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Market Power and Collusion on Interconnection Market in Tunisia: What Lessons from International Experiences

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ABSTRACT

We try to characterize the state of mobile phone market in Tunisia. This study will be based on a survey of foreign experience (Europe) in detecting collusive behavior and a comparison of the critical threshold of collusion between operators in countries like Tunisia. The market power will be estimated, based on the work of Parker Roller and the assumption "Balanced Calling Pattern". And the comparison of the critical threshold of collusion will be based on modeling Friedman .The "conduct parameter" measuring the intensity of competition is not null during the period (1993-2011). Results show that collusion is easier in Tunisian market that in Algerian, Jordanian, and Moroccan market. The results are comparable to those find by "Arab Advisor Group".

KEYWORDS : Termination Rate ; Market Power ; Competition.

INTRODUCTION

Liberalization of the telecommunications sector consists of opening all its segments to competition and privatization Wallsten, S. J (2001). The mobile phone market had known in the recent years a dynamic and changing structure in most of the countries who have undertaken to reform their telecommunications sectors. Depending on the characteristics of the local market (private or public sector) resulting from the restructuration and the implementation of progressive market liberalization policies, the number of actors (duopoly or oligopoly) and consequently their profits in the telecommunications industry has been variable. Tunisia has one of the more developed mobile markets in Africa as indicated by the high level of mobile penetration, which has are three mobile phone operators in the country: The market structure has gone through several stages, from the monopolistic structure (1992-2001), to the duopolistic one (2002-2009) until reaching a three operators structure (from 2010 until today). In addition to the market structure, there have been changes in the market shares of the public and the private operators. Indeed, the privatization of incumbent operator (T.T.) (the historical national operator) in 2006 transformed (theoretically) the market from a mixed (Private-Public) duopoly to a private one. With the entry of Orange Tunisia on the market in 2010, one should talk about a three private operators market. Obviously, the preference for collusion[1] is certainly not the same in these different market structures. At the same time, some changing in the market structure was the result of strategic behavior adopted by the several economic operators. In this context, collusion is one of the possibilities and strategies (Colombier et al. (2010)) that actors may adopt to control the market.

On a practical level and starting international experiences, several regulatory frameworks were able to detect these collusive behavior and their natures, enhancing the damage incurred by the economy and impose sanctions on operators due to these injuries. The case of French operators, operators Czechs and even operators of the European Union have the best-known cases worldwide. Detection instruments, the nature, scope and level of damage varies from one country to another. On the mobile phone market, factors that facilitate the implementation of collusive behavior are: exchange of information, convergence of market shares, the monetary transfer between operators and communication between them through regular meetings (Pénard (2002)). These factors are risk takers for possible collusion, as is the case of operators of mobile phone in France. Indeed, they have implemented two types of cartel practices restrictive of competition, exchanges of strategic information and agreement between 2000 and 2002 on stabilise their market share. This

information exchange reduces the competition intensity in the mobile market for this reason: In a market where not only three operators on which the entry is very difficult, the exchange of information of this type is likely to affect the competition. Consultation stabilisation of their market share has been established through the intersection of several major indexes, accurate and consistent, such as the existence of handwritten documents explicitly mentioning an "agreement" (explicit collusion), as well as similarities identified during this period in the trade policies of operators, particularly in terms of acquisition costs and pricing of communications. The Competition Council has therefore fined the three mobile operators, Orange France, SFR and Bouygues Telecom respectively amounting to € 256 million, € 220 million: € 58 million.

In this paper, our object will be the study of Tunisian mobile phone market state, and a comparison of collusion degree in three Arabian markets such us (Morocco, Algeria and Jordan) in Duopoly and Oligopoly structures where the actors are private, mixed or public. The market power will be estimated, based on the work of Parker Roller and the assumption "Balanced Calling Pattern"[2]. And the comparison of the critical threshold of collusion will be based on modeling Friedman (1971).and results of Cortade (2005) and Debbichi, Hichri (2013). Our findings can be used by the regulator to control collusion behavior, by changing the level of interconnection fees for each market structure and by implementing the suitable market liberalization policies. The paper is organized as follows: (Section 1) presents the related literature. In (Section 2) we present the data and methodology. Application results in (Section 3). Finally, we present a discussions and concluding remarks.

