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Threat of Entry, Complete Information and Pricing

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Abstract:
This paper analyses the impact of new market entrants on the pricing patterns of the mobile network operators in the East African Community under complete information. The study verifies whether incumbent mobile network operators within the East African Community engage in limit pricing when faced with threat of entry by analysing the pricing patterns of 21 incumbent mobile network operators for the period 2000-2019 within the Community's member states. The study examines panel data using geographical distance as a proxy to the threat of entry. The results reveal that the pricing patterns of incumbent mobile network operators are consistent with limit pricing.

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I. INTRODUCTION

The East African Community's telephony industry has been highly characterized with the uncompetitive practice of consistent price cuts far below operating costs among mobile network operators since the year 2000. The fringe (smaller) mobile network operators have formally blamed the dominant mobile network operators for intentionally initiating these price cuts in order to prevent them from expanding their mobile subscriber base. This is despite the industry's liberalization in the year 1995. Before then, there were five monopolists operating within the five member states of the East African Community. These included Safaricom limited in Kenya, MTN in Uganda, Vodacom in Tanzania, Airtel in Rwanda and Econet Leo in Burundi. This liberalization led to the entrance of other mobile network operators in each of the member states from the year 1995. This is because the member states removed their controls on the mobile network operator industry thereby opening up the East African Community's mobile network operator industry to private companies. This liberalization also led to the privatisation of these former monopoly firms placing them under private ownership and control. The entry of new mobile network operators elicited a strategic response from the former monopolists. In addition to their expensive and long-term pre-liberalization tariffs with high switching costs, these firms introduced cheaper and short-term tariffs with low switching costs in order to compete with their new competitors thereby maintaining their market power. These dominant mobile network operators price discriminate between their two tariffs with the fringe (smaller) mobile network operators having only one tariff, which is the competitive tariff with low switching costs. This explains why despite the industry being liberalized, the former monopolists are still dominating the market while acting as market leaders in their respective areas of operation (East African Common Market Scorecard, 2016). By the year 2016, Safaricom limited was dominant in Kenya with 33,582,172 mobile subscribers accounting for 70.12% of the market share while Vodacom in Tanzania had 34,712,602 mobile subscribers translating to 69.72% of the market share. In Uganda, MTN Uganda had 21,841,620 mobile subscribers, dominating at 68.13% with Airtel Rwanda dominating at 66.34% with 10,150,211 mobile subscribers in Rwanda. Econet in Burundi had 8,876,142 mobile subscribers commanding 61.3% of the market (East African Community Facts and Figures, 2016 Report). A report to the East African Community secretariat headquarters in Arusha Tanzania by Deloitte, a top UK consulting firm, on mobile telephony and taxation in the East African Community region for the period 2000-2014, revealed the presence of a consistent drop in service prices of over 62.8% among the mobile network operators within the period. On the contrary, the prices for the network equipment and the cost of civil works had consistently been on the rise over the same period. Only the dominant mobile network operators managed to maintain their profitability status while the fringe mobile network operators suffered massive losses over the study period. Though the marked decreases in prices had provided significant benefits for consumers in recent years, these falling prices had also led to the former monopolists maintaining their market dominance with the market share of their fringe counterparts continuously shrinking. The Report recommended for streamlining of the dominant mobile network operators to prevent them from abusing their market leadership positions through consistent price cuts far below their operating costs (Deloitte, 2015).

As per the East African Community Competition Act 2006, the recommended pricing policy is for these dominant mobile network operators to set their respective service prices at a level equal to or slightly above the respective marginal costs. In the year 2016, the East African Community Secretariat selected and tasked Analysys Mason, a UK consulting firm, to undertake a competition market study on telecommunication in the region. Their report for the same period 2000-2014 revealed the existence of persistent price cuts by the mobile

network operators despite the continued increase in the prices of network equipment and cost of civil works. The report by Analysys Mason further revealed that the consistent price cuts scared away other new potential competitors thus denying the consumer variety of choice. Two American mobile firms, Verizon wireless and Sprint postponed their market entry until further notice in 2008 and 2015 respectively. It also reported that many mobile network operators with a small number of mobile subscribers suffered massive losses during the period. This led to YU Mobile exiting the Kenyan market in 2014. The price cuts by the dominant mobile network operators forces these small competitors also to lower their prices in order to attract more subscribers thus incurring perpetual losses. Most of these fringe firms have reported this misbehaviour of dominant firms pricing below operating costs to the East African Competition Authority. Currently, the Authority is continuing to investigate the complaints by Airtel Kenya over Safaricom's money service, voice, data and short text-message price cuts below its operating costs. Most of the small firms consider forming mergers in order to contain the pressure from the dominant firms. A case in point is the merger between Airtel Kenya and Kenya Telecom, which is at an advanced stage to become Airtel-Telecom in order to counter the competition pressure from Safaricom the market leader (Analysys Mason, 2017). These findings sparked intense political debate among the Honourable members of the East African Legislative Assembly in Arusha, Tanzania. This debate is on the causes of the persistent price cuts within the Community's mobile network market. Much of this debate is revolving around the influence that the dominant mobile network operators have over the pricing patterns for the pre-paid competitive tariff within the East African Community's mobile network market ((Hansard- East African Legislative Assembly (EALA), 10TH SITTING –FOURTH ASSEMBLY-THIRD MEETING-FIRST SESSION, Wednesday, 14 March 2018)). The scenario of persistent service price cuts below operational costs witnessed within the mobile network market of the East African Community since the year 2000 is synonymous with the theory of limit pricing, which is anti-competitive and illegal worldwide and within the Community as per the East African Community Competition Act 2006. In this situation, the dominant mobile network operators lower their prices below operating costs to deter actual market entry or prevent the expansion of smaller mobile network operators. Reduction in the profits of the smaller firms and the prevention of new potential competitors sustains the monopoly power of the dominant mobile network operators. On the other hand, higher prices will increase the profits of the smaller firms and encourage other new potential competitors to enter the market. This poses a big threat to the market share of the dominant mobile network operators, thus forcing them to lower prices strategically below their operating costs in order to safeguard their market dominance. The East African Community's mobile network operator industry is not characterized by the presence of information asymmetry pertaining to the true operational costs involved since all mobile network providers are licensed to operate within a similar generation of mobile network technology under an identical value added tax per unit service provided (Deloitte, 2015).

Are the pricing patterns for the pre-paid competitive tariff of the mobile network operators in the East African Community consistent with limit pricing? A few empirical studies have analysed limit pricing based on cross-sectional data under incomplete information. The evidence from these studies is mixed and not conclusive (Morrison, 2001; Goolsbee and Syverson, 2008 and Gedge, Roberts and Sweeting, 2013). In addressing the above question, this research paper has analysed the pricing patterns for the pre-paid competitive tariff of 21 mobile network operators within the East African Community over the 2000-2019 period to verify whether they are consistent with limit pricing.

II. LITERATURE REVIEW

A few empirical scholars have examined the use of limit pricing as a strategy among operating firms. Hannan (1979) analyses passbook savings rates within Pennsylvania financial markets and reveals that incumbent banks raise interest rates paid to their customers as the number of new potential market entrants increases. The main reason for doing this is to signal to the potential market entrants that they are low cost banks when truly they are high cost, thus making them to defer entry. The potential entrants believe the signal since they are ignorant about the true operating costs of the banks. Masson and Shaanon (1986) provide evidence of limit pricing by pooling yearly data on pricing from 26 industries and concluded that there is more evidence of incumbents using limit pricing based on their private information on cost other than excess capacity to deter entry. They used a structural framework to provide evidence that prices and excess capacity across the 26 industries are strategically used. Kadiyali (1996) examines the pricing patterns in Kodak within the photographic film industry and shows that they are consistent with limit pricing. He analyses costs and demand at the firm level for the photographic film industry of the United States of America by estimating market structures both before and after entry. Although Kodak was a high cost firm, it lowered its prices to fool the potential entrants that it was a low cost firm. This is because the potential entrants were not aware of its true operating cost. This resulted into no entry by new firms into the film photographic industry during the study period. Kodak took advantage of its private information on cost to scare away its potential competitors from joining the film industry. Seamans (2013) examines limit pricing in the cable TV industry within the US under the presence of information asymmetry between the incumbent firms and potential entrants. He adopted the empirical methodology by Ellison and Ellison (2011) by using geographic distance as a proxy to the threat of entry. He divided the incumbents into two groups. The first group comprised of those incumbents that were members of the Research and Development Consortia with the second group being nonmembers. Only the firms that were members of the Research and Development Consortia engaged in limit pricing since they had private information about their true operating costs that was unknown to the potential entrants. Nonmembers of the Research and Development consortia did not engage in limit pricing since their true operating costs were common knowledge. He further shows that market size or economies of scale do not have any effect on price. Limit pricing is only possible due to the presence of information asymmetry or under incomplete information between the incumbents and the potential entrants. On the other hand, empirical results on limit pricing from some researchers have been partly consistent, inconsistent and inconclusive. Cooper, Garvin and Kagel (1997) study limit pricing in a lab setting and find support for the theoretical predictions in Milgrom and Roberts (1982). One unique feature of Cooper, Garvin and Kagel (1997) is that the lab setting allows the authors to create conditions with asymmetric information. Similar to this study, Savage and Wirth (2005) study the cable TV pricing in the presence of potential entrants. They use a probit model of observed entry decisions as a function of market characteristics to create probabilities of future entry events. These probabilities are used to proxy for potential competition in a simultaneous equation model, which shows that potential competition has no effect on price. Muller and Yehezkel (2009) examine limit pricing in the lab involving two operating firms with private information on their true operating costs and a potential entrant. Both the two operating firms are interested in entry deterrence and the high prices they choose may signal to a potential entrant that the costs in the industry are high and that entry is not profitable. They show that the potential entrant tends to enter when the market has lower prices and tends to stay out when the market has higher prices. This is inconsistent with the limit pricing theory, since the potential entrants are supposed to enter the market when the market prices are higher and to stay out when they are lower. Goolsbee and Syverson (2008) analyze entry into

