DETERMINANTS OF DEMAND FOR THE CHOICE OF MOBILE TELEPHONE SERVICE PROVIDERS IN KIAMBU DISTRICT

BY

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Declaration

The research project is my original work and has not been presented for a degree in any other university.

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This research project has been submitted for examination with our approval as university supervisors.

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Dedications

This research paper is dedicated to my wife Dorcas and our beloved sons Simon Wainaina and Evans Mwangi. And in memory of my brother George.

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Abstract

The major objective of the study was to identify which factors affect demand for the choice of different mobile telephone providers and their tariffs in Kiambu District. Though the demand is noted to on the increase, the price and income among other factors theoretically determine the different choices of tariffs; their influence on demand for the different tariffs has not been theoretically established in Kenya. Hence, the study therefore sets out to highlight some of these factors that lead to choice providers and a tariff regime .To achieve the objectives of the study, cross sectional primary data was collected using questionnaires from a sample of 100 respondents. Both descriptive and regression results were given .For the multinomial econometric analysis of the data, only 90 respondents were used because some of respondents gave incomplete data.

Due to the discrete nature of the demand for the choice of various providers and tariff regime, multinomial logit model was adopted to capture the demand for various choices.

The descriptive results revealed lack of consistency on ownership of the mobile telephones across the income divide. An important observation is that respondents chose various provider and tariff regimes in reference to whether they had congestion and they were cheap.

The regression results showed that price of respective mobile telephone service providers calls and convenience were the most significant determinants .The price was found to be negatively related to the choice of a provider and choice of a tariff regime.

The study revealed that mobile telephone and landline telephones are compliments rather than substitutes.

CHAPTER ONE:INTRODUCTION

1.1.1Background

The telecommunication services and especially telephone services are increasingly being recognized as a key component in the infrastructure of economic development. This results from the need for market information about selling and buying of goods and services, transport efficiency, regional development, coordination of internal and external security, according to the World Bank (2000).

The telecom sector has been extensively regulated throughout the world since early part of 20th century. Some of the main reasons for such regulations are the unique costs and demand conditions that characterize telecommunications markets. Accordingly, the ability to understand and critically analyze both commercial decision-making and government policies concerning the telecom sector requires some knowledge of telecommunications demand, supply and costs according to Savage J. S. (2002).

While the gap in telephone access between the developed and developing world is narrowing. The total telephone penetration (fixed line and mobile phones) stood at 49 telephones per 100 inhabitants in 1991 in developed nations, 3.3 in emerging nations and just 0.3 in the least developed nations according to International Telecommunication Union (2002).

Today, the levels are 121.1 telephones per 100 inhabitants in developed nations, 18.7 in emerging nations and 1.1 in the least developed nations. Ten years ago those countries that had mobile networks were the minority. Now, most nations have both. Africa has more than 20 million mobile phone users and by the end of 2001 and in twenty-eight African nations – over half the countries of the region had more mobile phones than fixed line subscribers, a higher percentage than any other continent.

Many developing and developed countries according to Hamilton J. (2001) have approached telecommunications reform by opening the market for mobile telephones to private participation and competition .One of this strategy is the astounding worldwide growth in mobile communications with developing countries accounting for the fastest growth. The believe is that mobile phones are complementary to fixed line telephony in developing countries, but they appear as a substitute for main lines in developing regions where access is low or non existent. This is associated with poor telecommunication infrastructure in developed countries.

Despite the growing importance of mobile telephony, very little is empirically established regarding its position as compared with fixed – line telephony as stimulus connectivity. Africa shows high growth and increasing competitiveness in mobile communications. It is also a region with very low access to fixed line telephones during the 1980's when cellular provision was practically non-existent. Today virtually all countries in the region have access to cellular service and many have at least two operators, one that is usually privately owned.

1.1.2 Telecommunication in Kenya

The Republic of Kenya (2001a), considers telecommunication an important sector in facilitating the integration of domestic economy and promoting trade and economic development. An efficient and modern communication network creates an economic environment that is conducive for import and export – oriented industrial complex, stimulates growth in all sectors of the economy, promotes public administration,

environmental protection and social mobilization. This sub sector also constitutes an effective medium for achieving the government rural urban policy.

The history of communication starts with the submarine cables linking Zanzibar, Mombasa and Dar- es- Salaam laid by African Telegraph Company in 1888 according to Communication Commission of Kenya (C.C.K) (2000). The Kenya's earliest telecommunications connections to the outside world linkages and to other parts of the country began in 1896 in conjunction with the building of the railway system, forming a dual "backbone" for Kenya's telecommunications infrastructure. In 1908 the public telephone network began service in Kenya, Nairobi and Mombasa. In the same year, eighteen telephone subscribers were connected. The development of Kenya's network has been gradual. At independence, in 1963, the Kenya government adopted a development strategy that incorporated development of communication system to achieve rapid economic growth.

Following the collapse of East African community in 1977, as noted by CCK (2000), the telecommunications infrastructure has grown rapidly in size and quality. The exchange capacity has grown from 88,000 lines in 1977 to 310,000 in 2001. Payphones have increased 588 in 1981 to approximately 10,000 currently. Majority of the Kenyan people still use payphones. The cellular phone subscribers number have also grown tremendously from 3000 in 1997 to 540,000 in 2001.

According to Communication Commission of Kenya (2001), Kenya's telecommunication sector is under the Ministry of Information, Transport and Communication (MOITC). The Kenya communication Act 1988 came into full effect on July 1st 1999. The Act promotes the establishment of the National Communications

Secretariat (NCS) within the ministry, which serves as the policy Advisor to the government of Kenya on matters pertaining to the telecommunications sectors. The Communication Commission of Kenya (CCK) serves as the regulator for the sector, the Appeals Tribunal serves as independent arbitrator and Telkom Kenya Limited and other licensed network operators serve as Public Telecommunication Operators. The policies formulated by the government aimed at improving the provision of telecommunication services, include:

(i) Attract the requisite investment fund to ensure advancement of technology and wide access to affordable services.

(ii) Privatization of Telkom Kenya Limited which was established in 1999 following the split of Kenya Post and Telecommunication Corporation (KPTC) to encourage effective competition by enhancing the participation of more regional telecommunication operators (RTOs) to compete with Telkom in the provision of local telecommunication services.

(iii) Encourage the expansion and reduction of costs and tariffs of telecommunication through licensing of fixed wireless telephone system operators.

(iv) Installation of the second satellite station at Kericho to add to Longonot Satellite station.

The Republic of Kenya (2001a) indicates that upon the enactment of Kenya Communication Act in 1998, Telkom Kenya was given the monopoly to provide fixed landline telephones for five years. Privatization of Telkom through sale of 49 percent of its equity shares is being undertaken in an effort to improve its service provision and

efficiency. The government has also inhibited reduction of tariffs and commissioning of two mobile telephone services. The third mobile telephone is to be commissioned by the mid 2003 to promote competition in the industry.

Currently, according to Communication Commission of Kenya (2002), there exist two mobile telephone service providers, which are Safaricom Company Limited with 60 percent of its shares held by Telkom Kenya and 40 percent by Vondafone U.K, and Kencell communications which is a Franco – Kenyan Consortium made up of Vivendi International 40 percent and sameer – investment group 60 percent. These two different companies have different rates of calling; they have also introduced various tariffs in order to attract more customers with varying needs and financial abilities. Prior to the commissioning of the two mobile telephone service providers, the former (KPTC) had introduced fixed mobile telephones, which were controlled by boosters installed at the subscriber's house.

Considering the fact that the mobile cellular phones became a public good in late 1990s, the number of users subscribing to them has portrayed an increased demand. However, the landline telephone services demand is also recorded to be on the increase, but at a lower rate than mobile phones. The result is the inability of the suppliers being unable to meet the demand for telephone services, which is manifested through congestion reported and delay in installation of landlines telephones. In terms of the cost making a telephone call, mobile telephone charges are far much higher than those of landline fixed telephone. These poses a problem as in normal expectation the demand for fixed telephone should be higher than mobile phones.

The Communication Commission of Kenya (2002) shows the continued growth in demand for mobile telephones as in Table 1. The cost per call per minute has been relatively constant, at an average cost per call per minute being Kshs.27 from 1997 to May 2002, when they increased to Kshs. 28 for Safaricom Limited. Kencell Limited has charged a uniform rate of Kshs 15 per call per minute since its introduction in 1999.

Table 1 Growth in Cellular Subscribers

Provider		1997	1998	1999	2000	2001	2002
Safaricom	No. of subscribers	5000	9000	15000	45000	350000	-
	Charge per unit (shs)	27	27	27	27	27	28
Kencell	No. of subscribers	-	-	-	40,000	33,000	-
	Charge per unit (shs)	-	-	-	15	15	15

However, two mobile telephone service providers have introduced other tariffs that charge different rates during peak and off peak, in an effort to attract more subscribers. Safaricom has three tariffs namely, Jambo Taifa and tariffic. Taifa charges a uniform rate of 28 shillings per minute any distance within the country and to landline and to Kencell phone subscribers. Tariffic introduces peak and off-peak hours charging different rates. Jambo charges a monthly fee plus a fixed call per minute less than that of Taifa tariff. It is mostly for corporate firms. Kencell phone provides services through two tariffs, Yes tariff and Family tariff. Yes tariff charges a uniform fee of Ksh. 15 to all Kencell subscribers, while Family charges Ksh. 10 to a given number of persons per minute. The charge per unit provided in Table 1 is considered as the average price since most of the subscribers have subscribed to tariffs with those charges (Kshs. 28 and Kshs. 15).

The cost of landline telephone is divided into local calls and trunk calls according to Telkom Directory (2002). Local calls are the one that originate from a telephone exchange center and terminates within 60 Kilometer radius from a designated reference charge point that can be shared by several exchanges. 1 unit equivalent of three minutes is charged Kshs. 5 for long distance calls are as follows trunk call 1 (60 – 230 km) charging Kshs. 18 per unit trunk call II over 230 km charging Kshs. 20 per unit unlike the landline telephone calls the mobile unit equivalent to one unit and charge is same through out any distance in the country.