RELATED LITERATURE

Economic issues in the telecommunications sector and regulation are very important (Flacher and Jennequin (2007)). Several economic issues are resolved, as the barriers to entry (Baranes and Flochel (1999)), interconnection networks (Bulatovic (2004), Schiff (2005), Colombier et al. (2010)), the level of pricing (Dessein (2003), Berger (2005)), privatization (Wallsten (2002)) and market structure De Donder (2005) and strategic behavior competitors (competition, collusion (Parker and Roller (1997), Souam and Pénard (2002), agreement fusion (Artz et al. (2009)) or deviation).

Interconnection is a key factor to competition Laffont and al. (1996). Each operator must pay an interconnection charge to its competitor for routing the call on its network *(two-way interconnection)* Baranes and Poudou (2010), Bulatovic (2004). The stability of the interconnection rate, leads us to ask about the state of competition, firstly, on the interconnection market and secondly, on the retail market (Steve G.Parsons (2002)). In this context, collusion is one of the possibilities and strategies (Colombier et al. (2010)) that actors may adopt to control the market. Collusion is a strategic behavior chosen by economic agents when the result is better in comparison with competition. Also, telecommunications operators may even use a high access charge as an instrument of collusion (Dessein (2003)). Laffont and Tirole (2000) present a study of competition in telecommunications, and a view of this competition from the United States was presented by Parsons (2002). Several studies have already highlighted the determinants of the choice of colluding (Parker and Roller (1997) and Hoffler (2009)), and especially its relationship with the level of interconnection fees.

DATA AND METHODOLOGY

History of Arabian mobile phone market structure

Algeria

The Algerian mobile market structure was historically a public monopoly with one operator (Algeria Telecom). The first offer "GSM "(Global System for Mobile) was launched in 1999. Since 2001, a private operator has entered on the market "Orascom Telecom Algeria". The first foreign private operator has commercially launched its brand "Djezzy" in February 2002. Last arrived on the market, Kuwait Wataniya Telecom took third license in December 2003 and six months later created his brand "Nedjma". Since 2004, three operators are competing in the market for mobile phone in Algeria.

Morocco

The Moroccan mobile market structure was historically a public monopoly with one operator (Maroc Telecom). With the opening of postal and telecommunications competition a second mobile license type "GSM" with (Médi Telecom) in 1999. Indeed, the privatization of (Maroc Telecom) (the historical national operator) in 2001 transformed (theoretically) the market from a mixed (Private-Public) duopoly to a private one. Finally, in 2010; a third private operator (Wana) joined the market to transform the duopoly private structure into a three private operators market.

Table 1: History of Arabian Mobile Phone Market Structure				
Years	Tunisia	Alegria	Jordan	Morocco
1998	Monopoly	Monopoly	Monopoly	Monopoly
1999	✓	✓	Duo poly	Duo poly
2000	✓	✓	Duo poly (priv)	✓
2001	✓	✓	✓	Duo poly(Priv)
2002	Duo poly	Duo poly	✓	✓
2003	✓	✓	✓	✓
2004	✓	Trio poly	✓	✓
2005	✓	✓	✓	✓
2006	Duo poly(Priv)	✓	✓	✓
2007	✓	✓	✓	✓
2008	✓	✓	✓	✓
2009	✓	✓	Trio poly	✓
2010	Trio poly	✓	✓	Trio poly

Jordan

The Jordanian market structure has also experienced a profound change. Indeed, a second mobile license type "GSM" was launched in 1999. The privatization of the historical national operator in 2001 transformed (theoretically) the market from a mixed (Private-Public) duopoly to a private one. In 2009, a third private operator joined the market to transform the duopoly private structure into a three private operators market.

