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## 竞争对移动通讯服务价格的影响

An Assessment of How Mobile Telecommunications Competition  
Effect on Mobile Call Prices

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## 摘要

世界范围内，各个行业都存在激烈的竞争。文献中，前人已经从各个角度分析了竞争带给经济的影响。本文通过分析来自 49 个国家，2010 年到 2014 年 5 年的面板数据，分析通讯行业内的竞争对通讯费的影响。本文的目标是判断行业竞争是否是影响通讯价格最主要的因素，以及竞争在发展中国家和发达国家的不同影响。本文中，通讯费的数据来自国际通讯报告(以占国内生产总值的比例计算而来)，其他变量来自世界银行和维基百科。固定国家效应和时间效应被纳入模型中，本文结果显示：竞争对于通讯费有重要的正面影响；此外，HHI 因素对于通讯费的影响在发展中国家更为显著。

**关键字：**竞争；通讯价格；HHI

## **Abstract**

Competition is a wide spread phenomenon present in almost all the industries in the world. In the academic research field competition has been examined from different angles. This thesis assesses the effect of mobile telecommunications competition on mobile call prices on a panel of 49 countries for a period of five years (from 2010 to 2014). The objective of this paper is to find out if competition is the most important determinant of mobile call prices and if its effect on call prices is different between developed and developing countries. To do this data on mobile call prices was collected from the International Telecommunication Union Reports (and computed as a percentage of Gross Domestic Product) while data on other variables were obtained from the World Bank and Wikipedia. Fixed country effects and time effects were used and the results suggested that competition has a positive and significant effect on mobile call prices. In addition, the HHI was found to have a higher and significant effect on call prices for developing countries than developed countries.

**Key Words: Competition; Mobile call prices; HHI**

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## Chapter 1: Introduction

The telecommunications industry is one of the most dynamic industries in the world because of the progressive growth and structural changes brought in by innovation and improvement in technology over the past decades especially in the mobile sector. Before now, the telecommunication industry most especially the fixed line sector and the mobile sector were characterized by monopoly markets. Though liberalization was uneven, it contributed to the expansion of the industry and equally encouraged competition in almost all the countries that were dominated by national monopolies until the mid-1990s with some of them being privatized <sup>1</sup> (Djiofack-Zebaze & Keck, 2009). Increase in demand equally encouraged competition (Polykalas & Prezerakos, 2015). Nearly all countries of the Organisation for Economic Cooperation and Development (OECD) were characterised by oligopoly markets by 2008 except New Zealand and Norway (Li, 2011). According to Peitz, Valletti, and Wright (2004) summary, in order to limit competition in the low user market (that is a market where demand is low) while increasing competition in the high demand market, firms could set higher access charges in the high demand market without a corresponding fall in price in the low demand market. In addition, the global change in the telecommunication industry was more present in the mobile sector than in the fixed line sector with regulatory authorities created in some countries to monitor the industry's development. This industry is important because it contributes enormously to economic development by reducing the level of unemployment, creating income as well as being an input used to produce other goods and service (Djiofack-Zebaze & Keck, 2009).

In the past, fixed line was the most widely used means of communication, but today it is substituted for the mobile communication network with mobile subscription outnumbering fixed line subscription partly because of competition and the granting of spectrum license (Gruber & Verboven, 2001). Furthermore, there are numerous factors which might affect mobile call prices among which population, population density, income, competition. Competition in the mobile telecommunication market has also been influenced by liberalization, privatization of some existing firms and the entering of new firms which has encouraged innovation. The fall in outgoing and incoming call prices in almost all countries

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<sup>1</sup> Only Japan, United Kingdom and the United States allowed competition in the basic telecommunication service in 1990, 1995 had 11 countries, by 1998 the number increased to 4q230 countries with Uganda being the only African country and in 2006 the number was almost 120 countries (Djiofack-Zebaze & Keck, 2009).

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in the world is attributed to technological progress because more network infrastructure could be set up at a lower cost. This fall in prices was equally a result of measures like mobile number portability, decrease in mobile termination rates, the entrance of new operators (mobile virtual network operators) in the market (ITU, 2014).

According to Djiofack-Zebaze and Keck (2009), though there is increasing competition in the mobile communications market, mobile call prices are still high compared to other regions of the world especially in Africa. This argument can be supported by the telecommunications mobile service price data which equally shows that over the years phone call prices have continuously been falling in terms of USD, purchasing power parity (PPP) or as a percentage of Gross National Income per capita (GNI p.c.). For example between 2013 and 2014 the mobile cellular call prices have continuously been falling both in relative and absolute terms in developed<sup>2</sup> countries from an average of 1.5 per cent of GNI p.c. to 1.4 per cent, in developing<sup>3</sup> countries from 11.6 per cent of GNI p.c. to 5.6 per cent and in the least<sup>4</sup> developed countries (LDC) from 29 per cent to 14 per cent for the year 2008 and 2014 respectively (ITU, 2015).

