	
PARAMETERS	(M/M/1)
λ	32
μ	50
ρ	0.64
L	1.778
Lq	1.138
W	0.056 (3.333 min)
Wq	0.036 (2.133 min)
P (n=0)	0.36
P(t<0)	0.36

Results of Queueing Model in Urban Areas

The result of findings from the observation of queues of restaurants in urban areas show that based on their queueing model (M/M/1), assuming system in steady-state condition, on average each customer stay in queue for 0.039 hour on weekdays, 0.112 hour on weekends and 0.049 hour on all days in a week (Table E3.9)

Table E3.9: Urban Queueing Analysis

Urban Queueing Option (Weekdays)	
PARAMETERS	Status Quo (M/M/1)
λ	55
μ	74
ρ	0.743
L	2.895
Lq	2.151
W	0.053
Wq	0.039
P (n=0)	0.257
P(t<0)	0.257

Urban Queueing Option (Weekends)	
PARAMETERS	Status Quo (M/M/1)
λ	67
μ	75
ρ	0.893
L	8.375
Lq	7.482
W	0.125
Wq	0.112
P (n=0)	0.107
P(t<0)	0.107

Urban Queueing Option (Week)	
PARAMETERS	Status Quo (M/M/1)
λ	58
μ	74
ρ	0.784
L	3.625
Lq	2.841
W	0.062
Wq	0.049
P (n=0)	0.216
P(t<0)	0.216

Chapter E4: Summary and Conclusion

In summary, this part presents the results of data analysis and findings of the main studies in the survey and observations. Questionnaires have been analysed through Factorial MANOVA after all assumptions have been met. M/M/1 queueing model is selected for the analysis of observations and the optimum length of the queue in different areas has been calculated. The next part presents the discussion and conclusion of the thesis and its relation to theory.

PART F: DISCUSSION AND CONCLUSION

Chapter F1: Introduction to Discussion and Conclusions

The final part of the thesis presents discussion and conclusions about the impact of queue length on the service variables and the optimum length of the physical queue in the food service organisations in the UK. It contains one main chapter (E2) that starts by looking at the exciting knowledge and empirical research on queueing theory and the needs for doing this research through its aim and objectives. The second and third sections of the chapter are discussed the testing of hypotheses from the conceptual framework on exciting queueing literature and the result of the queueing model of the observed restaurants in the UK. It continues with a debate on the research contributions and managerial implications the study makes to knowledge and practice, and finally, discuss the limitations of the study and future research directions.

Chapter F2: Discussion and Conclusions

F2.1: Overview of Literature Review

The discussion of the literature in part B, demonstrates the importance of empirical research in queueing theory. The findings in chapters B4, B5 and B6 show the issues and gaps in this area on how to find the optimum length of queue empirically to get a better advice to managers to run their business more efficiently.

The literature review indicates the importance of managing queue in front of service organisations has been studied in economics, psychology and operations. Some businesses try to manage and change the traditional way of staying in line by using new technologies and get numbers to customers known as abstract waiting.

Literature shows that queues in front of businesses have a different meaning for each person. For some of them, it has a positive signal that services or products of that shop are superior to others and for some, it is a negative point like the waiting cost and anxiety. The literature of psychology shows for people with high informative conformity the value and quality of products depend on the number of customers behind and in front of them in the queue. As a result, most of the literatures in queue shows that waiting time and long queues have a negative point in the view of customers and have a bad reputation for businesses. It shows the focus of traditional literature to solve the problems of queue statistically by making it shorter.

The literature shows that researches in the area of queuing mostly have used to find a better solution for the queuing system statistically and they ignored the operational behaviour of customers and the environment of the businesses. In recent years researchers found that the design of queue is not just the problem, understanding the behaviour of the customer in queue is also important. Reviewing literature shows the importance of analysing behavioural operations in service organisations. In recent years some scholars try to run the operation part of business more convinces by looking at the behaviour of customers in this area called behavioural operations management.

The interest of the researcher for doing this thesis is to fill the following gaps in the literature. The first one is that instead of finding a solution to reduce the number of customers in the queue to show the speed of services for attracting more customers, managers should understand what the behaviour of people is by looking at the length of queue and what should be the optimum queue length to attract customer. Secondly, our focus is on physical queues to see which customers get this external information as a positive signal and decide to join the queue.

F2.2: Research Contributions and Managerial Implications

This study contributes to our understanding of the impact of physical queue length on the customers. Accordingly, the study found the optimum length of the physical queue in service organisations and the perception of the customers on the service variables from the length of the queue. Importantly, this study contributes and offers empirically-based insights into the queueing literature on which, until now most of its focuses were on the mathematical solutions. The study is underpinned by a theoretically grounded framework, addressing repeated calls in the literature regarding the lack of study the optimum length of physical queue empirically. It thus presents future researchers with an empirically verified theoretical foundation on which to investigate related issues. The research findings lead to several contributions to queueing knowledge and practice on the subject matter as discussed below.

Managerial Implications to the Industries Studied

The findings of this research provide insights to service managers as to how the relationships and interactions between the different type of customers with location of businesses and the length of queue on the service variables can have implications for the organisation, especially as the results of this study suggest that length of physical queue can influence the behaviour of customers towards the services in the company. Firstly, we

discuss these effects in the food service industry and after that, we evaluate these effects in the retails and entertainment service industries.

Foods Service Industry

Table F2.1 represents a summary of the main hypothesis in the foodservice industry.

H1: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in foods service industries (here, restaurants)

H0: No interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in foods service industries (here, restaurants)

It presents the relationship and interaction of variables that has a significant effect on each dependent variable to the categories. By looking at the queue length and each dependents variable (quality, offer and intention to switch to alternatives), the value of *p* indicates that there are statistically significant results on the quality and offer (p is less than .05) It means the quality and offer level is different on queue length as an independent variable. In terms of effect size by looking at the Partial Eta Squared, for length of queue and quality, the effect size is 8.7% that shows the medium effect on the queue length.

For the interaction between queue length, customer type and location of the business in the foods service industry, it shows that all dependent variables are statistically significant. Offer has the highest effect size of 28% comparing to the quality with 18% and availability-of-alternative with 5.4%.

Table F2.1: Summary of hypothesis testing

Tests of Between-Subjects Effects			
Source	Dependent Variable	Sig.	Partial Eta Squared
QueueLength	**MQuality**	**.047**	**.087**
	MOffer	**.033**	**.110**
CustomerType * QueueLength	**MQuality**	**.045**	**.094**
	MOffer	**.026**	**.087**
CustomerType * BusinessLocation * QueueLength	**MQuality**	**.005**	**.180**
	MOffer	**.030**	**.280**
	MAlternative	**.042**	**.054**

Retails Service Industry

The results of the main hypothesis that business location, type of customers and length of physical queue interact to influence service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in retail industries shows in Table F2.2.

H1: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in retail industries.

H0: No interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in retail industries.

It presents the relationship and interaction of variables that have a significant effect on each dependent variable to the categories. By looking at the interactions of customer type and queue length, business location and queue length, customer type and business location and queue length and each dependents variables (quality, offer and intention to switch to alternatives), the value of *p* indicates that there are statistically significant results for the interaction of customer type and queue length on the offer (p=.46, P<.05) It means the offer level is different on customer type and queue length as an independent variable. It means that it does not differ base on the interaction of customer type and queue length. In terms of effect size by looking at the Partial Eta Squared, the effect size is 12% that shows the medium effect on it.

For the interaction between queue length, customer type and location of the business, it shows that offer and intention to switch to alternatives are statistically significant. The intention to switch to alternatives has the highest effect size of 14% comparing to the offer with 7.7%.

Table F2.2: Summary of Hypothesis Testing

Tests of Between-Subjects Effects			
Source	Dependent Variable	Sig.	Partial Eta Squared
CustomerType * QueueLength	**MOffer**	**.046**	**.120**
BusinessLocation * QueueLength	**MAlternative**	**.038**	**.132**
CustomerType * BusinessLocation * QueueLength	**MOffer**	**.024**	**.077**
	MAlternative	**.018**	**.140**

Entertainment Service Industry

The results of hypothesis testing that business location, type of customers and length of physical queue interact to influence service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in the entertainment industry shows in table F2.3.

H1: Interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in the entertainment industry.

H0: No interaction occurs between queue length, business location and customer type in effecting the service characteristics including quality of services, intention to switch to alternatives and offers to attract customers into the queue in the entertainment industry.

Table F2.3 presents the relationship and interaction of variables that have a significant effect on each dependent variable to the categories. By looking at the customer type, interaction of customer type and business location, and interaction of customer type and business location and queue length and each dependents variable (quality, offer and intention to switch to alternatives), the value of P indicates that they are statistically significant results. In terms of effect size by looking at the Partial Eta Squared, shows there are medium effect size on them. For the interaction between queue length, customer type and location of the business, it shows that the intention to switch to alternatives is statistically significant ($p=.36$, $p<.05$) with a medium effect size of 6.1%.

Table F2.3: Tests of Between-Subjects Effects

Tests of Between-Subjects Effects			
Source	Dependent Variable	Sig.	Partial Eta Squared
CustomerType	**MQuality**	**.047**	**.070**
CustomerType * BusinessLocation	**MAlternative**	**.041**	**.041**
CustomerType * BusinessLocation * QueueLength	**MAlternative**	**.036**	**.061**

This study provides the **first empirical evidence** pertaining to the relative impact of the length of physical queue on the perception of customers into the service variables in the UK. Past researches (Batt and Teriesch, 2015; Allon, et al., 2011; Seawright and Sampson, 2007) in the queueing and waiting lines limited on the effectiveness of the queue length on

the behavioural of customers. The findings of this study provide interesting insights into how the relations and interactions of customer type and business location influence the intention to switch to alternatives in entertainment service industries. It shows that the interaction between all three variables are stronger than just customer types and business locations. Service operations managers of these industries need to have all variables in place at the same time to keep their customers in the queue for more sales and profit.

Service Industries Comparison

A comparison of three service industries in Table F2.4 demonstrates the relationship and interaction of variables. It shows that just in the entertainments industry, quality is statistically significant based on the type of customer (p = .047) Queue length has just interaction in the foods service industry with the *quality* and *offer* variables. In all three service industries, intention to switch to alternatives is statistically significant, when different types of customers, business locations and length of the queue have interaction together.

Table F2.4: Comparison of Service Industries

Tests of Between-Subjects Effects		Foods		Retails		Entertainments	
Source	Dependent Variable	Sig.	Partial Eta Squared	Sig.	Partial Eta Squared	Sig.	Partial Eta Squared
CustomerType	**MQuality**	.075	.019	.547	.001	**.047**	**.070**
	MOffer	.165	.009	.237	.004	.385	.002
	MAlternative	.112	.016	.673	.000	.097	.007
BusinessLocation	MQuality	.090	.045	.643	.001	.299	.003
	MOffer	.244	.020	.629	.001	.679	.000
	MAlternative	.071	.008	.448	.001	.422	.002
QueueLength	**MQuality**	**.047**	**.087**	.247	.003	.614	.001
	MOffer	**.033**	**.110**	.297	.003	.128	.006
	MAlternative	.803	.000	.363	.002	.581	.001
CustomerType * BusinessLocation	MQuality	.276	.003	.329	.002	.103	.007
	MOffer	.688	.000	.109	.006	.423	.002
	MAlternative	.629	.001	.589	.001	**.041**	**.041**
CustomerType * QueueLength	**MQuality**	**.045**	**.094**	.786	.000	.863	.000
	MOffer	**.026**	**.087**	**.046**	**.120**	.636	.001
	MAlternative	.110	.006	.458	.001	.845	.000
BusinessLocation * QueueLength	MQuality	.752	.000	.143	.005	.691	.000
	MOffer	.488	.001	.345	.002	.316	.003
	MAlternative	.436	.000	**.038**	**.132**	.893	.000
CustomerType * BusinessLocation * QueueLength	**MQuality**	**.005**	**.180**	.973	.020	.076	.008
	MOffer	**.030**	**.280**	**.024**	**.077**	.613	.001
	MAlternative	**.042**	**.054**	**.018**	**.140**	**.036**	**.061**

Comparison of industries shows that service managers in foods industry needs to keep the quality of its services in high level and have standard offer all the time its' affect the behaviour of the customer and attract them to join the queue as suggested in prior research (Zhou, Soman, 2002).

Managerial Implications to the Restaurants Observed

In this section, the findings of observation for the two different locations of businesses in the UK are discussed. For each dates of the week (Weekdays, Weekend, Week) and two different locations as suburban and urban areas, we discuss the statistical results and then the efficiency analysis of the queueing model will be evaluated, after that the comparison of the queueing models (single server and multi-serve) is done to find the best options for the businesses in the different conditions.

The results show that in suburban areas, on Weekdays, the queueing model of M/M/1 has an arrival rate (λ) of 23 customers and service rate (μ) of 45 customers. It means the number of customers that are coming in the business to be served is lower the rate of server, so in this condition, the queue can be managed easily and there is an efficiency in the servers. The length of queue (Lq = 0.534) shows on average one customer is in the queue to be served and the average customers in the system (L = 1.045) is one customer. The server utilisation (ρ) shows the capacity and efficiency of the queue and overall system utilisation. For the business in suburban areas, on Weekdays this utilisation is 51% that presents the low efficiency of the system and high capacity.

The results show that in suburban areas, on Weekends, the queueing model of M/M/1 has arrival rate (λ) of 53 customers and service rate (μ) of 62 customers. It means the number of customers that are coming in the business to be served is lower the rate of server, so in this condition, the queue can be managed easily and there is an efficiency in the servers. The length of queue (Lq = 5.034) shows on average one customer is in the queue to be served and the average customers in the system (L = 5.889) are six customers. The server utilisation (ρ) shows the capacity and efficiency of the queue and overall system utilisation. For the business in suburban areas, on Weekends this utilisation is 85.5% that presents the high efficiency that needs to improve and manage the queue and system.

The results show that in suburban areas, all days in a Week, the queueing model of M/M/1 has arrival rate (λ) of 32 customers and service rate (μ) of 50 customers. It means the number of customers that are coming in the business to be served is lower the rate of server, so in this condition, the queue can be managed easily and there is an efficiency in the servers. The length of queue (Lq = 1.138) shows on average one customer is in the queue to be served and the average customers in the system (L = 1.778) are one customer. The server utilisation

(ρ) shows the capacity and efficiency of the queue and overall system utilisation. The server utilisation of 64% presents the medium efficiency of the system.

The results show that in urban areas, on Weekdays, the queueing model of M/M/1 has arrival rate (λ) of 54 customers and service rate (μ) of 74 customers. It means the number of customers that are coming in the business to be served is lower the rate of server, so in this condition, the queue can be managed easily and there is an efficiency in the servers. The length of queue (Lq = 2.151) shows on average one customer is in the queue to be served and the average customers in the system (L = 2.894) is one customer. The server utilisation (ρ) shows the capacity and efficiency of the queue and overall system utilisation. For the business in suburban areas, on Weekdays this utilisation of 74.3% presents the efficiency is bit high that needs to improve and manage the queue and system.

The results show that in urban areas, on Weekends, the queueing model of M/M/1 has an arrival rate (λ) of 67 customers and service rate (μ) of 75 customers. It means the number of customers that are coming in the business to be served is lower the rate of server, so in this condition the queue can be managed easily and there is an efficiency in the servers. The length of queue (Lq = 7.482) shows on average one customer is in the queue to be served and the average customers in the system (L = 8.375) is one customer. The server utilisation (ρ) shows the capacity and efficiency of the queue and overall system utilisation. For the business in suburban areas, on Weekends this utilisation of 89.3% is the highest that needs to improve the system more efficiently.

The results show that in urban areas, all Week, the queueing model of M/M/1 has arrival rate (λ) of 58 customers and service rate (μ) of 74 customers. It means the number of customers that are coming in the business to be served is lower the rate of server, so in this condition, the queue can be managed easily and there is an efficiency in the servers. The length of queue (Lq = 2.841) shows on average one customer is in the queue to be served and the average customers in the system (L = 3.625) are one customer. The server utilisation (ρ) shows the capacity and efficiency of the queue and overall system utilisation. The utilisation of 78.4% presents the efficiency is a bit high that needs to improve and manage the queue and system.

Table F2.5, shows that 57.13% of customers consider the long queue between 10 to 15 customers in the line and 29.36% of them consider 6 to 9 customers in the queue as a long queue. The results show that restaurant A and B serve more than 90% of customers

faster than expected by customers and no customer stay in a long queue. On the other hand, analysis of the observation for restaurants C and D shows that on average 50% of stay in the short queue length and just 8% of them are in the long queue. It demonstrates that restaurant C and D distributes customers in a more efficient way rather than restaurants A and B. As all customers of restaurants expected to stay longer in the queue, all restaurants can manage their operations and use of resources more efficiently.

Table F2.5: Queueing Length (by number of customers)

	$1 < q \leq 5$	$6 < q \leq 9$	$10 < q \leq 15$	$15 < q$
Res A	92.86%	7.14%	0.00%	0.00%
Res B	90.16%	9.84%	0.00%	0.00%
Res C	49.71%	42.15%	8.14%	0.00%
Res D	44.64%	48.27%	7.09%	0.00%
Long Queue (Survey Result)	8.26%	29.36%	57.13%	5.25%

Table F2.6, represents the time that customers stay in the queue. The results of the survey demonstrate that 21.67% of customers expected to stay in the queue for up to three minutes and 56.74% of them are happy to stay in the line up to 5 minutes. The data from observations show that restaurant A and B run the queue much faster than customers' expectations (i.e. on average 80% of customers stay in the queue less than 2 minutes) but in restaurants C and D, on average 60% of customers should stay in the queue up to 3 minutes. In restaurant D, more than 15% of customers stay longer than expected in the waiting line to be served. It demonstrates that all restaurants except restaurant D serve customers lower than expected times.

Table F2.6: Queuing Length (Time/Munities)

	$q \leq 1$	$1 < q \leq 2$	$2 < q \leq 3$	$3 < q \leq 4$	$4 < q \leq 5$	$5 < q \leq 6$	$6 < q \leq 7$	$7 < q \leq 8$	$8 < q \leq 9$	$9 < q$
Res A	50.48%	24.91%	11.50%	6.78%	3.84%	1.68%	0.00%	0.81%	0.00%	0.00%
Res B	61.14%	22.75%	4.39%	8.44%	0.00%	2.46%	0.82%	0.00%	0.00%	0.00%
Res C	5.48%	16.35%	44.24%	4.88%	9.06%	0.00%	18.83%	1.16%	0.00%	0.00%
Res D	2.37%	13.62%	40.03%	5.46%	17.75%	2.22%	14.66%	2.85%	0.00%	1.04%
Expected Q (Based on Survey)	2.46%	5.06%	21.67%	9.48%	56.74%	2.57%	1.18%	0.00%	0.84%	0.00%

Comparing the results of the survey for expected long queue length and the actual length of the queue that managers of restaurants serve customers, the data shows that more than 90% of customers in the suburban areas (restaurants A and B) served in the short or no queues at all. These results are the same for the times that they stayed in the waiting line. These results indicate that the restaurants in the suburban areas use their resources in a higher

expectation of customers and they can use their capacities in a more efficient way. The operations manager of restaurants in suburban areas can put their focus on their service qualities and reduce the pressure of running the queues faster. As customers are happy to stay longer in the queue for a better service, the operations manager can run their queues through one server until the number of customers reach up to 9 customers in the queue.