The Republic of Kenya (1997a), show that the number of telephone exchange connections has been rising steadily reflecting an annual growth rate of 5.1 percent. Operator assisted calls reduced by 15.8 percent from 5.7 million to 4.8 million in 1996, as shown in the Table 2.

Table 2 TELEPHONE SERVICES (1996-2001)

Table (units)	1996	1997	1998	1999	2000	2001
Direct telephone exchange connection ('000)	261	272	280	296	304	321
Public phones (no.)	5,932	6,309	7,263	8,397	8,388	8,346
Card phones (no.)	48	49	212	876	1,061	1,158
Manual calls made (million)	4.8	4.60	3.70	3.50	3.86	4.25
Mobile phones (no.)	2,727	5,000	9,000	15,000	85,000	668,000

Source: Economic survey 2002

The fall resulted from automation, phasing out of both analogue and manual exchange in network. Cellular mobile phones since introduction in the country in 1993 rose steadily

from 1162 to 2727 in 1996 at an annual growth of 33.7 percent following a drastic drop in their connection and handset price. Introduction of independent mobile telephone service provider, in 1997, saw the growth rate of subscription increase to approximately 668,000 in 2001. The increase in subscription was high despite the high price of calling using the cellular phones. Which runs up to five multiples of landline (fixed) telephone.

The inability of Telkom Kenya Limited to meet the customers demand on fixed telephone services, through poor services reflected on delay in connection, loss of telephone cables and insensitivity of customers needs led to accelerated growth demand of cellular phones connections according to Communication Commission of Kenya (2001). The government projection is to improve telephone penetration in rural areas from the 4 lines to 20 lines per 100 people by the year 2015, so as to meet the increased demand for telephone services. For this to happen, the government is expected to improve the service provision through privatization of Telkom and introduce an even level playing ground for competitors.

1.2 Statement of the problem

The demand for mobile phone services has been an upward trend as indicated by the ever-increasing number of subscribers. Although the total demand is noted to be on the increase, the mobile phone services are available through different service providers and tariff regimes based on different prices per unit of airtime. This is notwithstanding the factors determining the consumer's choices of different tariffs within the two mobile service providers are not apparent, while price and income among other factors theoretically determine the different choices of tariffs. Their influence on demand for the different providers and tariff regimes has not been empirically established in Kenya.

The study therefore attempts to establish the factors that determine demand for the different service providers and tariff regimes of mobile telephone services.

1.3 Objectives

The general objective is to establish the factors that determine the demand for the choice of different mobile telephone providers and their tariffs of mobile telephone services.

The specific objectives are

a) Identify the factors that influence the choices of the different providers and respective tariffs.

b) To find the significance of the factors in determining action of the different choices of providers and respective tariffs.

c) To make recommendation based on (a) and (b) above

1.4 Significance of the Study

The provision of suitable telecommunication services constitutes a prerequisite for rural economic development. The existing facilities need to be designed to facilitate adequate interaction between producers and customers. A study on demand for mobile telephone tariff services and other services will provide a framework for sound telecommunication policies, which would guide in promoting rural economy.

The policy would also guide the evolution of efficient and effective rural and urban telephone communication system in Kenya.

The study may also provide the service providers with information on how to improve the service delivery and future projections in terms of marketing and sales.

1.5 Telecommunication Network and development in Kiambu District.

According to Republic of Kenya (1997b), Kiambu District has 5 administrative divisions, 22 locations and 90 sub locations. The population according to 1999 census stands at 744,010 with a population density of 562 persons per km^2. Kiambu is predominantly an agricultural area with 97 percent of its land being arable. Due to favorable climate the District engages in growing both cash crops and food crops. The District's close proximity to the city of Nairobi, has led to industrialization, commercial trade and services, which has promoted cash economy and high level of interaction necessitating good transport and communication network.

The District is well served with telecommunication services, as the divisional heads are served with landline (fixed) telephones. Telephone exchange centers has been installed using modern telephone exchange systems, mobile telephone boosters for both mobile cellular telephone providers (Safaricom and Kencell) have been installed at various strategic places all over the District to enhance the signal reception and accessibility of the mobile telephones. However the District has reported that most of the telephone cables have been vandalized making the existing landline telephone non - functional. Stealing of telephone cables and handsets from the public telephone booths have been rampant, probably making the residents opt to use mobile telephones which are less vulnerable to vandalism.

1.6 Choice of the Study Area

Kiambu District was taken as a study area on the following accounts:

(a) Kiambu District is well supplied with adequate telephone exchange centers and boosters for improving signals for both mobile telephone networks and landline telephone network.

(b) Due to its endowment with many resources and high level of economical activities, it provides a reason for people to have a need for telephone services.

(c) The District is made up of both rural and urban settings making it an important case study, to represent an ideal situation to provide a recommendation for policy formulation.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Presented in this section is the literature review divided into two sections, general literature and literature specific to Kenya.

2.2 General Literatures

Rogati et al (1997) investigated the demand for residential phone lines under options for rural telecommunications development. The focus of the study revolved around implications of the various sector's models on rural telecommunication technology, cost trends, pricing and tariff. Setting option on how they apply to different demand or supply situation commercial viability and revenue generation potential. Wide range of desk methods were used in the study. However, the researchers have failed to name them. Useful case studies were collected from more than 30 countries mostly developing countries. They developed a model that assists planners to estimate the minimum number of lines, which are commercially feasible per community or population catchments area.

The model is based on estimates of rural per capita income and the cost of supply. Their research found out that, the number of lines deployed per community will depend on its population, economic activity and level of development, regional administrative importance, aggregate income level.

However, the service according to them is still not commercially viable in various large areas and localities and thus should be subsidized from more lucrative parts of the network.

According to Saunders R. J et.al (1994), on micro economic aspect of telecommunication, the identification and measurement of economic benefits relative to the cost of proposed telecommunication project requires, observation on how many subscribers and callers actually spend or are willing to spend to have access to and use telecommunication. The assumptions underlying their study were that decision makers i.e. individuals, households, firms and government agencies are rational and understands themselves better than outside planners. Their findings indicated that concept of consumers' surplus closely related to the concept of downward sloping demand curves. Therefore, since telephone calls are usually fixed the consumer pays the same productive process that is a factor of production. The analysis indicated that telephone density tend to increase faster than gross domestic product (GDP) per capita. These studies have however failed to show reasons for their higher growth in GDP per capita.

Mc Namara JR (1991) investigated market structure and technological advances in telecommunication industry, under the effect of regulatory practice on rate of technological innovation in telecommunication and economic consequences of advancing technology. The study observed that the nature of services offered by a modern telecommunication company must be considered to gain an understanding of the effects of price and other variables on the demands for the service. The study has highlighted various telephone services commonly provided. Which include, access and telephone network on demand, use of the system while in communication with other party, the

option to access any other subscriber including for example health and public safety organizations and services for recreational opportunities and information services. Telephone usage is further classified as residential (leisure) and business usage. The research findings indicate that the amount of each of the given services useful by an individual depends on prices charged for services, the income of the individual, the prices of complement and or substitute communication services and the tastes of the individual. Which are heavily influenced by employment, age and family status.

Further research by Mc Namara through empirical studies showed that price elasticities of demand for residential access were quite small for United States, price elasticity's for access appears to increase as income decreases. The study is credited for shedding light on factors determining demand for telephone services but has failed to provide the model used in conducting such an empirical study. The study however sheds light on the factors that affect other types of telephone demand mobile telephone inclusive.

Guldman J. M (2000) conducted a study on spatial interaction models of international telecommunication flows. The objectives of the study were to analyze the role of economic demographic factor in determining the volume and partial distribution of international telephone flows.

The result after analysis of data collected underscored the critical role of a country's level of telecommunication equipment size of the business sector, exports and imports, and tourist attraction. The importance of distance contiguity, commonalities in language and religion was confirmed. However, the study was not exhaustive as the research recommends further research, which would include other explanatory variables.

The study sheds light on role of telecommunication at international level, as this happens to be a summation of the local roles of telecommunication.

Vordinger W (1986) observes that several studies have shown that even the most remote underdeveloped areas derived high benefits on call-by-call bases. The study notes that benefits derived by rural users were higher than those in urban areas and that they typically increase with the distance and allow income state of society benefit too. Even though the average user may make only few calls per year. There may be always few users who could justify the cost of renting their own line even though high utility is derived from infrequent calls made. In Senegal 34 percent of calls made involved financial transactions and 37 percent involved urgent personal matters. These results have been repeated elsewhere. The conclusion was that distance traveled to make a telephone call is insignificant to rural users. The study shows the importance of the telephone.

Bjorn W. G (1996) assessed telecom sector reform phase 1 of 1989-1994 of telecommunication in Mexico. The objective of the study was to access the impact of telecom sector reform phase 1 in Mexico. The observation was that the program had bold initiatives, which included, liberalization of the market for value added terminal equipment private and mobile telephones. The center piece of the initial reforms was privatization of telemex designed to among other things providing investment funds for building out network and resolve backlog of service application of over 15million. The results of privatization resorted to high growth. The number of rural communities with telephone services was more than doubled to 2300, so that as per the concessions all the communities with more than 500 people has some services by 1994, payphone telephones increased from 83,000 in 1990 to rise for both main telephone lines and cellular phones

but the rate of increase in demand for mobile was higher than main lines. The research never investigated further the reasons for such an increase but they associated it with reforms put in place by the Mexico government.

According to Ambrose W. et. al (1990), perhaps the fastest growing service sector between developing and industrializing countries is mobile telephone. The observation was that cellular phone and paging networks are proliferating at rapid rate in many countries due to private sector involvement. The argument of the research is that advantages offered by cellular and paging systems are two fold. First they provide a new service in the form of mobile telephone, which adds to the range of communication services available in the country. Second, perhaps the most important is cost-efficient way of basic communications infrastructure. Other advantages include low infrastructure requirements; its connection is instant compared with telephone lines that last months or years. However, cellular tariffs are typically higher than standard telephones rates by multiples of two or three although this again depends on the regulatory structure of the economy in their research. They only evaluated the importance of telephone communications and more specifically lines with view to support privatization of the telecommunication sector.