the airline industry. They identify the threat of entry on a route between two airports E and F as the presence of an entrant airline in airports E and F separately. This means that if an entrant airline is already operating on the route E - G and now starts operating via the route F - H, then the presence of the entrant on both endpoints of the route E - F represents a threat that it will start operating on this route as well. This induces the incumbent airlines within the route to lower their prices in order to signal to the potential competitor that entry is not profitable. Although their results are at least consistent with limit pricing, they are inconclusive. In the East African Community mobile network operator industry, the presence of complete information characterizes the relationship between the incumbent firms and the potential entrants whereby the potential entrants are aware of the true operating costs of the incumbent firms (Deloitte, 2015). However, as per the available empirical literature, focus has been on the case where incomplete information characterizes the relationship between the incumbent and the potential entrant. This is the scenario where the potential entrants are not aware of the true operating costs of the incumbent firms. This research paper addresses this knowledge gap by empirically analyzing the pricing patterns of the mobile network operators in East Africa in response to the threat of entry under complete information. Furthermore, as can be noted, these prior studies provide mixed evidence on limit pricing. Limit pricing is a strategy that prevents actual market entry before it happens. Other strategies are excess capacity and early technology adoption. There is a large number of theoretical papers on these entry deterrence strategies. On the other hand, very few empirical studies on these entry deterrence strategies exist (Wilson, 1992); Lieberman (1987, 1989) reveals that there is no evidence to show that chemical processing firms usually use excess capacity to deter entry. On the other hand, Hamilton and McManus (2009) indicate that the early usage of new technology by the infertility treatment centers postpones competitor entry. Ghemawat (1993) indicates that still mill market entrants use new technology to prevent incumbent expansion into new markets. Therefore, this study contributes more broadly by adding to this strand of empirical literature on strategic entry deterrence. Ellison and Ellison (2011) give a tractable model of strategic entry deterrence that they use to analyze the pharmaceutical industry. The key feature in their model is that the incentives to prevent entry will vary non-monotonically with the market size.

According to their model, the incumbent will engage in market entry preventing activity if the markets involved are of an intermediate size instead of large or small. The intuition behind this prediction is that large markets will always attract new entrants with the small markets attracting none. Therefore, investing in the entry preventing activities in these large and small markets will not interfere with the likely outcomes. Instead, when the potential market entrant is about to enter the market, the incumbent's action most likely influences its decision. As we can see here, market size acts as a proxy for threat of entry because of the institutional characteristics of the pharmaceutical industry researched on by Ellison and Ellison. On the other hand, other industries may require different proxies for threat of market entry. In closely related work, Dafny (2005) adopts and applies the techniques from the work of Ellison and Ellison (2011) to the local surgical procedure markets. Dafny reveals that when incumbents magnify the surgical procedure volume they move away down the learning curve for that particular surgery, thereby setting up entry barriers that are more difficult for potential market entrants to overcome. Furthermore, Dafny argues that potential market entrants in this surgical business originate from other hospitals within the neighbouring area, which do not yet possess the required experience pertaining to the given surgical procedure. Dafny shows that the volume of incumbents' surgical procedure varies non-monotonically with the number of hospitals that are potential entrants. Therefore, Dafny uses a similar perspective to that used in Ellison and Ellison, but uses a proxy for the threat of entry that fits

the surgical procedure scenario that she studies. While analyzing limit pricing in the American Cable TV industry, Seamans (2013) also uses the techniques developed by Ellison and Ellison (2011). He uses geographic distance as a proxy to the threat of market entry and shows that pricing patterns of incumbent firms with private information about their operating costs varies non-monotonically with the distance to the nearest potential entrant. Similarly, this research paper uses geographic distance as a proxy for the probability of market entry. This geographic distance is appropriate for the mobile telecommunication industry's context. Therefore, another contribution of this study is to demonstrate that the techniques, which Ellison and Ellison (2011) developed, can be applied to other settings also.

III. THEORETICAL MODEL

The study adopts a theoretical model on limit pricing by Hillary Ekisa Nambanga (2020). In his analysis, Hillary Ekisa Nambanga (2020) takes into account a three-stage sequential price competition game among three market players comprising of one dominant (former monopolist) mobile network operator, one fringe (smaller) mobile network operator and a potential new mobile network operator entrant under complete information. The potential entrant represents the threat of entry from new mobile network operators. The dominant mobile network operator, the first incumbent and the fringe (smaller) mobile network operator, the second incumbent, are already in the market and offer differentiated services for mobile communication. The dominant mobile network operator offers two tariffs: the pre-liberalization tariff (former monopoly tariff) and the post-liberalization (competitive) tariff. This first incumbent price discriminates within these two tariffs. The pre-liberalization tariff is more expensive and its mobile subscribers have high switching costs. This pre-liberalization tariff is the one that existed before the liberalization of the East African Community's mobile telephony industry in 1995. The dominant mobile network operators introduced the post-liberalization (competitive) tariff after the liberalization. This post-liberalization tariff is cheaper with its mobile subscribers having low switching costs. The dominant mobile network operators introduced this post-liberalization (competitive) tariff in order to compete with the competitive tariffs of the other new competitors who entered the market after the liberalization. In his analysis, Hillary Ekisa Nambanga (2020) shows that, first, the dominant mobile network operator can make profit by highly price discriminating between its two tariffs based on their difference in the switching costs. Secondly, the dominant mobile network operator can be able to lower its pre-liberalization tariff price to a level lower enough to deter further market entry as long as its revenues are sufficiently high. The theoretical analysis by Hillary Ekisa Nambanga (2020) fits exactly into the empirical market set up of mobile network operators in the East African Community. The empirical implication of this finding is that, dominant price discriminating mobile network operators will always tend to lower their pre-liberalization tariff prices when faced with threat of entry or competition from their fringe (smaller) mobile network operators. The smaller mobile network operators adopt this limit pricing strategy by the dominant firms in order to attract more mobile network subscribers and remain in business. The profits of the smaller mobile network operators reduce under this pricing strategy of the dominant mobile network operators. In the worst-case scenario, some of these small mobile network operators can opt to exit out of the market. Consequently, the market share of the smaller mobile network operators will always continue to shrink while the dominant price discriminating mobile network operators will continue to expand their market share, thus maintaining the status quo of a vicious cycle of market dominance. An exciting evidence of the above vicious cycle of market dominance has been prevalent in the United States of America where 11 companies in various sectors have been dominant for the past 86 years. These firms are Apple in the

personal computers, ExxonMobil in the major integrated oil and gas, Microsoft in the application software and IBM in the diversified computer systems.
Also in the list are Wal-mat in the variety stores, General Electric in diversified machinery, AT&T in telecom services, Cisco in networking and communications, Altria in cigarettes, DuPont in chemicals and General Motors in auto manufacture (Statista Research Department, 2019). The theoretical analysis by Hillary Ekisa Nambanga (2020) leads to the following two possible empirical hypotheses:

1) . H_0 : The pricing patterns for the pre-paid competitive tariffs of the mobile network operators in the East African Community are not consistent with limit pricing.

H_a : The pricing patterns for the pre-paid competitive tariffs of the mobile network operators in the East African Community are consistent with limit pricing.