Figure 1 below shows the evolution of mobile telecommunications service prices as a percentage of Gross National Income per capita<sup>5</sup> from 2008 to 2014 with countries classified by level of development based on the United Nations classification. Prices are expressed as a percentage to properly show affordability of mobile call services by country. From the graph, LDCs and developing countries have been paying higher call prices compared to developed countries.

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<sup>2</sup> Countries are classified into developed countries by WESP (World Economic Situation and Prospects). more details at:

[http://www.un.org/en/development/desa/policy/wesp/wesp\\_current/2014wesp\\_country\\_classification.pdf](http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf)

<sup>3</sup> More details at:

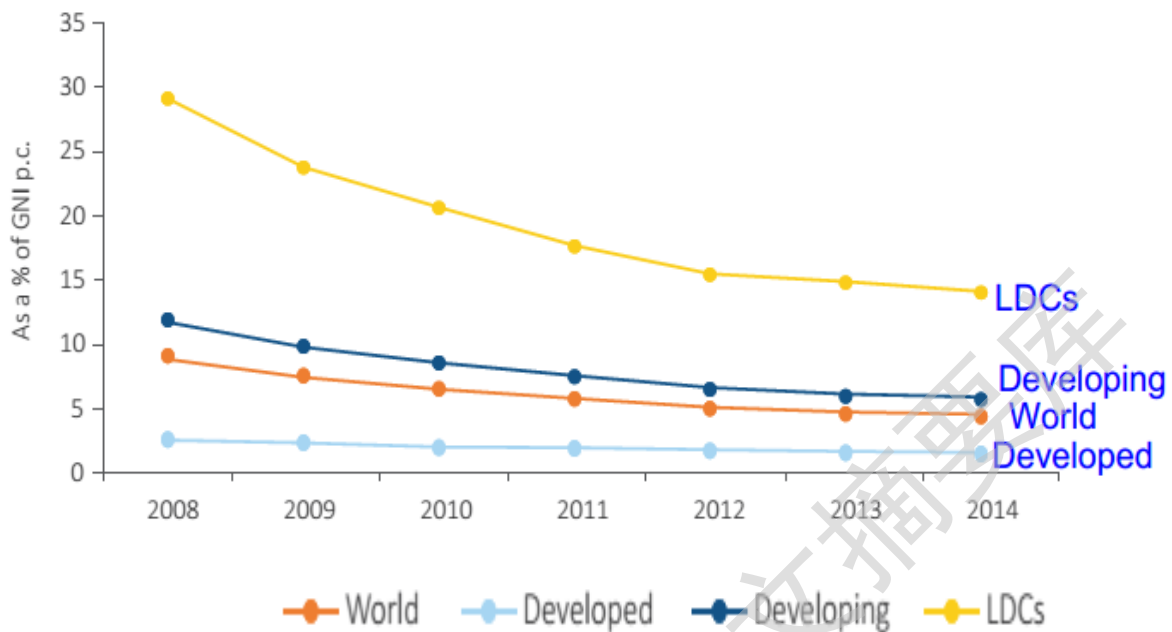
[http://www.un.org/en/development/desa/policy/wesp/wesp\\_current/2014wesp\\_country\\_classification.pdf](http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf)

<sup>4</sup> For more details on the classification: [http://www.un.org/en/development/desa/policy/cdp/ldc/ldc\\_list.pdf](http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_list.pdf)

<sup>5</sup> Based on a regional analysis Europe is the most affordable with an average price of 1.47 USD.



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**Figure 1: Mobile cellular basket in USD, 2008-2014**

Source: ITU (2015).

This different view on prices comes with the question “Does mobile telecommunications competition affect mobile call prices?” Is competition the most important determinant of telecommunications service prices? The main objective of this study is to assess how competition in the mobile sector affects mobile call prices using other control variables and control for inflation. I also evaluate the relative effect of increasing competition on prices in developed and developing countries. The hypothesis tested includes;

H0: mobile telecommunications competition does not significantly affect mobile calls prices

H1: mobile telecommunications communications significantly affects mobile call prices

This paper looks at the determinants of telecommunications prices because prices in part determine usage and usage is shown by Lam and Shiu (2010) to influence economic growth.

