COMPETITION IN THE BRAZILIAN MOBILE TELEPHONY SEGMENT

Paula Sarita Bigio Schnaider
Universidade de São Paulo, Brasil

Maria Sylvia Macchione Saes
Universidade de São Paulo, Brasil

Nuno Manoel Martins Dias Fouto
Universidade de São Paulo, Brasil

Claudio Felisoni De Angelo
Universidade de São Paulo, Brasil

ABSTRACT

Although there were 152 million mobile phones in Brazil as of January 2009, a research conducted by the International Communications Union in 2008 revealed that amongst the 154 countries surveyed, Brazilian users paid the most for the use of mobile phones. Between 2008 and 2009, Anatel introduced mobile number portability as a measure that would promote greater competition amongst operators. This article sought to evaluate the impacts of this policy on competition in the Brazilian mobile telephony segment, particularly as to fees charged. To this effect, both a static and a dynamic analytical framework were built, based on the Prisoners' Dilemma Game-Theoretic Model. Theoretical propositions were compared to empirical data related to the mobile fees charged in São Paulo and indicated that the implementation of the mobile number portability policy did not bring about the reduction of fees charged to consumers. This finding contradicts the price reduction phenomenon that occurred in other countries after implementing the portability policy and suggests the need for further rulings which pose to encourage carriers to charge lower fees.

Key-words: Number portability. Game theory. Price.

COMPETIÇÃO NO SETOR DE TELEFONIA MÓVEL BRASILEIRO

RESUMO

Apesar de existirem 152 milhões de telefones móveis no Brasil em janeiro de 2009, uma pesquisa realizada pela União Internacional de Telecomunicações em 2008 revelou que, dentre os 154 países pesquisados, os usuários brasileiros eram os que pagavam mais caro pelo uso do telefone celular. Entre 2008 e 2009, a Anatel introduziu a portabilidade numérica como uma medida que promoveria maior competição entre as operadoras. Este artigo buscou avaliar os efeitos da implantação dessa política sobre a competição no setor brasileiro de telefonia móvel, principalmente no que diz respeito às tarifas praticadas. Para isso, tanto um arcabouço conceitual estático quanto um dinâmico foram construídos com base no modelo do Dilema dos Prisioneiros, apresentado pela Teoria dos Jogos. Nossas proposições teóricas foram comparadas a dados empíricos relativos às tarifas telefônicas móveis praticadas em São Paulo e indicaram que a implementação da portabilidade numérica não proporcionou a redução das tarifas cobradas dos consumidores. Tal resultado contradiz o fenômeno da redução de tarifas observado em outros países após a implementação da portabilidade, o que sugere a necessidade de novas regulamentações destinadas a incentivar a cobrança de tarifas mais baixas por parte das operadoras.

Palavras-chave: Portabilidade numérica. Teoria dos jogos. Preço.

1 INTRODUCTION

Until the end of the 90´s both wire and mobile telephony were characterized as State monopolies, represented by the Telebrás system. Since the 80´s, public investments in the segment, particularly as a result of the Brazilian economic crisis, were insufficient to ensure the required infrastructure to meet the demand for access to telephones.

The economic crisis, coupled with the liberal doctrines of the time, lead to the privatization of the Telebrás System in 1998 and to the formation of Anatel as the segment´s regulatory agency. Regardless of success in as much as the expansion of the Brazilian telephony market is concerned, these measures prove to be insufficient to promote competition amongst companies and foster social welfare, that is, ensure competitive prices for the consumer.

Whilst the number of mobile accesses reached 152 million users in January 2009, representing very expressive growth, particularly if compared to the quantity of mobile accesses shortly before privatization in 1997, of 4,5 million (Anatel, 2009); research conducted in 2008 by the International Telecommunications Union revealed that Brazilian users, amongst 154 surveyed countries, were the ones that paid the most for the use of mobile phones (Globo.com, 2009).

Between 2008 and 2009, Anatel introduced the numeric portability, a measure that posed to considerably reduce the costs related to changing carriers and promote greater competition between them, reduce tariffs and improve the quality of customer services.

The purpose of this article is to evaluate the impacts of the implementation of this policy on competition and competition itself in the Brazilian mobile telephony segment, particularly as to tariffs charged. The study shall be structured into three parts.