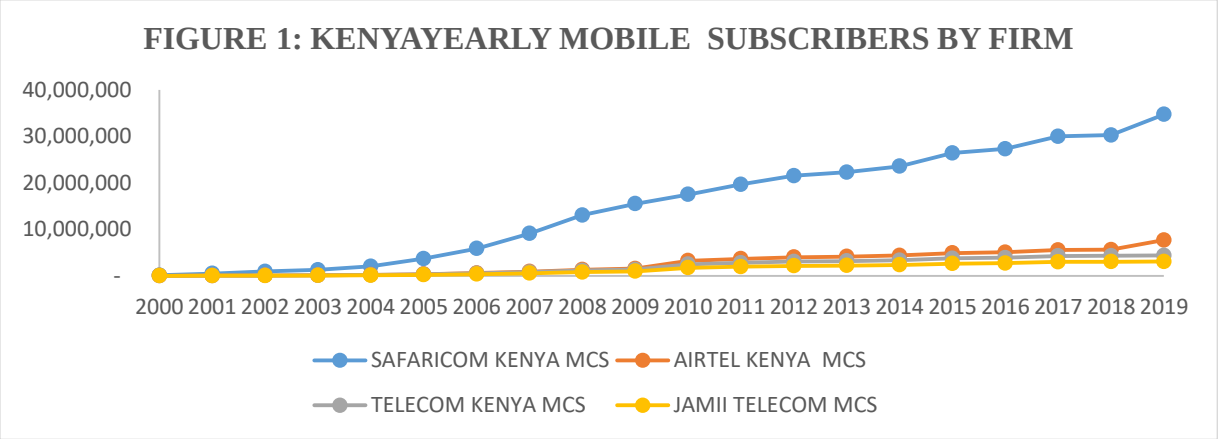
2) H_o : Number of mobile network subscribers per operator (market size) does not have an influence on the service price of the mobile network operators within the East African Community.

H_a : Number of mobile network subscribers per operator (market size) has negative influence on the service price of the mobile network operators within the East African Community.

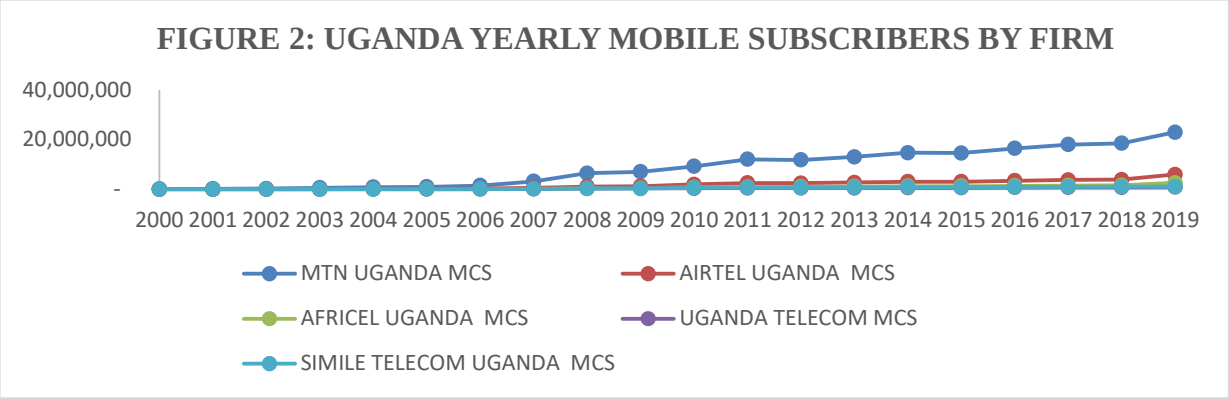
IV. EMPIRICAL ANALYSIS

4.1 Empirical Setting

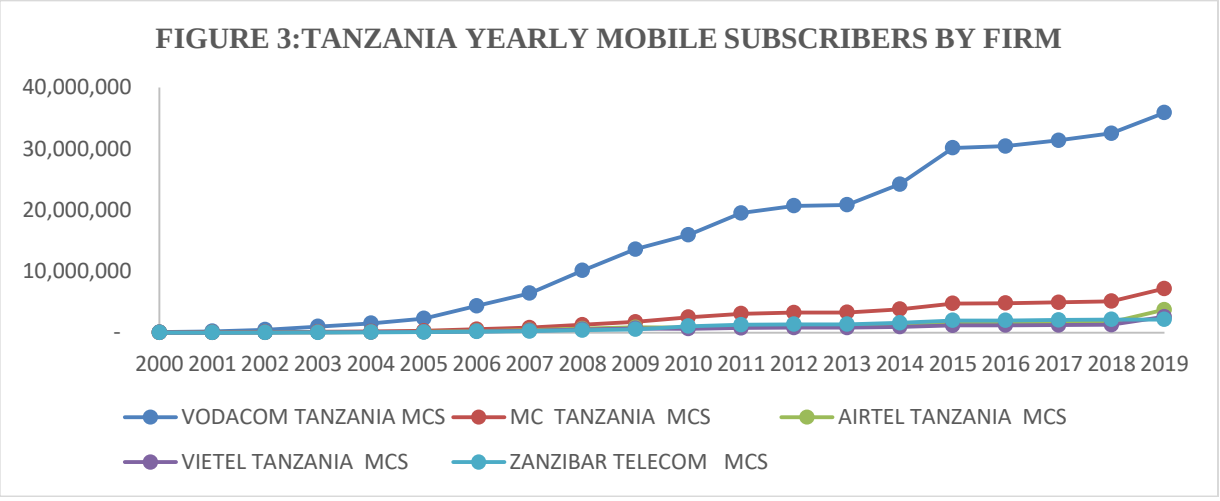
The empirical setting of the research is the East African Community telephony industry from 2000-2019. This is a key industry in the economy of the East African Community with great importance to the policy makers. In general, the demand for the mobile network services has been increasing consistently since the year 2000. The East African Community comprises of the following five countries: Kenya, Tanzania, Uganda, Rwanda and Burundi. Each of the countries has one dominant mobile network operator. These are Safaricom for Kenya, MTN for Uganda, Vodacom for Tanzania, Airtel Rwanda for Rwanda and Econet Leo for Burundi. The other competitors in each of the countries are fringe with a small number of subscribers.



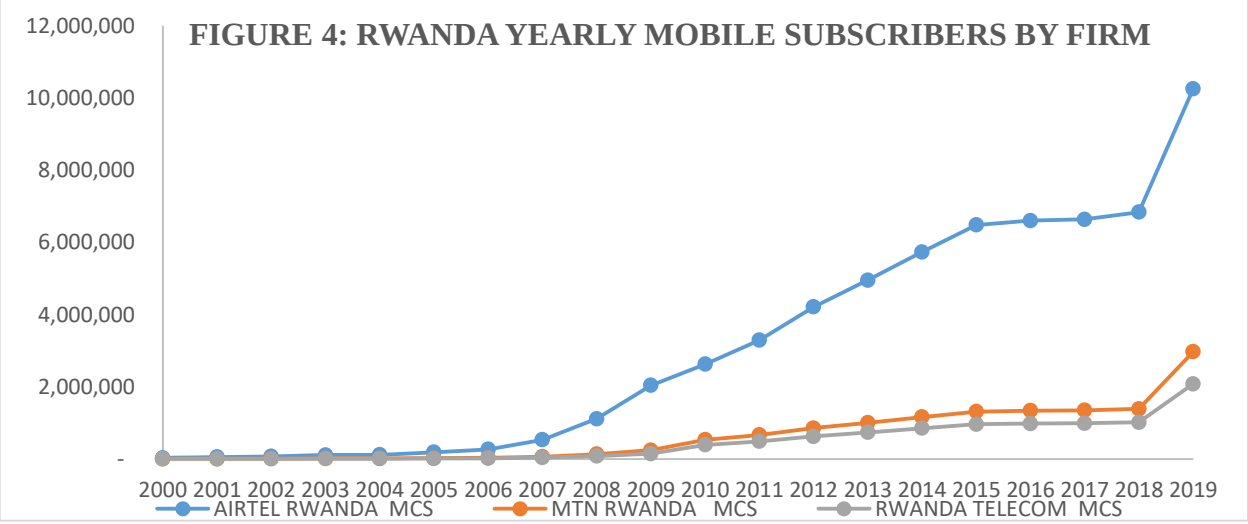
Source: Author's calculation based on data from Communication Authority of Kenya