Theoretically, prices will be determined in part by the determinants of demand and marginal cost. On the demand side we have population density, income and on the cost side we have input factors like the cost of operating telecom services. But prices will also in part be determined by the market structure. As shown in the next section, the level of firm competition in the market will determine equilibrium market and quantities. Thus to identify

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which is the most important factor(s), data was collected from Wikipedia, International Telecommunication Union (ITU) and the World Bank on a panel of 49 countries in the world for a period of 5 years from 2010 to 2014. It is hoped that the findings of my research will be a contribution to the previous works done as it attempts to assess the impact of mobile competition on call prices in the telecommunications industry.

My study is divided into five chapters; this chapter introduces the topic, identifies the research question, the research's objectives and states the hypothesis being tested: chapter two which is the literature review consists of some theories and empirical review: chapter three identifies the method of data collection, method of data analysis, specifies the method of estimation, the validation technique and limitations of the study: chapter four discusses the results and chapter five concludes.

## Chapter 2: Literature Review

This section will review some relevant theories and literature. Some conventional wisdom on competition is that of the classical and the neoclassical theories of competition. Smith, Ricardo, J.S. Mill developed the classical theory of competition in which competition is viewed as a mechanism coordinating the conflicting self-interest of individuals and directing them to the attainment of equilibrium (the attainment of natural prices). In other words, competition is a process which leads to an unequal price in the short run, different profit rates between firms in the industry and different prices between industries which will tend to be equal in the long run. J.S. Mill believed that natural prices and income could be determined in a strict way. They were criticised for not being clear on the requirements of a competitive behaviour and how it was affected by the number of participants; for not distinguishing clearly intra industry competition and inter industry competition (Tsoulfidis, 2011).

On the other hand, the neo-classicist theory of perfect competition assumes demand for a good is homogenous for all the industries; perfect knowledge or information about the market by consumers in terms of product characteristics and prices; utility maximization; profit maximization and perfect mobility of factors of production; large market size; free entry and exit of firms. Thus this theory assumes that with all the above conditions put together producers cannot influence the price of a product and the firm chooses the level of output which maximizes profit achieved where price equals the marginal cost of the product. At this point, welfare of society and consumer utility is maximized. This theory was used by Chamberlin in his formal theory of monopolistic competition but later rejected by him on the grounds that free enterprise has too long been loosely related to pure or perfect competition and is “in no sense an ideal” (S. D. Hunt, 2010). The theory of perfect competition was criticized by Shelby D. Hunt and Morgan (1995) because it did not explain why market based economies had superior quality goods compared to command economies, which their comparative advantage did, though they suggested more empirical and conceptual work be done to test, explore and further explain its possible future results.

Chamberlin<sup>6</sup> was a neo-classicist who developed the theory of monopolistic competition and argued that product differentiation (in terms of higher quality) leads to higher prices and output rates not at the lowest point of a firm's long run average cost curve (Shelby D. Hunt &

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<sup>6</sup> Chamberlin was from Harvard University and called his theory a hybrid theory of competition and monopoly. See (S. D. Hunt, 2010) for more details.

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Morgan, 1995). This theory is based on the assumptions that a general category of product is differentiated; demand and supply are heterogeneous; static equilibrium be used in economic analysis with reliance on geometric and mathematic reasoning; perfect competition should be used to judge monopolistic competition (S. D. Hunt, 2010). He advocated for perfect competition to be replaced by monopolistic competition because it deviated from the present economic life while other neo classicist (Friedman, Stigler and Harberger)<sup>7</sup> argued that perfect competition was the approximate result of the work of capitalism and monopolistic competition was a more complex approach. His theory of monopolistic competition was equally criticized for encouraging government intervention which according to him was necessary because competition was imperfect. In addition to that, Chamberlin's informal theory of monopolistic competition was not acknowledged by both the Chicago and Harvard school as a legitimate as it regarded perfect competition not to be an ideal for welfare economics. The main difference between these two schools of thought is that the classical viewed competition as a rivalry which never ends because firms strive to increase their market shares compared to the neo-classicists view of it as an end state (Tsoulfidis, 2011).