Wellenius B. (1996), investigated demand for mobile telephone services in Mexico. The objective of the study was to provide information about growth of cellular phones as compared to main telephone lines. The research findings indicate that in Long run more people will have subscribed to cellular phones than the main telephone line. This is attributed to increased mobility of people and easier access to them. However,

there is need for faster development of network resources, higher quality services, reduced cost and lower prices.

Hamilton J. (2001) conducted a research on whether mainlines and mobile phones are substitute or compliments? The findings of the research were: Use of prepaid card of mobile users also supports the view that mobile is substitute for main lines; The increased supply of cellular services allows an alternative to fixed telephone; Just like users in developed countries, some people in developing area are attracted to mobile not because there are no alternatives but because of convenience of mobile phones.

In the research ,panel data estimation techniques were used to analyze the impact of mobile competition on mainline access. The model estimation pooled data from 1985 to 1997. The model used fixed effects which assumed that countries in the sample each had characteristics that were unique and do not change over time. These differences were captured in the constant term. The result of the analysis indicated that cellular subscriptions play a complementary role to fixed telephone lines. The study failed to specify the duration upon which the mobile usage will be a substitution effect from complementary effects. The study gives direction on the various factors that determine demand for mobile telephones by citing accessibility and convenience.

The African Telecommunication Union (2001), has attributed Africa's poor telecommunication infrastructure to huge penetration of demand for telephone services, demand that suppliers of new wireless phones are rushing to meet. This had led most of African countries to adopt the policy of liberalization so as to bring more participants to the sector. There has been attempt to show the extent of demand for mobile telephone services all over Africa but the study doesn't show the causes or factors determining

demand for the same. The study does not account for the reasons why despite the poor state of economy in developing countries, telecommunication sector still competes for funds with agriculture, healthcare, housing and transport as well as being leading contributor to government's revenue.

The International Telecommunications Union (2001) studies in telecommunication on South East Asia, shows that despite financial crisis the sector has moved ahead with fixed telephone networks having an annual growth rate of 19.5 percent from 1991 to 1997, the world fastest growth again from 1997. The fixed telephone subscriber growth dropped sharply after 1997. These resulted to growth of mobile networks with an average rise of 70 percent. The study sees mobile cellular communication as supplement to fixed telephones. In Singapore 51 percent of households had mobile phones even though 98 percent already had fixed telephones. The research concludes that perhaps the biggest factor contributing to wireless phones success is that there were never many fixed lines to begin with, also years of conflict destroying most of the existing fixed network. Another reason could have been government to liberalize the market for verification of the reasons of a research needs to be carried out determines the factors that influence the demand for mobile telephones.

Savage J. S. (2002) did a research on structure of telecom demand. The idea was to present economic models of the demand for local telephone call and demand for Internet services. Both models are derived from the theory of consumer behavior and highlight several features that are peculiar to telecommunications. The model assumptions include; a consumer has purchased access to telephone network prior to use and N notes the total number of subscribes to the network.

The consumer obtains utility (U) from the consumption of two goods: local telephone calls (q_l) and a composite good (x) that represents all other goods in the economy.

The utility increases with the consumption of an additional unit of q_l and x that is

$$\partial U / \partial q_l > 0 \text{ and } \partial U / \partial x > 0.$$

Further the consumer utility increases with addition of other subscribers to the telephone network and $\partial U / \partial N > O$

Accordingly the consumer wants to maximize utility from the consumption of q_l and x subject to meeting her budget constraint.

The maximization problem becomes

$$\text{Max } U(q_l, x, N)$$

$$\text{Subject to } Y - PA = P_l, q_l + P_x x \text{ ---------- 2.1.1}$$

Where Y is consumer income, P_A price of access, and Px is the price of composite good.

Using the langragean multiplier the consumer's constrained utility maximization. The demand function for local telephone calls becomes

$$q_l = f(P_L, Px, N, Y\text{-}PA) \text{ ----------2.1.2}$$

Where f is the general functional relationship between the independent variables (Pl, Px,N,Y-PA) and dependant variable (q_l).

The budget constraint is Y – PA that reflects the condition of purchasing prior access. To the network, and the demand for calls depends on N, which reflects network externality ignoring the theoretical problems with aggregation, can be summed to obtain the market demand of function for local telephones calls

$$\theta_L = F(P_A P_L, Px, N, Y) \text{ ----------(2.1.3)}$$

Where capital denotes the total number of calls that are made by all N subscribers to a network during a given time period and Y is aggregate income.

According to the researcher the demand model presented has come into widespread use in the telephone industry to all telecom managers, to forecast future demand and access the impact of price changes on demand. However, the researcher failed to put into account other shift variable that could be much more significant in projecting the future demand, such as consumer behavior which is ignored.

Asher T. et al (2001), conducted a research for cellular telephones and their use in Israel. The study involved estimating and forecasting the demand for cellular telephones and their use in Israel. The estimate of the consumer's decision on whether to purchase a cellular telephone and what type was obtained by using a discrete choice model of multinomial logit type. The total number of cellular telephone purchases to be made in Israel during the years 1998-2008 was estimated using logistic growth model employing aggregate data over time.

The demand for airtime was based on the actual usage of date on various consumers in the year prior to the survey and the responses of those interviewed in the survey. From the survey it emerged that some 45 percent of the adult Jewish population possessed a mobile cellular telephones at the time of the interview .The mobile telephone users were relatively young: The 18-34 percent year old age group comprised 43 percent of the sample and about 50 percent of the total population of users, whereas the 55 percent and over age group comprised 22 percent of the sample and only 9 percent of the total population of users. Men comprised the larger part of the users .Use of cellular telephones rises a little with level of education .The likelihood of people who do not work

using cellular telephones was low: only 19 percent of this possessed a mobile telephone where as 55 percent of working people had one. However, the survey contained no evidence that possessing is more common among those with higher personal income.

The economic –statistical model for choosing among the different alternatives, including no-purchase alternative, was developed to suit the choice problem facing the home consumer in Israel. Each consumer was offered several alternatives for purchasing a cellular telephone. They included Cellcom, Pelephone and Golden, also the consumers were given a further choice of 3 cellular service alternatives, depending on the amount of cellular telephone usage anticipated. These were: Household alternative aimed at 'light users', with relatively low monthly usage; Business alternative aimed at 'heavy users' who use the telephone Intensively; Leisure alternative aimed at consumers whose monthly usage is expected to be very small. It offers a low monthly charge together with a very low airtime cost during off-peak hours.

The assumption of this study is that a consumer is aware of all the alternatives that will provide him with the maximum utility. The utility of the consumer from the specific alternatives depends on the nature and level of use of the cellular telephones anticipated and characteristics of the consumer. Each consumer in the sample faced the ten alternatives where he/she had to choose one. It was assumed that the utility of the consumer I from the alternative j is as follows:

$$U_{ij} = X_{ij}\, ß_j + e_{ij} \qquad (2.2.1)$$

Where $ß_j$ is a vector that includes K_i fixed parameters that need to be estimated and X_{ij} includes K-variables representing various characteristics of alternatives j and consumer i. e_{ij} denoted a random error.

The study adopted the model of Mc Fadden (1973) and assumed that the random errors e_{ij} are independent and have the same Weibull distribution. This implies that probability of consumer i choosing alternative j is defined as

$$P_{ij} = \exp\ (X_{ij}\, ß_{j)} / \{\sum_k (X_{ik}\, ß_k)\} \qquad (2.2.2)$$

J =0, …, 9 I =1,… 1000.

The probability defines the multinomial logit model to yield

$$\text{Ln}\ (l) = \sum_i \sum_j Y_{ij}\, \text{Ln}\, (P_{ij}) \qquad (2.2.3)$$

Where Y_{ij} =1 if consumer i chooses alternatives j and 0 other wise.

The higher cost was found to contribute to a decrease in demand for more costly alternative. Apart from the cost per minute of airtime in the leisure alternative, the effect of cost variables was significant for Golden. The effects of personal income on the utility consumers derive from the business and household alternative was found to be positive but not significant for leisure alternatives or house hold alternatives offered by Golden. Older consumers were found to prefer a business or household alternative to the leisure alternative.

The study further estimated the penetration of the cellular telephones into the Israeli market. The conclusion was that the economic potential of Israeli's cellular

telephone market is substantial .The problems that the researcher failed to address is sustainability of the forecasts incase of change in future price policy, also in case of reduction in price the researcher failed to explain how the provider will meet the shortfall in terms of the cost of providing the services and also earn profit. Further, the issue of convenience was not addressed in the research.

2.3Review of Literature Specific to Kenya

This section will look at the studies conducted in Kenya concerned with demand for telephone services.

Tyler M. et al (1997), examined challenges of telecommunications in an open economy in Kenya. The concern of the study was to find out the achievements and challenges facing Kenya and the role of communications. The study's conclusion is that challenges facing Kenya include acquiring of quality education, provision of adequate health facilities and citizen's empowerment in terms of information for business development and the rest of the world. The study attributes them to increased demand for telecommunication services in general.

According to I.T.U. (2002), the government policy framework as set out by the government gives emphasis on the supply side without integration and recognition of economic process thereby ignoring the demand side. Since the prices set for acquiring mobile phones are considered unaffordable, the report recommends reduction of operations cost so as the phones can be affordable.

Communication Commission of Kenya (2002), has given details on how the supply of telephone services is covered in the country. It states that telephone service

density (teledensity) stand at about 0.16 fixed lines per 100 people. In terms of telephone penetration factor (percentage of house households / offices with telephone), nationally about 4.2 percent of the households have telephone lines. However, most of the telephones in the urban areas are within offices rather than households.

From the research carried out the only thing that is revealed is drastic growth of demand for telephone services. However, these studies fail to account for the factors determining the demand for telephone both landline and mobile phones, in the country.

CHAPTER THREE

3.0 THEORETICAL FRAMEWORK AND EMPIRICAL MODEL

3.1 Theoretical Framework

Mobile telephone service is a consumer good. As a consumer good, the service help people to be informed, transact business and deliver messages, which would otherwise have caused immense costs. Mobile telephone services are therefore demanded to increase human satisfaction.