Market Power in Tunisian Market

An operator has market power if it sets non-competitive prices above marginal cost[3]. In the absence of cost accounting, the measurement of marginal cost will be more difficult and assessment of market power will become impossible. For this reason, Parker and Roller (1997) consider "The conduct parameter" ϑ defined by:

$$a(q_{ij}) + \vartheta \acute{a}(q_{ij})q_{ij} = \theta_i \tag{1}$$

$$a(q_{ij}) - \theta_i = -\vartheta \acute{a}(q_{ij})q_{ij} \Leftrightarrow \vartheta = \left(\frac{-1}{\acute{a}(q_{ij})q_{ij}}\right)(a(q_{ij}) - \theta_i) \tag{2}$$

$$\text{Finally, } \vartheta = \left(\frac{-a}{\acute{a}(q_{ij})q_{ij}}\right)\left(\frac{a(q_{ij}) - \theta_i}{a(q_{ij})}\right) \Leftrightarrow eL \tag{3}$$

With q_{ij} the quantity of interconnection exchanged between two networks, θ_i the marginal cost and a the termination price, and e the demand elasticity of interconnection. The price elasticity of demand is assumed constant (8%) between the years (2002-2011) for both operators and is calculated from the following formula and based on the hypothesis "*Balanced Calling Pattern*"[1] Debbichi, s. and Ben Khalifa, A. (2013).

$$ea\backslash q = \frac{\dfrac{a^1 - a^0}{a^0}}{\dfrac{q_{12}^1 - q_{12}^0}{q_{12}^0}} \tag{4}$$

The Lerner index (margin) of the operator is equal to its market share divided by demand elasticity (request to interconnection), given by the following expression[2]:

$$\frac{(a(q_{ij}) - \theta_i)}{a(q_{ij})} = \frac{\propto_i}{e} = L_i \tag{5}$$

Now we have already seen that the HHI is equal to the sum of the squared market shares:

$$HHI = \sum_{i=1}^{n} \alpha_i^2 \qquad (6)$$

and: $\bar{L} = \sum_{i=1}^{n} \alpha_i L_i$

$$\bar{L} = \sum_{i=1}^{n} \alpha_i \left(\frac{a - \theta_i}{a}\right) = \left(\frac{a - \bar{\theta_1}}{a}\right) \qquad (7)$$

The average index is equal to $\bar{L} = \left(\frac{a - \bar{\theta_1}}{a}\right)$ with $\bar{\theta} = \sum_{i=1}^{2} \alpha_i \theta_i$ the weighted average unit cost of interconnection service.

Moreover, as $\frac{(a(q_{ij}) - \theta_i)}{a(q_{ij})} = \frac{\alpha_i}{e}$ this average value is also given by

$$\bar{L} = \sum_{i=1}^{n} \frac{\alpha_i^2}{e} = \frac{HHI}{e} \qquad (8)$$

It was shown that the average Lerner index is proportional to the HHI on the interconnection market. We are faced with two alternatives; $\vartheta \to 0$ perfect competition of interconnection market, and $\vartheta \to 1$ the market is monopolistic. Generally, in the case of Cournot competition between n symmetric operator[4] $\vartheta \to \frac{1}{n}$. The parameter ϑ measures the degree of collusion. In this case it's possible to construct an econometric test to reject or to accept the assumption that industry is competitive, monopolistic comparing the theoretical value to estimated value.

1/ If $\vartheta = 0$, $a = \theta$ prices equal marginal costs and the industry is perfectly competitive.

2/ If $\vartheta > 0$, the price is above marginal cost, and interconnection industry in a collusive situation.

Table 2: Tunisian Market Power Value (1993-2011)			
Years	**Market Power Value**	**Years**	**Market Power Value**
1993	1.00*[2]	**2003**	0.6058
1994	1.00*	**2004**	0.5848
1995	1.00*	**2005**	0.5103
1996	1.00*	**2006**	0.5024
1997	1.00*	**2007**	0.5014
1998	1.00*	**2008**	0.5002
1999	1.00*	**2009**	0.5018
2000	1.00*	**2010**	0.4580
2001	1.00*	**2011**	0.3333*
2002	0.6058		

From the table1 above $\vartheta \to \frac{1}{n} = \frac{1}{2} > 0$ the interconnection price is above marginal cost. This result is valid for three cases of market structure (monopoly, duopoly and triopoly), but the intensity of market power decreases with increasing the number of operators on the market. Debbichi, S and Hichri, W. (2013) studied a Cournot model that compares the intensity of market power by the critical threshold of collusion in Duopoly and Oligopoly Markets where the actors are private, mixed or public. Their findings can be used by the decision makers to control collusion, by acting on the level of interconnection fees for each market structure and by implementing the suitable market liberalization policies in this sector.