In our analysis we found the optimum length of the physical queue and what the long queue means for the customers. In this case, operations managers can manage the queue and capacity of servers in the organisations base on the customers' expectation. Also, the operations manager can increase the quality of their services and made offers to the customers to increase their expectation of staying in the queue.

The analysis of observations indicates that on average 20% of customers in the urban areas stayed in the queue around two minutes more than their expected times. To keep them satisfied and happy from the services, operations managers can increase their performance at this time for example through asking customers to start looking at the menu and do the process of ordering faster. Also, operations managers to keep the queue in the optimum length can keep customers in the groups rather than single in the queue to reduce the feeling of late in the view of customers and reduce the pressure of work in themselves (Jones and Peppiatt, 1996)

It has been observed that in the suburban area restaurants do not have any entertainment in the waiting line areas occupy the time of customers when they are in the queue. It causes that managers try to increase the facilities and capacities to run the queue as fast as they can. According to Davis and Heineke, 1994, occupying customers' time in the queue will reduce their feeling of long wait. Operations managers can keep customers base on their expectations in the queue by occupying their time as well.

Productivity Analysis

The productivity analysis of the locations of businesses in the urban and suburban areas are presented in Tables F2.7 and F2.8. It shows how businesses can increase or decrease their performance on different days of the week or in the busy or quiet times. In the Suburban area on the Weekdays, the performance of the business does not affect the length of the queue as increasing or decreasing by 5%, but on Weekends, it affects the queue length and decreasing by 5% will reach the length of the queue to the maximum expected length by customers. Operations managers of businesses can decide to manage their services and queue

length better on Weekdays as the length of the queue does not affect their performance. It means that they can put their staff and capacity on the other part of the business and run the queue by one server and staff.

In the urban area (Table F2.8), the length of the physical queue on Weekdays is lower than the customer expected length as well. As the queue length affects the choice of other people for the perception of service quality, operations managers can improve the occupying time of customers in the queue and focus on the quality aspect of services in the business. In this case, they do not need to improve or think about the advancing waiting line performance for more speed and can manage their staff in other parts of the business.

Table F2.7: Suburban Productivity Analysis

Suburban Efficiency Level Analysis (Weekdays)			
EFFICIENCY PARAMETERS	-5%	M/M/1	5%
LAMBDA (λ)	23	23	23
MU (μ)	42.75	45	47.25
RHO (ρ)	0.538	0.511	0.487
L	1.165	1.045	0.948
Lq	0.627	0.534	0.462
W	0.051	0.045	0.041
Wq	0.027	0.023	0.02
P (0)	0.462	0.489	0.513

Suburban Efficiency Level Analysis (Weekends)			
EFFICIENCY PARAMETERS	-5%	M/M/1	5%
LAMBDA (λ)	53	53	53
MU (μ)	58.9	62	65.1
RHO (ρ)	0.9	0.855	0.814
L	8.983	5.889	4.38
Lq	8.083	5.034	3.566
W	0.169	0.111	0.083
Wq	0.153	0.095	0.067
P (0)	0.1	0.145	0.186

Suburban Efficiency Level Analysis (Week)			
EFFICIENCY PARAMETERS	-5%	M/M/1	5%
LAMBDA (λ)	32	32	32
MU (μ)	47.5	50	52.5
RHO (ρ)	0.674	0.64	0.61
L	2.065	1.778	1.561
Lq	1.391	1.138	0.951
W	0.065	0.056	0.049
Wq	0.043	0.036	0.03
P (0)	0.326	0.36	0.39

Table F2.8: Urban Productivity Analysis

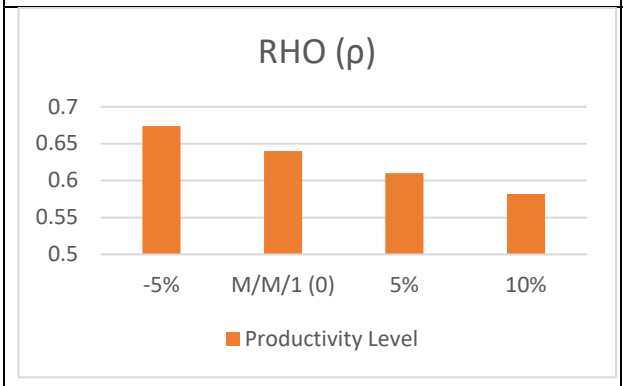
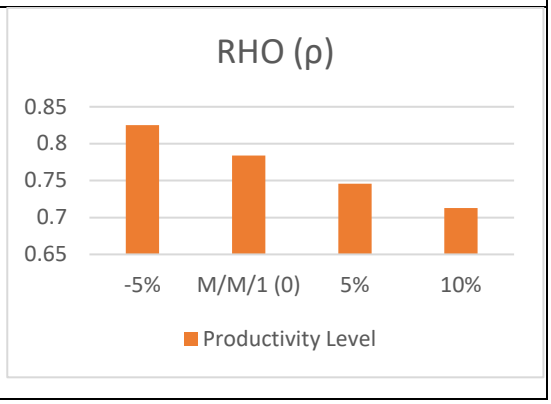
Urban Efficiency Level Analysis (Weekdays)			
EFFICIENCY PARAMETERS	-5%	M/M/1	5%
LAMBDA (λ)	55	55	55
MU (μ)	70.3	74	77.7
RHO (ρ)	0.782	0.743	0.708
L	3.595	2.895	2.423
Lq	2.812	2.151	1.715
W	0.065	0.053	0.044
Wq	0.051	0.039	0.031
P (0)	0.218	0.257	0.292

Urban Efficiency Level Analysis (Weekends)			
EFFICIENCY PARAMETERS	-5%	M/M/1	5%
LAMBDA (λ)	67	67	67
MU (μ)	71.25	75	78.75
RHO (ρ)	0.94	0.893	0.851
L	15.765	8.375	5.702
Lq	14.824	7.482	4.851
W	0.235	0.125	0.085
Wq	0.221	0.112	0.072
P (0)	0.06	0.107	0.149

Urban Efficiency Level Analysis (Week)			
EFFICIENCY PARAMETERS	-5%	M/M/1	5%
LAMBDA (λ)	58	58	58
MU (μ)	70.3	74	77.7
RHO (ρ)	0.825	0.784	0.746
L	4.715	3.625	2.944
Lq	3.89	2.841	2.198
W	0.081	0.062	0.051
Wq	0.067	0.049	0.038
P (0)	0.175	0.216	0.254

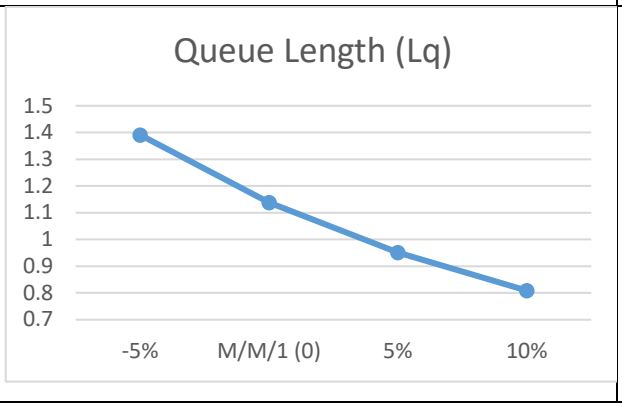
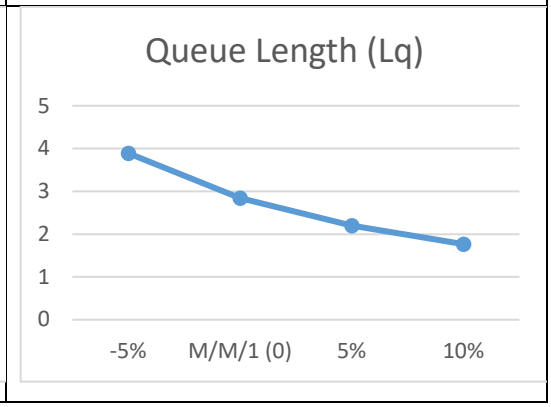
Table F2.9, shows the efficiency and system utilisation of the waiting line in different scenarios in urban and suburban locations. From the results, businesses in suburban areas can manage their queues by reducing 5% in their systems. It means that they can increase their profitability, for example, training one staff to do different jobs and be more committed to its role. On the other hand, the times that the system is busy-like in urban areas-by increasing their efficiency level they can keep customers in their expected length and time and make them happy from the services that they request.

Table F2.9: Productivity Level and System Utilisation (Week)

Suburban	Urban
	

The relationship between the length of the queue and the productivity of the system for all day in a week is shown in Table F2.10. By increasing or decreasing the service productivity in the business, operations managers can use their capacity and staff more efficiently to manage their queues. In the times that length of queue is lower than customer expectation, managers can reduce the productivity in the waiting line and focus on the other aspect of the services and business, but when the queue is busy and that is more than customer expectation, they can increase the efficiency of the waiting line to make their customer more satisfied.

Table F2.10: Productivity Level and Physical Queue Length (Week)

Suburban	Urban
	

Comparison of Queueing Models

Most of the observed restaurants used one or two cashiers or staff to serve customers in the queuing system of their businesses. It means they used a multi-server queueing model

to serve customers. To be more productive and efficient, managers can use more or fewer servers in the queueing system.

Tables F2.11 and F2.12 compared the different types of queueing models in the suburban and urban areas to assess the efficiency of the service organisations base on the number of servers on different days. The results show that in the suburban areas there are not any difference-by adding more server to the system in the length of queue on Weekdays, as in all models, there are maximum one customer on average in the queue. In Weekends, it shows that on the busy times when the length of the queue is more than expected times, by running one server to the system the length of the queue would be in the limited optimum length (Table F2.11)

The analysis of queueing models in the urban locations shows the length of queue on Weekdays reduced from 2.151 in a single server to 0.119 in two serves. It demonstrates that in all conditions one server is enough to run customers in the queue as it does not change customers perception and also helps to keep the physical queue in the optimum length.

Table F2.11: Suburban Areas: Comparison of Queuing Models

PARAMETERS (Weekdays)			
	M/M/1	M/M/2	M/M/3
λ	23	23	23
μ	45	45	45
ρ	0.511	0.256	0.17
L	1.045	0.547	0.514
Lq	0.534	0.036	0.003
W	0.045	0.024	0.022
Wq	0.023	0.002	0
P (n=0)	0.489	0.593	0.599
P(t<0)	0.489	0.896	0.984

PARAMETERS (Weekends)			
	M/M/1	M/M/2	M/M/3
λ	53	53	53
μ	62	62	62
ρ	0.855	0.427	0.285
L	5.889	1.046	0.879
Lq	5.034	0.191	0.025
W	0.111	0.02	0.017
Wq	0.095	0.004	0
P (n=0)	0.145	0.401	0.423
P(t<0)	0.145	0.744	0.938

PARAMETERS (Week)			
	M/M/1	M/M/2	M/M/3
λ	32	32	32
μ	50	50	50
ρ	0.64	0.32	0.213
L	1.778	0.713	0.648
Lq	1.138	0.073	0.008
W	0.056	0.022	0.02
Wq	0.036	0.002	0
P (n=0)	0.36	0.515	0.526
P(t<0)	0.36	0.845	0.971

Table F2.12: Urban Areas: Comparison of Queuing Models

PARAMETERS (Weekdays)			
	M/M/1	M/M/2	M/M/3
λ	55	55	55
μ	74	74	74
ρ	0.743	0.372	0.248
L	2.895	0.862	0.757
Lq	2.151	0.119	0.014
W	0.053	0.016	0.014
Wq	0.039	0.002	0
P (n=0)	0.257	0.458	0.474
P(t<0)	0.257	0.799	0.957

PARAMETERS (Weekends)			
	M/M/1	M/M/2	M/M/3
λ	67	67	67
μ	75	75	75
ρ	0.893	0.447	0.298
L	8.375	1.116	0.922
Lq	7.482	0.223	0.029
W	0.125	0.017	0.014
Wq	0.112	0.003	0
P (n=0)	0.107	0.382	0.406
P(t<0)	0.107	0.724	0.931

PARAMETERS (Week)			
	M/M/1	M/M/2	M/M/3
λ	58	58	58
μ	74	74	74
ρ	0.784	0.392	0.261
L	3.625	0.926	0.801
Lq	2.841	0.142	0.017
W	0.062	0.016	0.014
Wq	0.049	0.002	0
P (n=0)	0.216	0.437	0.455
P(t<0)	0.216	0.779	0.951

Contributions to Service Organisations

The last part of the managerial contribution is to service organisations for lack of management in the queues or running the wrong form of queueing model in different situations.

Many service organisations take the advantages of queuing theory as a mathematical approach to analysis their queueing process. Also, It helps the service operations managers to make a right decision in their day to day activity. Right model has high impact to improve the physical queue in services which is viewed as key to manage the length of the queue at optimal level and hence profitability. Running the right form of queueing model at the right time has a high impact on the performance of the service organisations. Managers of service operations should be aware of this information on and the impact of the optimum length of queue on their sales.

The implications of this research are to manage and design a queue structure to improve consumers' product evaluation to the service industry and using services in an efficient and effective way. According to the results, the value of the product would be higher as the number of customers in the physical queue is higher. It helps the managers to direct the attention of customers to the people in the queue that improves consumers' product evaluation (Allon, Federguen and Pierson, 2011). The operations managers of other similar organisations like health systems and transport companies can take advantages of these contributions to enhance their services and increase their profitability (Raz and Ert, 2008).

Knowledge Contributions

The primary contribution of this thesis is to investigate the optimum length of physical queues at businesses and their impact on customers to join such queues. Review of the queueing theory on behaviour of customers in the service organisation literature in Part B amply demonstrated that understanding the impact of the optimum length of the physical queue has been relatively under-researched (Obamiro, 2010; Dais and Famula, 2010; Gosha, 2007). Furthermore, the empirical evidence of prior research shows that patience is often a characteristic of the system state (Taylor, 1994; Leclerc et al., 1995; Hui and Tse, 1996; Carmon and Hanneman, 1988). Therefore, this study contributes to the queueing literature by expanding the scope of research and investigating the optimum length of physical queues at businesses and its impact on customers to join such queues. The contributions of this study to knowledge of queueing subjects are in several ways as discussed next.

The first contribution of the study is to find the optimum length of the physical queue in the service organisations empirically as it has not been researched before. Previous findings (Maister, 1985; Levine, 1997; Thieery, 1994; Zakay and Hornik,1996; Zohar et al., 2002) were based on the assumptions and simulations as this study thus extends knowledge of the subject matter by empirically investigating the optimum length of physical queue.

Secondly, in the queueing literature, there is some investigation on the behaviour of customers in the queue in hospital in Nigeria by Obamiro (2010) that conclude the "knowledge of queuing theory can help service managers to make decisions that increase the satisfaction of customers, employees and management". Dais and Famula (2010) found that an international bank, "the traffic intensity obtained is 0.8378 which indicates the probability of a customer queueing or waiting for service on arrival". This study is the first on its own to find and compare the perception of customers from the length of physical queue empirically in three different service industries (i.e. foods, entertainment, retails). The

Thirdly, the past research on physical queue just considered the direct effect of queue on the product and service perceptions in one industry without considering the interaction of customer type and location of businesses (Levin, 2000; Soman, 2001; Shaw et al., 2000; Hocknehull, 2000). Hence, to fill out the research gaps, this study included independents variables as type of customers and location of businesses to understand their interaction and relationship of them to the length of queue and customers service perceptions as well as the interaction effect of the customer types and different business locations on different service variables (i.e. offers, intention to switch to alternatives and quality) in different service industries that did not examined before.

Fourthly, the framework demonstrates in the study suggests that different type of service industry has an impact on the customer's decision by looking at the queue length. The results confirm the findings of other researchers, for example in the fast-food drive-thru industry customers trade off price and waiting time (Riordan, 1962; Zohar et al., 2002; Brandt and Brandt, 2000).

Furthermore, prior research by Lu, et al., (2013) shows that "waiting in the queue has a nonlinear impact on purchase incidence and that customers appear to focus mostly on the length of the queue, without adjusting enough for the speed at which the line moves". Batt and Terwiesch (2015), shows that in queues that are at least partially visible, Erlang-A-type models do not fully capture abandonment behaviour. Beyond just the queue length, it replicates that patients respond to other visual aspects of the queue in very sophisticated ways. Thus, the findings of this thesis contribute that type of service variables in different

service category has a different impact on the customers that see the length of the physical queue in front of businesses.

Finally, this contribution naturally translates to service organisations of other countries that have a similar culture and society like European countries.

F2.3: Research Limitations and Future Directions

The strength of any research project lies in its ability to recognise its limitations. This allows the findings to be interpreted in the context of the constraints and provide directions for future research to alleviate the focal limitations. The following discussion is about the limitations and future directions of this study.

The first limitation of the study is the service variables that have been selected base on the queueing literature and past research. Other variables and factors may influence the consumers' perception of queue length as well.

Secondly, one limitation is the requirements of direct observation (Meredith, 1998), and particularly the constraints of cost, time, and access (Bryman, 1989) This thesis has not been constrained by these factors, though the expense of cost, time and access is significant on four businesses (restaurants) in one service industry for seven days. This may limit the generalisation of our findings if it happens in other times of the year. As a result, further study is recommended to cover some selected restaurants for a longer period and at different time of the year.

Thirdly, the observation has been done on one type of service industry. It is recommended in future studies, another service industry like the retail industry would be observed.

Fourthly, this study just observed and considered physical ordering. To get more realistic data for suggestions to the managers, different types of ordering like telephone and online ordering should be considered to know how it affects the length of the queue.

Fifthly, there may be concerns regarding the respondents online. To ensure data quality, visually checking the data and removing respondents indulging in straight-lining and identifying any respondents by the speed at which they completed the survey and by analysing the quality of response.

Sixthly, this study is conducted in the United Kingdom and therefore the findings may only reflect their perspective raising the question of the transferability of these findings to other countries. The future research can be done in other countries, to compare the similarities and differences of the people in that region.

Finally, this study measure intentions which are used as a proxy for behaviour. Future studies can measure actual behaviour by employing a longitudinal research design.

REFERENCES

Adler, I. Naor, P. (1969) Social optimization versus self-optimization in waiting lines. Technical Report 126, Department of Operations Research, Stanford University, Stanford, CA.

Agnew, C. E. (1976) "Dynamic modeling and control of congestion-prone systems", *Operations Research*, 24(3), pp. 400-419.

Akşin, Z., Ata, B., Emadi, S. and Su, C. (2017) "Impact of Delay Announcements in Call Centers: An Empirical Approach", *Operations Research*, 65(1), pp. 242-265.