The consumer is assumed to derive utility from the use of mobile phone and from consumption of other goods and services. The consumers have the preference for various choices of tariffs. The mobile phone service alternatives available to the household are Safaricom tariffs; Taifa, Tariffic and Jambo while Kencell tariffs are Yes and the Family tariffs.

The demand for the different tariffs is based on the theory of utility. These 5 types of tariffs are the choices available to the consumer. A consumer chooses the tariff that offers the highest utility, where the utility of the consumer i depends on the attributes of the tariff and the provider j, (Z_{ij}) and the attributes of the consumer i, (X_i).

The utility of the individual i, faced with making a discrete choice amongst J tariffs of the two mobile telephone service providers, can be given as

$$U_{ij} = U_{ij}(X_i, Z_{ij}, \Sigma_{ij}) \qquad (3.1)$$

$$i = 1,\ldots, N$$

$$i = 1,\ldots, J, \text{ where } J = 5$$

The U_{ij} is the expected utility of individual i using alternative tariffs j

Σ_{ij} is the error term.

If the tariff k is preferred to tariff m then the utility derived from m is smaller than utility derived from k i.e. see (Mc Fadden 1975). This can be expressed as:

$$U_{ik}\ (X_i, Z_{ik}, \Sigma_{ik}) > U_{im}\ (X_i, Z_{im}, \Sigma_{im}) \qquad (3.2)$$

The utility values are stochastic and the event that $U\ (X_i, Z_{ij}, \Sigma_{ij})$ holds will occur with some probability, so that 3.2 can be transformed to:

$$P_{ik} = \text{Prob}\ (U_{ik}\ (X_i, Z_{ik}, \Sigma_{ik}) > U_{im}\ (X_i, Z_{im}, \Sigma_{im})\} \qquad (3.3)$$

$$J=1,2,3,4,5 \text{ and } j=1,\ldots,k,m,\ldots,J$$

For j number of alternative tariffs where P_{ik} is the probability of choosing k over m

It is also possible to write the stochastic probability as $U_{ij}(X_i, Z_{ij}, \Sigma_{ij})$ into non-stochastic and stochastic component as follows:

$$U\ (X_i, Z_{ij}, \Sigma_{ij}) = \underbrace{V\ (X_i, Z_{ij})}_{\text{Non-stochastic}} + \underbrace{\Omega(X_i, Z_{ij})}_{\text{Stochastic}} \qquad (3.4)$$

Substituting 3.4 into 3.3 gives:

$$P_{ik} = \text{Prob}\ [V\ (X_i, Z_{im}) - V\ (X_i, Z_{ik}) < \eta\ (X_i, Z_{ik}) - \eta\ (X_i, Z_{im})]$$

$$= \text{Prob}\ [V\ (X_i, Z_{im}) - \eta\ (X_i, Z_{ik}) < V(X_i, Z_{ik}) - \eta\ (X_i, Z_{im}) \qquad (3.5)$$

Which is also same as

$$P_{ik} = \text{Prob}\ [\eta\ (X_i, Z_{im}) - \eta\ (X_i, Z_{ik}) < V(X_i, Z_{ik}) + V\ (X_i, Z_{im})] \qquad (3.6)$$

$j = 1, \ldots,k,m,\ldots J$ and $J = 5$ where $k \neq m$

Let $\theta'\ (t_1, \ldots, t_J)$ denote the cumulative joint distribution function of

$$[\eta\ (X_i, Z_{i1}), \eta\ (X_i, Z_{i2}), \ldots, \eta\ (X_{ij}, Z_{iJ})] \qquad (3.7)$$

Let the first derivation of cumulative joint distribution function w.r.t the k^{th} argument be θ' and let $V_j = V\ (X_i, Z_{ij})$ then; (see, McFadden, 1975, p.52)

Equation 3.6 becomes

$$P_{ik} = \int_{-\infty}^{\infty} \theta_k (t + V_k - V_1, t + Vk - V2, \text{----------} t + Vk - VJ)\, dt \qquad (3.8)$$

Depending on the unknown parameters of the distribution of V_j the probabilities can be obtained for any unspecified joint probability distribution such as normal

In the case of two tariff choices, the choice probability of the first tariff can give from (3.8) as:

$$P_{ik} = \int_{-\infty}^{=\infty} \theta_1 (t + V(X_i, Z_{i1}) - V(X_i, Z_{i2}))\, dt \qquad (3.9)$$

Alternatively, the probability P_{ik} can obtained introducing the cumulative distribution function for $\eta(X_i, Z_{i2}) - \eta(X_i, Z_{i1})$ as:

$$p_{ik} = G(V(X_i, Z_{i1}) - V(X_i, Z_{i2})) \qquad (3.10)$$

The V has the general of:

$$V(X_i, Zij) = W^1(Xi, Zij)\beta_1 + W^2(Xi, Zij)\beta_2 + \ldots + W^J(Xi, Zij)\beta_J = W(Xi, Zij)'\beta \qquad (3.11)$$

Where the $W^j(Xi, Zij)$ are empirical functions with no unknown parameters and β is a vector of a vector of unknown parameters. The $W^1, W^2, \ldots, W^J$ are transformations of both the individual and tariff attributes.

If the distribution of function G is linear over the range of V, the (3.10) and (3.11) yields a linear probability model (McFadden, 1975, p.55):

$$p_{ik} = (W(X_i, Z_{i1}) - W(X_i, Z_{i2}))'\beta = \beta_1 X + \beta_2 Z. \qquad (3.12)$$

Alternatively, the function G may be specified as an Ogive and the commonly used cumulative distribution functions are normal, logistic and Cauchy. The logit distribution for the two-tariff case above yields the probability:

$$p_{ik} = \frac{1}{1+\exp\left[\beta' W(X_i, Z_{i2}) - \beta' W(X_i, Z_{i1})\right]} \tag{3.13}$$

Using the inverse transformations of the logistic distribution, the model can specify as binary logit probability model as:

$$\log\left[\frac{p_1}{1-p_1}\right] = \beta_1 X + \beta_2 Z \tag{3.14}$$

Turning to the multi-choice case of five tariffs, the logistic probability function of choosing tariff k to m can be expressed as (assuming Weibull distributed errors; see McFadden, 1975, pp. 61-71):

$$P_{ik} = \frac{\exp(W(X_i, Z_{ik})\beta}{\sum_{j=1}^{J} \exp(W(X_i, Z_{ij})\beta} \tag{3.15}$$

$$\log\left[\frac{p_{1k}}{1-p_{k1}}\right] = \beta_1 X + \beta_2 Z + \varepsilon$$

Therefore, a multinomial logit model becomes

(3.16)

Where
ε is the disturbance term

X is a matrix of all individual attributes variables.

Z is a matrix of all attributes of the tariff variables.

The consumer chooses the provider and tariffs, which brings the maximum utility.

Where $C = P_{1k}/(1-P_{1k})$ is the choice of a specific provider or tariff.

A is the level of consumption of other services related to mobile phones

The function is represented as:

$U = U(C, A)$ (3.16)

The consumer's utility maximization problem can be stated as:

$$\text{Max } U = U(C, A)$$

$$\text{s.t. } P_1C + P_2A = Y \qquad (3.17)$$

Where

P_1 is the price of mobile telephone services.

P_2 is the price of the other related telephone service providers.

Y is the individual income.

A langrangian function is formed to solve the utility maximization problem. Its first order conditions are solved to yield:

$$C = C(P_1, P_2, Y) \qquad (3.18)$$

$$A = A(P_1, P_2, Y) \qquad (3.19)$$

Hence C is the demand for the choice of a provider or a tariff. The study postulates a relationship between the choice of a provider or a tariff and the determinants.

The demand (C) is determined by consumer's attributes (X_i) and the attributes of the tariff (Z_{ij}).

Where

Xi are explanatory consumers variables.

$i = 1,2,..,\eta$

Where X_1 = is the income of the consumer

X_2 = level of education (E_L)

X_3 = Gender(S)

X_4 = Age of the consumer (A_g)

X_5 = Status symbols (Sq)

X_6 = New technology (N_t)

X_7 = Phone utility (P_u)

X_8= Landline ownership O_L

Z is the explanatory choice of a tariff attributes.

Where Z_1 = price of the mobile phone call per minute per tariff (P_1).

Z_2 = price of the landline telephone call per minute (P_2).

Z_3 = convenience (Cv).

The equation is given as

$$C = f(Y, E_L, S, Ag, Sq, N_t, P_u, O_L, P_1, P_2, Cv) \quad (3.20)$$

3.2 Empirical Model

The model will involve estimation of a logit model as explained and derived in theoretical framework as discussed by (Mc Fadden 1975). A specific dichotomous multinomial logit regression model which, pertain to choices of the consumer of a mobile telephone service provider and tariff alternatives is given as:

$$\text{Logit}(C_n) = \propto_o + \propto_{ni} Vm + \ldots + \propto_{nm} V + \epsilon \quad (3.21)$$

Where, $C_n = P_{1k}/(1-P_{1k})$, $V=V_j (X_i Z_{ij})$. So the functional form is given as $C_n = f(X_i Z_{ij})$

Where, V_j refers to specific explanatory variables, $\propto_n$ refers to the specific outcome of the dependent variable.

Dichotomous logistic regression models are specified for estimating the choice of provider and respective tariffs.