First, the evolution of this market in Brazil shall be presented utilizing the concepts of Industrial Organization. Furthermore, this section shall present the context of the mobile telephony market which preceded numeric portability. The second part shall cover numeric portability and the economic logic that promotes

its maintenance based on literature relative to Costs of Exchange. The analysis shall be based on strategies associated with pricing policies that might be adopted by carriers after portability, according to the Games Theory. Finally, conclusions shall be presented based on the findings that result from this study.

2 CONTEXTUALIZATION OF THE MARKET´S EVOLUTION

2.1   EVOLUTION OF TELECOMMUNICATIONS IN BRAZIL

The introduction of mobile telephony in Brazil occurred in 1988 during the Sarney government, when a decree defined mobile telephony as a restricted public service, granting the right to explore the new system to state owned companies (Ministry of Communications, 2009).

In December 1990, Rio de Janeiro launched wireless services in Brazil which then operated on the so called A Bandwidth. In an analogous manner to that of wireline telephony, the infrastructure dedicated to mobile services was very poor in as much as investments is concerned, a fact that limited the expansion and offering of services to all Brazilians, resulting in waiting lists for line acquisition (Lários, 2003). Regardless of the geographical expansion of the mobile service during the subsequent two years, investments in the segment continued to be insufficient to provide for efficient addressing of the demand.

This scenario was significantly modified by the typical world trend of rupturing monopolies in the telecommunication segment, undertaken in Brazil in 1995, when private companies were allowed to render telephony services.

In 1996, the so called Specific Law, which opened the market to B Bandwidth mobile telephony services, was approved. Its successor, the General Telecommunications Law (GTL) of 1997, defined the guidelines of the new institutional model and set up the National Telecommunications Agency (Anatel) as an independent regulatory organization (Ministry of Telecommunications, 2009).

The privatization model consisted of an auction at the Rio de Janeiro Stock Exchange market, where the government sold bonds equivalent to 20% of the shares of the companies that comprised the Telebrás holding and which corresponded to its shareholding equity position. The field of mobile telecommunications that resulted from the privatization operation was divided into two large operational bandwidths: A and B. The A Bandwidth was exclusively reserved for the companies that resulted from the Telebrás privatization auction. B Band, in turn, resulted from the sale of the concession for mobile telephony services to tem private companies which were attracted to the Brazilian market whose large demand for mobile phones was not met by companies that already operated in the country (Folha Online, 2000).

So as to expand the offer of services and promote competition between mobile telephony carriers, in the year 2000, Anatel introduced new rules with the Personal Mobile Service (PMS) which would substitute the Mobile Wireless Service as of 2001 and inclusively rule the companies that already operated under A and B bandwidths (Folha Online, 2000).

PMS divided the country into three major regions: region I comprising the states of the north, northeast and southeast – except São Paulo. Region II, in turn, was formed by the central-west and southern states. Finally, region III comprised the state of São Paulo, exclusively (Anatel, 2009).

The new plan further envisioned the inclusion of three new frequency ranges – named Bandwidths C, D and E – in each of the three major regions. Occupation took place by means of auctions and resulted in the entry of TIM, OI and Claro on the market (Lários, 2003).

The new ruling additionally foresaw that once bandwidths were occupied, entry in the mobile telephony market would only take place by means of merges and acquisitions of the companies that already operated in this segment (Lários, 2003).

2.2. THE CONCENTRATION OF THE BRAZILIAN TELEPHONY MARKET

The Economic Theory describes the telephony segment as a natural monopoly given the advantages offered to companies by large scale economies which are typical of this market. Given the fact that it constitutes a natural monopoly, the company in this market is encouraged to adopt strategies to maximize profit by means of under production and price raises, thus hindering the benefit of consumers (Eaton & Eaton, 1999; Mcguigan, Moyer & Harris, 2004).

For this reason, Friedman (1977) states that there isn´t an optimal solution for natural monopoly but rather a choice between three evils: public ruling, public monopoly and private monopoly. According to the author, the latter, if tolerable, constitutes the most minor evil.

In Brazil, the segment constituted a state monopoly since its launch until the privatization of the Telebrás system, in 1998. Shortly before privatization, in 1997, the price of a residential phone line was R$1.117,63 and the amount paid for a subscription per month was R$ 0,44. Two years after privatization of the system, the price of a residential phone line was reduced to R$ 50,00, but the amount paid for a subscription was raised to R$ 14,11 per month (Anatel, 2000).