Furthermore, we have the classic models of oligopoly which consist of the Cournot model, the Bertrand model. The Cournot model of oligopoly is a static game of complete information where firms compete over quantities and the Cournot equilibrium is the Nash equilibrium of quantities (which is a pair of output such that neither firm can increase its profits by unilaterally deviating). It is based on the assumptions that firms produce homogenous products, compete with each other once and decide what quantity to produce at the same time and choose the output level. Here the firm have market power (because prices exceed marginal cost) measured by the Herfindahl-Hirschman Index. The theory of oligopoly assumes there is a positive relationship between market power and concentration. This market power reduces with the number of firms competing in the market. This model was criticised by Joseph Bertrand on the basis that firms compete over prices and not quantities. According to Bertrand's model of competition, firms compete over prices and the Nash equilibrium price (which are a pair of prices such that given the Nash equilibrium price of its rival the firm will have no incentive to unilaterally deviate) is attained where price equals marginal cost ( $P=MC$ ) with zero profit. It is the based on the assumptions that firms produce the same goods, simultaneously choose their price and no other producer can enter the market. The Bertrand model equally considers the situation where products are differentiated and

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<sup>7</sup> They were associated with the Chicago University

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concludes that firms equally compete over prices rather than quantities. These two models considered a duopoly market (Church & Ware, 2000). According to the book of industrial organization by Church and Ware (2000), in the basic Cournot model with N firms where,

$P = A - bQ$  And  $C(q_i)$ , Cournot equilibrium output and price is given by

$$P(q_i, q_{-i}) + \frac{dP(q_i, q_{-i})}{dQ} q_i = MC_i(q_i)$$

$$\frac{P(q_i, q_{-i}) - MC_i(q_i)}{P(q_i, q_{-i})} = - \frac{dP(q_i, q_{-i})}{dQ} q_i \frac{1}{P(q_i, q_{-i})} * \frac{Q}{Q}$$

$$\frac{P(q_i, q_{-i}) - MC_i(q_i)}{P(q_i, q_{-i})} = \frac{1}{\varepsilon} * \frac{q_i}{Q}$$

Multiplying both sides by  $s_i$ , we get

$$s_i * \frac{P(q_i, q_{-i}) - MC_i(q_i)}{P(q_i, q_{-i})} = \frac{1}{\varepsilon} * \frac{q_i}{Q} * s_i$$

$$s_i * \frac{P(q_i, q_{-i}) - MC_i(q_i)}{P(q_i, q_{-i})} = \frac{1}{\varepsilon} * s_i^2$$

Taking the sum of both sides over N

$$\sum_{i=1}^N s_i \frac{P(q_i, q_{-i}) - MC_i(q_i)}{P(q_i, q_{-i})} = \frac{1}{\varepsilon} \sum_{i=1}^N s_i^2 \quad \text{where } \frac{q_i}{Q} = s_i (\text{market share of firm } i)$$

$$P - MC/P = HHI/\varepsilon$$

$$\sum_{i=1}^N s_i^2 = HHI \quad \text{and}$$

$P(q_i, q_{-i}) = \text{cournot equilibrium price and}$

$\varepsilon = \text{absolute value of market demand elasticity}$

$s_i = 1/N$  if all firms have the same market share

$$HHI = 1/N$$

Furthermore,

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$$Q = N \left[ \frac{A - c}{(N + 1)b} \right], \quad \text{and } P = \frac{A + Nc}{N + 1},$$

The equations above show that Cournot equilibrium output is obtained when marginal cost equals marginal revenue. The Lerner index which measures the market power has a positive relationship with the HHI: meaning that the higher the HHI, the higher the firm's market power. Also, increasing the number of firms in the market reduces the market share of other firms, their market power and their respective output but the overall output in the market increases resulting to a fall in price. Thus there is an inverse relationship between HHI and the number of firms. Cournot equilibrium output for N firms is given by Q and equilibrium price by P.

For the past decades competition in the telecommunications industry has attracted a lot of attention in the academic research field among which the relationship between mobile network and the fixed line network. According to Rodini, Ward, and Woroch (2003), mobile service moderately replaces the fixed line and this substitution will continuously increase overtime. Vagliasindi, Güney, and Taubman (2006) looked at fixed and mobile competition in transition economies and results showed that competition led to a substitution effect between mobile and fixed line subscription on Eastern Europe countries and the rest of Soviet Union. This substitution effect was equally acknowledged by Garbacz and Thompson (2007) whom examined the relationship between economic development, public policy and telecommunications technology through telephone demand models and the use of price equation developed in Garbacz and Thompson (2005). This mobile and fixed demand model incorporated a new variable price. The hypothesis of whether mobile phones and wire line phones were substitutes or complements was tested. Three equations were formed; the first one not controlling for price endogeneity, the last two which controlled for price endogeneity their estimated prices were used as actual prices in the demand model for mobile phones and fixed lines with one of the equations including density. Privatization, competition and independent regulators dummy variables were used as instruments to control for endogeneity. The models were estimated through two stage ordinary least square with fixed effects for 53 countries over an 8 year period. Data was in log form so as to interpret the estimates as elasticities. The results showed that fixed line service monthly price is statistically insignificant in the fixed line demand model but significant in mobile demand model while mobile service prices are statistically significant in both the fixed line and mobile demand model. Also, the mobile model estimates suggested that mobile phones and fixed lines are

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substitutes in the mobile market but complements in the fixed line market. Thus he suggested a reassessment of universal services and competitive market initiatives.