(i) A dichotomous logit model of $C_{T1}=1$, if Kencell is chosen and Cn=o if

otherwise.

$$\text{Logit } (C_{T1}) = \alpha_0 + \alpha_{ni} V_m + \ldots + \alpha_{nm} V_m + \varepsilon \quad (3.22)$$

(ii) A dichotomous logit model of $C_{T2}=1$, if Taifa tariff is chosen, Cn=0 otherwise.

$$\text{Logit } (C_{T2}) = \alpha_0 + \alpha_{ni} V_m + \ldots + \alpha_{nm} V_m + \varepsilon \quad (3.23)$$

(iii) A dichotomous logit model of $C_{T3}=1$, if Tariffic tariff is chosen, Cn=0 otherwise.

$$\text{Logit } (C_{T3}) = \alpha_0 + \alpha_{ni} V_m + \ldots + \alpha_{nm} V_m + \varepsilon \quad (3.24)$$

(iv)A dichotomous logit model of $C_{T4}=1$,if Jambo is chosen, Cn=0 otherwise.

$$\text{Logit } (C_{T4}) = \alpha_0 + \alpha_{ni} V_m + \ldots + \alpha_{nm} V_m + \varepsilon \quad (3.25)$$

(v) A dichotomous logit model of $C_{T5}=1$,if Family is chosen, Cn=0 otherwise.

$$\text{Logit } (C_{T5}) = \alpha_0 + \alpha_{ni} V_m + \ldots + \alpha_{nm} V_m + \varepsilon \quad (3.26)$$

(vi) A dichotomous logit model of $C_{T6}=1$,if Yes is chosen, Cn=0 otherwise.

$$\text{Logit } (C_{T6}) = \alpha_0 + \alpha_{ni} V_m + \ldots + \alpha_{nm} V_m + \varepsilon \quad (3.27)$$

X_i are the explanatory consumer variables i = 1,2, ...9 and Z_j, the explanatory tariff choice variables j = 1 ...6 as explained earlier. $\propto$ are the parameters to be estimated showing the probability that Cn will be chosen or not. The function estimates the probability that a given tariff is chosen.

A logit model is based on the cumulative logistic probability function. Logit Cn is the logarithm of the odds ratio, and linear in X_i and Z_{ij}. It is the dependent

variable and is the logarithm of the odds that a particular choice was made. The co efficient thus obtained would measure the change in the log of the odds choosing a tariff as a result of a unit change in the consumer X_i, and choice attributes (Z_{ij}).

3.3 Description and measurement of variables

Choice of mobile tariff (C)

This is the dependent variable. It is a measure of demand for the choice of mobile telephone service provider and the tariffs of mobile telephone services measured by the probability that, a service provider and a tariff are chosen. Six dummies are introduced: C_{T1}= 1 if Kencell is chosen, 0 otherwise. C_{T2}= 1 if the Taifa tariff is chosen, 0 otherwise. C_{T3}=1 if Tariffic tariff, 0 otherwise C_{T4}= 1 if Jambo tariff is chosen, 0 otherwise. C_{T5}=1 if Family tariff, 0 otherwise. C_{T6}=1 if Yes tariff and 0 otherwise.

Price of the mobile telephone service (P_1)

It is the money charged per minute in shillings by the caller using a given tariff .

Price of landline telephone service (P_2)

This is the amount of money paid per minute in shillings by a caller using landline telephone.

Income of the individual (Y)

Is the total earnings of an individual. It is captured by gross pay of the individual.

Level of education (E_L)

This is the highest level of formal education attained by the owner of the mobile phone. Four categories of formal education are recognized: primary education, secondary education, college education and university education. Four dummies are introduced:

E_{L1}=1 if primary education, 0 otherwise; E_{L2}=1if secondary education, 0 otherwise;

E_{L3}=1 if college, 0 otherwise and E_{L4} =1 if university, zero otherwise.

Convenience (Cv)

This is the quality of being useful, easy or suitable to an existing situation.

It will be captured by use of a dummy which is equal to 1 if convenience, Zero otherwise.

Age of the mobile telephone owner (Ag)

Measured in number of years from date of birth

Gender (S)

Captured by a dummy variable that takes the value 1 if male or 0 otherwise

Status symbol (Sq)

This refers to the position an individual is assumed or seen to have acquired in terms of wealth and social status. A dummy variable is used where the value 1 if the phone gives recognized status or 0 otherwise.

New Technology (N_t)

The variable looks at whether the ownership is as a result of desire to be associated with the new technology and use it or not, dummy variable is used with the value 1 if desire is to try the new experience or 0 otherwise.

Phone utility (P_u)

This refers to the use of the phone whether business or social use. This involves use of dummy variable, which takes the value 1 if business, or 0 otherwise.

Landline ownership (O_L)

This refers to whether and individual owns a private fixed line or not. Dummy variable is used where value 1 if a person owns or 0 otherwise.

3.4 Data Source

In order to analyze the determinants of demands for different tariffs of telephone services data on different users of mobile telephone and the explanatory variables were obtained from primary sources. A questionnaire was designed and administered to individuals.

3.5 Sampling Procedure and Data Collection

Kiambu district has 5 divisions and 22 locations. Random sampling was used to select 3 out of the 5 divisions. A cluster sampling procedure was used to select 2 locations in each of the divisions. The sub locations were purposively selected to fall into areas where there are both business centers and various institutions. Civil servants, teachers and businesspersons were purposely selected since it is easier to get valid information in various levels of incomes. A sample size of 100 was chosen.

The researcher with the help of a few assistants moved from one sub location to another, to institutions, administration offices and business premises. People found were issued with a copy of questionnaire and filled on the spot.

3.6 Data analysis

Regression analysis was employed where the choice of providers and tariffs were considered as the dependent variables. E-views as a computer package was used to carry out the analysis. Econometric problems that arose were solved to pave way for interpretation of results.

CHAPTER FOUR

4.0 DATA ANALYSIS AND INTERPRETATION.

4.1 Descriptive statistics.

In this section, the characteristics of the sample are presented.

Price of the mobile telephone service (P_1)

Table 4.1

Telephone call price (shs)	No. of callers	Percentage
10.00	9	10
10.50	30	33.33
15.00	16	17.78
15.75	11	12.22
28.00	24	26.67
Mean=16.55 maximum price=28.00 range=18 median=15.00 minimum=10.00 mode=10.50		

From the above the highest number (33.33 percent) of the callers paid Kshs.10.50 per minute, while only 9 percent of callers paid Kshs. 10.00 per minute. This is an indication that more people out of the sample have subscribed to the Safaricom Tariffic tariff. While the smallest number having subscribed to the Kencell Family tariff.

Landline ownership (O_L)

Table 4.2

Ownership	**No. of the respondents**	**Percentage**
Those who own	14	15.56
Those who do not own	76	84.44
Total	90	100

From the table 4.2, 15.56 percent of the respondents owned landline telephones. This percentage is small compared with the number of the respondents who do not own landline. The reasons availed by those who do not own landline telephone are: lack of reliability and delayed installation.

Income of the individual who own mobile telephone (Y)
Table 4.3

Income (Shs.)	No. of the respondents	Percentage
Below 5000	16	17.78
5001-8000	6	6.67
8001-10,000	9	10.00
10,001-15,000	19	21.11
15,001-20,000	7	7.78
20,001-30,000	26	28.89
Above 30,001	7	7.78
Total	90	100
Mean Y=15,111.1 median Y=12,500 mode Y=25,000 maximum Y=35000 minimum Y=0		

Table 4.3 shows that though majority (67.78 percent) of the individuals with mobile phones had an income of between Kshs 10,000- 30,000 per month, there is lack of consistency on ownership of the mobile telephones across the income divide. The implication is that ownership is not the preserve of a particular income group

Level of education (E_L)
Table 4.4

Level	Primary	Secondary	College	University	Total
Number	0	3	37	50	90
Percentage	0.0	3.33	41.11	55.56	100

Table 4.4 shows that majority (55.56 percent) of the mobile telephone holders had attained university education. Out of all the respondent only 3.33 percent had secondary education as the highest level of education. It appeals more to educated, in fact the appeal increases as one's education level improves.

Convenience (C)

From the majority (84.4 percent) of the respondents, the choice of a provider was based on convenience. The provider appeals majority of subscribers because of convenience the service providers' offer.

Age (Ag)

Table 4.5 Individual Age in years.

Age	No. of respondents	Percentage
21-25	15	16.67
26-30	9	10.00
31-35	36	40.00
36-40	16	17.78
41-45	12	13.33
46-50	2	2.22
Total	90	100

From the Table 4.5, 40 percent of mobile phone owners are aged between 31-35 years .The age between 21 –25 and 36-40 years constitutes a percent of 16.67 and 17.78 respectively. Though not consistent 84.45 percent of owners are between 21-40 years. This happens to be the working group. The implication is that majority have the ability to own a mobile telephone and can make choices in reference to usage (whether business use or social use).

Gender (S)

Table 4.6 Gender of the mobile subscriber.

Gender	No. of respondents	Percentage
Male	44	49
Female	46	51
Total	90	100

Out of the 90 respondents interviewed 51 percent were female while 49 percent were male. This is an indication that there is no much difference in usage of mobile telephone in terms of gender.

Status symbol (Sq)

The study shows that 33.3 percent of the respondents chose the mobile telephone provider and various tariffs because they perceived it would make them be associated with a higher social status.

New Technology (N_t)

The study revealed that only 23.33 percent of the respondents owned a mobile telephone, chose a provider and their respective tariffs, just to be associated with new technology. The rest (76.7 percent) were only concerned with the desire to communicate with their friends.

Phone Utility (Pu)

The study revealed that only 17.8 percent of the respondent had subscribed to various tariffs for business use. Majority (82.2 percent) had subscribed to various tariffs only for social use. This is an indication that most of the respondents own phones for purpose of interaction with friends and relatives.

Table 4.7 Reasons for the choice of the tariff.

Provider/reason	Cheap	Popularity	Less congestion	Uniformity in calls	Flexibility
Taifa	12	4	0	8	0
Tariffic	24	4	0	0	2
Jambo	10	0	0	1	0
Family	2	3	4	0	0
Yes	1	6	9	0	0
Total	49	17	13	9	2

The table 4.7 shows that 24 of the respondents who have subscribed to tariffic tariff argued that, it was the cheapest tariff. Popularity and less congestion were the reasons that made respondents to choose Yes tariff. Overall, 49 of the respondent who subscribed to the respective tariff did so because it was the cheapest choice amongst the available tariffs.

4.2 Regression results.

This sub section presents the estimated results using a logit of the model of the individual and provider attributes that are important in explaining the choice of a tariff of mobile telephone. This was to establish the direction and significance of their effects on the choice.