The entry of new companies intensified investments in the segment, resulting in expressive improvements in the quality of services rendered, in addition to contributing with the picking up of competition. However, despite being subject to deconcentration after the monopoly was extinguished, the segment still remained concentrated (HHI above 1800), according to the Herfindahl-Hirschman index (HHI - Measure evaluating the market concentration level obtained as of the sum of square market shares of players of a given segment. The Federal Trade Commission classifies markets according to the HHI as follows: competitive market/low concentration: HHI<1000; moderate market concentration: 1000<HHI<1800; concentrated market: HHI>1800).
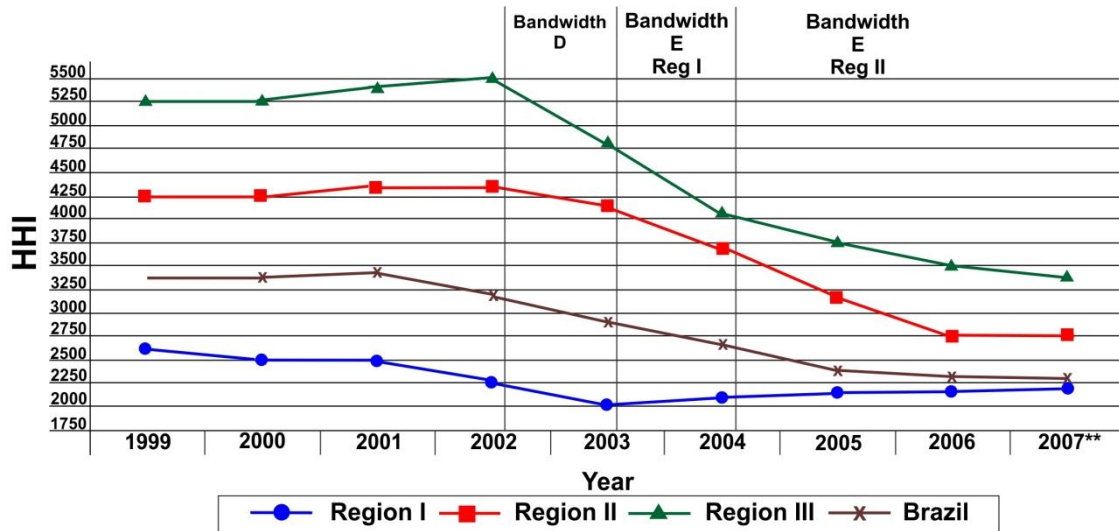
Graph 1: HHI Evolution

Source: Anatel (2007)

Given this is a segment that is still pretty much concentrated and which follows the privatization of natural monopolies movements on the international market, the need to set up a regulatory agency arose, particularly when one verifies the economic performance of new entrants in terms of welfare for society. The National Telecommunications Agency (Anatel) only constituted itself as an independent ruling organization after the disruption of the monopoly, with the General Telecommunications Law (GTL) and (LGT), and progressed to pose to "regulate telecommunications in Brazil, exercising the granting power of public services, of orderly management of private activities and auditing of services including quality and market organization aspects."(Ventura, 2004, p. 103)

So as to ensure greater social well being, that is, securing competitive prices to the consumer, Anatel introduced portability, as shall discussed in suit.

3 NUMERIC PORTABILITY

3.1. THE MOBILE TELEPHONY NUMERIC PORTABILITY

Telephonic numeric portability consists in a measure that was approved in March, 2007 by Anatel (Resolution Nbr.460, of March 10, 2007 and attachment - Portability General Ruling), that enables the user to change mobile telephony carriers within his registry region (Area Code - *DDD*);without, however, altering his telephone number. In practice, with this measure, the client becomes the owner of his telephone number (Globo.com, 2009), acquiring greater freedom in as much as choosing the carrier is concerned.

Portability in Brazil is quite recent and takes place according to the schedule presented in Table 1.