Aksin, Z. N. et al. (2007) "The modern call center: A multi-disciplinary perspective on operations management research", *Production and Operations Management*, 16(6), pp. 665-688.

Archibald, T. W., Thomas, L. C. Betts J. M., and Johnston R. B., (2002) "Should start-up companies be cautious? Inventory policies which maximise survival probabilities", *Management Science*. 48(9), pp. 1161-1174.

Allon, G., and Bassamboo, A. (2011) "The Impact of Delaying the Delay Announcements", *Operations Research*, 59(5), pp. 1198-1210.

Allon, G., Bassamboo, A. and Gurvich, I. (2011) "We Will Be Right with You: Managing Customer Expectations with Vague Promises and Cheap Talk", *Operations Research*, 59(6), pp. 1382-1394.

Allon, G., Federgruen, A. and Pierson, M. (2011) "How Much Is a Reduction of Your Customers' Wait Worth? An Empirical Study of the Fast-Food Drive-Thru Industry Based on Structural Estimation Methods", *Manufacturing & Service Operations Management*, 13(4), pp. 489-507.

Allon, G. and Hanany, E. (2012) "Cutting in Line: Social Norms in Queues", *Management Science*, 58(3), pp. 493-506.

Allon, G. et al. (2011) "How Much Is a Reduction of Your Customers, Wait Worth? An Empirical Study of the Fast-Food Drive-Thru Industry Based on Structural Estimation Methods", *Manufacturing and Service Operations Management*, 13(4), pp. 489–507.

Anand, K., Paç, M. and Veeraraghavan, S. (2011) "Quality–Speed Conundrum: Trade-offs in Customer-Intensive Services", *Management Science*, 57(1), pp. 40-56.

Antonides, G. et al. (2002) "Consumer Perception and Evaluation of waiting time: A Field Experiment", *Journal of Consumer Psychology*, 12(3), pp. 193–202.

Arasli, H., Katircioglu, S.T., and Mehtap-Smadi, S. (2005) "A Comparison of Service Quality in the Banking Industry: Some Evidence from Turkish and Greek Speaking Areas in Cyprus", *International Journal of Bank Marketing*, 23(7), pp. 508-526.

Armony, M., Maglaras. C. (2004) "Contact centers with a call-back option and real-time delay information", *Operations Research*, 52(4), pp. 527-545.

Armony, M., Maglaras. C. (2004b) "On customer contact centers with a call-back option: Customer decisions, routing rules, and system design", *Operations Research*, 52(2), pp. 271-292.

Armony, M., Plambeck, E. and Seshadri, S. (2009) "Sensitivity of Optimal Capacity to Customer Impatience in an Unobservable M/M/S Queue (Why You Shouldn't Shout at the DMV)", *Manufacturing & Service Operations Management*, 11(1), pp. 19-32.

Armony, M., Shimkin, N. and Whitt, W. (2009) "The Impact of Delay Announcements in Many-Server Queues with Abandonment", *Operations Research*, 57(1), pp. 66-81.

Aronson, E., Ellsworth, P.C., Carlsmith, lM. and Gonzales, M.H. (1990) *Methods of Research in Social Psychology*. 2nd edn. New York: McGraw-Hill.

Ata, B. and Shneorson, S. (2006) “Dynamic Control of an M/M/1 Service System with Adjustable Arrival and Service Rates”, *Management Science*, 52(11), pp. 1778-1791.

Athanassopoulos, A., Gounaris, S. and Stathakopoulos, V. (200I) “Behavioural Responses to Customer Satisfaction: An Empirical Study”, *European Journal of Marketing*, 35(5/6), pp. 687-707.

Babes, M., and Serma, G. V. (1991) “Out-patient Queues at the Ibn-Rochd Health Centre”, *Journal of Operational Research*, 42(10) pp. 1086-1087.

Babbie, E. (2013) *The Practice of Social Research.* 14th edn. Wadsworth: Thomson Learning Inc.

Baddeley, M. (2010) “Herding, social influence and economic decision-making: socio-psychological and neuroscientific analyses”, *Phil. Trans. R. Soc. B*, 365(1), pp. 281–290.

Banerjee, A., and Fudenberg D. (2004) “Word-of-mouth learning, games and economic behaviour”, *Games and Economic Behavior*, 46(1), pp. 1–22.

Banerjee A.V. (1992) “A simple model of herd behaviour”, *The Quarterly Journal of Economics*, 107(1), pp. 797–817.

Bansal, H.S. and Taylor, S.F. (1999) “The Service Provider Switching Model: A Model of Consumer Switching Behavior in the Services Industry”, *Journal of Service Research*, 2(2), pp. 200-218.

Barrot, c., Becker, J.U. and Meyners, J. (2013) “Impact of Service Pricing on Referral Behaviour”, *European Journal of Marketing*, 47(7), pp. 1052-1066.

Basset, C., and Basset, J. (2003) “Quantitative and Qualitative research”, *British Journal of Perioperative Nursing, Harrogate*, 13(3), pp. 116-118.

Batt, R. and Terwiesch, C. (2015) “Waiting Patiently: An Empirical Study of Queue Abandonment in an Emergency Department”, *Management Science*, 61(1), pp. 39-59.

Becker, G. (1991) “A note on restaurant pricing and other examples of social influences on price”, *Journal of Political Economy*, 99(5), pp. 1109–1116.

Belson, G. V. (1988), “Waiting Times Scheduled Patient in the Presence of Emergency Request”, *Journal of Operational Management*, 2(3)

Bennett, R. (1998) “Queues, customer characteristics and policies for managing waiting-lines in supermarkets”, *International Journal of Retail & Distribution Management*, 26(2), pp. 78-87.

Berman, O., Wang, J. and Sapna, K. (2005) “Optimal management of cross-trained workers in services with negligible switching costs”, *European Journal of Operational Research*, 167(2), pp. 349-369.

Bharucha-Reid, A.T. (1988) *Elements of the Theory of Markov Processes and Their Applications*. Dover Publications, INC Mineola, New York, NY.

Bikhchandani, S., D. Hirshleifer, I. Welch. (1992) “A theory of fads, fashion, custom and cultural change as information cascades”, *Journal of Political Economy*, 100(1) pp. 992-1026.

Bitner, MJ. (1990) “Evaluating Service Encounters: The Effects of Physical Surroundings and Employee Responses”, *Journal of Marketing*. 54(2), pp. 69-82.

Bitran, G., Ferrer, J. and Rocha e Oliveira, P. (2008) “OM Forum-Managing Customer Experiences: Perspectives on the Temporal Aspects of Service Encounters”, *Manufacturing & Service Operations Management*, 10(1), pp. 61-83.

Blanc, J. (2009) “Bad luck when joining the shortest queue”, *European Journal of Operational Research*, 195(1), pp. 167-173.

Boots, N.K. and Tijms, H. (1999) “A multi-server queueing system with impatient customers”, *Management Science*, 45(3), pp. 444-448.

BoshotT, C. (1997) “An Experimental Study of Service Recovery Options”, *International Journal of Service Industry Management,* 8(2), pp. 110-130.

Boudali, O. and Economou, A. (2012) “Optimal and equilibrium balking strategies in the single server Markovian queue with catastrophes”, *European Journal of Operational Research*, 218(3), pp. 708-715.

Boudali, O. and Economou, A. (2013) “The effect of catastrophes on the strategic customer behavior in queueing systems”, *Naval Research Logistics (NRL),* 60(7), pp. 571-587.

Bountali, O. and Economou, A. (2017) “Equilibrium threshold joining strategies in partially observable batch service queueing systems”, *Annals of Operations Research*, 277(2), pp. 231-253.

Brahimi, M. and Worthington, D. (1991) “The finite capacity multi-server queue with inhomogeneous arrival rate and discrete service time distribution-and its application to continuous service time problems”, *European Journal of Operational Research*, 50(3), pp. 310-324.

Brann, D.M and Kulick, B.C. (2002) “Simulation of restaurant operations using the Restaurant Modelling Studio”, *IEEE Press*, 1(1), pp. 1448-1453.

Brown, L., N. et al. (2005) “Statistical analysis of a telephone call center: A queueing-science perspective”, *Journal of the American Statistical Association*, 100(469), pp. 36-50.

Bryman, A. (1984) “The debate about qualitative and quantitative research: A question of method or epistemology?”, *The British Journal of Sociology*, 35(1), pp. 75-92.

Bryman, A. & Bell, E. (2011) *Business research methods.* 3rd edn. Oxford University Press, Oxford.

Bunday, B.D. (1996) *An Introduction to Queuing Theory*. New York: Halsted Press.

Burnetas, A. (2011) “Customer equilibrium and optimal strategies in Markovian queues in series”, *Annals of Operations Research*, 208(1), pp. 515-529.

Carbone, L.P. & Haeckel, S.H. (1994) “Engineering customer experiences”, *Marketing Management*, 3(3), pp. 8-19.

Carmines, E.G. and Zeller, R.A. (1979) *Reliability and Validity Assessment*. Thousand Oaks: Sage Publications Inc.

Chambers, C. and Kouvelis, P. (2009) “Modeling and Managing the Percentage of Satisfied Customers in Hidden and Revealed Waiting Line Systems”, *Production and Operations Management*, 15(1), pp. 103-116.

Chamley, C. P. (2004) *Rational Herds: Economic Models of Social Learning*. Cambridge University Press, Cambridge, UK.

Chaniotakis, I. E. and Lymperopoulos, C. (2009) “Service Quality Effect on Satisfaction and Word of Mouth in the Health Care Industry”, *Managing Service Quality: An International Journal*, 19(2), pp. 229-242.

Clark, R. A., and Goldsmith, R. E. (2006) “Global innovativeness and consumer susceptibility to interpersonal influence”, *Journal of Marketing Theory and Practice*. 14(4), pp. 275-285

Collis, J. &Hussey, R. (2003) *Business research: A practical guide for undergraduate and postgraduate students.* 2nd edn. Palgrave Macmillan, Hampshire, UK.

Crahill, T. et al. (1977) “A classified bibliography of research on optimal design and control queues”, *Operations Research*, 25(2), pp. 219-232.

Crano, W. D., Brewer, M. B. and Lac, A. (2014) *Principles and methods of social research*. 3rd edn. New York: Routledge

Creswell, J.W. (2012) *Qualitative inquiry and research design: Choosing among five approaches.* 3rd edn. Sage, Thousand Oaks.

Creswell, J.W. (2013) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th edn. Thousand Oaks, CA: SAGE Publications.

Cronin, P., Ryan, F. and Coughlan, M. (2008) "Undertaking a Literature Review: A Step-ByStep Approach", *British Journal of Nursing*. 17(1), pp. 38-43.

Dais, F. Famule, F. (2010) "Analysis Of M/M/1 Queueing Model with Applications To Waiting Time Of Customers In Banks", *Global Journal of Computer Science and Technology*, 10(13), p.50

Davis, M. (1991) "How Long Should a Customer Wait for Service?", *Decision Sciences*, 22(2), pp. 421-434.

Davis, M. and Maggard, M. (1990) "An analysis of customer satisfaction with waiting times in a two-stage service process", *Journal of Operations Management*, 9(3), pp. 324-334.

Davis, M. M., Aquilano, J. N., Chase, B. R. (2003) *Fundamentals of Operations Management*. Boston: McGraw- Hill Irwin, Fourth Edition.

Davis, M.M. and Heineke, J. (1994) "Understanding the Roles of the Customer and the Operation for Better Queue Management", *International Journal of Operations& Production Management*, 14(5), pp. 21-34.

Davis, M.M., and Vollmann, T.E. (1990) "A framework for relating waiting time and customer satisfaction in a service", *Operations Journal of Services Marketing*, 4(1), pp. 61-69.

Debo, L., C. Parlour, U. Rajan. (2007) *The value of congestion*. Working paper, University of Chicago, Chicago.

Debo, L.G. & Veeraraghavan, S. (2014) "Equilibrium in queues under unknown service rates and service value", *Operations Research*, 62(2), pp. 38-57.

Delgado-Alvarez, C., et al. (2017) "Managing capacity at a service facility: An experimental approach", *European Journal of Operational Research*, 259(1), pp. 216-228.

Dellaert, N., Cayiroglu, E. and Jeunet, J. (2015) "Assessing and controlling the impact of hospital capacity planning on the waiting time", *International Journal of Production Research*, 54(8), pp. 2203-2214.

De Vaus, D. (2001) *Research Design in Social Research*. London: Sage Publications Ltd.

Dewan, S. and Mendelson, H. (1990) "User delay costs and internal pricing for a service facility", *Management Science*, 36(12), pp. 1502-1517.

Drekic, S. and Woolford, D. (2005) "A preemptive priority queue with balking", *European Journal of Operational Research*, 164(2), pp. 387-401.

Dube R.L., et al. (1988) "Consumer's reaction to waiting: when delays affect the perception of service quality", *Advances in Consumer Research*. 16(1), pp. 55-68.

Duder, J. and Rosenwein, M. (2001) "Towards "zero abandonments" in call center performance", *European Journal of Operational Research*, 135(1), pp. 50-56.

Economou, A. and Kanta, S. (2011) "Equilibrium customer strategies and social-profit maximization in the single-server constant retrial queue". *Naval Research Logistics (NRL)*, 58(2), pp. 107-122.

Economou, A. and Manou, A. (2011) "Equilibrium balking strategies for a clearing queueing system in alternating environment", *Annals of Operations Research*, 208(1), pp. 489-514.

Economou, A. and Manou, A. (2016) “Strategic behavior in an observable fluid queue with an alternating service process”. *European Journal of Operational Research*, 254(1), pp. 148-160.

Farahmand, K. and Martinez, AFG. (1996) “Simulation and Animation of the Operation of a Fast Food Restaurant”, *Proceedings of the 1996 Winter Simulation Conference, IEEE Press*, 1(1), pp. 1264-1271.

Frankfort-Nachmias, C., and Nachmias, D. (1996) *Research methods in the social sciences*. 5th edn. London: Edward Arnold.

Frenzen, J.K. and Davis, H.L. (1990) “Purchasing Behavior in Embedded Markets”, *Journal of Consumer Research*, 17(1), pp. 1-12.

Fowler Jr, F. J. (2013) *Survey research methods*. London: Sage Publications.

Frankfort-Nachmias, C., and Nachmias, D. (1996) *Research methods in the social sciences*. 5th edn. London: Edward Arnold.

Gans, N. (2002) “Customer loyalty and supplier quality competition”, *Management Science*. 48, pp. 207-221.

Gelbrich, K. (2011) “I Have Paid Less Than You!: The Emotional and Behavioral Consequences of Advantaged Price Inequality”, *Journal of Retailing*. 87(2), pp. 207-224.

Ghauri, P. & Gronhaug, K. (2002) *Research methods in business studies: A practical guide.* 2nd edn. Prentice Hall, Dorset.

Gibbons, F., and Buunk, B. (1999) “Individual differences in social comparison: Development of a scale of social comparison orientation”, *Journal of Personality and Social Psychology*, 76(1), pp. 129-142.

Gross, D., Harris, C.M. (1985) *Fundamentals of Queuing Theory*. 2nd edn. New York: John Wiley.

Groves, R. M., et al. (2009) *Survey methodology.* Chichester: John Wiley & Sons.

Guo, P. and Hassin, R. (2011) “Strategic Behavior and Social Optimization in Markovian Vacation Queues”, *Operations Research*, 59(4), pp. 986-997.

Guo, P. and Hassin, R. (2012) “Strategic behavior and social optimization in Markovian vacation queues: The case of heterogeneous customers”, *European Journal of Operational Research*, 222(2), pp. 278-286.

Guo, P., Sun, W. and Wang, Y. (2011) “Equilibrium and optimal strategies to join a queue with partial information on service times”, *European Journal of Operational Research*, 214(2), pp. 284-297.

Guo, P. and Zipkin, P. (2007) “Analysis and Comparison of Queues with Different Levels of Delay Information”, *Management Science*, 53(6), pp. 962-970.

Guo, P. and Zipkin, P. (2008) “The effects of information on a queue with balking and phase-type service times”, *Naval Research Logistics*, 55(5), pp. 406-411.

Guo, P. and Zipkin, P. (2009) “The effects of the availability of waiting-time information on a balking queue”, *European Journal of Operational Research*, 198(1), pp. 199-209.

Guo, P. and Zhang, Z. (2013) “Strategic Queueing Behavior and Its Impact on System Performance in Service Systems with the Congestion-Based Staffing Policy”, *Manufacturing & Service Operations Management*, 15(1), pp. 118-131.

Ha, A. Y. (2001) “Optimal pricing that coordinates queues with customer-chosen service requirements”, *Management Science*, 47(7) pp. 915-930.

Hair, J. F., et al. (2006) *Multivariate Data Analysis*. 7th edn. Pearson Prentice Hall.

Hair, IF., Black, W.e., Babin, BJ. and Anderson, R.E. (2010) *Multivariate Data Analysis: A Global Perspective*. edn. Upper Saddle River: Pearson.
Hasija, S. et al. (2008) "Call center outsourcing contracts under information asymmetry", *Management Science*, 54(4), pp. 793–807.

Hassin, R. (1985) "On the optimality of first come last served queues". *Econometrica*, 53(1), pp. 201-202.

Hassin, R. (2007) "Information and uncertainty in a queuing system", *Probability in the Engineering and Informational Sciences*, 21(3), pp. 361.373.

Hassin, R., M. Haviv. (2003) *To Queue or Not To Queue: Equilibrium Behavior in Queuing Systems*. Kluwer Academic Publishers, Norwell, MA.

Haxholdt, C., et al. (2003) "Mode locking and chaos in a deterministic queueing model with feedback", *Management Science*, 49(6), pp. 816-830.

Heaton, J. (2004) *Reworking Qualitative Data*. London: SAGE Publications.

Helm, S. (2003) "Calculating the Value of Customers' Referrals, Managing Service Quality", *An International Journal*, 13(2), pp. 124-133.

Hogan, J.E., Lemon, K.N. and Libai, B. (2003) "What is the True Value of a Lost Customer", *Journal of Service Research*. 5(3), pp. 196-208.

Huang, W. II. (2010) "Other-Customer Failure: Effects of Perceived Employee Effort and Compensation on Cnmplainer and Non-Complainer Service Evaluations", *Journal of Service Management*, 21(2), pp. 191-211.

Hu, B. and Benjaafar, S. (2009) "Partitioning of Servers in Queueing Systems During Rush Hour", *Manufacturing & Service Operations Management*, 11(3), pp. 416-428.

Huang, T., Allon, G. and Bassamboo, A. (2013) "Bounded Rationality in Service Systems", *Manufacturing & Service Operations Management*, 15(2), pp. 263-279.

Hui, M.K., and Tse, D.K. (1996) "What to Tell Consumers in Waits of Different Lengths: An Integrative Model of Service Evaluation", *The Journal of Marketing*, 60(2), pp. 81–90.

Hwang, J. and Zhao, J. (2010), "Factors influencing customer satisfaction in the restaurant business, using answer tree methodology", *Journal of Quality Assurance in Hospitality and Tourism*, 11(2), pp. 93-110.