The functional relation ship of the model was given as:

$$Cn = f(V_m) = f(X_i, Z_{ij}) \quad \text{(see equation3.21)}$$

Where X_i are the explanatory consumer attributes.

Z_{ij} are the explanatory choice of the tariff attributes.

V_m refers to explanatory variables.

Cn is the demand for the choice of a provider or a tariff.

Thus,

$C = f(Y, E_L, S\ Ag, Sq, Nt, Pu, OL, P_1, Cv)$

Where

Y is the income of the individual

E_L level of Education

S Gender of the subscriber

Ag age of the subscriber

Sq status quo

Nt New Technology

Pu phone utility

O_L Landline ownership

P1 price of the mobile telephone call per minute

Cv convenience

Being a dichotomous function as indicated in equation (3.21), the regression concern is not the value of the coefficients but the sign and the significance of the coefficients. Six models were estimated and only two models gave consistent results. The models indicating the choice of various tariffs were dropped because the respondents were not well informed about various choices within different service providers. The two models thus estimated include:

(1) The choice of the provider where 1=Kencell and 0 otherwise.

(2) The choice between a tariff with a monthly deposit fee and those tariffs without a monthly deposit fee. Where 1= Tariff with deposit (Jambo), 0 otherwise.

Demand for the choice of provider of mobile telephones services in Kiambu District

Dependent variable: 1 if kencell

0 Otherwise

N= total observations =90.

Mc-Fadden R-squared 0.204777

$$\text{Logit}(C_{T1}) = 0.607376 - 0.022699Ag + 2.46E\text{-}05Y + 0.756489S + 1.521128Nt -$$
$$(0.256542)\quad (-0.468109)\quad (0.650951)\quad (1.222162)^{*}\quad (2.014551)^{**}$$

$$0.835955Sq - 0.65453P_1 - 0.141496E_{L3} - 1.658625\,E_{L4} + 1.204940\,O_L -$$
$$(-1.24599)^{*}\quad (-2.859103)^{**}\quad (-0.090460)\quad (0.939585)\quad (1.503875)^{*}$$

$$0.87231Pu + 0.566588\,E_{L2} + 1.974553Cv$$
$$(-0.97708)\quad (0.257504)\quad (2.087749)^{**}$$

Note * represents significance at 1 percent and ** represent significance at 5percent.
The values in the parentheses are the Z-statistics

Demand for Tariff with a monthly Deposit fee (Jambo) of mobile telephones services in Kiambu District.

Dependent variable: 1 if Jambo

0 Otherwise

N= total observations =90.

Mc-Fadden R-squared= 0.694374

$$\text{Logit}(C_{T3}) = -11.67589 + 0.161814Ag - 0.000135Y + 1.308742S + 6.588403Pu +$$
$$(-0.781358)\ \ (0.967830)^*\ \ (-1.467000)^*\ \ (0.706324)\ \ (2.897786)^{**}$$

$$2.451565O_L - 2.232080Nt + 0.519653Sq + 1.836705E_{L2} +$$
$$(1.670873)^*\ \ \ (-1.332016)^*\ \ \ (0.385001)\ \ (0.135959)$$

$$1.280728E_{L3} + 3.131307E_{L4} - 0.804219Cv - 0.019065P_1$$
$$(0.095674)\ \ \ (0.231783)\ \ \ (-0.428170)\ \ (-0.155169)$$

Note * represent significance at 1 percent and ** represents significance at 5 percent.
The values in the parentheses are the Z-statistics

Table 4. Correlation Matrix

	Ag	Cv	El2	El3	El4	Nt	Ol	P1	Pu	Sq	S	Y
Ag	1.00											
Cv	0.12	1.00										
El2	-0.14	-0.26	1.00									
El3	-0.03	-0.07	-0.15	1.00								
El4	0.06	0.17	-0.21	-0.89	1.00							
Nt	-0.03	-0.13	0.04	-0.14	0.18	1.00						
Ol	0.25	-0.07	-0.08	0.01	0.07	0.85	1.00					
P1	0.18	0.23	-0.07	0.06	-0.03	-0.06	0.02	1.00				
Pu	-0.04	-0.20	0.39	-0.09	-0.05	-0.08	-0.20	-0.07	1.00			
Sq	0.03	0.11	-2.0E5	-0.11	0.15	0.39	-0.04	-0.09	0.04	1.00		
S	0.16	-0.13	0.18	0.13	-0.24	0.06	0.00	-0.13	0.24	0.02	1.00	
Y	0.36	0.02	-0.17	-0.50	0.61	0.13	0.17	0.11	-0.12	0.12	-0.21	1.00

4.3 Interpretation of the regression results.

Introduction

From the sample, a total of 90 cases were included in the analysis. Six equations were estimated through a dichotomous logit model. However four of the equations gave inconsistent results, which was attributed to the respondents not being informed of the existing tariffs and their benefits. The inconsistency would be eliminated if the study was probably carried out after a period of time so that people would by then have known the operations of various tariffs in different mobile service providers. The Mc-Fadden R-squared shows the percentage of variation explained in the dependent variable.

Experience from past research has shown that a Mc- Fadden R-squared of above 20 percent indicates a strong relationship between the independent and dependent variables. (Shem 2002 p.133). The research confirmed that the expected signs were obtained except for income of the mobile subscriber, which was negative contrary to the expectation. The age of the subscriber was also expected to be significant but the research confirmed otherwise. However, the expected signs were obtained for both equations estimated. Phone utility, price of the mobile telephone call and convenience were significant variables at five percent level of significance. Landline Ownership, status quo and Gender of the subscriber were found to be significant at one percent level of significance. The rest of the variables were found to be insignificant in the model estimating the demand for the choice of various mobile telephone service providers.

The choice of a tariff that involved a monthly deposit model revealed that at five percent level of significance; only phone utility, as a variable was significant. Income of

the subscriber, Landline ownership, New Technology and price of the mobile telephone call were significant at one percent. The rest of the variables were found to be insignificant.

Convenience (Cv)

Convenience was found to be a significant factor in determining the demand for the choice of a provider. The positive sign implied that there was a tendency to prefer Kencell for purposes of convenience. The explanation was that many of those who chose Kencell did it so that they could communicate for social reasons without failure due congestion and collapsed lines.

The second equation estimating the demand for the choice of a tariff regime revealed that, convenience was negatively related but not significant. Though not significant the implication is that there was tendency for a subscriber to shift to other tariffs that do not have a monthly deposit for the purposes of convenience.

Age (Ag)

The age of the subscriber was found to be insignificant however it showed a negative relationship. This means that as age increase there is a tendency for the subscriber to choose another provider other than Kencell .The reason associated with it is that as age increase there is need for communication for business purposes rather than social reasons which is consistent with Kencell service provider.

The equation estimating the choice of a tariff regime showed a positive sign that was also significant. This implies that, as age increase there is a tendency for subscribers to shift from a tariff with a monthly deposit fee to other alternatives, which don't require any monthly deposit fee.

Income of the mobile telephone owner (Y)

Income of the subscriber was found to be significant at one percent level of significance but negatively related to the choice of the tariff that requires a monthly deposit fee contrary to the expected outcome. The implication is that as the level of income increases the tariff becomes unpopular and people tend to shift to the tariffs without a monthly deposit fee.

Income was found to be insignificant but positive, in the equation estimating the demand for the choice of provider. This implies that as income increase people tend to prefer Kencell.

Price of mobile telephone call (P_1)

The price of mobile telephone call was found to be significant at five percent and negatively related with the demand for the choice of a provider. This was in conformity with the expectation that as prices increases the demand for a good or a service decreases. The implication is that as the price increases there is a tendency for a shift from Kencell to the other service provider.

The price of mobile telephone call was found to be negatively related with demand for the choice of a tariff regime. However the price was insignificant, the implication though insignificant shows that as the price mobile telephone call increases subscribers tend to shift to other tariffs.

Gender (S)

The gender was found to be significant and positive at one percent. This means that females prefer Kencell to the other provider. This is basically identified for social use since many of them call their friends who are in the same provider's service.

In the estimation of the demand for the choice of a tariff regime, gender was found to be insignificant.

Phone Utility (Pu)

Phone utility was found to be the most significant variable in determining the choice of a tariff between the one with a monthly deposit and the one with no deposit .The level of significance was at five percent and positively related .The implication is that there is a tendency to prefer a tariff without a monthly deposit since it is flexible to make telephone calls to any line at lower cost.

Phone utility showed a negative sign however; it was found to be insignificant as a determinant for the choice of the service providers of mobile telephones.

New Technology (Nt)

The desire to be associated with the new technology was found to be a significant determinant for the provider of mobile telephone services at five percent. The positive sign indicated that subscription to Kencell was as result of desire to be associated with new technology.

For the choice of a tariff with a monthly deposit: the sign was negative and significant at one percent. This implies that a tariff without monthly fee is preferred as a means of acquiring a new status.

Landline Ownership (O_L)

The ownership of the landline telephone was found to be significant and positive at one percent level of significance for both equations estimated. This means that ownership of mobile telephone and landline are compliments and not substitutes.

Other variables

The level of education and status quo were found to be insignificant. The level of education tarried with the age of the subscribers implying that higher age and education tends to make people use mobile telephones for business rather than social reasons.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS.

This section provides the summary of the results and highlights the possible policy recommendation.

5.1 Summary.

The descriptive statistics showed that more people out the sample have subscribed to the Safaricom Tariffic tariff and in general majority chose Safaricom as a service provider. The percentage of the respondents who own landlines and mobile telephones is small when compared to the number of the respondents who own mobile telephones only.

The study revealed that there lacked consistency in ownership of the mobile telephones across the income divide. The majority of the subscribers owned mobile telephones for convenience purposes. Appeal for mobile telephones increase with one's level of education and age. This group happens to be in the working class.

The gender of the mobile telephone subscribers indicated that there was no much difference in usage of mobile telephone in terms of gender. Only 33.3 percent of the subscribers chose a given provider because it was associated with a higher social status. In reference to desire to be associated with new technology, only 23,3 percent owned mobile telephone, just to be associated with new technology.