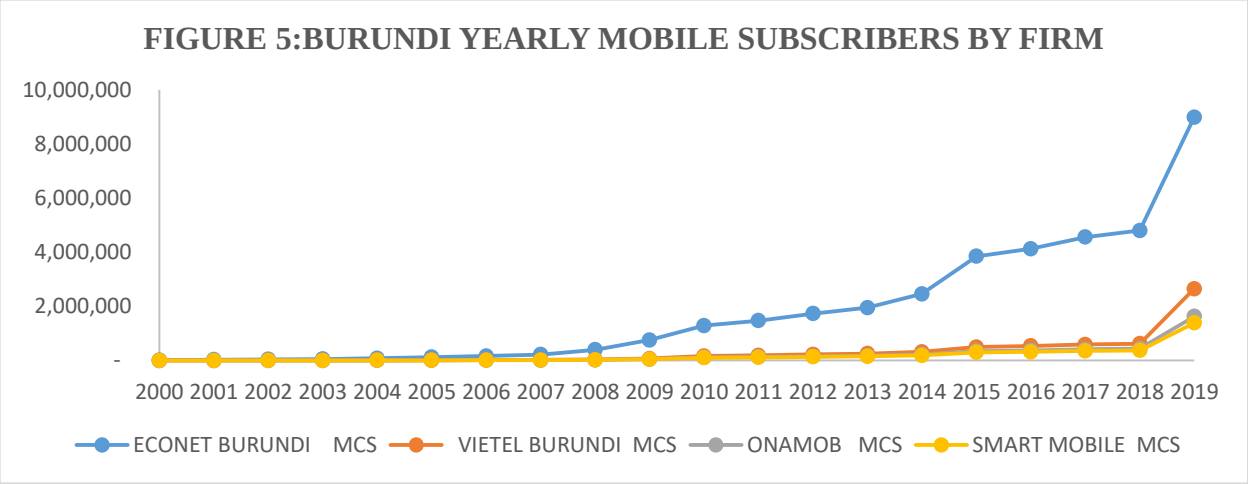
Source: Author's calculation based on Uganda Communications Commission data



Source: Author's calculation based on Tanzania Communications Regulatory Authority data



Source: Author's calculation based Regulatory Agency for Public Utility Services of Rwanda data



Source: Author's calculation based on Ministry of Transport and Telecommunications of Burundi data

4.2 Data

This study used secondary panel data pertaining to 21 mobile network operators within the East African Community from the year 2000 to 2019. These 21 firms consisted of 5 dominant mobile network operators and 16 fringe (small) mobile network operators. The data set in this panel comprised of the pre-paid competitive tariff service prices involving the money service, internet data service, per minute voice call service and short text message service. The money service fee involved four categories with each of the categories having three levels with level one being KSHS (1-10,000), level two being KSHS (10,001-35,000) and level three being KSHS (35,001-70,000). These categories are money transfer fee to registered users, money transfer fee to other mobile users, money transfer fee to non-registered users and money withdrawal fee from the agent. The internet data service involved three levels of daily, weekly and monthly data bundles. The per minute voice call service involved on-net and off-net categories with both the on-net and off-net categories segmented into two parts of 8 am to 10 pm and 10 pm to 8 am. The short text message service comprised of the on-net and off-net categories. Furthermore, the data set in the panel included the price index for the network equipment, number of mobile subscribers per operator and number of mobile subscribers per country. These data were obtained from the annual Sector Statistics Reports by the Communications Authority of Kenya, Uganda Communications Commission, Tanzania Communications Regulatory Authority, Regulatory Agency for Public Utility Services of Rwanda and the Ministry of information for Burundi. Finally, the data set in the panel included the distance to the nearest potential mobile network operator entrant in miles. The study obtains the data on the location of potential mobile network operator entrants from the East African Communications Organisation. The study calculates distances from each city in which an incumbent mobile operator's signal tower is located to the city in which the closest potential mobile network operator's signal tower is located using Google Maps Distance Function in Excel, thus creating the variable $\boldsymbol{distance\ to\ potential\ entrant_{it}}$. Seamans (2013) adopted this technique in his empirical analysis of limit pricing in the U.S cable Television industry within the context of information asymmetry. All the regressions involved the Logs of these distances in order to correct for skewness in the data and to be consistent with Ellison and Ellison (2011).

4.3 Empirical Method

The mobile network operator industry has many nice features that allow for easy and careful identification of incumbents and potential entrants. Mobile network markets occur in the geographical boundary of the area in which the incumbent firm operates. This effectively

segments the East African Community into a number of non-overlapping geographic markets. Entrants normally focus on a specific geographic area and base entry decisions on the nearness to their existing network towers. When the distance is small, the better. Therefore, one can measure the chance of entry into the mobile network operator market by determining the interval between an incumbent mobile network operator and the boarder of the closest potential entrant. To address the two hypotheses, the study analyzed the influence of the threat of entry (distance to the nearest potential entrant) and market size on the pricing patterns of incumbent mobile network operators. Variation in incumbent interests, variation in the distance to potential market entrants and the large number of the non-overlapping geographic markets made the testing of the hypotheses possible. To test the first hypothesis, the researcher identified the distances to the closest potential mobile network operator entrants and then tested whether the variation in the distance to the closest potential entrant significantly influences service price among the mobile network operators in the East African Community. On the same first hypothesis, the researcher tested whether the distance to the nearest potential entrant squared (low threat of entry) had any significant influence on service price. For the second hypothesis on market size, the study tested whether the number of mobile subscribers per operator had an influence on the service price. The study adopted the methodology used by Ellison and Ellison (2011) that demonstrates that the provocation to deter entry would vary non-monotonically with the chance of entry. This is because of the ease in tracking the variation in the distance to the nearest potential entrant and the presence of many non-overlapping geographic markets segmented by signal towers of each mobile network operator. In the East African Community mobile network context, the probability of entry increases as the distance to the potential entrant reduces. In a situation where the potential entrant has a low probability of entry into an incumbent's market, as may be the case when the potential entrant is in a geographically far location, then the incumbent may decide not to use limit pricing because entry is not likely to happen under this scenario. As the distance to the potential entrant reduces, the probability of entry begins to increase, and the incumbent is very likely to practice limit pricing since the relative costs of using a low price are less than the potential cut in the chance of entry. However, as chance of entry increases past a certain level, the incumbent may be less likely to practice limit pricing. The incumbent will not be ready to accept foregoing some profits by pricing low if, regardless of whatever it does, the probability of entry by the potential entrant is very high and approaching one.

At the extreme, if the probability of entry by a potential entrant is one, then it will not be viable for the incumbent to engage in limit pricing. Therefore, so long as the incumbent engages in limit pricing, its response via pricing will vary non-monotonically with the distance to the potential entrant.This will yield a non-monotonic U-shaped pricing response. In the spirit of Ellison and Ellison (2011), the study adopted the following specification as defined and used by them:

$$lnprice_{ist} = \beta_0 + \beta_1 lndistance\ to\ potential\ entrant_{it} + \beta_2 lndistance\ to\ potential\ entrant_{it}^2 + \beta_3 lnsubscribers_{it} + \beta_4 lncost\ of\ network\ euipment_{it} + \gamma_i + Year_t + \varepsilon_{ist} \quad (1)$$

Where $lnprice_{ist}$ is the natural log of price for the mobile network operator i with service type s at time t. $lndistance\ to\ potential\ entrant_{it}$ is the natural log of the distance in miles to the closest potential mobile network operator to the incumbent mobile network operator i at time t. The term $lndistance\ to\ potential\ entrant_{it}^2$ is included to capture any non-monotonicity in the pricing pattern. Signs on the coefficients of $\beta_1 < 0$ and $\beta_2 > 0$ will provide evidence of a non-monotonic U-shaped pricing response. $lnsubscribers_{it}$ is the number of mobile subscribers for firm i at time t. $lncost\ of\ network\ euipment_{it}$ is the cost of

network equipment for firm i at time t. γ_i is the fixed effect for the mobile network operators (firm), $year_t$ is the year effect with ε_{ist} as the error term. Price is the dependent variable in all regressions. Price varies by mobile network operator, service type and year, and the study uses the log of price following other research on pricing ((McCann and Vroom (2010); Simon (2005) and Yamawaki (2002)). The independent variables of interest are the distance to the nearest potential entrants (high threat of entry), distance to the nearest potential entrant squared (low threat of entry) and the number of mobile subscribers per operator. The study used the following control variable that usually varies with time. Network equipment price index: This is our main control variable. A continuous variable that measures the average cost for the network equipment over time. Its importance is that it controls for the possibility that lower costs incurred can lead to a reduced price in the case of testing the influence of high threat of entry(distance to the nearest potential entrant), low threat of entry (distance to the nearest potential entrant squared) and the number of mobile subscribers per operator. Since the main empirical model above takes care of the firm level fixed effects, the cross-sectional control variables were not be included.

V. RESULTS AND DISCUSSIONS

5.1 Summary statistics

The summary statistics for all the variables are in table1. The mobile network operators usually provide money transfer services within their registered mobile subscribers. The fee charged depends on the amount of money transferred. For those transferring not more than ten thousand shillings (level1), the fee charge is 79.02 shillings on average.