Ibrahim, R. and Whitt, W. (2011) "Wait-Time Predictors for Customer Service Systems with Time-Varying Demand and Capacity", *Operations Research*, 59(5), pp. 1106-1118.

Imenda, S. (2014) "Is There a Conceptual Difference between Theoretical and Conceptual Frameworks", *Journal of Social Science*, 38(2), pp. 185-195.

Ittig, P.T. (2002) "The real cost of making customer wait", *International Journal of Service Industry Management*, 13(3), pp. 231-241.

Ivalis, S. and Millard, P. (2003) "Health care modeling operating the black box", *British Journal of Health Care Management*, 8(7), pp. 251-255.

Janakiraman, N. et al. (2011) "The Psychology of Decisions to Abandon Waits for Service", *Journal of Marketing Research*, 48(1), pp. 970-984.

Jones, L. (1999) "Inferring Balking Behavior From Transactional Data", *Operations Research*, 47(5), pp. 778-784.

Jouini, O., Akşin, Z. and Dallery, Y. (2011) "Call Centers with Delay Information: Models and Insights", *Manufacturing & Service Operations Management*, 13(4), pp. 534-548.

Kahneman D. (2003) “Maps of bounded rationality: psychology for behavioural economics”, *American Economic Review*, 93(1), pp. 1449–1475.

Katz, K., Larson, K., and Larson, R. (1991) “Prescription for the waiting in line Blues: Entertain, Enlighten and Engage”, *Sloan Management Review*, 32(2), pp. 44-53.

Kendall, D.G. (1951) “Some problems in the theory of queue”, *Journal of the Royal Statistical Society Series B-Statistical Methodology*, 13(2), pp. 151-185.

Kim, N., Chae, K. and Chaudhry, M. (2004) “An Invariance Relation and a Unified Method to Derive Stationary Queue-Length Distributions”, *Operations Research*, 52(5), pp. 756-764.

Kittsteiner, T. and Moldovanu, B. (2005) “Priority Auctions and Queue Disciplines That Depend on Processing Time”, *Management Science*, 51(2), pp. 236-248.

Kostami, V. and Rajagopalan, S. (2014) “Speed Quality Trade-Offs in a Dynamic Model”, *Manufacturing & Service Operations Management*, 16(1), pp. 104-118.

Koo, M., and Fishbach, A. (2010) “A silver lining of standing in line: Queuing increase value of products”, *Journal of Marketing Research*. 47(1), pp. 713-724.

Kostami, V. and Ward, A. (2009) “Managing Service Systems with an Offline Waiting Option and Customer Abandonment”, *Manufacturing & Service Operations Management*, 11(4), pp. 644-656.

Kremer, M. and Debo, L. (2016) “Inferring Quality from Wait Time”, *Management Science*, 62(10), pp. 3023-3038.

Kumar, P., Kalwani, M. and Dada, M. (1997) “The Impact of Waiting Time Guarantees on Customers' Waiting Experiences”, *Marketing Science*, 16(4), pp. 295-314.

Lariviere, M. and Van Mieghem, J. (2004) “Strategically Seeking Service: How Competition Can Generate Poisson Arrivals”, *Manufacturing & Service Operations Management*, 6(1), pp. 23-40.

Larson, R. (1987) “OR Forum-Perspectives on Queues: Social Justice and the Psychology of Queueing”, *Operations Research*, 35(6), pp. 895-905.

Larson, R. (1987) “Perspectives on Queues: Social Justice and the Psychology of Queuing”, *Operations Research,* 35(6), pp. 895-905.

Lee, Y. J., and Park, J.K. (2008) “The mediating role of consumer conformity in e-compulsive buying”, *Advances in Consumer Research*, 35(1), pp. 387-392.

Li, L., Jiang, L. and Liu, L. (2012) “Service and Price Competition When Customers Are Naïve”, *Production and Operations Management*, 21(4), pp. 747-760.

Lincoln Y.S., Lynham S.A. & Guba E.G. (2011) “Paradigmatic controversies, contradictions, and emerging confluences, revisited”, in Denzin, N.K. & Lincoln, Y.S. (ed.) *The Sage handbook of qualitative research.* 4th edn. Los Angeles: Sage.

Liu, N. (2015) “Optimal Choice for Appointment Scheduling Window under Patient No-Show Behavior”, *Production and Operations Management*, 25(1), pp. 128-142.

Loewenstein G. (2000) “Emotions in economic theory and economic behaviour”, *American Economic Review*, 90(1), pp. 426-432.

Lu, Y., Musalem, A., Olivares, M. and Schilkrut, A. (2013) “Measuring the Effect of Queues on Customer Purchases”, *Management Science*, 59(8), pp. 1743-1763.

Luo, W., J. Liberatore, M., L. Nydick, R., B. Chung, Q. and Sloane, E. (2004) "Impact of process change on customer perception of waiting time: a field study", *Omega*, 32(1), pp. 77-83.

Mandelbaum, A. and Zeltyn,S. (2004) "The impact of customers patience on delay and abandonment: Some empirically-driven experiments with the manage queue", *Operation Research Spectrum*, 26(3), pp. 377-411.

Medhi, J. (2003) *Stochastic Models in Queuing Theory.* Amsterdam: Academic press, Second Edition.
Manou, A., Canbolat, P. and Karaesmen, F. (2017) "Pricing in a Transportation Station with Strategic Customers" *Production and Operations Management*, 26(9), pp. 1632-1645.

Manou, A., Economou, A. and Karaesmen, F. (2014) "Strategic Customers in a Transportation Station: When Is It Optimal to Wait?", *Operations Research*, 62(4), pp. 910-925.

Manski, C. (2000) "Economic analysis of social interactions", *Journal of Economic Perspective*, 14(3), pp. 115-136.

Maoui, I., Ayhan, H. and Foley, R. (2009) "Optimal static pricing for a service facility with holding costs", *European Journal of Operational Research*, 197(3), pp. 912-923.

Matthews, B. and Ross, L. (2010) *Research methods: A practical guide for the social sciences*. Harlow: Longman.

Mathieu, J. E. and Taylor, S. R. (2006) "Clarifying Conditions and Decision Points for Mediational Type Inferences in Organizational Behavior", *Journal of Organizational Behavior*, 27(8), pp. 03-056.

Mendelson, H. and Yechiali, U. (1981) "Controlling the GI/M/l queue by conditional acceptance of customers", *European Journal of Operational Research*, 7(1), pp. 77-85.

Morikawa, K. and Takahashi, K. (2017) "Scheduling appointments for walk-ins", *International Journal of Production Economics*, 190(1), pp. 60-66.

Naor, P. (1969) "The regulation of queue size by levying tolls", *Econometrica,* 37(1), pp. 15-24.

Neuts, M. F. (1981) *Matrix-Geometric Solutions in Stochastic Models: An Algorithmic Approach*. Dover Publications, New York.

Ni, G., Xu, Y. and Dong, Y. (2013) "Price and speed decisions in customer-intensive services with two classes of customers", *European Journal of Operational Research*, 228(2), pp. 427-436.

Nie, W. (2000) "Waiting: integrating social and psychological perspectives in operations management", *Omega*, 28(6), pp. 611-629.

Niyirora, J. and Zhuang, J. (2017) "Fluid approximations and control of queues in emergency departments", *European Journal of Operational Research*, 261(3), pp. 1110-1124.

Nosek Ronald Anthony, Jr. and James, P. (2001) "Theory and customer satisfaction: a review of terminology, trends, and applications to pharmacy practice", *Hospital Pharmacy*, 36(3), pp. 275–279.

Odoni, A. and Roth, E. (1983) "An Empirical Investigation of the Transient Behavior of Stationary Queueing Systems", *Operations Research*, 31(3), pp. 432-455.

Okoye, et al. (2011) "Application of Queueing theory to port congestion problem in Nigeria", *European Journal of Business and Management*. 3(8) pp.1

O'Leary, A. (2004) *The Essential Guide to Doing Research*. London: SAGE Publications.

Osadchiy, N. and KC, D. (2015) "Are Patients Patient? The Role of Time to Appointment in Patient Flow", *Production and Operations Management*, 26(3), 469–490

Podsakoff, P. M., MacKenzie, S. B., Lee, J. and Podsakoff, N. P. (2003) "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, 88(5), pp. 879.

Pallant, J. (2010) *SPSS Survival Manual*. 4th edn. Berkshire: Open University Press.

Park, H., Kim, T. and Chae, K. (2010) "Analysis of a two-phase queueing system with a fixed-size batch policy", *European Journal of Operational Research*, 206(1), pp. 118-122.
Png, IPL. and Reitman, D. (1994) "Service time competition", *The Rand Journal of Economics*, 1(1), pp. 619–634.

PodsakotT, P.M., MacKenzie, S.8., Jeong-Yeon, L. and PodsakotT, N.P. (2003) "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies", *Journal of Applied Psychology*, 88(5), pp. 879-903.

Pradhan, S. and Gupta, U. (2017) "Analysis of an infinite-buffer batch-size-dependent service queue with Markovian arrival process", *Annals of Operations Research*, 277(2), pp. 161-196.

Rapoport, A., et al. (2004) "Equilibrium play in single-server queues with endogenously determined arrival times", *Journal of Economic Behavior & Organization*, 55(1), pp. 67-91.

Rothkopf, M.H. and Rech, P. (1987) "Perspectives on Queues: Combining Queues Is Not Always Beneficial", *Operations Research*, 35(6), pp. 906-09.

Raz, O. & Ert, E. (2008) "Size counts: The effect of queue length on choice between similar business", *Advances in Consumer Research*. 35(1), pp. 803- 804.

Reinartz, W. and Ulaga, W. (2008) "How to Sell Services more Profitably", *Harvard Business Review*, 86 (5), pp. 90-96.

Remenyi, D., Williams, B. & Money, A. (1998) *Doing Research in Business and Management: An Introduction to Process and Method*. London: Sage.

Robinson, L. and Chen, R. (2011) "Estimating the Implied Value of the Customer's Waiting Time", *Manufacturing & Service Operations Management*, 13(1), pp. 53-57.

Ross, SM. (1968) "Non-discounted denumerable Markovian decision models". *Annual Mathematic Statistics*, 39(2), pp. 412–423.

Rowlands, B.H. (2005) "Grounded in Practice: Using Interpretive Research to Build Theory", *Electronic Journal of Business Research Methods*, 3(1), pp. 81-92.

Sekaran, U. and Bougie, R. (2009) *Research methods of business: A skill-building approach*. New York: John Wiley & Sons.

Saunders, L., Lewis, P. & Thornhill, A. (2009) *Research methods for business students*. 5th edn. Pearson Education Limited, Essex.

Saunders, M., Lewis, P. and Thornhill, A. (2019) *Research methods for business students*. 8th edn. London: Pearson Education.

Saxena, K., and Soni, K. (2011) "A Study Of Applicability Of Waiting Line Model In Health Care: A Systematic Review", *International Journal of Management Technology*, 19(1), p.52.

Scharfstein D.S. and Stein J.C. (1990) "Herd behaviour and investment", *American Economic Review*, 80(1), pp. 465–479.

Scotland, R. (1991) "Customer Service: A Waiting Game", *Marketing*, 1(1), pp. 1-3.

Shim, J., K and Siegel, J., G. (1999) *Operations Management*. Barron's Educational Series, USA.

Seale, D. A. (2005) “Joining a queue or staying out: Effects of information structure and service time on arrival and staying out decisions”, *Experimental Economics*, 8(2), pp. 117-144.

Seawright, K. and Sampson, S. (2006) “A video method for empirically studying wait-perception bias”, *Journal of Operations Management*, 25(5), pp. 1055-1066.

Shi, Y. and Lian, Z. (2016) “Optimization and strategic behavior in a passenger–taxi service system”, *European Journal of Operational Research*, 249(3), pp. 1024-1032.

Shiller R.J. (1995) “Conversation, information and herd behaviour”, *American Economic Review*, 85(1), pp. 181–185.

Shone, R., Knight, V. and Williams, J. (2013) “Comparisons between observable and unobservable M/M/1 queues with respect to optimal customer behaviour”, *European Journal of Operational Research*, 227(1), pp. 133-141.

Simonovits, A. (1976) “Self and social optimization in queues”, *Studia Scientiarum Mathematicarum Hungarica*, 11(1), pp. 131–138.

Sidonia, O., Cernea, M., and Jaradat, M. (2010) “Characteristics Of Waiting Line Models – The Indicators Of The Customer Flow Management Systems Efficiency”, *Annales Universitatis Apulensis Series Oeconomica*, 12(2), pp.

Singh, V. (2007) *Use of Queuing Models in Health Care*. Department of Health Policy and Management, University of Arkanses for medical science.

Sinha, S., Rangaraj, N. and Hemachandra, N. (2010) “Pricing surplus server capacity for mean waiting time sensitive customers”, *European Journal of Operational Research*, 205(1), pp. 159-171.

Sitzia J., Wood N. (1997) “Patient Satisfaction: A Review of Issues and Concepts”, *Social Science and Medicine*, 45(1), pp. 1829-1843.

Smith, D.R. and Whitt, W. (1981) “On the Efficiency of Shared Resources in Queuing Systems”, *Bell Systems Technology Journal*, 60(1) pp. 39-57.

Stein, W. et al. (2007) “Batch queues with choice of arrivals: Equilibrium analysis and experimental study”, *Games and Economic Behaviour*, 59(2), pp. 345-363.

Stidham, S. (1992) “Pricing and capacity decisions for a service facility - stability and multiple local optima”, *Management Science*, 38(8), pp. 1121-1139.

Stidham, S. and Weber, R. R. (1989) “Monotonic and insensitive optimal policies for control of queues with undiscounted costs”, *Operations Research*, 37(4), pp. 611-625.

So, K. and Tang, C. (1996) “On managing operating capacity to reduce congestion in service systems”, *European Journal of Operational Research*, 92(1), pp. 83-98.

Su, X., S. A. Zenios. (2004) “Patient choice in kidney allocation: The role of the queueing discipline”, *Manufacturing Service Operations and Management,* 6(4), pp. 280–301.

Su, X., S. A. Zenios. (2005) “Patient choice in kidney allocation: A sequential stochastic assignment model”, *Operational Research*. 53(3), pp. 443–455.

Takagi, H. (2015) “Waiting time in the M/M/ $$ m $$ m LCFS nonpreemptive priority queue with impatient customers”, *Annals of Operations Research*, 247(1), pp. 257-289.

Taylor, S. (1994) “Waiting for Service: The Relationship between Delays and Evaluations of Service”, *The Journal of Marketing*, 58(2), pp. 56-69.

Tranfield, D ., Denyer, D. and Smart. P. (2003) “Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review”, *British Journal of Management*. 14(3), pp. 207-222.

Veeraraghavan, S. and Debo, L. (2011) “Herding in Queues with Waiting Costs: Rationality and Regret”, *Manufacturing & Service Operations Management*, 13(3), pp. 329-346.

Veeraraghavan, S. and Debo, L. (2009) “Joining Longer Queues: Information Externalities in Queue Choice”, *Manufacturing & Service Operations Management*, 11(4), pp. 543-562.

Veeraraghavan, S. and Debo, L. (2008) *Is it worth the wait? Service choice when waiting is expensive*, Working paper, Wharton School, University of Pennsylvania, Philadelphia.

Walker, J. (2011) *The Business: From Concept to Operation*. 6th edn. John Wiley & Sons.

Wang, C. (2016) “On Socially Optimal Queue Length”, *Management Science,* 62(3), pp. 899-903.

Wang, K., Lan, S. and Jiang, Z. (2016) “Impact of customer impatience on a production service system”, *International Journal of Production Research*, 54(9), pp. 2731-2749.

Wang, J. and Zhang, F. (2013) “Strategic joining in M/M/1 retrial queues”, *European Journal of Operational Research*, 230(1), pp. 76-87.

Wang, J., Zhang, X. and Huang, P. (2017) “Strategic behavior and social optimization in a constant retrial queue with the N -policy”, *European Journal of Operational Research*, 256(3), pp. 841-849.

Whitt, W. (1986) “Deciding which queue to join: Some counterexamples”, *Operational Research*. 34(1), pp. 55–62.

Whitt, W. (1999) “Predicting Queueing Delays”, *Management Science*, 45(6), pp. 870-888.

Whitt, W. (1999) “Improving service by informing customers about anticipated delays”, *Management science*, 45(2), pp. 192-207.

Whitt, W. (2006) “Sensitivity of Performance in the Erlang-A Queueing Model to Changes in the Model Parameters”, *Operations Research*, 54(2), pp. 247-260.

Whyte, T., and D. W. Starks (1996) “ACE: A Decision Tool for Restaurant Managers”, *Proceedings of the 1996 Winter Simulation Conference, IEEE Press*, pp. 1257-1263.

Williams, A., S. (2003) *An Introduction to Management Science - Quantitative Approaches to Decision Making*. 10th edn. South-Western, USA.

Wolff, R. W. (1982) “Poisson arrivals see time averages”, *Operational Research*, 30(2), pp. 223–231.

Wu, A.D. and Zumbo, B.D. (2008) “Understanding and Using Mediators and Moderators”, *Social Indicators Research*, 87(3), pp. 367-392.

Xu, S., Gao, L. and Ou, J. (2007) “Service Performance Analysis and Improvement for a Ticket Queue with Balking Customers”, *Management Science*, 53(6), pp. 971-990.

Xu, SH. Shanthikumar, JG. (1992) “Optimal expulsion control-A dual approach to admission control of an ordered-entry system”, *Operational Research*, 41(6), pp. 1137–1152.

Yimaz, K. (2013) “Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences”, *European Journal of Education*, 48(2), pp. 311-25.

Yechiali, U. (1972) “Customers’ optimal joining rules for the GI=M=s queues”, *Management Science*, 18(7), pp. 434–443.

Yechiali, U. (1971) “Optimal balking rules and toll charges in GI/M/1 queuing process”, *Operations Research*, 19(2), pp. 347-370.

Yechiali, U. and Naor, P. (1971) “Queuing problems with heterogeneous arrivals and service”, *Operations Research*, 19(3), pp. 722-738.

Yin, R.K. (2014) *Case study research: Design and methods*. 5th edn. Sage Publications, Thousand Oaks.

Yu, Q., Allon, G. and Bassamboo, A. (2017) “How Do Delay Announcements Shape Customer Behavior? An Empirical Study”, *Management Science*, 63(1), pp. 1-20.

Zhou, R. and Soman, D. (2003) “Looking Back: Exploring the Psychology of Queuing and the Effect of the Number of People Behind”, *Journal of Consumer Research*, 29(4), pp. 517-530.

Zhou, W., Lian, Z. and Wu, J. (2014) “When should service firms provide free experience service?”, *European Journal of Operational Research*, 234(3), pp. 830-838.

Ziani, S., Rahmoune, F. and Radjef, M. (2015) “Customers’ strategic behavior in batch arrivals M2/M/1 queue”, *European Journal of Operational Research*, 247(3), pp. 895-903.

Zohar, E. et al. (2002) “Adaptive behaviour of impatient customers in tele-queues: Theory and empirical support”, *Management Science*, 48(4), pp. 566-583.