Table 1: Schedule for the implementation of portability in Brazil

National Area Code	Implementation period
14(SP), 17(SP), 27(ES), 37(MG), 43(PR), 62(GO), 67(MS), 86(PI)	August 29 to 31, 2008
28(ES), 32(MG), 68(AC)	August 03 to 08, 2008
33(MG), 38(MG), 44(PR), 49(SC), 84(RN)	November 10 to 16, 2008
48(SC), 85(CE), 88(CE), 98(MA), 99 (MA)	November 17 to 22, 2008
47(SC), 69(RO), 71(BA), 73(BA), 89(PI)	November 24 to 29, 2008
12(SP), 13(SP), 82(AL), 83(PB)	December 01 to 07, 2008
18(SP), 51(RS), 55(RS), 63(TO), 65(MT), 92(AM), 97(AM)	January 05 to 11, 2009
16(SP), 41(PR), 34(MG), 35(MG), 74(BA)	January 12 to 18, 2009
31(MG), 42(PR), 54(RS), 75(BA), 77(BA), 79(SE)	January 19 to 25, 2009
15(SP), 95(RR), 96(AP)	January 26 to February 1, 2009
19(SP), 45(PR), 46(PR), 93(PA), 94(PA)	February 02 to 08, 2009
21(RJ), 22(RJ), 24(RJ), 61(DF E ENTORNO)	February 09 to 15, 2009
81(PE), 87(PE)	February 16 to 22, 2009
11(SP), 53(RS), 64(GO), 66(MT), 91(PA)	February 23 to March 1, 2009

Source: adapted from Folha Online (2008)

Portability is a practice destined to promote transformations in the Brazilian mobile telephony market, which seeks to intensify competition between operators and result in the reduction of telephone tariffs, as described by Anatel (2009): "Portability is a stimulus for competition, price reduction and improvement in the quality of customer services".

3.2. THE ECONOMIC LOGIC

FUTURE|SRJ
FUTURE STUDIES RESEARCH JOURNAL:
TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific editor: James Terence Coulter Wright
Evaluation: Doublé Blind Review by SEER/OJS
Revision: Grammatical, normative and of layout

The economic theory that supports the numeric portability policy is based on the concept of exchange or swapping costs. According to Klemperer (1987, p. 99), consumers of a company would incurr in substantial costs if they chose to change the product bought for another identical one from a competing company.

These costs therefore constitute any lack of utility experienced by consumers during the change of a product for another similar one from a competitor, which, in the case herein, would consist in the change of service providers. (Chen & Hitt, 2002, p. 258) Tal fato impediria ou criaria barreira à migração do consumidor para a concorrência (Hess & Ricart, 2002, p. 1).

Klemperer (1987) defines three categories of exchange costs: transaction costs, learning and contractual (or artificial) costs. The first relate to costs relative to changes between brands that sell identical products. In this context, according to the author, clients who migrate between Banks that offer identical services presented high closure and opening of new accounts costs. In an analogous manner, such costs apply to the churn between carriers.

Learning costs, in turn, relate to the possibility that the knowledge acquired with a product of a given brand might not be transferred to another even if both portray identical functionalities.

Finally, the third exchange cost category defined by Klemperer (1987), that is, the so called contractual or artificial costs, consists of mechanisms that companies develop, characterized by the absence of social costs related to the change of brands.

Under this classification one finds retention programs developed by air line companies, or still, in the mobile telephony context, the accumulation of points acquired during the use of services and which can be exchanged for prizes such as mobile phones or discounts.

This third category further includes an important factor that relates to the Brazilian mobile telephony segment: the acquisition of mobile phone contracts. It is widely known that carriers often subsidize mobile phones to their "post-paid" customers given the signing of a contract that impedes the cancelling of services during a previously established time frame, on pain of fines.

FUTURE|SRJ
FUTURE STUDIES RESEARCH JOURNAL:
TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific editor: James Terence Coulter Wright
Evaluation: Doublé Blind Review by SEER/OJS
Revision: Grammatical, normative and of layout

Alternatively, Haucap (2003, p. 29) classifies exchange costs as endogenous or exogenous. These resemble the first two categories defined by Klemperer (1987b), in as much as they are not shaped by producers, but rather, data.

The efforts relative to the mapping of information concerning alternative suppliers or the costs of churning to another Carrier in the absence of numeric portability, characterized by the lack of use in view of the change of the phone number, are examples of exogenous exchange costs. Exchange costs result in substantial loss in consumer well being, characterized by the practice of high prices and by the presence of the characteristic dead weight typical of closed oligopolies, culminating in the loss of social welfare. (KLEMPERER, 1995).

Endogenous exchange costs, in turn, correspond to contractual or artificial costs, as defined by Klemperer (1987b). According to Corrocher and Zirulia (2005), such costs emerge given that companies attempt to implement externalities of artificial networks. To this effect, one notices that mobile carriers often practice lower tariffs on calls placed to other clients of the same company, offering customers benefits to customers that use the same carrier as their network of contacts.