The Model Friedman (1971)

Hypothesis

1. We assume that the market is composed of two to three operators which are in one part of Cournot competition. Each operator $i = 1,2,3$ is characterized by an interconnection fee a_i (Flochel (1999), Harbord Pagnozzi and (2010)).

2. The operators agree on a common interconnection tariff $a_1 = a_2 = a_3 = a$. We also assume that the two operators charge retail rates $P_1 = P_2 = P$. Let $P = 1 - Q = 1 - (q_{12} + q_{21})$ the inverse demand function and the total amount of exchanged traffic between the two networks.

3. There is two industrial configurations in the market, a private and public operators. The first maximize:

$$\pi_1 = (1 - q_{12} - q_{21} - a)\, q_{12} + a q_{21} \qquad (9)$$

And the second maximize his profit:

$$\pi_2 = \frac{1}{2}(q_{12} + q_{21})^2 + (1 - q_{12} - q_{21} - a)q_{21} + a q_{12} \qquad (10)$$

4. If there is privatization of the incumbent, duopoly market structure becomes private.

Let's assume N operators on the Phone Market, who have the choice between colluding and competing. The incitation to collude will depend on the critical threshold of preference for collusion (C.T.P.C.) that is related to the discount factor δ of each operator. Each operator has to choose between two strategic behaviors: either competing or colluding, regarding to the comparison between short-term gains to deviate and long-term losses after deviation, in a repeated game. In such a context, collusion is possible when the preference for the present, reflected by the discount rate r, (with $\delta = \frac{1}{1+r}$ et $0 \leq \delta \leq 1$) is very low (Friedman (1971)).

Players are concerned with an indefinitely repeated sequential game where in the first stage, at period $t = 0$, they decide to collude. If they cooperate in period $t = 1$, player i, where $i = 1, 2$ ($N = 2$) realizes a profit equal to π_i^{Coll} A unilateral deviation from collusion will change this profit to π_i^{Dev}, with $\pi_i^{Dev} > \pi_i^{Coll}$

We assume that a deviation of one player in period t will be followed by a change in the cooperative behavior of the other operator in period $t + 1$ such that the profit of each operator becomes equal to π_i^{Comp}, as both operators deviate from collusion.

Calculations of the updated value of profit after Deviation V^{Dev} and the updated value of profit after Collusion V^{Coll} show that:

$$V^{Dev} = \sum_{t=1}^{\infty} \delta^t \pi_i^{Comp} = \frac{\delta}{1-\delta} \pi_i^{Comp} \qquad (11)$$

And;

$$V^{Coll} = \sum_{t=1}^{\infty} \delta^t \pi_i^{Coll} = \frac{\delta}{1-\delta} \pi_i^{Coll} \qquad (12)$$

Collusion is a better strategy if the profit resulting from Deviation, in a repeated game, is lower than the difference between the updated value of profit after Collusion and the updated value of profit after Deviation:

$$\frac{\delta}{1-\delta}\left(\pi_i^{Coll} - \pi_i^{Comp}\right) > \pi_i^{Dev} - \pi_i^{Coll} \qquad (13)$$

From this inequality, we can calculate the threshold of the discount factor $\bar{\delta}$ from which collusion becomes possible:

$$\delta > \bar{\delta} = \frac{\pi^{Dev} - \pi^{Col}}{\pi^{Dev} - \pi^{Conc}} \qquad (14)$$

Consequently, if the value of δ for one operator is higher than $\bar{\delta}$, collusion will be the best strategy to choose. We will discuss next the variation of $\bar{\delta}$ when the interconnection fees a vary to see, for each value of a, the variation of the critical threshold of preference for collusion (C.T.P.C.).