Zhou, R. and Soman, D. (2003) “Looking back: exploring the psychology of queuing and the effect of the number of people behind”, *Journal of Consumer Research*, 29 (1), pp. 1-10.

APPENDICES

Appendix I: Observation Recording Sheet

Kingston University London

Observation Recording Sheet

Ehsan KHAJEH
Tel: +44 (0) 208 417 9000
Email: e.khajeh@kingston.ac.uk

Kingston University
Kingston Hill Campus
Kingston upon Thames
KT2 7LB

Name of restaurant:

Date:

Observer:

No.	Arrival Time	Inter-arrival Time	Service Time	Departure Time	Service Time
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Appendix II: Survey

Kingston University London

Kingston Business School

Faculty of Business and Social Sciences

T +44 (0) 208 417 9000
F +44 (0) 208 417 5026
www.kingston.ac.uk

Kingston University
Kingston Hill Campus
Kingston upon Thames

Block 1: Introduction and Instruction

Thank you for considering participating in this study. This information sheet outlines the purpose of the study and provides a description of your involvement and rights as a participant, if you agree to take part.

My name is Ehsan Khajeh. I am a student at Kingston Business School, Kingston University London, pursing a doctoral degree in Operations Management. You were chosen for this study because you are a resident of England at the time of the study.

The purpose of this study is to investigate the impact of physical queue length on customers and how to best attract them to join the queue. This study may contribute to business practices by helping businesses identify and determine factors to improve their services for more revenue. This survey takes no more than **10 minutes** to complete.

Your decision as to whether to take part in this study is completely voluntary. You can withdraw at any point of the study, without having to give a reason. The records from this study will be kept as confidential as possible. The survey is anonymous and there will not be used in any reports or publications resulting from the study. All digital files, transcripts and summaries will be given codes and stored separately from any names or other direct identification of participants. Any hard copies of research information will always be kept in locked files. Only I and my supervisors will have access to the files and the digital records.

If you need any more information regarding this survey and research, you can contact me at any time by sending an email to e.khajeh@kingston.ac.uk.

Required questions are marked by an asterisk (*)

Block 2: Type of Service Organisations

Q2.1. Have you ever visited a service organisation in London?

o Yes

o No _ End of Survey

Q2.2. If yes, please select one category that your most visited in the last month from the following list:

o 1. Foods industry (e.g. Restaurants, Fast foods, bars, etc.)

o 2. Retail Industry (Fashion Shops, Shops, etc.)

o 3. Entertainment industry (Museum, Theatres, etc.)

Block 3: Type of Customer and Location of Business

Q3.1. How often on average, do you visit the service organisation that you select from the above category?

o	Daily	o	Once a month
o	2-3 times a week	o	Rarely
o	Once a week	o	Other, please specify_____

Q3.2. When do you usually buy/use services from the organisation? (You can select more than one option)

o	When I am at work	o	When I do not cook at home
o	When I am away from home	o	Other, please specify _____
o	On Weekends		

Q3.3. Where is the location of business that you use at most often?

o Urban (i.e. in central locations where the majority of shops and businesses are)

o Suburban (i.e. in a more residential area)

Block 4: Intention to switch to alternatives

Q4.1. Thinking about your most visited service organisation in the last month from the selected category, please rate the following statement, on a scale of 1 (Extremely Unlikely) to 7 (Extremely Likely)

	1.Extremely unlikely	2.Moderately unlikely	3.Slightly unlikely	4.Neither likely nor unlikely	5.Slightly likely	6.Moderately likely	7.Extremely likely
How likely are you to switch your service choice to an alternative based on the length of the physical queue?	o	o	o	o	o	o	o

Q4.2. Thinking about your most visited service organisation in the last month from the selected category, please rate the following statement, on a scale of 1 (Very Improbable) to 7 (Very Probable)

	1.Very Improbable	2.Somewhat Improbable	3.Less Improbable	4.Neutral	5.Less probable	6.Somewhat probable	7.Very Probable
How likely are you to switch your service choice to an	o	o	o	o	o	o	o

alternative based on the length of the physical queue?							

Q4.3. Thinking about your most visited service organisation in the last month from the selected category, please rate the following statement, on a scale of 1 (No Chance) to 7 (Very Certain)

	1.No Chance	2.Very Little Chance	3.Some Chance	4.Neutral	5.Less Certain	6.Some Certain	7.Very Certain
How likely are you to switch your service choice to an alternative based on the length of the physical queue?	o	o	o	o	o	o	o

Block 5: General Attractiveness

Q5.1. Have you ever chosen a service because you have seen other people already in the queue?

o Yes

o No

if Yes, answer next question

Q5.2. Having chosen a service based on the number of people in the queue, please rate the following statements, on a scale of 1 (Extremely Unlikely) to 7 (Extremely Likely)

	1.Strongly disagree	2.Disagree	3.Somewhat disagree	4.Neither agree nor disagree	5.Somewhat agree	6.Agree	7.Strongly agree
1. I trust the services at this business	o	o	o	o	o	o	o
2. I feel attracted to this business	o	o	o	o	o	o	o
3. I feel good about using services from this organisation	o	o	o	o	o	o	o

Q5.3. Thinking about your most visited services in the last month (i.e. the service you have used most often in the last month), please rate the following statements a scale of 1 (Strongly Disagree) to 7 (Strongly Agree)

	1.Strongly disagree	2.Disagree	3.Somewhat disagree	4.Neither agree nor disagree	5.Somewhat agree	6.Agree	7.Strongly agree
1. The service is close to my home	o	o	o	o	o	o	o
2. The service I visit is near to public transport (Train, bus station)	o	o	o	o	o	o	o
3. There are cultural and historical attractions in the area near to the service.	o	o	o	o	o	o	o
4. I usually walk to the service from home	o	o	o	o	o	o	o

5. There are other businesses near the place where I use it's services.	o	o	o	o	o	o	o
6. The service is close to my work	o	o	o	o	o	o	o

Block 6: Quality Aspects of the Service Organisation

Q6. Thinking about your most visited services that you used from category in the last month (i.e. the service you have used most often in the last month), please rate the following statements a scale of 1 (Strongly Disagree) to 7 (Strongly Agree)

	1.Strongly disagree	2.Disagree	3.Somewhat disagree	4.Neither agree nor disagree	5.Somewhat agree	6.Agree	7.Strongly agree
1. Trustworthy and customer care staff	o	o	o	o	o	o	o
2. Polite and efficient staff.	o	o	o	o	o	o	o
3. Knowledge and skills of staff	o	o	o	o	o	o	o
4. Professionalism and credibility of staff	o	o	o	o	o	o	o
5. Accurate bill and cleanliness	o	o	o	o	o	o	o
6. Managing complaints efficiently	o	o	o	o	o	o	o

Block 7: Offers/Promotions Aspects of The Service Organisation

Q7. Thinking about your most visited service (i.e. the service you have used most often in the last month), please rate the following statements a scale of 1 (Strongly Disagree) to 7 (Strongly Agree)

	1.Strongly disagree	2.Disagree	3.Somewhat disagree	4.Neither agree nor disagree	5.Somewhat agree	6.Agree	7.Strongly agree
1. I am not willing to go to extra effort to find lower prices.	o	o	o	o	o	o	o
2. I will visit more than one service to take the advantages of offers and low prices	o	o	o	o	o	o	o
3. The money saved by findings low prices is usually not worth the time and effort	o	o	o	o	o	o	o
4. I would never visit more than one service organisation to find low prices.	o	o	o	o	o	o	o
5. The time it takes to find low prices is usually not worth the effort.	o	o	o	o	o	o	o

Block 8: Length of Queue

Q8.1. To use services like shopping from your selected organisation, would you be happy to stay in the queue to be served?

	1.Strongly disagree	2.Disagree	3.Somewhat disagree	4.Neither agree nor disagree	5.Somewhat agree	6.Agree	7.Strongly agree
I am happy to stay in the queue to be served	o	o	o	o	o	o	o

Q8.2. How do you measure the length of queue (Long or Short Queue) in the service?

▢ By number of customers in the queue

▢ By time that you stay in the queue

▢ Other, please specify_____

Q8.3. How many people do you consider in the queue as a long queue (i.e. you will decide to find the alternative businesses to use its' service)

o Up to 6 customer/s in the queue

o Between 6 to 9 customers in the queue

o Between 10 to 15 customers in the queue

o More than 15 customers in the queue

Q8.4. How many minutes do you consider in the queue as a long queue (i.e. you will decide to find the alternative businesses to use its' service)

o Up to 2 minutes stay in the queue

o Between 2 to 5 minutes stay in the queue

o Between 5 to 10 minutes stay in the queue

o More than 10 minutes stay in the queue

Block 9: Demographic Information

Q9.1. What is your gender?

o Male

o Female

Q9.2. What is your age group?

o	Under 18	o	35- 44
o	18 - 24	o	45 - 55
o	25 - 34	o	Above 55

Q9.3. What is your total yearly income?

o	Less than £18,000	o	£49,000 to 57,000
o	£18,000 to £32,000	o	Above £58000
o	£33,000 to 48,000	o	Family Support

Q9.4. What is your ethnicity?

o	White	o	Asian / Asian British

o	Black / African / Caribbean / Black British	o	Middle East
o	Mixed / Multiple ethnicity	o	Other, please specify_____

Q9.5. What is your employment status?

o	Employed full time	o	Retired
o	Employed part time	o	Student
o	Unemployed looking for work	o	Disabled
o	Unemployed not looking for work		

Q9.6. What is your marital status?

o	Married	o	Separated
o	Widowed	o	Single
o	Divorced		

Q9.7. What is your level of education?

o	Less than high school	o	Professional degree
o	High school graduate	o	Doctorate
o	Some college		

Q9.8. Which part of London do you live? Please enter your postcode (e.g. KT2) or county name (e.g. Kingston upon Thames)

o Post code _____

o County Name _____

End of Survey

Thank you

Appendix III: Total Frequency Table for all Business

BusinessType					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Foods	406	33.5	33.5	33.5
	2 Retails	405	33.4	33.4	66.9
	3 Entertainment	401	33.1	33.1	100.0
	Total	1212	100.0	100.0	

CustomerType					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Infrequent	599	49.4	49.4	49.4
	2 Frequent	613	50.6	50.6	100.0
	Total	1212	100.0	100.0	

BusinessLocation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Urban	584	48.2	48.2	48.2
	2 Suburban	628	51.8	51.8	100.0
	Total	1212	100.0	100.0	

QueueLength					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Short	598	49.3	49.3	49.3
	2 Long	614	50.7	50.7	100.0
	Total	1212	100.0	100.0	

Appendix IV: Factorial MANOVA Output _ Food

General Linear Model

Between-Subjects Factors			
		Value Label	N
CustomerType	1	Infrequent	202
	2	Frequent	204
BusinessLocation	1	Urban	195
	2	Suburban	211
QueueLength	1	Short	202
	2	Long	204

Descriptive Statistics						
	CustomerType	BusinessLocation	QueueLength	Mean	Std. Deviation	N
MQuality	1 Infrequent	1 Urban	1 Short	6.1765	.21451	51
			2 Long	6.1367	.36217	50
			Total	6.1568	.29611	101
		2 Suburban	1 Short	6.0673	.44680	52
			2 Long	5.9592	.48416	49
			Total	6.0149	.46613	101
		Total	1 Short	6.1214	.35409	103
			2 Long	6.0488	.43400	99
			Total	6.0858	.39595	202
	2 Frequent	1 Urban	1 Short	6.0852	.32299	45
			2 Long	6.0782	.29678	49
			Total	6.0816	.30794	94
		2 Suburban	1 Short	5.8395	.60740	54
			2 Long	5.8452	.59277	56
			Total	5.8424	.59724	110
		Total	1 Short	5.9512	.51135	99
			2 Long	5.9540	.49002	105
			Total	5.9526	.49925	204
	Total	1 Urban	1 Short	6.1337	.27319	96

			2 Long	6.1077	.33104	99
			Total	6.1205	.30344	195
		2 Suburban	1 Short	5.9513	.54432	106
			2 Long	5.8984	.54523	105
			Total	5.9250	.54412	211
		Total	1 Short	6.0380	.44541	202
			2 Long	6.0000	.46497	204
			Total	6.0189	.45518	406
MOffer	1 Infrequent	1 Urban	1 Short	6.0980	.37175	51
			2 Long	6.1600	.39383	50
			Total	6.1287	.38219	101
		2 Suburban	1 Short	6.0269	.52098	52
			2 Long	5.9918	.52593	49
			Total	6.0099	.52106	101
		Total	1 Short	6.0621	.45247	103
			2 Long	6.0768	.46922	99
			Total	6.0693	.45967	202
	2 Frequent	1 Urban	1 Short	6.1111	.38271	45
			2 Long	6.0000	.49497	49
			Total	6.0532	.44594	94
		2 Suburban	1 Short	5.8370	.58545	54
			2 Long	5.9571	.54032	56
			Total	5.8982	.56357	110
		Total	1 Short	5.9616	.51956	99
			2 Long	5.9771	.51762	105
			Total	5.9696	.51734	204
	Total	1 Urban	1 Short	6.1042	.37499	96
			2 Long	6.0808	.45168	99
			Total	6.0923	.41479	195
		2 Suburban	1 Short	5.9302	.56030	106
			2 Long	5.9733	.53137	105
			Total	5.9517	.54523	211
		Total	1 Short	6.0129	.48790	202
			2 Long	6.0255	.49603	204
			Total	6.0192	.49143	406
MAlternative	1 Infrequent	1 Urban	1 Short	6.1699	.54721	51
			2 Long	6.1600	.57633	50
			Total	6.1650	.55901	101
		2 Suburban	1 Short	6.1346	.55722	52
			2 Long	5.9320	.67693	49
			Total	6.0363	.62343	101
		Total	1 Short	6.1521	.54986	103
			2 Long	6.0471	.63534	99
			Total	6.1007	.59414	202
	2 Frequent	1 Urban	1 Short	5.9926	.57511	45
			2 Long	5.9932	.41661	49
			Total	5.9929	.49605	94
		2 Suburban	1 Short	5.8395	.63027	54
			2 Long	5.9940	.60132	56
			Total	5.9182	.61776	110
		Total	1 Short	5.9091	.60762	99
			2 Long	5.9937	.52089	105
			Total	5.9526	.56483	204
	Total	1 Urban	1 Short	6.0868	.56454	96
			2 Long	6.0774	.50805	99
			Total	6.0821	.53523	195
		2 Suburban	1 Short	5.9843	.61098	106
			2 Long	5.9651	.63536	105
			Total	5.9747	.62182	211
		Total	1 Short	6.0330	.59014	202
			2 Long	6.0196	.57844	204
			Total	6.0263	.58361	406

Box's Test of Equality of Covariance Matrices[a]	
Box's M	45.113
F	1.370
df1	42
df2	255124.526
Sig.	.101
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	

a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
CustomerType	Wilks' Lambda	.962	5.174[b]	3.000	396.000	.072	.008
BusinessLocation	Wilks' Lambda	.943	7.960[b]	3.000	396.000	.210	.007
QueueLength	Wilks' Lambda	.997	.456[b]	3.000	396.000	**.013**	**.073**
CustomerType * BusinessLocation	Wilks' Lambda	.996	.469[b]	3.000	396.000	.074	.004
CustomerType * QueueLength	Wilks' Lambda	.991	1.255[b]	3.000	396.000	**.020**	**.079**
BusinessLocation * QueueLength	Wilks' Lambda	.997	.388[b]	3.000	396.000	.038	.005
CustomerType * BusinessLocation * QueueLength	Wilks' Lambda	.986	1.932[b]	3.000	396.000	**.024**	**.160**

a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength

b. Exact statistic

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
MQuality	11.083	7	398	.412
MOffer	5.313	7	398	.407
MAlternative	2.576	7	398	.208

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength

Tests of Between-Subjects Effects

Source	Dependent Variable	F	Sig.	Partial Eta Squared
CustomerType	MQuality	7.802	.075	.019
	MOffer	3.690	.165	.009
	MAlternative	6.304	.112	.016
BusinessLocation	MQuality	18.920	.090	.045
	MOffer	8.272	.244	.020
	MAlternative	3.268	.071	.008
QueueLength	**MQuality**	.719	**.047**	**.087**
	MOffer	.034	**.033**	**.110**
	MAlternative	.062	.803	.000
CustomerType * BusinessLocation	MQuality	1.191	.276	.003
	MOffer	.161	.688	.000
	MAlternative	.234	.629	.001
CustomerType * QueueLength	**MQuality**	.695	**.045**	**.094**
	MOffer	.009	**.026**	**.087**
	MAlternative	2.559	.110	.006
BusinessLocation * QueueLength	MQuality	.100	.752	.000
	MOffer	.481	.488	.001
	MAlternative	.028	.436	.000
CustomerType * BusinessLocation * QueueLength	**MQuality**	.212	**.005**	**.180**
	MOffer	2.881	**.030**	**.280**
	MAlternative	2.274	**.042**	**.054**

Estimated Marginal Means

1. Customer Type

Dependent Variable	Customer Type	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
MQuality	1 Infrequent	6.085	.031	6.024	6.146

	2 Frequent	5.962	.031	5.901	6.023
MOffer	1 Infrequent	6.069	.034	6.002	6.136
	2 Frequent	5.976	.034	5.909	6.043
MAlternative	1 Infrequent	6.099	.041	6.019	6.179
	2 Frequent	5.955	.041	5.875	6.035

2. Business Location

Dependent Variable	Business Location	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
MQuality	1 Urban	6.119	.032	6.057	6.181
	2 Suburban	5.928	.030	5.868	5.988
MOffer	1 Urban	6.092	.035	6.024	6.161
	2 Suburban	5.953	.034	5.887	6.019
MAlternative	1 Urban	6.079	.041	5.997	6.160
	2 Suburban	5.975	.040	5.897	6.053

3. Queue Length

Dependent Variable	Queue Length	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
MQuality	1 Short	6.042	.031	5.981	6.103
	2 Long	6.005	.031	5.944	6.066
MOffer	1 Short	6.018	.034	5.951	6.086
	2 Long	6.027	.034	5.960	6.094
MAlternative	1 Short	6.034	.041	5.954	6.114
	2 Long	6.020	.041	5.940	6.099

4. Customer Type * Business Location

Dependent Variable	Customer Type	Business Location	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Urban	6.157	.044	6.070	6.243
		2 Suburban	6.013	.044	5.927	6.100
	2 Frequent	1 Urban	6.082	.046	5.992	6.171
		2 Suburban	5.842	.042	5.759	5.925
MOffer	1 Infrequent	1 Urban	6.129	.048	6.034	6.224
		2 Suburban	6.009	.048	5.914	6.105
	2 Frequent	1 Urban	6.056	.050	5.957	6.154
		2 Suburban	5.897	.046	5.806	5.988
MAlternative	1 Infrequent	1 Urban	6.165	.058	6.052	6.278
		2 Suburban	6.033	.058	5.920	6.146
	2 Frequent	1 Urban	5.993	.060	5.876	6.110
		2 Suburban	5.917	.055	5.808	6.025