Those transferring between ten thousand and thirty five thousand shillings (level2), pay a fee of 103 shillings on average. Finally, for those transferring between thirty five thousand and seventy thousand shillings (level3), the cost on average is 114.2 shillings. For those sending money to other mobile subscribers who are not within the same network, the charges are slightly higher. Those sending less than ten thousand shillings (level1), are charged 86.4 shillings on average. Under the level2 bracket, the average cost is 113.5 shillings. For level3, between thirty five thousand and seventy thousand shillings, the average fee charged is 127.4 shillings. The mobile network operators also provide money withdrawal services using their registered agents. On average, withdrawing less than ten thousand shillings (level1), attracts a service fee of 55.2 shillings. For those withdrawing between ten thousand and thirty five thousand shillings (level2), the average charge is 148.3 shillings. Finally, those withdrawing between thirty five thousand and seventy thousand shillings (level3), have to part with 235.8 shillings on average as service fee. Internet service provision is another key role played by the mobile network operators. This they do by way of data bundle provision. They offer data bundles on a daily, weekly and monthly basis at a cost of 87.7 shillings on average for the daily case. On a weekly basis, the average cost is 511.2 shillings. Under the monthly category, the average cost is 2,355.5 shillings. The main service provided by the mobile network operators is the voice call service. This they bill per minute within the pre-paid platform. Making calls to people within the same operator, on-net, is cheaper compared to calling those that are registered with alternative operators, off-net. For the on-net calls, the average cost per minute is 229.5 shillings from 8.00 am to 10.00 pm and 187.1 shillings from 10.00 pm to 8.00 am. For the off-net calls, the average charge per minute is 359.7 shillings starting from 8.00 am to 10.00 pm and 287.2 shillings from 10 pm to 8 am. For the short text message service, the on-net average cost per minute is 52.7 shillings while the off-net cost per minute is 64.6 shillings. The average distance to the potential entrant in miles is 50.3 while the average price index for the network equipment is 134.9. The total number of mobile subscribers per operator on average is 2,778,932 while the total number of mobile

subscribers per country on average is 30,456,890. From these summary statistics, the average service cost across networks is higher than the average service cost within the same networks. This implies that the mobile network operators discourage their mobile network subscribers from using alternative networks. This is a clear sign of intense competition that usually characterizes the mobile network operator markets.

Table 1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Money transfer fee to registered users					
Level 1 KSHS (1-10,000)	420	79.0252	41.2774	20.5	176
Level 2 KSHS (10,001-35,000)	420	103.061	33.6585	47	198
Level 3 KSHS (35,001-70,000)	420	114.208	39.4976	60	217
Money transfer fee to other mobile users					
Level 1 KSHS (1-10,000)	420	86.3645	46.2287	21.2	215
Level 2 KSHS (10,001-35,000)	420	113.52	46.1444	40.5	245
Level 3 KSHS (35,001-70,000)	420	127.411	48.7084	51.7	267
Money transfer fee to non-registered users					
Level 1 KSHS (1-10,000)	420	120.047	42.3076	51.5	226
Level 2 KSHS (10,001-35,000)	420	240.718	39.2411	155	320
Level 3 KSHS (35,001-70,000)	420	274.514	39.301	177	395
Money withdrawal fee from the agent					
Level 1 KSHS (1-10,000)	420	55.2329	28.1082	13	130
Level 2 KSHS (10,001-35,000)	420	148.308	34.0754	84	230
Level 3 KSHS (35,001-70,000)	420	235.818	52.4754	111	350
Internet data bundle cost					
Level 1 Daily	420	87.6621	39.7482	14.6	253
Level 2 Weekly	420	511.244	160.02	278.6	900
Level 3 Monthly	420	2355.56	995.094	1165	4500
Per minute voice charge					
On-net 8 am-10 pm	420	229.598	220.943	1.5	800
On-net 10 pm-8 am	420	187.126	193.984	1	659
Off-net 8 am-10 pm	420	359.743	309.126	2.5	1100
Off-net 10 pm-8 am	420	287.189	248.692	2	850
Short text message charge					
On-net	420	52.6762	61.2544	1	224
Off-net	420	64.566	72.983	1	275
Distance to potential entrant in miles	420	50.3	102.48	38.7	300
Price index for the network equipment	420	134.87	25.4414	100	192.283
Number of mobile subscribers per operator	420	2778932	5931526	816	3.29E+07
Number of mobile subscribers per country	420	1.24E+07	1.38E+07	16320	4.39E+07

5.2 Regression outputs and interpretation

This subheading shows the results of the regression findings for the two hypotheses. These pertain to the variables affecting the service fee charged by the mobile network operators within the East African Community. These are distance to the nearest potential entrant (high threat of entry) and distance to the nearest potential entrant squared (low threat of entry) under the first hypothesis. The number of mobile network subscribers per operator (market size) is under the second hypothesis and the cost of the network equipment is the control variable with the first three being the independent variables of interest for the study. The results were generated by the STATA software based on equation (1) using the fixed effects regression method. This method holds after doing a Hausman Test before running each regression. The Hausman value is 0.00 for all the results, as demonstrated in the Appendix1, implying that Fixed Effects Estimation is preferred to Random Effects Estimation for all the regressions.

5.2.1 How Panel Data Problems were managed

i) **Endogeneity**: This is a case where some of the explanatory variables correlate with the error term. The use of the fixed effects method for estimation offered solution to this problem without resorting to instrumental variables. Instead, this method relies on longer period of data collection pertaining to the same entity. The fixed effects method eliminates the time-invariant explanatory variables under the first differencing.

ii) **Autocorrelation and Heteroskedasticity**: The use of the variance-covariance matrix of the estimators (VCE) Robust Standard Errors takes care of this as recommended in example 3 for –xtreg-entry in Stata 13.1 user manual.

iii) **Firm fixed effects and Year fixed effects**: The command: xtset firm year controls for these fixed effects in the static panel as per Stata 13.1 user manual.

iv) **Multicollinearity**: There is no significant problem of multicollinearity since all the coefficients of the independent variables have smaller standard errors and have expected signs. Therefore, all the independent variables are statistically significant with expected signs.

5.2.2 Economics of regression results summary

This subsection outlines the Economics of the regression results summary used for testing the following empirical hypotheses and other explanatory variables based on the following study model in equation (1).

$$lnprice_{ist} = \beta_0 + \beta_1 lndistance\ to\ potential\ entrant_{it} + \beta_2 lndistance\ to\ potential\ entrant_{it}^2 + \beta_3 lnsubscribers_{it} + \beta_4 lncost\ of\ network\ euipment_{it} + \gamma_i + Year_t + \varepsilon_{ist} \quad (1)$$

1) . H_0 : The pricing patterns for the pre-paid competitive tariffs of the mobile network operators in the East African Community are not consistent with limit pricing.

H_a : The pricing patterns for the pre-paid competitive tariffs of the mobile network operators in the East African Community are consistent with limit pricing.

2) H_o : Number of mobile network subscribers per operator (market size) does not have an influence on the service price of the mobile network operators within the East African Community.

H_a : Number of mobile network subscribers per operator (market size) has negative influence on the service price of the mobile network operators within the East African Community.

Tables 2, 3, 4 and 5, display the regression output results for all the seven service price categories. These are the money transfer fee to the registered users and other mobile users in table 2; money transfer fee to non-registered users and money withdrawal fee from the agent in table 3; internet data bundle price and short text message fee in table 4 and per minute voice call fee in table 5.

Hypothesis 1: We reject the null hypothesis because of the following two reasons. First, the coefficients on distance to the nearest potential entrant (high threat of entry) are significant and are negative in all the regressions as displayed in all the tables 2, 3, 4 and 5. Secondly, the coefficients on distance to the nearest potential entrant squared (low threat of entry) are significant and are positive in all the regression outputs in tables 2, 3, 4 and 5. These results imply that service price varies non-monotonically with the threat of entry. The mobile network operators lower their service price when the distance to the nearest potential entrant is small and raise their service price when the distance to nearest potential entrant is big. This finding confirms the results of the theoretical model in this dissertation on the existence of a limit pricing equilibrium among the mobile network operators in the East African Community. Furthermore, this finding is as expected within the context of our

empirical method as per Ellison and Ellison (2011). Therefore, the pricing patterns of the pre-paid competitive tariff among the mobile network operators in the East African Community are consistent with limit pricing. This finding is consistent with the findings of other previous scholars on empirical evidence on limit pricing (Dafny, 2005; Sweeting, 2013 and Seamans, 2013).

Hypothesis 2: We reject the null hypothesis since the coefficients on the number of mobile network subscribers per operator (market size) are significant and negative in all the regression models as displayed in all the regression output tables 2, 3, 4 and 5. The negative sign implies that the service price is decreasing with the market size. This result confirms the finding of the theoretical model in this dissertation whereby high revenues (large market size) sustains the limit pricing equilibrium under complete information. However, this is not the case under information asymmetry where the presence of incomplete information sustains the limit pricing equilibrium. Therefore, this finding contradicts the empirical finding by Seamans (2013) in his analysis of limit pricing strategy for entry deterrence in the US Cable television industry under incomplete information. After controlling for firm size using number of systems as a continuous variable for each firm I at time t and studying several split samples, he proved that market power or economies of scale does not have any influence on price. His finding is that, the presence of incomplete information is the only factor that leads to lower prices for entry deterrence in the US Cable television industry. The coefficients of the cost of network equipment are significant and negative in all the regression models as shown in all the regression output tables 2, 3, 4 and 5.