Most of the subscribers owned mobile telephones for the purposes of interactions with friends and relatives. Overall, 49 of the respondents which is over 50 percent chose a particular tariff because, in their opinion it was the cheapest choice available amongst the tariffs

In regression analysis the significant determinants of the demand for the choice of a provider and tariffs wereprice of the respective tariff calls, level of income of the individual, convenience, age, desire to be associated with new technology, gender, phone utility and landline ownership. However the most significant determinants of demand for the choice of a provider are convenience and price.

The study revealed that price was negatively related to the demand for the choice of a provider and the choice of tariffs within the providers. The implication was that as prices increases, people tend to shift to the other provider (Safaricom) and other tariffs without monthly deposit. The explanation is that they are cheaper or they would make subscribers derive more utility from them.

The significance of convenience implied that subscribers chose a provider that will offer services they desired. These services are: Easy accessibility, flexibility when one calls different lines and ability to play a complimentary role to landline telephones.

Phone utility and desire to be associated with the new technology are significant and positively related to the general demand for the choice of a provider. Income and landline ownership are significant and negatively related to the general demand for the choice of a tariff with a monthly deposit. Gender of the subscriber was significant at one percent and positively related to the demand for mobile telephone service providers and the choice of tariffs in reference to deposit and non-deposit tariffs. Level of education and the age of the subscriber were insignificant and negatively related to the demand for the choice of various tariffs and mobile phone service providers.

The model estimated for the determinants of demand for the choice of a mobile telephone service provider showed a Mc-Fadden R-squared greater than 20 percent,

which implies that the model explains over 20 percent of variation in the dependent variable. The model for estimating the determinants of demand for choice of various tariffs in reference to monthly deposit and non-deposit tariffs had a Mc Fadden R-squared of more than 69percent, implying that over 69 percent of the model explains the variations in the dependent variable.

5.2 Conclusion

There is lack of consistency on ownership of the mobile telephones across the income divide. Hence, ownership is not the preserve of a particular income group .How ever the owner ship of mobile telephones is more popular with the earning group. As the level of education improves the appeal to own a mobile telephone increases.

The choices of different service providers are based on convenience, flexibility of the tariffs and price of the mobile telephone call. The choice of a tariff based on deposit is determined by: Income, use of the mobile telephone (social or business) and ownership of landline (fixed) telephone .The conclusion is that mobile telephones are compliments of landline telephones rather than substitutes and people subscribe to mobile telephone service providers for convenience.

5.3 Policy Recommendations

From research findings, telephone services are increasingly becoming essential services in the society. This is shown by the increasing demand for more telephone services. A lot of emphasis has been put on increasing the number of telephone providers. This include introduction of different mobile telephone providers and different tariffs. The following policy recommendations are thus made:

(i) The fact that price is a significant factor in determining the choice of a provider, the government should subsidize the service providers so that the prices can be reduced so as to attract more subscribers and retain the existing ones.

(ii) The inference is that, better incomes reflect increase in ownership of mobile telephone. The government should focus on the increase of incomes to encourage more to subscribe to the current service providers

(iii) Since majority own mobile telephones for social use, improvement of service delivery by providers even to rural areas should be made through installation of boosters to enhance reception.

(iv) The research reveals that mobile telephones and landlines are compliments. Therefore, there is need to improve and expand service delivery for landline telephone service so that they become perfect compliments.

5.4 Limitations of the study/areas for further research

(i) The study only covered those individuals found in institutions, business premises and hospitals. There are other areas in the rural areas such as those in farms and in homes who could have provided more information.

(ii) The study concentrated on the demand for choice of mobile telephone service providers and different tariffs based on deposit vs non-deposit. Another study can be carried out to determine the factors that influence demand for mobile phone handsets, choice on the basis of per minute call or per second call .

(iii) The study failed to gather information on the price of the handsets and cost of charging the mobile phone batteries. Another study could be carried out to assess the effect of the two variables.

(iv) A similar study should be carried out in other districts to find out if the findings are consistent.

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Appendix I

QUESTIONNAIRE

The main objective of this study is to analyze the factors that determine the demand for different tariffs of mobile telephone services in Kiambu District. This leads to the award of masters of Arts Degree (Kenyatta University).

Your participation is highly appreciated, as it will also contribute towards suggesting the policies on how to improve provision of telephone services in Kenya in general
These questions are addressed (with help of an interviewer) to persons found in institutions and premises. Any information you give will be treated with utmost confidentiality

To fill in the form tick as appropriate or give reasons where asked

PART 1

1. Gender a) male[ ] b) female [ ]

2. Age a) 15 – 19[ ] b) 20 – 25[ ] c) 26 – 35[ ]
d) 36 – 45[ ] e) 45 & above[ ]

PART 2

3. Did you attend school? a) Yes [ ] b) No [ ]

4. If yes to (3) above what is the highest level of education attained?

a) Primary[ ] b) Secondary[ ] c) College[ ] d) University [ ]

PART 3.

5. Please specify which type of telephone you use.
   a) Landline Fixed Telephone [ ]
   b) Mobile Telephone [ ]
   c) Both [ ]

6. Which of the following types of telephones do you own?
   a) Landline Fixed Telephone [ ]
   b) Mobile Telephone [ ]
   c) Both [ ]

7. What are the reasons why you own a landline telephone ?

a) _____
b) _____
c) _____
d) _____

8. What are the reasons why you **do not** own a landline telephone?
a) _____
b) _____
c) _____
d) _____

9. Indicate the reason(s) out of the following that made you own a mobile telephone.

a) Prestige [ ]
b) Business Use [ ]
c) Desire to be associated with the new technology [ ]
d) Convenience [ ]
e) Social/personal use [ ]

10) Would you say that the ownership of a mobile phone is associated with whatever position you hold in the society. a) Yes [ ] b)No [ ]

11. Currently there are two mobile telephone service providers; Kencell Limited and Safaricom limited .Of the two, which have you, subscribed to?

a) Kencell [ ]
b) Safaricom [ ]
c) Both [ ]

12. Please give reasons for (No. 11)
a) _____
b) _____
c) _____
d) _____

13. If you have subscribed to Kencell, which of the two tariffs have you subscribed to
   a) Family Tariff (Charges Kshs.10 per minute per call to one member of the family in the same tariff.)[ ]
   b) Yes Tariff (Charges Kshs.15 per minute per call) [ ]

14. If you have subscribed to Safaricom, which of the three tariffs have you subscribed to?
   a) Taifa tariff (Charges Kshs.28 per minute per call). [ ]
   b) Tariffic tariff (Charges Kshs.10 per minute per call during off peak hours (after 8pm to 6am and weekends)). [ ]

c) Jambo tariff (Has a monthly charge of Kshs.750 and charges of Kshs. 15 per minute per call). [ ]

15. Highlight 4 most important reasons of choosing the tariff you have subscribed to.

a) _____
b) _____
c) _____
d) _____

PART 4

16. Are you employed? a) Yes[ ] b) No [ ]

17. If yes to No. (16) above in which sector is your occupation?

a) Public Sector [ ]
b) Private Sector [ ]
c) Any other (specify) [ ]

18. On average how much would you say you earn per month. (Gross pay)

a) 1 – 5000 [ ]
b) 5001 - 8000 [ ]
c) 8001 - 10,000 [ ]
d) 10,001 – 15,000 [ ]
e) 15,001 – 20,000 [ ]
f) 20,001- 30,000 [ ]
g) 30,001 and above [ ]

19. If no to (No. 16) above where do you get your finances?

a) Spouse [ ]
b) Parents [ ]
c) Fiancée [ ]
d) Friends [ ]

From (No. 20 – 25) please mark the range of expenditure per month in any of the following:

20. Food a) 1 – 3000 [ ] b) 3001 - 5000 [ ] c) 5001 and above [ ]
21. Education a) 1 – 3000 [ ] b) 3001 - 5000 [ ] c) 5001 and above [ ]
22. Clothing a) 1 – 3000 [ ] b) 3001 - 5000 [ ] c) 5001 and above [ ]

23. Health a) 1 – 3000 [ ] b) 3001 - 5000 [ ] c) 5001 and above [ ]
24. Transport a) 1 – 3000 [ ] b) 3001 - 5000 [ ] c) 5001 and above [ ]
25. Telephones a) 1 – 3000 [ ] b) 3001 - 5000 [ ] c) 5001 and above [ ]

PART 5

26. For how long have you been using mobile telephone service?

a) 0 – 6 months [ ]
b) 6 – 12 months [ ]
c) 12 - 18 months [ ]
d) 18 - 24 months [ ]
e) 24 and above [ ]

27. Are you satisfied with mobile telephone services

a) Yes [ ]
b) No [ ]

28. If No to No. 27. What particular aspect don't you like?

a) _____
b) _____
c) _____
d) _____

29. What do you suggest should be done to improve the services?

a) _____
b) _____
c) _____
d) _____

Thank you.