Table 3: Modeling Results in Different Market Structures (Debbichi, S., and Hichri W. (2013))	
Duopoly with Private Operators	**Oligopoly with Three Private Operators**
$$\overline{\delta} = \dfrac{\frac{1}{64} + \frac{1}{4}a\left(a - \frac{1}{2}\right)}{\frac{9}{64} + \frac{1}{4}a\left(a - \frac{1}{2}\right) - \frac{1}{9}(1 + 2a)(1 - a)} = \dfrac{9}{17}$$	$$\overline{\delta} = \dfrac{\frac{3}{4}a^2 - \frac{2}{3}a + 3/54}{\frac{3}{4}a^2 - \frac{2}{3}a + \frac{1}{9} + \frac{1}{16}(1 - a).(1 - 3a)}$$
Duopoly with Mixed Operators	**Mixed Oligopoly with a Public Operator and Two Private**
$$\overline{\delta} = \dfrac{a^2 + a - \frac{3}{4}}{5a^2 - 3a + \frac{1}{4}}$$	$$\overline{\delta} = \dfrac{3a^2 + 2a - \frac{5}{3}}{9a^2 - 4a + 1/3}$$

The incentive critical threshold for collusion depends on the interconnection fees. We will discuss next the variation of $\overline{\delta}$ when the interconnection fees a vary to see, for each value of a, and for each Arabian market structure between (1999-2008). The critical threshold is constant in a private duopoly is equal to $\frac{9}{17}$. This result is found in the case of Internet operators by Cortade (2005).

APPLICATION RESULTS

As shown in (Figure1), the values of the critical threshold of preference for collusion (C.T.P.C) in Tunisia are increasing but negative during the period (2002-2006). From 2007, the year following the privatization of (TT), the threshold is positive but constant. This is due to a transition from the mixed structure to the private market structure when the public operator (Tunisia Telecom (T.T.)) becomes private. In the Tunisian mobile market, we have between (2002-2006):
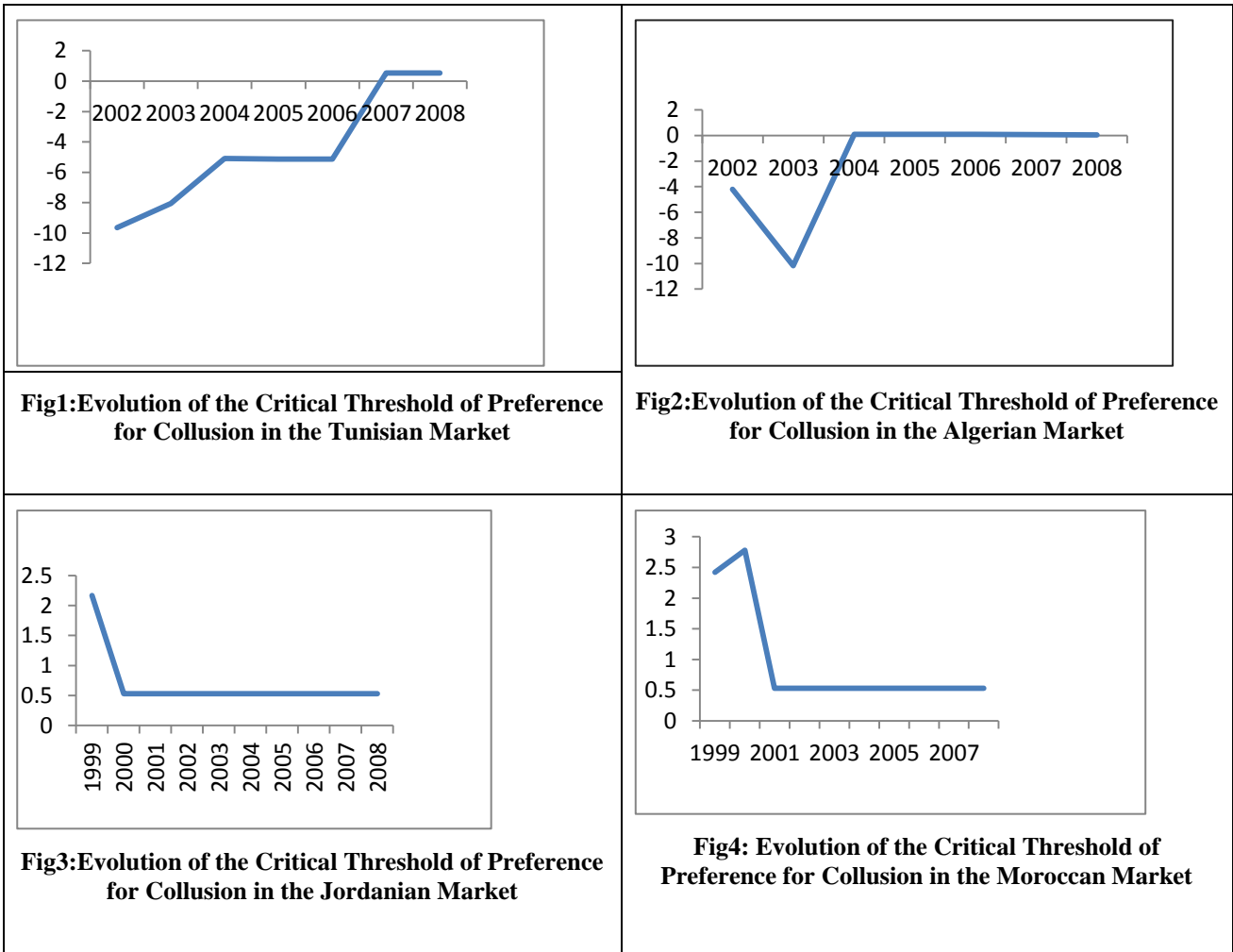
$$\pi_i{}^{Conc} < \pi_i{}^{Dev} < \pi_i{}^{Col} \tag{15}$$