This implies that service price is decreasing with cost. This finding is consistent with reports by deloitte (2015) and Analysys Mason (2017). They revealed the decreasing service prices despite the increasing costs in network equipment and civil works among the mobile network operators in the East African Community. However, this is inconsistent with the available theory on price and cost. The relationship between them is supposed to be positive. The scenario whereby service price is decreasing with cost is synonymous with limit pricing. Firms are reducing their prices despite the increase in cost in order to deter new market entry or prevent their competitors from expanding their business. Furthermore, the R^2 in all the regression models is at least 44.0 percent. This implies that, on average, all the regression models account for at least 44.0 percent of the variation in the service price among the mobile network operators. Our empirical analysis has proved that threat of entry and market size have an influence on price. The empirical findings of this research paper are consistent with the results of the theoretical analysis by Hillary Ekisa Nambanga (2020) on the existence of a limit pricing equilibrium among the dominant price discriminating mobile network operators and its influence on the pre-paid competitive tariff prices among the mobile network operators in the East African Community. These empirical findings are consistent with the theory of limit pricing since service price is decreasing with the distance to the nearest potential entrant (high threat of entry) and increasing with the distance to the nearest potential entrant squared (low threat of entry). This pricing pattern is non-monotonic U shaped and is consistent with limit pricing as per the empirical methodology by Ellison and Ellison (2011) as shown in Figure 6. These empirical findings confirm the influence that the dominant mobile network operators have on the pre-paid competitive tariff prices among the mobile network operators in the East African Community. This is because the pricing patterns of the pre-paid competitive tariffs are consistent with limit pricing as per the corollary of the theoretical model of this dissertation. Most importantly, these empirical findings fully settle the debate among the Honourable Members of the East African Legislative Assembly in Arusha Tanzania on the influence that the dominant mobile network operators have on the

pricing patterns of the pre-paid competitive tariffs among the mobile network operators. This is within the mobile network operator in the East African Community. ((Hansard- East African Legislative Assembly (EALA), 10TH SITTING –FOURTH ASSEMBLY-THIRD MEETING-FIRST SESSION, Wednesday, 14 March 2018))

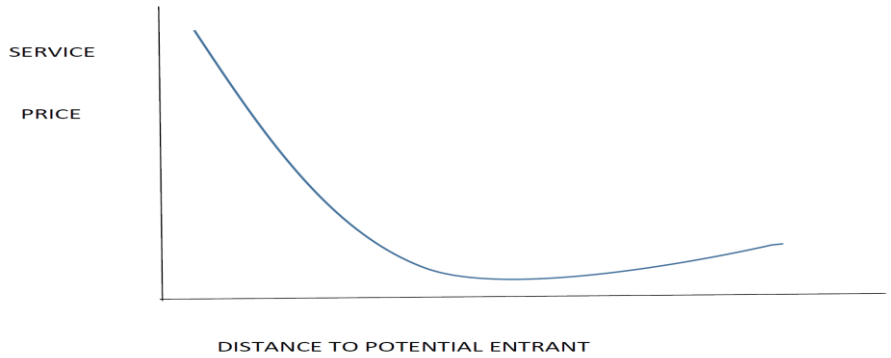


Figure 6: Non-monotonic U-shaped curve

5.3 Independent variables' coefficients and their interpretation

We use elasticities in the interpretation of all the coefficients pertaining to the independent variables since all our regression models are log-log linear. Table 2 shows the regression results for the money transfer fee to registered users within the same network in models (1), (2), (3) and money transfer fee to those users who are registered under different networks in models (4), (5), (6) . The coefficients of distance to the nearest potential entrant (high threat of entry) are all negative and significant at all the three levels of 1%, 5% and 10% as shown in all the six regression models. The negative sign implies that, on average, when other explanatory variables are held constant, a 1% increase in the distance to the nearest potential entrant (high threat of entry) leads to a 0.337%, 0.263%, 0.257%, 0.242%, 0.253% and 0.241% decrease in service price respectively. The coefficients on the distance to the nearest potential entrant squared (low threat of entry) are all positive and significant at all levels as displayed in all the six regression models. This implies that, on average, when other factors are held constant, a 1% increase in the distance to the nearest potential entrant squared (low threat of entry) results into a 0.278%, 0.251%, 0.247%, 0.214%, 0.218% and 0.215% increase in service price respectively on average. The coefficients on the number of mobile network subscribers per operator (market size) are all negative and significant at all the three levels of 1%, 5% and 10% in all the 6 models. This implies that, holding other regressors constant, a 1% increase in the number of mobile network subscribers leads into a 0.258%, 0.185%, 0.188%, 0.180%, 0.180% and 0.175% decrease in service price respectively on average. The coefficients on the network equipment cost are negative and significant at the two levels of 5% and 10% in all the 6 regression models. Keeping other factors constant, a 1% increase in the cost of network equipment will result into a 0.364%, 0.291%, 0.300%, 0.235%, 0.250% and 0.235% decrease in service price respectively on average. All the six regression models account for the variation in the money transfer fee to registered users within and across networks by 58.8%, 58.4%, 59.2%, 56.9%, 56.6% and 57.7% respectively on average.

Table 2: Money transfer fee to registered users within and across other networks
Dependent variables: lnPrice (OLS Models)

VARIABLES	(1) lnPriceA1	(2) lnPriceA2	(3) lnPriceA3	(4) lnPriceB1	(5) lnPriceB2	(6) lnPriceB3
lnDistance to Potential Entrant	-0.337***	-0.263***	-0.257***	-0.242***	-0.253***	-0.241***
	(0.0947)	(0.0407)	(0.0446)	(0.0469)	(0.0378)	(0.0529)
lnDistance to Potential Entrant^2	0.278***	0.251***	0.247***	0.214***	0.218***	0.215***
	(0.0498)	(0.0266)	(0.0272)	(0.0275)	(0.0242)	(0.0297)
lnCost of Network Equipment	-0.364**	-0.291**	-0.300**	-0.235**	-0.250**	-0.235**
	(0.142)	(0.111)	(0.112)	(0.103)	(0.101)	(0.0976)
lnNumber of Subscribers per Operator	-0.258***	-0.185***	-0.188***	-0.180***	-0.180***	-0.175***
	(0.0361)	(0.0305)	(0.0301)	(0.0294)	(0.0285)	(0.0273)
Constant	8.176***	7.147***	7.201***	6.961***	7.057***	7.130***
	(0.721)	(0.646)	(0.636)	(0.603)	(0.576)	(0.553)
Controls Included:						
Firm Fixed Effects	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	420	420	420	420	420	420
R-squared	0.588	0.584	0.592	0.569	0.566	0.577
Number of firm	21	21	21	21	21	21

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 outlines the regression output results for the money transfer fee to non-registered users and the money withdrawal fee from the agent as per the models (1), (2), (3) and (4), (5), (6) respectively. The coefficients of distance to the nearest potential entrant (high threat of entry) are all negative and significant at 1%, 5% and 10% levels as shown in all the six regression models. The negative sign means that when other factors are held constant, a 1% increase in the distance to the nearest potential entrant (high threat of entry) results into a 0.198%, 0.424%, 0.0897%, 0.243%, 0.248% and 0.258% decrease in service price respectively on average. Similarly, under all the six regression models, the coefficients of the distance to the nearest potential entrant squared (low threat of entry) are all positive and significant. This means that, a 1% increase in the distance to the nearest potential entrant squared (low threat of entry) leads to a 0.164%, 0.342%, 0.0722%, 0.175%, 0.199% and 0.172% increase in the service price respectively on average. The coefficients on the number of mobile network subscribers per operator (market size) are all negative and significant at 1%, 5% and 10% in all the regressions. This means that, when other regressors are not varying, a 1% increase in the number of mobile network subscribers per operator leads into a 0.159%, 0.311%, 0.0685%, 0.159%, 0.199% and 0.172% decrease in service price respectively on average. The coefficients on the network equipment cost are also negative and significant at all the three levels in model (3), two levels in models (1), (2), (5), (6) and one level in model (4). Other factors not changing, a 1% increase in the cost for network equipment will lead into a 0.199%, 0.389%, 0.100%, 0.161%, 0.246% and 0.229% reduction in service price respectively on average. All the regression models explain the variation in the money transfer fee to non-registered users and money withdrawal fee from the agent by 52.1%, 54.4%, 48.7%, 46.1%, 50.2% and 49.9% respectively on average.