Appendix II

Summary of raw data

Observation	P1	P2	Y	EL1=P	EL2=S	EL3=C	EL4=U	Cv
1	10.00	2.00	2,500.00	0	0	1	0	1
2	15.00	2.00	2,500.00	0	0	1	0	1
3	15.00	2.00	2,500.00	0	0	1	0	1
4	28.00	2.00	2,500.00	0	0	1	0	1
5	15.75	2.00	2,500.00	0	0	1	0	1
6	10.50	2.00	2,500.00	0	0	1	0	1
7	28.00	2.00	9,000.00	0	0	1	0	1
8	28.00	2.00	12,500.00	0	0	1	0	1
9	28.00	2.00	12,500.00	0	0	1	0	1
10	10.50	2.00	9,000.00	0	0	1	0	1
11	15.00	2.00	17,500.00	0	0	1	0	1
12	15.75	2.00	6,500.00	0	1	0	0	0
13	10.50	2.00	17,500.00	0	0	0	1	1
14	28.00	2.00	6,500.00	0	0	1	0	1
15	15.75	2.00	6,500.00	0	1	0	0	1
16	15.75	2.00	12,500.00	0	0	0	1	1
17	15.75	2.00	12,500.00	0	0	0	1	1
18	10.50	2.00	9,000.00	0	0	1	0	0
19	15.75	2.00	12,500.00	0	0	1	0	0
20	28.00	2.00	17,500.00	0	0	0	1	1
21	28.00	2.00	2,500.00	0	0	1	0	1
22	10.50	2.00	12,500.00	0	0	1	0	0
23	10.00	2.00	2,500.00	0	1	0	0	0
24	15.00	2.00	25,000.00	0	0	0	1	1
25	15.00	2.00	25,000.00	0	0	0	1	1
26	28.00	2.00	12,500.00	0	0	1	0	1
27	28.00	2.00	6,500.00	0	0	1	0	1
28	28.00	2.00	25,000.00	0	0	0	1	1
29	28.00	2.00	9,000.00	0	0	1	0	1
30	10.50	2.00	25,000.00	0	0	0	1	1
31	10.50	2.00	25,000.00	0	0	0	1	1
32	28.00	2.00	12,500.00	0	0	1	0	1
33	10.50	2.00	25,000.00	0	0	0	1	1
34	10.50	2.00	25,000.00	0	0	0	1	1
35	10.50	2.00	25,000.00	0	0	0	1	1
36	15.75	2.00	25,000.00	0	0	0	1	0
37	10.50	2.00	25,000.00	0	0	0	1	1
38	10.50	2.00	25,000.00	0	0	0	1	0
39	10.50	2.00	25,000.00	0	0	0	1	0
40	10.50	2.00	25,000.00	0	0	0	1	1
41	10.50	2.00	25,000.00	0	0	0	1	1

Continued

Observation	Ag	Sx	Sq	Nt	Pu	OL	Tariff	Reason
1	25	1	0	0	0	0	family	cheap
2	33	1	0	0	0	0	yes	l.congestion
3	28	1	0	0	0	0	yes	l.congestion
4	40	1	0	0	0	0	taifa	cheap
5	42	1	0	0	1	0	jambo	cheap
6	32	0	0	0	0	0	tariffic	cheap
7	44	0	0	0	0	1	taifa	cheap
8	33	0	0	0	0	0	taifa	cheap
9	33	0	0	0	0	0	taifa	cheap
10	40	1	0	0	0	0	tariffic	cheap
11	45	1	0	0	0	0	yes	good network
12	35	1	0	0	1	0	jambo	uniformity
13	40	1	1	0	0	0	tariffic	cheap
14	33	0	0	0	0	0	taifa	cheap
15	25	1	1	0	1	0	jambo	cheap
16	33	1	0	0	1	0	jambo	cheap
17	42	1	0	0	0	1	jambo	cheap
18	33	1	0	0	0	0	tariffic	popularity
19	33	1	1	0	1	0	jambo	cheap
20	44	1	0	0	0	0	taifa	cheap
21	33	1	0	0	0	0	taifa	cheap
22	33	1	0	1	0	0	tariffic	cheap
23	27	1	0	1	1	0	family	popularity
24	30	1	0	0	0	0	yes	good network
25	30	0	0	0	0	0	yes	cheap
26	50	1	0	0	0	1	taifa	accessibility
27	27	0	0	1	0	0	taifa	accessibility
28	33	0	1	0	0	0	taifa	popularity
29	25	1	1	0	0	0	taifa	cheap
30	33	0	1	0	0	0	tariffic	popularity
31	33	1	0	0	0	0	tariffic	cheap
32	40	0	1	0	0	0	taifa	cheap
33	33	0	1	1	0	0	tariffic	cheap
34	40	0	0	0	0	0	tariffic	cheap
35	33	0	1	1	0	0	tariffic	cheap
36	40	1	0	1	1	1	jambo	cheap
37	33	0	0	0	0	0	tariffic	cheap
38	33	0	0	0	0	0	tariffic	cheap
39	33	1	0	0	0	0	tariffic	cheap
40	33	0	0	1	0	0	tariffic	popularity
41	50	1	1	0	0	0	tariffic	limited use

Summary continued

Observation	P1	P2	Y	EL1=P	EL2=S	EL3=C	EL4=U	Cv
42	10.50	2.00	17,500.00	0	0	1	0	1
43	28.00	2.00	25,000.00	0	0	0	1	1
44	10.50	2.00	12,500.00	0	0	0	1	1
45	10.50	2.00	25,000.00	0	0	0	1	0
46	15.00	2.00	6,500.00	0	0	1	0	0
47	15.00	2.00	9,000.00	0	0	1	0	1
48	15.00	2.00	9,000.00	0	0	1	0	1
49	15.00	2.00	9,000.00	0	0	1	0	0
50	15.00	2.00	12,500.00	0	0	0	0	1
51	15.00	2.00	9,000.00	0	0	1	0	1
52	15.00	2.00	12,500.00	0	0	1	0	1
53	15.75	2.00	2,500.00	0	0	1	0	1
54	10.50	2.00	25,000.00	0	0	0	1	1
55	10.50	2.00	0.00	0	0	1	0	1
56	28.00	2.00	25,000.00	0	0	0	1	1
57	15.00	2.00	17,500.00	0	0	0	1	1
58	15.00	2.00	25,000.00	0	0	1	0	1
59	28.00	2.00	17,500.00	0	0	0	1	1
60	28.00	2.00	12,500.00	0	0	0	1	1
61	10.50	2.00	12,500.00	0	0	0	1	1
62	28.00	2.00	9,000.00	0	0	0	1	1
63	28.00	2.00	25,000.00	0	0	0	1	1
64	10.00	2.00	12,500.00	0	0	0	1	1
65	28.00	2.00	25,000.00	0	0	0	1	1
66	10.00	2.00	35,000.00	0	0	0	1	1
67	28.00	2.00	25,000.00	0	0	0	1	1
68	28.00	2.00	35,000.00	0	0	0	1	1
69	15.75	2.00	35,000.00	0	0	0	1	1
70	28.00	2.00	25,000.00	0	0	0	1	1
71	10.00	2.00	25,000.00	0	0	0	1	1
72	28.00	2.00	17,500.00	0	0	0	1	1
73	15.00	2.00	35,000.00	0	0	1	1	1
74	15.00	2.00	25,000.00	0	0	0	1	1
75	28.00	2.00	35,000.00	0	0	0	1	1
76	10.50	2.00	0.00	0	0	0	1	1
77	10.00	2.00	0.00	0	0	0	1	1
78	10.50	2.00	0.00	0	0	0	1	1
79	10.00	2.00	0.00	0	0	0	1	1
80	10.50	2.00	0.00	0	0	0	1	1
81	10.50	2.00	25,000.00	0	0	0	1	1

Continued

Observation	Ag	Sx	Sq	Nt	Pu	OL	Tariff	Reason
42	35	0	1	0	0	0	tariffic	cheap
43	33	0	0	0	0	0	taifa	cheap
44	40	0	1	1	0	0	tariffic	cheap
45	33	0	0	0	0	0	tariffic	cheap
46	25	0	1	1	0	1	yes	popularity
47	25	0	0	0	0	0	yes	popularity
48	45	0	0	0	0	0	yes	popularity
49	45	1	1	1	0	0	yes	good network
50	45	1	0	0	0	0	yes	good network
51	45	1	0	0	0	0	yes	popularity
52	33	1	1	0	0	0	yes	accessibility
53	25	0	0	0	1	1	jambo	cheap
54	35	1	1	0	0	0	tariffic	cheap
55	26	1	1	0	0	0	tariffic	cheap
56	30	0	0	0	0	0	taifa	popularity
57	30	0	0	0	1	0	yes	popularity
58	33	1	0	0	1	0	yes	good network
59	25	1	0	0	0	0	taifa	cheap
60	30	0	1	0	0	0	taifa	cheap
61	33	1	0	0	0	0	tariffic	cheap
62	33	0	0	0	0	0	taifa	popularity
63	40	0	1	1	0	0	taifa	cheap
64	40	0	1	1	0	0	family	popularity
65	33	0	1	1	0	0	taifa	cheap
66	35	1	1	1	1	0	family	diversity
67	40	0	0	0	0	0	taifa	cheap
68	35	0	0	1	0	0	taifa	cheap
69	35	0	1	1	1	0	jambo	cheap
70	40	0	0	0	0	0	taifa	popularity
71	40	0	0	0	0	1	family	popularity
72	36	1	1	1	1	0	taifa	cheap
73	40	0	1	1	0	1	yes	popularity
74	40	0	0	0	0	1	yes	reliability
75	45	1	0	0	0	1	taifa	good network
76	25	0	0	0	0	0	tariffic	cheap
77	25	0	0	0	0	0	family	cheap
78	25	1	1	1	0	0	tariffic	cheap
79	25	1	1	0	0	0	family	l.congestion
80	25	0	0	0	0	0	tariffic	popularity
81	35	0	0	0	0	0	tariffic	flexibilty

Summary continued

Observation	P1	P2	Y	EL1=P	EL2=S	EL3=C	EL4=U	Cv
82	10.50	2.00	0.00	0	0	1	0	0
83	10.50	2.00	0.00	0	0	1	0	1
84	15.75	2.00	12,500.00	0	0	1	0	1
85	10.00	2.00	0.00	0	0	1	0	1
86	10.50	2.00	35,000.00	0	0	0	1	1
87	10.50	2.00	12,500.00	0	0	1	0	0
88	15.75	2.00	35,000.00	0	0	0	1	0
89	10.00	2.00	0.00	0	0	0	1	1
90	10.50	2.00	6,500.00	0	0	1	0	1

Continued

Observation	Ag	Sx	Sq	Nt	Pu	OL	Tariff	Reason
82	23	0	0	0	0	0	tariffic	cheap
83	23	0	0	0	0	0	tariffic	cheap
84	40	1	0	0	1	1	jambo	cheap
85	23	1	0	1	0	0	family	l.congestion
86	35	0	1	0	1	1	tariffic	cheap
87	25	0	0	0	0	0	tariffic	cheap
88	35	1	0	0	1	1	jambo	cheap
89	33	1	1	1	0	1	family	cheap
90	45	1	1	0	0	0	tariffic	cheap