And after (2006):

$$\pi^{Dev} - \pi^{Col} = k(\pi^{Dev} - \pi^{Comp}) \text{with k = cte} \tag{16}$$

As shown in (Figure 2), in Algerian Market, the values of the critical threshold of preference for collusion (C.T.P.C) are increasing but negative during the period (2002-2004). From 2004, the year of entry of a third operator, the threshold becomes positive. This is due to a transition from the duopoly market structure to an oligopoly market structure.

In Jordanian and Moroccan market respectively (Figure 3), (Figure 4), the values of the critical threshold of preference for collusion (C.T.P.C) are increasing but positively, and become constant. In both markets the market structures substantially the same.

Fig1:Evolution of the Critical Threshold of Preference for Collusion in the Tunisian Market

Fig2:Evolution of the Critical Threshold of Preference for Collusion in the Algerian Market

Fig3:Evolution of the Critical Threshold of Preference for Collusion in the Jordanian Market

Fig4: Evolution of the Critical Threshold of Preference for Collusion in the Moroccan Market

DISCUSSIONS

For comparaison, the critical threshold of collusion in the Algerian market is higher than that of the Tunisian market (See Fig5). In this case we can say that collusion is easier in Tunisian market that in Algerian, Jordanian, and Moroccan market. This result is logical as the market for mobile phone in Algeria is more competitive (oligopolistic) during this period that his Tunisian counterpart. The entry of a third operator was in (2004) and in Tunisia was in (2010). In fact, there is a relationship between the number of competitors and collusion, as shown in Selten (1973) who presents a theory that investigates "the connection between the number of competitors and the tendency to cooperate."