Table 3: Money transfer fee to non-registered users and money withdrawal fee from the agent

Dependent variables: lnPrice (OLS Models)

VARIABLES	(1) lnPriceC1	(2) lnPriceC2	(3) lnPriceC3	(4) lnPriceD1	(5) lnPriceD2	(6) lnPriceD3
lnDistance to Potential Entrant	-0.198***	-0.424***	-0.0897***	-0.243***	-0.248***	-0.258***
	(0.0406)	(0.0704)	(0.0107)	(0.0543)	(0.0385)	(0.0446)
lnDistance to Potential Entrant^2	0.164***	0.342***	0.0722***	0.175***	0.199***	0.197***
	(0.0240)	(0.0428)	(0.00774)	(0.0304)	(0.0256)	(0.0270)
lnCost of Network Equipment	-0.199**	-0.389**	-0.100***	-0.161*	-0.246**	-0.229**
	(0.0864)	(0.167)	(0.0343)	(0.0900)	(0.114)	(0.105)
lnNumber of Subscribers per Operator	-0.159***	-0.311***	-0.0685***	-0.159***	-0.199***	-0.172***
	(0.0263)	(0.0503)	(0.00993)	(0.0280)	(0.0345)	(0.0316)
Constant	7.403***	10.72***	6.616***	7.206***	7.630***	7.741***
	(0.531)	(0.961)	(0.215)	(0.540)	(0.668)	(0.619)
Controls Included:						
Firm Fixed Effects	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	420	420	420	420	420	420
R-squared	0.521	0.544	0.487	0.461	0.502	0.499
Number of firm	21	21	21	21	21	21

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 shows the regression output results for the internet data bundle price and short text message fee in models (1), (2), (3) and models (4), (5) respectively. The coefficients of the distance to the nearest potential entrant (high threat of entry) are all negative and significant at all levels as shown in all the five regression models. The negative sign on the coefficient means that when other factors are not changing, a 1% increase in the distance to the nearest potential entrant (high threat of entry) leads to a 0.224%, 0.181%, 0.200%, 0.370% and 0.328% decline in the service price respectively on average. Similarly, under all the five models, a 1% rise in the distance to the nearest potential entrant squared (low threat of entry) results into a 0.175%, 0.141%, 0.153%, 0.283% and 0.275% increase in the service price respectively on average. This is because all its coefficients are positive and significant at all the three levels. The coefficients of the number of mobile network subscribers per operator (market size) are all negative and significant at all levels in all the five regressions. This insinuates that, when other regressors do not change, a 1% rise in the number of mobile network subscribers per operator on average results into a 0.174%, 0.138%, 0.159%, 0.276% and 0.371% decrease in the service price respectively. The coefficients of the network equipment cost are also negative and significant at two levels in models (1), (4), (5) and one level in models (2), (3). Keeping other factors constant, a 1% rise in the cost for network equipment will on average result into a 0.203%, 0.152%, 0.172%, 0.364% and 0.411% reduction in service price respectively. On average, all the five regression models explain the total variation in the internet data bundle price and short text message fee by 52.6%, 52.5%, 51.8%, 48.0% and 44.0% respectively.

Table 4 Internet data bundle price and short text message fee
Dependent variables: lnPrice (OLS Models)

VARIABLES	(1) lnPriceData1	(2) lnPriceData2	(3) lnPriceData3	(4) lnPr.smsonnet	(5) lnPr.smsoffnet
lnDistance to Potential Entrant	-0.224***	-0.181***	-0.200***	-0.370***	-0.328***
	(0.0527)	(0.0329)	(0.0317)	(0.104)	(0.0579)
lndistance to Potential Entrant^2	0.175***	0.141***	0.153***	0.283***	0.275***
	(0.0297)	(0.0194)	(0.0202)	(0.0580)	(0.0409)
lnCost of Network Equipment	-0.203**	-0.152*	-0.172*	-0.364**	-0.411**
	(0.0965)	(0.0784)	(0.0918)	(0.156)	(0.196)
lnNumber of Subscribers per Operator	-0.174***	-0.138***	-0.159***	-0.276***	-0.317***
	(0.0293)	(0.0240)	(0.0277)	(0.0468)	(0.0595)
Constant	7.981***	8.330***	10.21***	8.517***	9.264***
	(0.574)	(0.442)	(0.531)	(0.943)	(1.142)
Controls Included:					
Firm Fixed Effects	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES
Observations	420	420	420	420	420
R-squared	0.526	0.525	0.518	0.480	0.440
Number of firm	21	21	21	21	21

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 displays the regression results for the voice calls service. These are on-net and off-net services. On-net calls are calls made within the same network. These are calls among the mobile subscribers registered with the same mobile network operator. On the other hand, off-net calls are calls among the mobile subscribers registered with different mobile network operators. The on-net and off-net calls rates depend on time with calls made during daytime (8.00am-10pm) being more expensive compared to the ones made overnight (10pm-8am). Both the on-net and off-net calls use per minute billing. The distance to the nearest potential entrant (high threat of entry) has all its coefficients being negative and significant at all levels of significance in models (1), (2), (3) and at two levels in model (4). The negative sign on the coefficients means that if other independent variables are not changing, a 1% increase in the distance to the nearest potential entrant (high threat of entry) leads to a 0.478%, 0.547%, 0.417% and 0.263% decline in the voice call charge per minute respectively on average. Likewise, holding other regressors constant in all the four models, a 1% rise in the distance to the nearest potential entrant squared (low threat of entry) leads to a 0.381%, 0.421%, 0.334% and 0.250% increase in the voice call charge per minute respectively on average. This is because all its four coefficients are both positive and significant at all levels. The coefficients on the number of mobile network subscribers per operator (market size) are negative and significant at all levels in all the four regression models. This implies that, when other independent variables are constant, a 1% rise in the number of mobile network subscribers per operator results into a 0.346%, 0.404%, 0.316% and 0.272% decrease in voice call charge per minute respectively on average. The coefficients of the network equipment cost are negative and significant at two levels as displayed in all the four regression models. Keeping other independent variables fixed, a 1% rise in the cost for network equipment will lead to a 0.417%, 0.455%, 0.385% and 0.374% decrease in the voice call per minute charge respectively on average. All the four regression models explain the total variation in the voice call per minute charge by 52.4%, 52.7%, 50.3% and 49.2% respectively on average.

Table 5 Voice call charge per minute
Dependent variables: lnPrice (OLS Models)

VARIABLES	(1) lnPr.vonnet1	(2) lnPr.vonnet2	(3) lnPr.voffnet1	(4) lnPr.voffnet2
lnDistance to Potential Entrant	-0.478***	-0.547***	-0.417***	-0.263**
	(0.0699)	(0.129)	(0.0612)	(0.0944)
lnDistance to Potential Entrant^2	0.381***	0.421***	0.334***	0.250***
	(0.0458)	(0.0714)	(0.0403)	(0.0543)
lnCost of Network Equipment	-0.417**	-0.455**	-0.385**	-0.374**
	(0.195)	(0.212)	(0.181)	(0.165)
lnNumber of Subscribers per Operator	-0.346***	-0.404***	-0.316***	-0.272***
	(0.0585)	(0.0655)	(0.0550)	(0.0460)
Constant	10.20***	11.18***	9.626***	8.984***
	(1.120)	(1.297)	(1.069)	(1.010)
Controls Included:				
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Observations	420	420	420	420
R-squared	0.524	0.527	0.503	0.492
Number of firm	21	21	21	21

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VI. CONCLUSIONS AND IMPLICATIONS