5. Customer Type * Queue Length

Dependent Variable	Customer Type	Queue Length	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Short	6.122	.044	6.036	6.208
		2 Long	6.048	.044	5.961	6.135
	2 Frequent	1 Short	5.962	.045	5.875	6.050
		2 Long	5.962	.043	5.877	6.047
MOffer	1 Infrequent	1 Short	6.062	.048	5.968	6.157
		2 Long	6.076	.049	5.980	6.172
	2 Frequent	1 Short	5.974	.049	5.878	6.071
		2 Long	5.979	.048	5.885	6.072
MAlternative	1 Infrequent	1 Short	6.152	.057	6.040	6.264
		2 Long	6.046	.058	5.932	6.160
	2 Frequent	1 Short	5.916	.058	5.801	6.031
		2 Long	5.994	.057	5.883	6.105

6. Business Location * Queue Length

Dependent Variable	Business Location	Queue Length	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
MQuality	1 Urban	1 Short	6.131	.045	6.042	6.220
		2 Long	6.107	.044	6.020	6.195
	2 Suburban	1 Short	5.953	.043	5.869	6.038

		2 Long	5.902	.043	5.817	5.987
MOffer	1 Urban	1 Short	6.105	.050	6.007	6.202
		2 Long	6.080	.049	5.984	6.176
	2 Suburban	1 Short	5.932	.047	5.839	6.025
		2 Long	5.974	.048	5.881	6.068
MAlternative	1 Urban	1 Short	6.081	.059	5.965	6.197
		2 Long	6.077	.058	5.962	6.191
	2 Suburban	1 Short	5.987	.056	5.877	6.097
		2 Long	5.963	.057	5.852	6.074

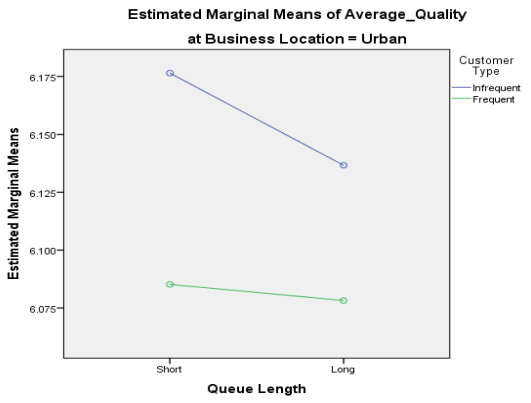
7. Customer Type * Business Location * Queue Length

Dependent Variable	Customer Type	Business Location	Queue Length	Mean	Std. Error	95% Confidence Interval	
						Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Urban	1 Short	6.176	.062	6.055	6.298
			2 Long	6.137	.063	6.014	6.260
		2 Suburban	1 Short	6.067	.061	5.947	6.188
			2 Long	5.959	.063	5.835	6.083
	2 Frequent	1 Urban	1 Short	6.085	.066	5.956	6.215
			2 Long	6.078	.063	5.954	6.202
		2 Suburban	1 Short	5.840	.060	5.721	5.958
			2 Long	5.845	.059	5.729	5.961
MOffer	1 Infrequent	1 Urban	1 Short	6.098	.068	5.964	6.232
			2 Long	6.160	.069	6.025	6.295
		2 Suburban	1 Short	6.027	.067	5.894	6.159
			2 Long	5.992	.069	5.855	6.128
	2 Frequent	1 Urban	1 Short	6.111	.072	5.969	6.254
			2 Long	6.000	.069	5.863	6.137
		2 Suburban	1 Short	5.837	.066	5.707	5.967
			2 Long	5.957	.065	5.829	6.085
MAlternative	1 Infrequent	1 Urban	1 Short	6.170	.081	6.011	6.329
			2 Long	6.160	.082	5.999	6.321
		2 Suburban	1 Short	6.135	.080	5.977	6.292
			2 Long	5.932	.083	5.770	6.094
	2 Frequent	1 Urban	1 Short	5.993	.086	5.823	6.162
			2 Long	5.993	.083	5.831	6.155
		2 Suburban	1 Short	5.840	.079	5.685	5.994
			2 Long	5.994	.077	5.842	6.146

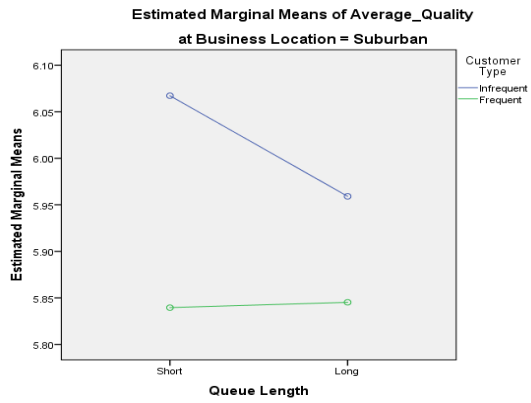
Profile Plots

MQuality: Queue Length * Customer Type * Business Location

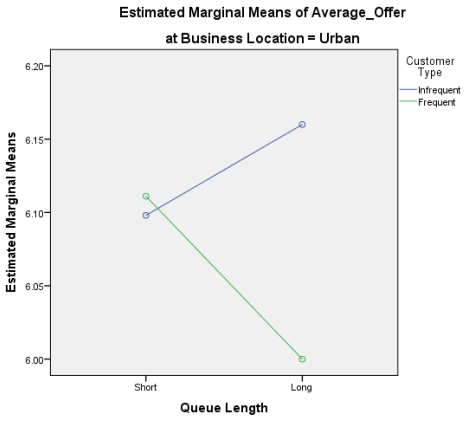
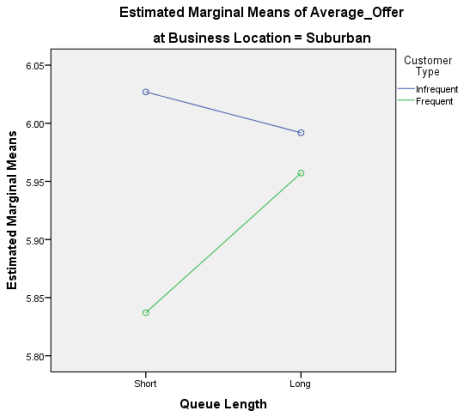
Plot 1



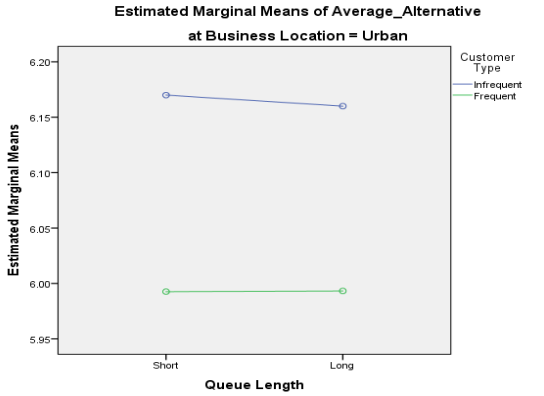
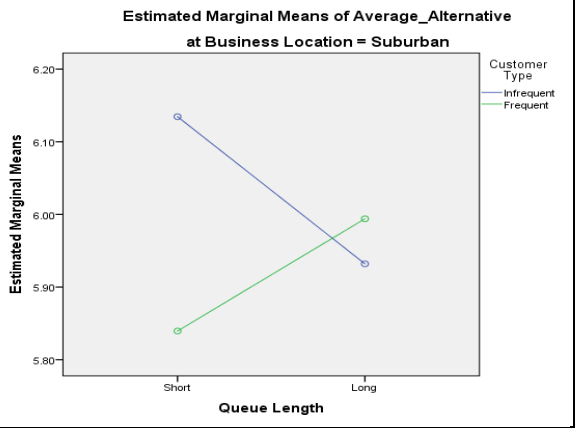
Plot 2



MOffer: Queue Length * Customer Type * Business Location

Plot 1	Plot 2
	

MAlternative: Queue Length * Customer Type * Business Location

Plot 1	Plot 2
	

Appendix V: Factorial MANOVA Output_Retail

General Linear Model

Between-Subjects Factors			
		Value Label	N
CustomerType	1	Infrequent	201
	2	Frequent	204
BusinessLocation	1	Urban	201
	2	Suburban	204
QueueLength	1	Short	196
	2	Long	209

Descriptive Statistics						
	CustomerType	BusinessLocation	QueueLength	Mean	Std. Deviation	N
MQuality	1 Infrequent	1 Urban	1 Short	6.1879	.35204	47
			2 Long	6.0654	.50230	51
			Total	6.1241	.43888	98
		2 Suburban	1 Short	6.1038	.53332	53
			2 Long	6.1067	.35116	50
			Total	6.1052	.45193	103
		Total	1 Short	6.1433	.45691	100
			2 Long	6.0858	.43244	101
			Total	6.1144	.44461	201
	2 Frequent	1 Urban	1 Short	6.1596	.41697	47

			2 Long	6.0625	.47627	56
			Total	6.1068	.45064	103
		2 Suburban	1 Short	6.1599	.35998	49
			2 Long	6.1827	.28822	52
			Total	6.1716	.32357	101
		Total	1 Short	6.1597	.38686	96
			2 Long	6.1204	.39979	108
			Total	6.1389	.39328	204
	Total	1 Urban	1 Short	6.1738	.38406	94
			2 Long	6.0639	.48653	107
			Total	6.1153	.44392	201
		2 Suburban	1 Short	6.1307	.45696	102
			2 Long	6.1454	.32129	102
			Total	6.1381	.39409	204
		Total	1 Short	6.1514	.42304	196
			2 Long	6.1037	.41524	209
			Total	6.1267	.41920	405
MOffer	1 Infrequent	1 Urban	1 Short	6.1489	.31614	47
			2 Long	6.0353	.52567	51
			Total	6.0898	.43942	98
		2 Suburban	1 Short	5.9623	.53358	53
			2 Long	6.0320	.41475	50
			Total	5.9961	.47854	103
		Total	1 Short	6.0500	.45249	100
			2 Long	6.0337	.47165	101
			Total	6.0418	.46113	201
	2 Frequent	1 Urban	1 Short	6.1064	.38865	47
			2 Long	6.0393	.50079	56
			Total	6.0699	.45219	103
		2 Suburban	1 Short	6.1633	.46668	49
			2 Long	6.0846	.43987	52
			Total	6.1228	.45252	101
		Total	1 Short	6.1354	.42895	96
			2 Long	6.0611	.47080	108
			Total	6.0961	.45202	204
	Total	1 Urban	1 Short	6.1277	.35299	94
			2 Long	6.0374	.51037	107
			Total	6.0796	.44501	201
		2 Suburban	1 Short	6.0588	.51016	102
			2 Long	6.0588	.42644	102
			Total	6.0588	.46901	204
		Total	1 Short	6.0918	.44206	196
			2 Long	6.0478	.47028	209
			Total	6.0691	.45681	405
MAlternative	1 Infrequent	1 Urban	1 Short	6.0496	.65563	47
			2 Long	6.0980	.62288	51
			Total	6.0748	.63594	98
		2 Suburban	1 Short	6.0755	.56855	53
			2 Long	6.0467	.57147	50
			Total	6.0615	.56735	103
		Total	1 Short	6.0633	.60802	100
			2 Long	6.0726	.59555	101
			Total	6.0680	.60029	201
	2 Frequent	1 Urban	1 Short	5.9858	.64440	47
			2 Long	6.2738	.49281	56
			Total	6.1424	.58224	103
		2 Suburban	1 Short	6.1020	.51462	49
			2 Long	6.0064	.59953	52
			Total	6.0528	.55923	101
		Total	1 Short	6.0451	.58163	96
			2 Long	6.1451	.56051	108
			Total	6.0980	.57132	204
	Total	1 Urban	1 Short	6.0177	.64733	94
			2 Long	6.1900	.56285	107
			Total	6.1095	.60843	201
		2 Suburban	1 Short	6.0882	.54080	102
			2 Long	6.0261	.58339	102
			Total	6.0572	.56197	204
		Total	1 Short	6.0544	.59378	196
			2 Long	6.1100	.57745	209
			Total	6.0831	.58535	405

Box's Test of Equality of Covariance Matrices[a]	
Box's M	81.103
F	1.883
df1	42
df2	25525.463
Sig.	.072
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength	

Multivariate Tests[a]							
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**
CustomerType	Wilks' Lambda	.996	.536[b]	3.000	395.000	.658	.004
BusinessLocation	Wilks' Lambda	.996	.495[b]	3.000	395.000	.686	.004
QueueLength	Wilks' Lambda	.993	.909[b]	3.000	395.000	.437	.057
CustomerType * BusinessLocation	Wilks' Lambda	.992	1.004[b]	3.000	395.000	.391	.008
CustomerType * QueueLength	Wilks' Lambda	.997	.346[b]	3.000	395.000	**.029**	**.140**
BusinessLocation * QueueLength	Wilks' Lambda	.983	2.261[b]	3.000	395.000	**.046**	**.075**
CustomerType * BusinessLocation * QueueLength	Wilks' Lambda	.992	1.100[b]	3.000	395.000	**.039**	**.180**
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength							
b. Exact statistic							

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
MQuality	1.810	7	397	.084
MOffer	2.335	7	397	.124
MAlternative	2.255	7	397	.329
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.				
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength				

Tests of Between-Subjects Effects				
Source	**Dependent Variable**	**F**	**Sig.**	**Partial Eta Squared**
CustomerType	MQuality	.364	.547	.001
	MOffer	1.400	.237	.004
	MAlternative	.178	.673	.000
BusinessLocation	MQuality	.215	.643	.001
	MOffer	.233	.629	.001
	MAlternative	.577	.448	.001
QueueLength	MQuality	1.344	.247	.003
	MOffer	1.089	.297	.003
	MAlternative	.830	.363	.002
CustomerType * BusinessLocation	MQuality	.953	.329	.002
	MOffer	2.585	.109	.006
	MAlternative	.292	.589	.001
CustomerType * QueueLength	MQuality	.074	.786	.000
	MOffer	.314	**.046**	**.120**
	MAlternative	.552	.458	.001
BusinessLocation * QueueLength	MQuality	2.152	.143	.005
	MOffer	.894	.345	.002
	MAlternative	3.925	**.038**	**.132**
CustomerType * BusinessLocation * QueueLength	MQuality	.001	.973	.020
	MOffer	1.151	**.024**	**.077**
	MAlternative	1.736	**.018**	**.140**

Estimated Marginal Means

1. Customer Type					
				95% Confidence Interval	
Dependent Variable	Customer Type	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Infrequent	6.116	.030	6.058	6.174
	2 Frequent	6.141	.029	6.083	6.199
MOffer	1 Infrequent	6.045	.032	5.981	6.108
	2 Frequent	6.098	.032	6.035	6.161
MAlternative	1 Infrequent	6.067	.041	5.986	6.149
	2 Frequent	6.092	.041	6.011	6.173

2. Business Location					
				95% Confidence Interval	
Dependent Variable	Business Location	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Urban	6.119	.030	6.060	6.177
	2 Suburban	6.138	.029	6.080	6.196
MOffer	1 Urban	6.082	.032	6.019	6.146
	2 Suburban	6.061	.032	5.998	6.123
MAlternative	1 Urban	6.102	.041	6.021	6.183
	2 Suburban	6.058	.041	5.977	6.138

3. Queue Length					
				95% Confidence Interval	
Dependent Variable	Queue Length	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Short	6.153	.030	6.094	6.212
	2 Long	6.104	.029	6.047	6.161
MOffer	1 Short	6.095	.033	6.031	6.159
	2 Long	6.048	.032	5.986	6.110
MAlternative	1 Short	6.053	.042	5.971	6.135
	2 Long	6.106	.040	6.027	6.186

4. Customer Type * Business Location						
					95% Confidence Interval	
Dependent Variable	Customer Type	Business Location	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Urban	6.127	.042	6.043	6.210
		2 Suburban	6.105	.041	6.024	6.187
	2 Frequent	1 Urban	6.111	.042	6.029	6.193
		2 Suburban	6.171	.042	6.089	6.254
MOffer	1 Infrequent	1 Urban	6.092	.046	6.001	6.183
		2 Suburban	5.997	.045	5.909	6.086
	2 Frequent	1 Urban	6.073	.045	5.984	6.162
		2 Suburban	6.124	.045	6.035	6.213
MAlternative	1 Infrequent	1 Urban	6.074	.059	5.958	6.190
		2 Suburban	6.061	.058	5.948	6.174
	2 Frequent	1 Urban	6.130	.058	6.016	6.243
		2 Suburban	6.054	.058	5.940	6.169

5. Customer Type * Queue Length						
					95% Confidence Interval	
Dependent Variable	Customer Type	Queue Length	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Short	6.146	.042	6.063	6.229
		2 Long	6.086	.042	6.004	6.168
	2 Frequent	1 Short	6.160	.043	6.075	6.244
		2 Long	6.123	.040	6.043	6.202
MOffer	1 Infrequent	1 Short	6.056	.046	5.966	6.145
		2 Long	6.034	.045	5.944	6.123
	2 Frequent	1 Short	6.135	.047	6.043	6.226
		2 Long	6.062	.044	5.976	6.148
MAlternative	1 Infrequent	1 Short	6.063	.059	5.948	6.178
		2 Long	6.072	.058	5.958	6.187
	2 Frequent	1 Short	6.044	.060	5.927	6.161
		2 Long	6.140	.056	6.030	6.251

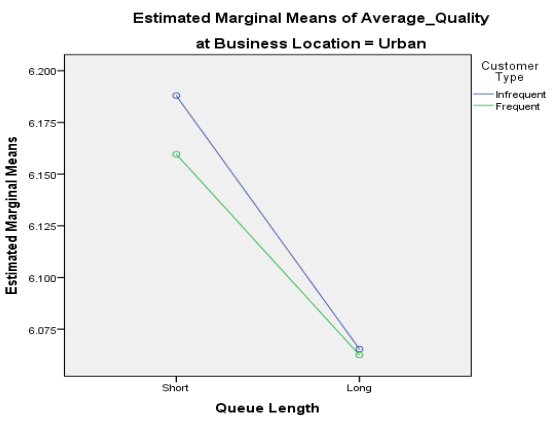
6. Business Location * Queue Length						
					95% Confidence Interval	
Dependent Variable	Business Location	Queue Length	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Urban	1 Short	6.174	.043	6.089	6.259
		2 Long	6.064	.041	5.984	6.144
	2 Suburban	1 Short	6.132	.042	6.050	6.214
		2 Long	6.145	.042	6.063	6.226
MOffer	1 Urban	1 Short	6.128	.047	6.035	6.220
		2 Long	6.037	.044	5.950	6.124
	2 Suburban	1 Short	6.063	.045	5.974	6.152
		2 Long	6.058	.045	5.969	6.147
MAlternative	1 Urban	1 Short	6.018	.060	5.899	6.136
		2 Long	6.186	.057	6.075	6.297
	2 Suburban	1 Short	6.089	.058	5.975	6.203
		2 Long	6.027	.058	5.913	6.140