Fig 5 : Comparing the critical threshold of preference for collusion in the Tunisian and Algerian Market
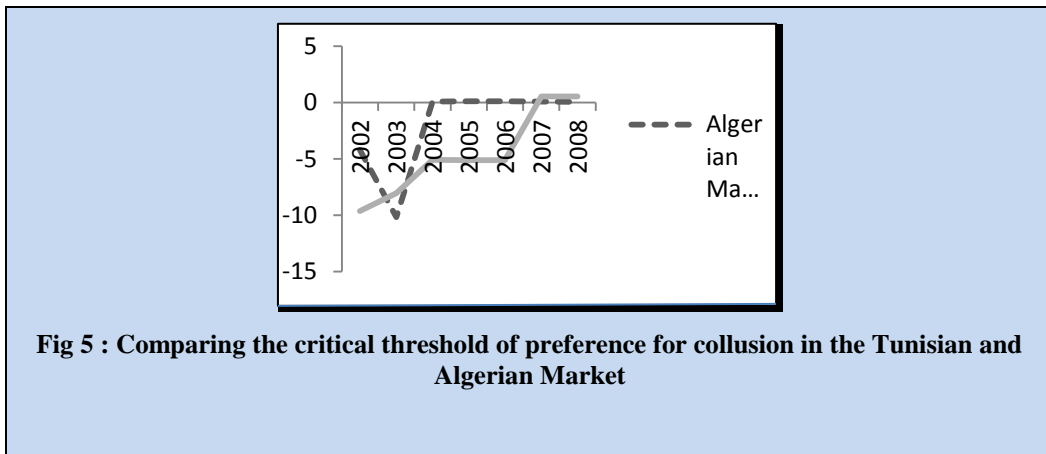
Studies conducted by The "Arab Advisor Group" shows that the Cellular Competition Intensity Index results for April 2011 revealed that Saudi Arabia tops the score as the most competitive Arab market with a 76.01% mark followed by Jordan (75.37%), in 6 th rank Morocco (64.72%), Tunisia (63.23%) in 8 th rank, and , and Algeria (61.17%) In 9 th rank. The Cellular Competition Intensity Index is relative in nature as it compares the state of every market relative to other markets. As such, even if a market's absolute level of competition improved, its score in this relative index will also depend on how other markets developed. In this work we will develop microeconomic models for the study of market competition and the preference for collusion operators on interconnection market.

CONCLUSION

We characterized in this paper the state of mobile phone market in Tunisia. The model presented above determines the market power of operators on interconnection market, using the Lerner index. This index is a relevant indicator available for the regulator to judge the nature of competition. To keep a certain degree of competition, the regulator, as in Flacher and Jennequin (2007), can set the level of interconnection rate at a level that minimizes collusion. In this paper the regulator can control market structure to minimize prices. The "*conduct parameter*" measuring the intensity of competition is not null during the period (1993-2011), in this situation interconnection price is not oriented to marginal cost and mobile phone operators practice Market power. In fact, operators can maintain these high interconnection charges to inflate prices paid by consumers and reduce the probability of detecting collusion retail prices. Results show that collusion is easier in Tunisian market that in Algerian, Jordanian, and Moroccan market. However, we must recognize that our analysis has some limitations. These results are comparable to those find by "Arab Advisor Group". A theoretical extension is to estimate the "conduct parameter" to ugly variables related to market structure and prices.

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End notes

[1] The collusion may relate to price, quality of service and technical standardization networks. The establishment of such a practice is through regular meetings of leaders. Such is the case between "Deutsche Telekom", "France Telecom", "Telecom Italia", "Telefonica" and "Vodafone" convicted of monopolistic agreement after secret meetings, four meetings in fifteen months, October 2010 in Paris, February 2011 in Barcelona, July 2011 in Venice and on January in London. This is the subject that could be investigated by the European Commission concern of a possible collusion between them, including the standards for future mobile communication services.

[2]Laffont and Tirole (2000) defined this hypothesis that the fraction of calls cause of network and ends on the other competing network is proportional to the market share of the latter. In other words, the flow of incoming and outgoing calls is balanced even if market shares are not.

[3]For More details see Debbichi, S. and Ben Khalifa, A (2013) "Market conduct, interconnection costs and benchmarking in mobile phone industry: the Tunisian case," Int. J. Mobile Learning and Organisation, Vol. 7, No. 1

[4]values are estimated according to the equation$\vartheta = \frac{1}{n}$