This research paper provides evidence that incumbent firms with market power can strategically lower their prices in order to deter the entry of new potential competitors or to prevent the market expansion of their fringe competitors under complete information. The dominant incumbents strategically lower their prices when faced with high threat of entry in order to block new potential competitors from entering the market. Fringe firms with smaller market size make losses within this limit pricing equilibrium. These fringe firms with a smaller market share have to adopt this pricing pattern by the dominant firms in order to attract mobile network subscribers. This results into the fringe firms incurring heavy losses facing some of them to form mergers or even exit the market in the worst-case scenario. The latest real-life example involving a US chipmaker company called Qualcomm and its smaller competitor called Icera happened this year on 18th July. In this case, the EU Commission fined Qualcomm a total sum of 242 million euros after proving it guilty of strategically lowering its prices below cost in order to prevent the market expansion by Icera and eventually drive it out out of business. Icera had reported incurring heavy losses and was considering exiting the market because of these lower prices by Qualcomm (EU Commission-Brussels, Qualcomm, Case AT.39711, 18 July 2019). This is the first study of limit pricing involving former monopolists who are still dominant and practicing price discrimination in the provision of their services. These firms are retaining their market leadership while still enjoying the first mover advantage benefits. In addition to giving empirical evidence on limit pricing, this dissertation in its theoretical analysis reveals that even under complete information, limit pricing is still a viable pricing option for the dominant price discriminating incumbents facing a threat of potential market entry. The analysis focuses on the East African Community mobile telecommunication industry. The community comprises of the following five countries: Kenya, Uganda, Tanzania, Rwanda and Burundi. The mobile telecommunication industry is very important for public policy within the East African Community. Its industrial organization coupled with the wealth of information pertaining to the services offered to the mobile subscribers makes it easy to study the entry deterrence scenario within it. We can

easily identify the incumbents, potential entrants and market demarcations. Firm fixed effects eliminate many of the obvious extra explanations. Potential entrants in the mobile telecommunication industry enter by expanding off from their existing footprint by installing their network towers for their full network coverage. Therefore, we can obtain a continuous measure for the threat of entry by estimating the distance between the incumbent and the closest potential entrant. The study investigates the pricing patterns of the pre-paid competitive tariff among the incumbent mobile network operators within the East African Community. These mobile network operators provide four services. These are money service, internet data service, voice call service and the short text message service. The study investigates the pricing responses to distance to the nearest potential entrant (high threat of entry), distance to the nearest potential entrant squared (low threat of entry), number of mobile network subscribers per operator and the cost of network equipment for all the above services. The obtained results provide evidence that is consistent with limit pricing as per the empirical method by Ellison and Ellison (2011). This research paper provides evidence that incumbents with a large market share use price as a strategic variable for deterring entry of potential competitors and for preventing the market expansion of their small competitors.

This research paper suggests two key areas for further research. The first avenue for further research is to ascertain how firms decide on the type of the entry deterring strategy to use. Incumbents can use other strategies to deter market entry instead of using limit pricing. Operating firms may invest in research and development, advertising and excess capacity (Smiley, 1988; Dean and Brown, 1995). Therefore, further research is required to determine how incumbents select between the entry deterring strategies. Furthermore, (Thomas, 1999; Simon, 2005; McCann and Vroom, 2010) reveal that some incumbents choose to wait and only respond after actual entry has taken place. Therefore, the other area for further research is to analyze the conditions under which the incumbent will respond before entry or wait to respond after the actual entry has occurred. While the research paper makes an important contribution to the empirical literature on limit pricing, and suggests promising areas for further research, it is good to acknowledge its limitation. The setting is limited to one industry, and it is not clear to which extend the findings can be generalized to other industries. Despite handling many cases on below cost pricing, the Antitrust and Competition Authorities have been relying mainly on the firms' operating cost while investigating cases of limit pricing. Much focus has also been in industries characterized with the presence of information asymmetry. The findings of this research paper are vital in aiding the Antitrust and Competition Authorities to update their policy framework. First, specifically, the East African Competition Authority can be able to regulate the pre-liberalization tariff among the dominant price discriminating mobile network operators based on these findings. The authority should immediately formulate Policies aimed at reducing the switching costs involved in this pre-liberalization tariff among the dominant mobile network operators. This will ensure easier switching to other competitive tariffs by the mobile network subscribers. This enhances fair competition among firms, promotes innovation by firms and widens the scope of choice for the mobile network subscribers. Generally, the Antitrust and Competition Authorities should widen their scope of below cost pricing investigations to include industries under complete information. This is because limit pricing can happen even in the context of complete information under certain conditions according to our empirical findings. These authorities should consider the threat of new entrants and the presence of fringe competitors in their investigations. These are the two main factors that induce the dominant incumbents to lower their prices below cost in order to eliminate competition. In addition, these authorities should consider market size in addition to firms' operating costs while analyzing cases pertaining to limit pricing. They should also regulate price discrimination

among the dominant incumbents in order to maintain fair competition. Furthermore, they should streamline mergers between firms that can result into market dominance for fair competition to prevail among all market players.

References

Analysys Mason., (2018) "Telecommunication Competition Market Study in the East African Community,"www.analysysmason.com .

Bagwell K., and G. Ramey, (1991) "Oligopoly Limit Pricing," *Rand Journal of Economics* 22, 155-172.

Bain J. S., (1949) "A note on Pricing in Monopoly and Oligopoly," *American Economic Review* 39(2), 448-464.

Camerer C., (2003) "Behavioral Game Theory: Experiments on Strategic Interaction," *Princeton University Press*.

Cooper D. J., Gravin S., and Kagel J. H., (1997) "Signaling and Adaptive Learning in an Entry Limit Pricing Game," *Rand Journal of Economics* 28, 662-683.

Communication Authority of Kenya, *Annual Sector Statistics Reports*: www.ca.go.ke

Communications Commission of Uganda, *Annual reports*: www.ucc.co.ug

Cooper D., J., Gravin S., and Kagel J., H., (1997) "Adaptive Learning versus Equilibrium Refine-ments in an entry limit pricing game," *Economic Journal* 107, 553-575.

Dafny L., (2005) "Games hospitals play: entry deterrence in hospital procedure markets," *Journal of Economics and Management Strategy* 14 (3), 513-542.

Deloitte, (2011) "Mobile Telephony and Taxation within the East African Community," www.deloitte.co.uk .

East African Communications Organisation: www.eaco.int

East African Community Facts and Figures, (2016): http://www.eac.int

East African Community Secretariat, annual reports: www.eac.int

European Commission: https://ec.europa.eu

European Commission, (1997) "Irish Sugar" *Official Journal of the European Communities* L258, 22 September.

Ellison G., and Ellison S., (2011) "Strategic entry deterrence and the behaviour of pharmaceutical incumbents prior to patent expiration" *American Economic Journal: Microeconomics* 3, 1-36.

Gedge C., Roberts JW., and Sweeting A., (2013) "A model of Dynamic Limit Pricing with an Application to the Airline Industry," *Mimeo*.

Ghemawat P., (1993) "Commitment to a process innovation: Nucor, USX and thin-slab casting," *Journal of Economics and Management Strategy* 2 (1), 135-161.

Goolsbee A., and Syverson C., (2008) "How do incumbents respond to the threat of entry? Evidence from the major airlines" *Quarterly Journal of Economics* 123 (4), 1611-1633.

Hannan T., (1979) "Limit pricing and the banking industry," *Journal of Money, Credit and Banking* 11(4), 438-446.

Nambanga, H. E. (2020). Limit Pricing under Complete Information: A Theoretical Analysis of Mobile network Operators. *International Journal of Science and Business*, *4*(12), 115-122.

Nambanga, H. E. (2021). Limit Pricing through Price Discrimination: A Theoretical study among Telocommunication Companies in East Africa. *International Journal of Science and Business*, *5*(1), 57-66.

Martin S., (1995) "Oligopoly Limit pricing: Strategic Substitutes, Strategic Complements," *International Journal of Industrial Organization* 13, 41-65.

Martinelli C., and Matsui A., (2002) "Policy Reversals: Electoral Competition with Privately Informed Parties," *Journal of Public Economic Theory* 4, 39-61.

Matthews S., and Fertig D., (1990) "Advertising Signals of Product Quality," *CMSEMS Discussion Paper* No. 881, Northwestern University.

Milgrom P., and Roberts J., (1982) "Limit Pricing and Entry Under Incomplete Information: An Equilibrium Analysis," *Econometrica* 50, 443-459.

Ministry of ICT and Innovation for Rwanda, annual reports: www.mitec.gov.rw

Ministry of Transport, Posts and Telecommunications of Burundi, Annual reports: www.burundi-gov.bi

Muller S., and Yehezkel, (2009) "Oligopoly Limit Pricing in the Lab," *Games and Economic Behaviour*

66 (1), 373-393.
McCann B., and Vroom G., (2010) "Pricing response to entry and agglomeration effects," *Strategic Management Journal* 31 (3), 284-305.
Regulatory Agency for Public Utility Services of Rwanda, annual reports: www.rura.rw
Salop S., C.; and Scheffman D., T., (1983) "Raising Rivals' costs," *American Economic Review* 73 (2), 267-271.
Seamans R., (2013) "Threat of entry, asymmetric information and pricing," *Strategic Management Journal* 34 (4), 426-444.
Simon D., (2005) "Incumbent pricing responses to entry," *Strategic Management Journal* 26, 1229-1248.
Singh S., Utton M., and Waterson M., (1998) "Strategic behaviour of incumbent firms in the UK," *International Journal of Industrial Organization* 16 (2), 229-251.
Schmalensee R., (1981) "Output and welfare implications of monopolistic-third degree price discrimination," *American Economic Review* 71 (1), 242-247.
Schultz C., (1996) "Polarization and Inefficient Policies," *Review of Economic Studies* 63, 331-344.
Schultz C., (1999) "Limit Pricing when Incumbents have Conflicting Interests," *International Journal of Industrial Organization* 17, 801-825.

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