7. Customer Type * Business Location * Queue Length							
						95% Confidence Interval	
Dependent Variable	Customer Type	Business Location	Queue Length	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Urban	1 Short	6.188	.061	6.067	6.308
			2 Long	6.065	.059	5.950	6.181
		2 Suburban	1 Short	6.104	.058	5.990	6.217
			2 Long	6.107	.059	5.990	6.223
	2 Frequent	1 Urban	1 Short	6.160	.061	6.039	6.280
			2 Long	6.063	.056	5.952	6.173
		2 Suburban	1 Short	6.160	.060	6.042	6.278
			2 Long	6.183	.058	6.068	6.297
MOffer	1 Infrequent	1 Urban	1 Short	6.149	.067	6.018	6.280
			2 Long	6.035	.064	5.910	6.161
		2 Suburban	1 Short	5.962	.063	5.839	6.086
			2 Long	6.032	.065	5.905	6.159
	2 Frequent	1 Urban	1 Short	6.106	.067	5.975	6.237
			2 Long	6.039	.061	5.919	6.159
		2 Suburban	1 Short	6.163	.065	6.035	6.291
			2 Long	6.085	.063	5.960	6.209
MAlternative	1 Infrequent	1 Urban	1 Short	6.050	.085	5.882	6.217
			2 Long	6.098	.082	5.937	6.259
		2 Suburban	1 Short	6.075	.080	5.918	6.233
			2 Long	6.047	.083	5.884	6.209
	2 Frequent	1 Urban	1 Short	5.986	.085	5.818	6.153
			2 Long	6.274	.078	6.120	6.427
		2 Suburban	1 Short	6.102	.083	5.938	6.266
			2 Long	6.006	.081	5.847	6.166

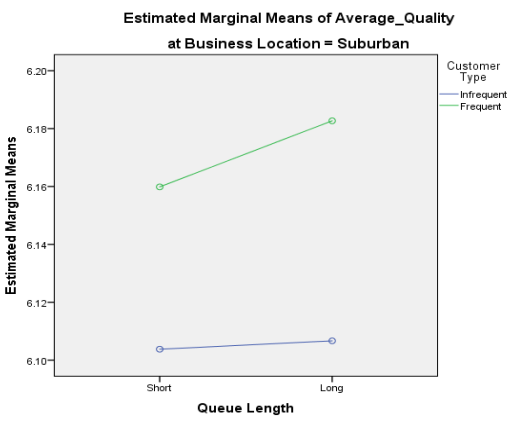
Profile Plots

MQuality: Queue Length * Customer Type * Business Location

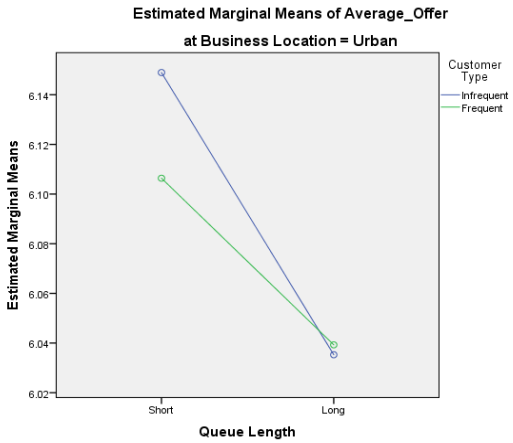
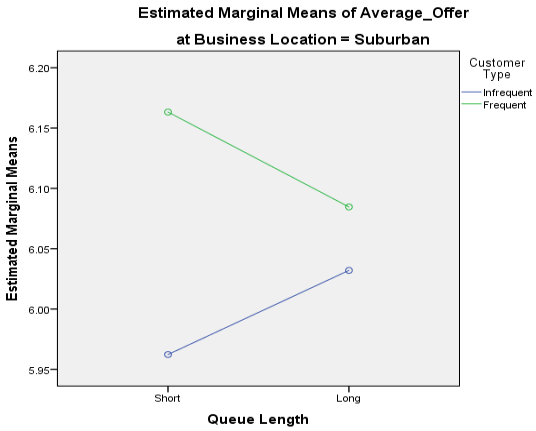
Plot1



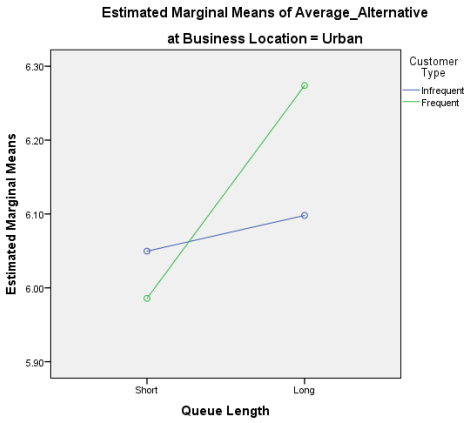
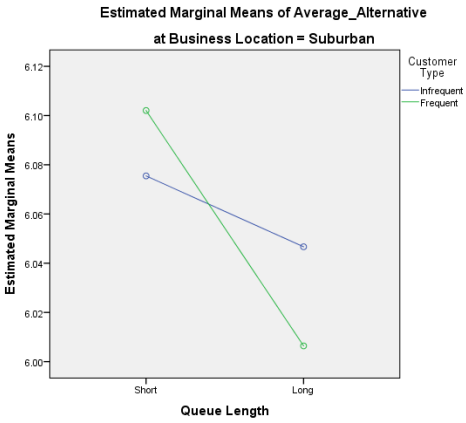
Plot 2



MOffer: Queue Length * Customer Type * Business Location

Plot 1	Plot 2
	

MAlternative: Queue Length * Customer Type * Business Location

Plot 1	Plot 2
	

Appendix VI: Factorial MANOVA Output_Entertainment

General Linear Model

Between-Subjects Factors			
		Value Label	N
CustomerType	1	Infrequent	196
	2	Frequent	205
BusinessLocation	1	Urban	188
	2	Suburban	213
QueueLength	1	Short	200
	2	Long	201

Descriptive Statistics						
	CustomerType	BusinessLocation	QueueLength	Mean	Std. Deviation	N
MQuality	1 Infrequent	1 Urban	1 Short	6.1556	.40421	45
			2 Long	6.2118	.30118	48
			Total	6.1846	.35395	93
		2 Suburban	1 Short	6.2400	.31073	50
			2 Long	6.1635	.28587	53
			Total	6.2006	.29920	103
		Total	1 Short	6.2000	.35862	95

			2 Long	6.1865	.29277	101
			Total	6.1930	.32557	196
	2 Frequent	1 Urban	1 Short	6.2041	.33379	49
			2 Long	6.1413	.26520	46
			Total	6.1737	.30259	95
		2 Suburban	1 Short	6.0804	.30317	56
			2 Long	6.1019	.21577	54
			Total	6.0909	.26293	110
		Total	1 Short	6.1381	.32230	105
			2 Long	6.1200	.23934	100
			Total	6.1293	.28432	205
	Total	1 Urban	1 Short	6.1809	.36797	94
			2 Long	6.1773	.28483	94
			Total	6.1791	.32816	188
		2 Suburban	1 Short	6.1557	.31562	106
			2 Long	6.1324	.25363	107
			Total	6.1440	.28572	213
		Total	1 Short	6.1675	.34058	200
			2 Long	6.1534	.26893	201
			Total	6.1604	.30646	401
MOffer	1 Infrequent	1 Urban	1 Short	6.0800	.36282	45
			2 Long	6.1000	.43467	48
			Total	6.0903	.39947	93
		2 Suburban	1 Short	6.0680	.51998	50
			2 Long	6.2113	.31235	53
			Total	6.1417	.42989	103
		Total	1 Short	6.0737	.45011	95
			2 Long	6.1584	.37769	101
			Total	6.1173	.41548	196
	2 Frequent	1 Urban	1 Short	6.1469	.38465	49
			2 Long	6.1696	.42785	46
			Total	6.1579	.40412	95
		2 Suburban	1 Short	6.1107	.41239	56
			2 Long	6.1741	.38076	54
			Total	6.1418	.39663	110
		Total	1 Short	6.1276	.39819	105
			2 Long	6.1720	.40103	100
			Total	6.1493	.39922	205
	Total	1 Urban	1 Short	6.1149	.37387	94
			2 Long	6.1340	.43044	94
			Total	6.1245	.40218	188
		2 Suburban	1 Short	6.0906	.46446	106
			2 Long	6.1925	.34742	107
			Total	6.1418	.41207	213
		Total	1 Short	6.1020	.42343	200
			2 Long	6.1652	.38856	201
			Total	6.1337	.40705	401
MAlternative	1 Infrequent	1 Urban	1 Short	6.1407	.57511	45
			2 Long	6.0000	.64869	48
			Total	6.0681	.61495	93
		2 Suburban	1 Short	6.0867	.63464	50
			2 Long	6.1887	.49142	53
			Total	6.1392	.56500	103
		Total	1 Short	6.1123	.60457	95
			2 Long	6.0990	.57647	101
			Total	6.1054	.58878	196
	2 Frequent	1 Urban	1 Short	6.2381	.54433	49
			2 Long	6.3043	.39016	46
			Total	6.2702	.47464	95
		2 Suburban	1 Short	6.1905	.47506	56
			2 Long	6.0432	.53020	54
			Total	6.1182	.50600	110
		Total	1 Short	6.2127	.50663	105
			2 Long	6.1633	.48662	100
			Total	6.1886	.49637	205
	Total	1 Urban	1 Short	6.1915	.55839	94
			2 Long	6.1489	.55652	94
			Total	6.1702	.55638	188
		2 Suburban	1 Short	6.1415	.55577	106
			2 Long	6.1153	.51417	107
			Total	6.1283	.53417	213

		Total	1 Short	6.1650	.55617	200
			2 Long	6.1310	.53331	201
			Total	6.1480	.54441	401

Box's Test of Equality of Covariance Matrices[a]	
Box's M	91.348
F	2.120
df1	42
df2	24660.757
Sig.	.092
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength	

Multivariate Tests[a]							
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**
CustomerType	Wilks' Lambda	.978	2.889[b]	3.000	391.000	**.035**	**.022**
BusinessLocation	Wilks' Lambda	.994	.761[b]	3.000	391.000	.517	.006
QueueLength	Wilks' Lambda	.991	1.198[b]	3.000	391.000	.310	.009
CustomerType * BusinessLocation	Wilks' Lambda	.983	2.304[b]	3.000	391.000	**.037**	**.057**
CustomerType * QueueLength	Wilks' Lambda	.999	.086[b]	3.000	391.000	.968	.001
BusinessLocation * QueueLength	Wilks' Lambda	.996	.498[b]	3.000	391.000	.684	.004
CustomerType * BusinessLocation * QueueLength	Wilks' Lambda	.979	2.819[b]	3.000	391.000	**.039**	**.081**
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength							
b. Exact statistic							

Levene's Test of Equality of Error Variances[a]				
	F	df1	df2	Sig.
MQuality	.877	7	393	.525
MOffer	1.514	7	393	.161
MAlternative	3.949	7	393	.347
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.				
a. Design: Intercept + CustomerType + BusinessLocation + QueueLength + CustomerType * BusinessLocation + CustomerType * QueueLength + BusinessLocation * QueueLength + CustomerType * BusinessLocation * QueueLength				

Tests of Between-Subjects Effects				
Source	Dependent Variable	F	Sig.	Partial Eta Squared
CustomerType	**MQuality**	3.975	**.047**	**.070**
	MOffer	.755	.385	.002
	MAlternative	2.761	.097	.007
BusinessLocation	MQuality	1.084	.299	.003
	MOffer	.171	.679	.000
	MAlternative	.646	.422	.002
QueueLength	MQuality	.254	.614	.001
	MOffer	2.329	.128	.006
	MAlternative	.305	.581	.001
CustomerType * BusinessLocation	MQuality	2.669	.103	.007
	MOffer	.643	.423	.002
	MAlternative	4.186	**.041**	**.041**
CustomerType * QueueLength	MQuality	.030	.863	.000
	MOffer	.224	.636	.001
	MAlternative	.038	.845	.000
BusinessLocation * QueueLength	MQuality	.158	.691	.000
	MOffer	1.008	.316	.003
	MAlternative	.018	.893	.000
CustomerType * BusinessLocation * QueueLength	MQuality	3.163	.076	.008
	MOffer	.256	.613	.001
	MAlternative	4.434	**.036**	**.061**

Estimated Marginal Means

1. Customer Type

Dependent Variable	Customer Type	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
MQuality	1 Infrequent	6.193	.022	6.150	6.236
	2 Frequent	6.132	.021	6.090	6.174
MOffer	1 Infrequent	6.115	.029	6.057	6.172
	2 Frequent	6.150	.029	6.094	6.206
MAlternative	1 Infrequent	6.104	.039	6.028	6.180
	2 Frequent	6.194	.038	6.120	6.269

2. Business Location

Dependent Variable	Business Location	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
MQuality	1 Urban	6.178	.022	6.134	6.222
	2 Suburban	6.146	.021	6.105	6.188
MOffer	1 Urban	6.124	.030	6.066	6.183
	2 Suburban	6.141	.028	6.086	6.196
MAlternative	1 Urban	6.171	.039	6.093	6.248
	2 Suburban	6.127	.037	6.054	6.200

3. Queue Length

Dependent Variable	Queue Length	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
MQuality	1 Short	6.170	.022	6.128	6.212
	2 Long	6.155	.022	6.112	6.197
MOffer	1 Short	6.101	.029	6.045	6.158
	2 Long	6.164	.029	6.107	6.220
MAlternative	1 Short	6.164	.038	6.089	6.239
	2 Long	6.134	.038	6.059	6.209

4. Customer Type * Business Location

Dependent Variable	Customer Type	Business Location	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Urban	6.184	.032	6.122	6.246
		2 Suburban	6.202	.030	6.143	6.261
	2 Frequent	1 Urban	6.173	.031	6.111	6.234
		2 Suburban	6.091	.029	6.034	6.148
MOffer	1 Infrequent	1 Urban	6.090	.042	6.007	6.173
		2 Suburban	6.140	.040	6.061	6.219
	2 Frequent	1 Urban	6.158	.042	6.076	6.241
		2 Suburban	6.142	.039	6.066	6.219
MAlternative	1 Infrequent	1 Urban	6.070	.056	5.960	6.181
		2 Suburban	6.138	.053	6.033	6.243
	2 Frequent	1 Urban	6.271	.056	6.162	6.380
		2 Suburban	6.117	.052	6.015	6.218

5. Customer Type * Queue Length

Dependent Variable	Customer Type	Queue Length	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Short	6.198	.031	6.136	6.259
		2 Long	6.188	.030	6.128	6.247
	2 Frequent	1 Short	6.142	.030	6.084	6.201
		2 Long	6.122	.031	6.061	6.182
MOffer	1 Infrequent	1 Short	6.074	.042	5.992	6.156
		2 Long	6.156	.041	6.076	6.236
	2 Frequent	1 Short	6.129	.040	6.050	6.207
		2 Long	6.172	.041	6.091	6.252
MAlternative	1 Infrequent	1 Short	6.114	.056	6.004	6.223
		2 Long	6.094	.054	5.988	6.200
	2 Frequent	1 Short	6.214	.053	6.110	6.318
		2 Long	6.174	.054	6.067	6.280

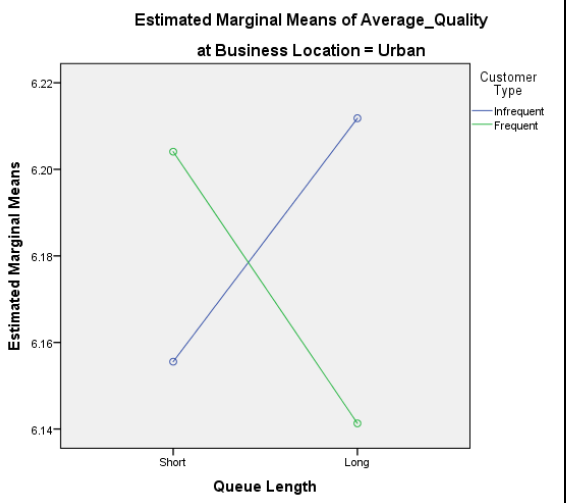
6. Business Location * Queue Length						
					95% Confidence Interval	
Dependent Variable	Business Location	Queue Length	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Urban	1 Short	6.180	.031	6.118	6.242
		2 Long	6.177	.031	6.115	6.238
	2 Suburban	1 Short	6.160	.030	6.102	6.218
		2 Long	6.133	.029	6.075	6.191
MOffer	1 Urban	1 Short	6.113	.042	6.031	6.196
		2 Long	6.135	.042	6.052	6.218
	2 Suburban	1 Short	6.089	.040	6.011	6.167
		2 Long	6.193	.039	6.115	6.270
MAlternative	1 Urban	1 Short	6.189	.056	6.080	6.299
		2 Long	6.152	.056	6.042	6.262
	2 Suburban	1 Short	6.139	.053	6.035	6.242
		2 Long	6.116	.052	6.013	6.219

7. Customer Type * Business Location * Queue Length							
						95% Confidence Interval	
Dependent Variable	Customer Type	Business Location	Queue Length	Mean	Std. Error	Lower Bound	Upper Bound
MQuality	1 Infrequent	1 Urban	1 Short	6.156	.045	6.066	6.245
			2 Long	6.212	.044	6.125	6.298
		2 Suburban	1 Short	6.240	.043	6.155	6.325
			2 Long	6.164	.042	6.081	6.246
	2 Frequent	1 Urban	1 Short	6.204	.044	6.119	6.290
			2 Long	6.141	.045	6.053	6.230
		2 Suburban	1 Short	6.080	.041	6.000	6.160
			2 Long	6.102	.041	6.020	6.183
MOffer	1 Infrequent	1 Urban	1 Short	6.080	.061	5.960	6.200
			2 Long	6.100	.059	5.984	6.216
		2 Suburban	1 Short	6.068	.058	5.955	6.181
			2 Long	6.211	.056	6.101	6.321
	2 Frequent	1 Urban	1 Short	6.147	.058	6.032	6.261
			2 Long	6.170	.060	6.051	6.288
		2 Suburban	1 Short	6.111	.055	6.004	6.218
			2 Long	6.174	.056	6.065	6.283
MAlternative	1 Infrequent	1 Urban	1 Short	6.141	.081	5.982	6.299
			2 Long	6.000	.078	5.846	6.154
		2 Suburban	1 Short	6.087	.077	5.936	6.237
			2 Long	6.189	.074	6.043	6.335
	2 Frequent	1 Urban	1 Short	6.238	.077	6.086	6.390
			2 Long	6.304	.080	6.148	6.461
		2 Suburban	1 Short	6.190	.072	6.048	6.333
			2 Long	6.043	.074	5.898	6.188