Kalmus and Wiethaus (2010) used a two stage Cournot model to investigate to what extent mobile virtual network operators exerted a competitive constraint on mobile network operators. The first stage assumed that mobile network operators decided on the amount of capacity (or wholesale minutes) to allocate to their retail businesses and wholesales (to Virtual Operators) and in the second stage mobile virtual network operators decided on the amount of minute calls to purchase while they both competed in the retail market. The sample was made up of two network operators and  $n$  number of virtual operators in the mobile market. The results revealed that the entrance of virtual operators in to the mobile market does not increase the level of competition in the retail market nor does it induce a decrease in price. In addition, based on their results they think less wholesales capacity will be offered by the mobile operators to prevent mobile virtual operators to compete with them in the retail market and no capacity will be offered at all if their products are substitutes. Also, Cricelli, Grimaldi, and Ghiron (2011) looked at competition amongst mobile network operators mobile virtual network operator and hosting network operators and concluded that collaboration between the incumbent and virtual network operators is the best strategy in terms of profit margin and market shares.

Other researchers tried to assess regulatory reforms and performance in the telecommunication sector. Maiorano and Stern (2007) assessment of the relationship between regulation and performance in the mobile sector showed a significant positive effect of regulatory reforms on mobile telecommunication diffusion and gross domestic product per capita. Liberalization in the telecommunications sector associated with competition led to economic growth, increased sectorial performance, quality of service rendered and equally caused prices to fall (Djiofack-Zebaze & Keck, 2009). In the same direction, Fink, Mattoo, and Rathindran (2003) estimated the impact of telecommunications regulatory reforms (competition and privatisation) on performance for developing countries with data collected from the ITU for more than 100 countries. In his study he tried to find out if sequential implementation of these policies was important in boosting mainline penetration. He controlled for serial correlation and heteroskedasticity. The estimated results suggested that introducing competition and privatisation at the same time was more effective in boosting or increasing performance than if competition was introduced after privatisation. The test for sequential implementation showed that privatisation had a positive and significant effect on

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mainline penetration when implemented alone while competition was not significant when implemented alone. On the other hand, Garrone and Zaccagnino (2015) found no precise relation between competition and market reforms while examining the relationship between competition and telecommunication investment for 29 OECD countries where they first checked for breakpoints in investments at country level for 18 OECD countries for (33 years) and if these breakpoints could be associated with market reforms such as the liberalization of the mainline markets and unbundling obligations. Secondly, they conducted a bivariate analysis to see if market competition influenced incumbent fixed investment with the use of a unit root test for 29 OECD countries from 1993 to 2008. One of the limitations in their analysis is that they didn't distinguish between investment in the mobile and fixed line sector.

The assessment of key variables affecting the mobile telecommunications was also one of the main issues addressed by some studies. In that light, Gruber and Verboven (2001) assessed the role of technology, regulatory decisions and competition in the diffusion of mobile telecommunications on a panel consisting of European Union members using a logistic model of technology diffusion. The final result showed that transition from the analogue to the digital technology and increase in spectrum capacity, had a major impact on the diffusion of mobile telecommunications. He suggested more works be done with the price variable. Furthermore, Gruber (1999) studying investment issues affecting the mobile telecommunications sector concluded that public action can become an important stabilising element in involving private investors with otherwise shorter time horizons.

Nucciarelli, Gastaldi, and Levialdi (2009) examined the determinants of pricing in the international telecom market and concluded that the market structure determined tariff in a bilateral market. Percy and Savage (2015) empirically evaluated the impact of international simple resale on actual and potential competition and price in the United States international telecommunications market and found out a limited effect on competition and a fall in prices by employing a reduced form equation model on a 9 year data. Hausman and Ros (2013) assessed telecommunication prices and consumer surplus in Mexico with the use of a panel data which consists of countries similar to Mexico. Their objective was to show that telecom prices (mobile and fixed line prices) in Mexico are lower compared to other OECD countries despite the fact this market is considered more concentrated than the telecom markets in other countries using demand models for both fixed and mobile and found out that prices actual call prices in Mexico were smaller compared to countries similar to Mexico.



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