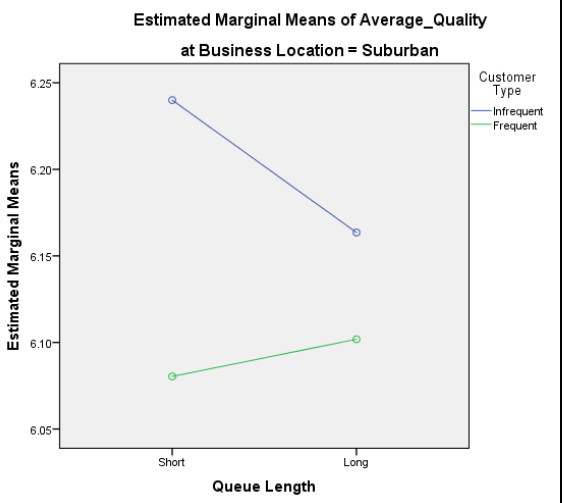
Profile Plots

MQuality: Queue Length * Customer Type * Business Location

Plot 1

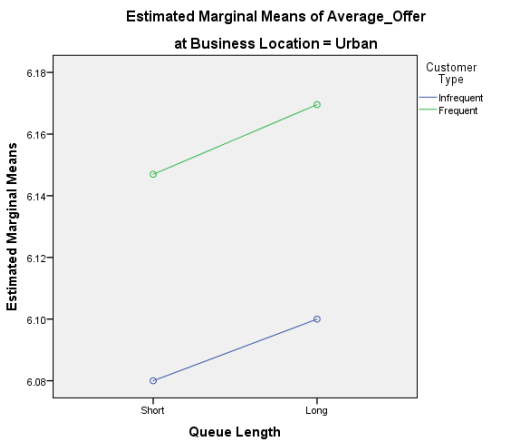


Plot 2

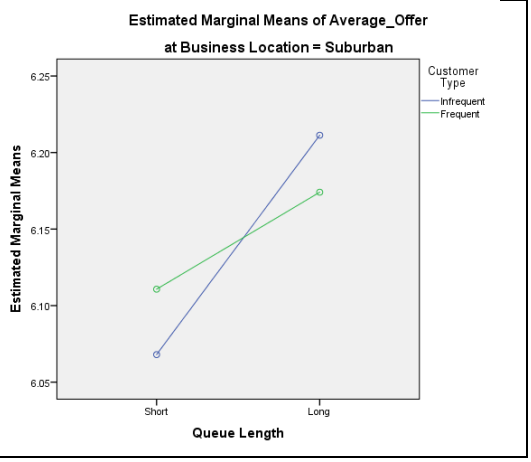


MOffer: Queue Length * Customer Type * Business Location

Plot 1

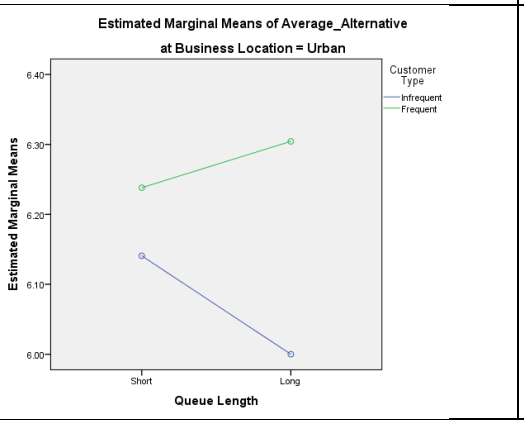


Plot 2

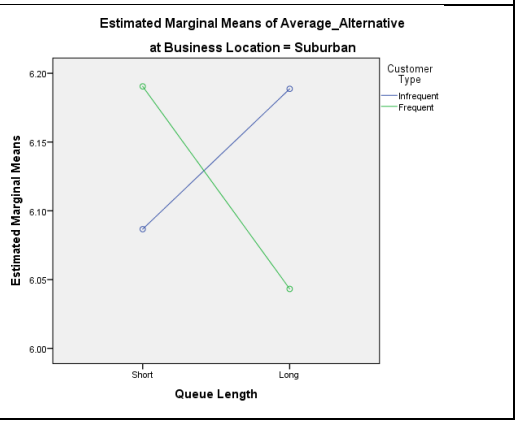


MAlternative: Queue Length * Customer Type * Business Location

Plot 1



Plot 2



Appendix VII: Psychometric Analysis_Food

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.745	.747	5

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Offer_1	24.02	3.933	.619	.393	.660
Offer_2	24.06	4.130	.486	.245	.709
Offer_3	24.16	4.115	.513	.288	.699
Offer_4	24.09	4.068	.476	.249	.714
Offer_5	24.06	4.305	.458	.216	.718

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.757	.756	3

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Alternatives_1	11.94	1.367	.715	.516	.521
Alternatives_2	12.08	1.814	.479	.271	.785
Alternatives_3	12.14	1.403	.585	.421	.682

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.811	.818	6

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Quality_1	30.16	5.585	.623	.394	.773
Quality_2	29.95	5.583	.571	.389	.782
Quality_3	30.13	5.572	.589	.350	.779
Quality_4	30.02	5.303	.485	.285	.805
Quality_5	30.05	5.651	.550	.321	.786
Quality_6	30.25	4.560	.670	.466	.759

Appendix VIII: Psychometric Analysis_Retail

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.735	.738	3

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Alternatives_1	12.06	1.459	.678	.462	.509
Alternatives_2	12.30	1.704	.476	.268	.742
Alternatives_3	12.14	1.493	.536	.353	.680

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.701	.703	5

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Offer_1	24.17	3.478	.528	.289	.620
Offer_2	24.30	3.781	.333	.112	.703
Offer_3	24.33	3.651	.492	.260	.637
Offer_4	24.34	3.507	.476	.236	.641
Offer_5	24.24	3.532	.461	.223	.648

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.745	.748	6

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Quality_1	30.68	4.722	.531	.340	.698
Quality_2	30.54	4.699	.463	.266	.714
Quality_3	30.69	4.590	.468	.244	.713
Quality_4	30.68	4.732	.425	.226	.725
Quality_5	30.56	4.851	.472	.274	.713
Quality_6	30.64	4.107	.553	.331	.689

Appendix IX: Psychometric Analysis_Entertainment

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.712	.710	6

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Quality_1	30.87	2.678	.553	.167	.463
Quality_2	30.73	2.693	.416	.089	.517
Quality_3	30.88	2.438	.495	.115	.480
Quality_4	30.84	2.643	.446	.095	.503
Quality_5	30.78	2.647	.444	.126	.504

Quality_6	30.71	2.305	.445	.161	.452

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.703	.703	3

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Alternatives_1	12.15	1.161	.672	.458	.404
Alternatives_2	12.44	1.512	.470	.320	.670
Alternatives_3	12.29	1.412	.435	.256	.720

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.736	.738	5

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Offer_1	24.41	2.848	.460	.222	.550
Offer_2	24.56	2.862	.457	.134	.600
Offer_3	24.60	2.986	.448	.125	.602
Offer_4	24.55	2.933	.477	.145	.588
Offer_5	24.56	2.832	.408	.185	.573

Appendix X: Data Distribution_Food

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Male	215	53.0	53.0	53.0
	2 Female	191	47.0	47.0	100.0
	Total	406	100.0	100.0	

AgeGroup					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Under 18	11	2.7	2.7	2.7
	2 18 - 24	114	28.1	28.1	30.8
	3 25 - 34	78	19.2	19.2	50.0
	4 35- 44	97	23.9	23.9	73.9
	5 45 - 55	59	14.5	14.5	88.4
	6 Above 55	47	11.6	11.6	100.0
	Total	406	100.0	100.0	

Income					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Less than £18,000	57	14.0	14.0	14.0
	2 £18,000 to £32,000	96	23.6	23.6	37.7
	3 £33,000 to 48,000	77	19.0	19.0	56.7
	4 £49,000 to 57,000	59	14.5	14.5	71.2
	5 Above £58000	35	8.6	8.6	79.8
	6 Family Support	82	20.2	20.2	100.0
	Total	406	100.0	100.0	

Ethnicity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 White	132	32.5	32.6	32.6
	2 Black / African / Caribbean / Black British	90	22.2	22.2	54.8
	3 Mixed / Multiple ethnicity	51	12.6	12.6	67.4
	4 Asian / Asian British	84	20.7	20.7	88.1
	5 Middle East	48	11.8	11.9	100.0
	Total	405	99.8	100.0	
Missing	System	1	.2		
Total		406	100.0		

EmploymentStatus					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Employed full time	170	41.9	41.9	41.9
	2 Employed part time	40	9.9	9.9	51.7
	3 Unemployed looking for work	18	4.4	4.4	56.2
	4 Unemployed not looking for work	5	1.2	1.2	57.4
	5 Retired	37	9.1	9.1	66.5
	6 Student	136	33.5	33.5	100.0
	Total	406	100.0	100.0	

MaritalStatus					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Married	199	49.0	49.0	49.0
	3 Divorced	8	2.0	2.0	51.0
	5 Single	199	49.0	49.0	100.0
	Total	406	100.0	100.0	

Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 High school graduate	51	12.6	12.6	12.6
	3 Some college	100	24.6	24.6	37.2
	4 Professional degree	179	44.1	44.1	81.3
	5 Doctorate	76	18.7	18.7	100.0
	Total	406	100.0	100.0	

Appendix XI: Data Distribution_Retail

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Male	218	54.0	54.0	54.0
	2 Female	187	46.0	46.0	100.0
	Total	405	100.0	100.0	

AgeGroup					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Under 18	15	3.7	3.7	3.7
	2 18 - 24	66	16.3	16.3	20.0
	3 25 - 34	69	17.0	17.0	37.0
	4 35- 44	121	29.9	29.9	66.9
	5 45 - 55	93	23.0	23.0	89.9
	6 Above 55	41	10.1	10.1	100.0
	Total	405	100.0	100.0	

Income					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Less than £18,000	55	13.6	13.6	13.6
	2 £18,000 to £32,000	108	26.7	26.7	40.2
	3 £33,000 to 48,000	93	23.0	23.0	63.2
	4 £49,000 to 57,000	63	15.6	15.6	78.8
	5 Above £58000	27	6.7	6.7	85.4

	6 Family Support	59	14.6	14.6	100.0
	Total	405	100.0	100.0	

Ethnicity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 White	115	28.4	28.5	28.5
	2 Black / African / Caribbean / Black British	76	18.8	18.9	47.4
	3 Mixed / Multiple ethnicity	73	18.0	18.1	65.5
	4 Asian / Asian British	79	19.5	19.6	85.1
	5 Middle East	60	14.8	14.9	100.0
	Total	403	99.5	100.0	
Missing	System	2	.5		
Total		405	100.0		

EmploymentStatus					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Employed full time	168	41.5	41.6	41.6
	2 Employed part time	81	20.0	20.0	61.6
	3 Unemployed looking for work	21	5.2	5.2	66.8
	4 Unemployed not looking for work	1	.2	.2	67.1
	5 Retired	39	9.6	9.7	76.7
	6 Student	94	23.2	23.3	100.0
	Total	404	99.8	100.0	
Missing	System	1	.2		
Total		405	100.0		

MaritalStatus					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Married	220	54.3	54.5	54.5
	3 Divorced	8	2.0	2.0	56.4
	4 Separated	1	.2	.2	56.7
	5 Single	175	43.2	43.3	100.0
	Total	404	99.8	100.0	
Missing	System	1	.2		
Total		405	100.0		

Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 High school graduate	28	6.9	6.9	6.9
	3 Some college	129	31.9	31.9	38.9
	4 Professional degree	202	49.9	50.0	88.9
	5 Doctorate	45	11.1	11.1	100.0
	Total	404	99.8	100.0	
Missing	System	1	.2		
Total		405	100.0		

Appendix XII: Data Distribution_Entertainment

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Male	197	49	49	49
	2 Female	204	51	51	100.0
	Total	401	100.0	100.0	

AgeGroup					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Under 18	7	1.7	1.7	1.7
	2 18 - 24	52	13.0	13.0	14.7
	3 25 - 34	80	20.0	20.0	34.7
	4 35- 44	122	30.4	30.4	65.1
	5 45 - 55	107	26.7	26.7	91.8

	6 Above 55	33	8.2	8.2	100.0
	Total	401	100.0	100.0	

Income					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Less than £18,000	72	18.0	18.0	18.0
	2 £18,000 to £32,000	81	20.2	20.2	38.2
	3 £33,000 to 48,000	95	23.7	23.7	61.8
	4 £49,000 to 57,000	67	16.7	16.7	78.6
	5 Above £58000	31	7.7	7.7	86.3
	6 Family Support	55	13.7	13.7	100.0
	Total	401	100.0	100.0	

Ethnicity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 White	116	28.9	29.2	29.2
	2 Black / African / Caribbean / Black British	86	21.4	21.7	50.9
	3 Mixed / Multiple ethnicity	59	14.7	14.9	65.7
	4 Asian / Asian British	67	16.7	16.9	82.6
	5 Middle East	69	17.2	17.4	100.0
	Total	397	99.0	100.0	
Missing	System	4	1.0		
Total		401	100.0		

EmploymentStatus					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Employed full time	184	45.9	45.9	45.9
	2 Employed part time	79	19.7	19.7	65.6
	3 Unemployed looking for work	25	6.2	6.2	71.8
	5 Retired	33	8.2	8.2	80.0
	6 Student	80	20.0	20.0	100.0
	Total	401	100.0	100.0	

MaritalStatus					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Married	226	56.4	56.4	56.4
	3 Divorced	6	1.5	1.5	57.9
	4 Separated	8	2.0	2.0	59.9
	5 Single	161	40.1	40.1	100.0
	Total	401	100.0	100.0	

Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 High school graduate	16	4.0	4.0	4.0
	3 Some college	134	33.4	33.4	37.4
	4 Professional degree	216	53.9	53.9	91.3
	5 Doctorate	35	8.7	8.7	100.0
	Total	401	100.0	100.0	

Appendix XIII: Suburban Queueing Analysis

Suburban Efficiency Level Analysis (Weekdays)				Suburban Queueing Options (Weekdays)		
EFFICIENCY	-5%	M/M/1	5%	PARAMETERS	(M/M/1)	M/M/2
PARAMETERS				λ	23	23
LAMBDA (λ)	23	23	23	μ	45	45
MU (μ)	42.75	45	47.25	ρ	0.511	0.256
RHO (ρ)	0.538	0.511	0.487	L	1.045	0.547
L	1.165	1.045	0.948	Lq	0.534	0.036
Lq	0.627	0.534	0.462	W	0.045 (2.727 min)	0.024
W	0.051	0.045	0.041	Wq	0.023 (1.394 min)	0.002
Wq	0.027	0.023	0.02	P (n=0)	0.489	0.593
P (0)	0.462	0.489	0.513	P(t<0)	0.489	0.896
Suburban Efficiency Level Analysis (Weekends)				**Suburban Queueing Options (Weekends)**		
EFFICIENCY	-5%	M/M/1	5%	PARAMETERS	(M/M/1)	M/M/2
PARAMETERS				λ	53	53
LAMBDA (λ)	53	53	53	μ	62	62
MU (μ)	58.9	62	65.1	ρ	0.855	0.427
RHO (ρ)	0.9	0.855	0.814	L	5.889	1.046
L	8.983	5.889	4.38	Lq	5.034	0.191
Lq	8.083	5.034	3.566	W	0.111 (6.667 min)	0.02
W	0.169	0.111	0.083	Wq	0.095 (5.699 min)	0.004
Wq	0.153	0.095	0.067	P (n=0)	0.145	0.401
P (0)	0.1	0.145	0.186	P(t<0)	0.145	0.744
Suburban Efficiency Level Analysis (Week)				**Suburban Queueing Options (Week)**		
EFFICIENCY	-5%	M/M/1	5%	PARAMETERS	(M/M/1)	M/M/2
PARAMETERS				λ	32	32
LAMBDA (λ)	32	32	32	μ	50	50
MU (μ)	47.5	50	52.5	ρ	0.64	0.32
RHO (ρ)	0.674	0.64	0.61	L	1.778	0.713
L	2.065	1.778	1.561	Lq	1.138	0.073
Lq	1.391	1.138	0.951	W	0.056 (3.333 min)	0.022
W	0.065	0.056	0.049	Wq	0.036 (2.133 min)	0.002
Wq	0.043	0.036	0.03	P (n=0)	0.36	0.515
P (0)	0.326	0.36	0.39	P(t<0)	0.36	0.845

Appendix XIV: Urban Queueing Analysis

Urban Efficiency Level Analysis (Weekdays)				Urban Queueing Options (Weekdays)		
EFFICIENCY	-5%	EFFICIENCY	-5%	EFFICIENCY	-5%	EFFICIENCY
PARAMETERS		PARAMETERS		PARAMETERS		PARAMETERS
LAMBDA (λ)	55	LAMBDA (λ)	55	LAMBDA (λ)	55	LAMBDA (λ)
MU (μ)	70.3	MU (μ)	70.3	MU (μ)	70.3	MU (μ)
RHO (ρ)	0.782	RHO (ρ)	0.782	RHO (ρ)	0.782	RHO (ρ)
L	3.595	L	3.595	L	3.595	L
Lq	2.812	Lq	2.812	Lq	2.812	Lq
W	0.065	W	0.065	W	0.065	W
Wq	0.051	Wq	0.051	Wq	0.051	Wq
P (0)	0.218	P (0)	0.218	P (0)	0.218	P (0)
Urban Efficiency Level Analysis (Weekends)				Urban Queueing Options (Weekends)		
EFFICIENCY	-5%	EFFICIENCY	-5%	EFFICIENCY	-5%	EFFICIENCY
PARAMETERS		PARAMETERS		PARAMETERS		PARAMETERS
LAMBDA (λ)	67	LAMBDA (λ)	67	LAMBDA (λ)	67	LAMBDA (λ)
MU (μ)	71.25	MU (μ)	71.25	MU (μ)	71.25	MU (μ)
RHO (ρ)	0.94	RHO (ρ)	0.94	RHO (ρ)	0.94	RHO (ρ)
L	15.765	L	15.765	L	15.765	L
Lq	14.824	Lq	14.824	Lq	14.824	Lq
W	0.235	W	0.235	W	0.235	W
Wq	0.221	Wq	0.221	Wq	0.221	Wq
P (0)	0.06	P (0)	0.06	P (0)	0.06	P (0)
Urban Efficiency Level Analysis (Week)				Urban Queueing Options (Week)		
EFFICIENCY	-5%	EFFICIENCY	-5%	EFFICIENCY	-5%	EFFICIENCY
PARAMETERS		PARAMETERS		PARAMETERS		PARAMETERS
LAMBDA (λ)	58	LAMBDA (λ)	58	LAMBDA (λ)	58	LAMBDA (λ)
MU (μ)	70.3	MU (μ)	70.3	MU (μ)	70.3	MU (μ)
RHO (ρ)	0.825	RHO (ρ)	0.825	RHO (ρ)	0.825	RHO (ρ)
L	4.715	L	4.715	L	4.715	L
Lq	3.89	Lq	3.89	Lq	3.89	Lq
W	0.081	W	0.081	W	0.081	W
Wq	0.067	Wq	0.067	Wq	0.067	Wq
P (0)	0.175	P (0)	0.175	P (0)	0.175	P (0)