Kemplerer (1987b, p. 377) examines the implications of exchange costs on the competitivity of markets, verifying that they make the individual demand of each company become more inelastic, which in turn reduces rivalry between the companies. To this effect, Dubé, Hitsch and Rossi (2006) state that the presence of exchange costs makes markets become les competitive. Such a fact is justified by means of the limitation established by exchange costs of consumer incentives in as much as migrating to more economic services is concerned.

In an analogous manner, one might infer that within the Brazilian mobile telephony market, numeric portability shall give rise to a significant reduction in exchange costs. Such an assumption is based on Kim´s (2005) study mentioned by Lyons (2006), who verified a 35% reduction in exchange costs after the introduction of numeric portability in South Korea.

Therefore in this manner consumer selection possibilities are increased contributing with the increment of rivalry between carriers and transfers the bargaining power from vendors to buyers (Hess & Ricart, 2002).

3.3   PRECEDENTS

Numeric portability arose in the United States in May 1993 in as much as wire toll free telephonic services is concerned. In this market, the introduction of portability significantly reduced exchange costs, making it more competitive given that there was an average reduction of 14% in telephonic tariffs after its implementation (Viard, 2007).

In the mobile telephony context, in 1997 Singapore pioneered in the adoption of this practice, followed by Holland, Hong Kong and the United Kingdom two years later and by several countries along time, constituting a world trend. In Hong Kong, portability lead to an immediate reduction of approximately 60% in prices (Shi, Chiang & Rhee, 2006).

In addition to the previously presented studies, Lyons (2006) evaluated the impacts of the introduction of numeric portability in 37 countries, verifying a positive relation between the adoption of this practice and the technical quality of the service, evaluated by the existing time interval between the request of portability and the technical implementation of the order. The author verified that in countries that presented high quality, i.e., a time interval inferior to five days, there was an average reduction of 6,58% in prices in the short term and of 12% in the long term.

3.4   NUMERIC PORTABILITY IN BRAZIL

The analysis of the economic logic of portability can be understood as of the Game Theory that enables the formation of inferences as to expected results for the mobile telephony market and thus prepare predictions of what might happen in the Brazilian market. These results shall be compared to price data from the São Paulo market.

3.4.1   Prisoner dilemma – single round

Table 2 exposes a representation of pricing policies that might be adopted by mobile telephony carriers, according to the Game Theory (the option for the Games Theory is justifiable since this theory analyses strategic decisions taken by players considering the attitudes and replies of the other participants of the game). This model abides to the logic of the Bertrand Model which analyses the relation between a dominating company that detains greater market share and the other carriers that operate on the Brazilian market (in Brazil there is a carrier that in 2009 held approximately 30% of the market share and can be considered dominating (Anatel, 2009)).

Table 2: Single round payoff matrix

		Other companies	
		High prices	Low prices
Dominating company	High prices	(R_{E1}, R_{E2})	(R_{E3}, R_{B1})
	Low prices	(R_{B1}, R_{E3})	(R_{B2}, R_{B3})

Source: author

The differences that exist between R_{E1} and R_{E2} and between R_{B2} and R_{B3} can be attributed to the scale advantage of the dominating company. With numeric portability and low exchange cost, the market would become contestable since only the possibility of customers exchanging carriers, would lead companies to maintain their prices close to the competitive market.

It must be emphasized, however, that for this market, a pricing model based on balanced competition might lead to loss since, in general, the marginal cost is lower than the average cost. As exposed previously, companies that offer telephony services traditionally constitute natural monopolies and tend to thus present an extremely low marginal cost, possibly lower than the average cost.

Therefore, the results foreseen by the single round model consist in the set of pricing strategies based on tariff reduction. It is a result that is in line with

those obtained on the international market whose reduction in telephone tariffs has already been presented.

3.4.2   Prisoner dilemma – infinite repetition

The model discussed in the previous section presumed that companies would take their strategic decisions on a single shot basis. It is however known that in the real world, decisions taken by firms have an infinite operational horizon in mind.

It is calls for a model that might reflect the true dynamics of this market, considering successive strategic decisions taken by firms as to the establishing of their tariffs and eventual interactions between the strategies adopted by companies which comprise this industry.

To this effect, the model exposed in Table 2 which reproduces the Prisoner Dilemma Model, might be analysed from an infinite repetition perspective, starting as of the assumption that carriers monitor pricing strategies adopted by competing companies by means of the promotional campaigns directed to consumers.

Thus the payoffs of the infinite game can be obtained by means of the generic expression (Equation 1) exposed in suit, whereby π represents the value of the game, π_1 the result at the first interaction and α, the discount rate (or the probability of repetition of the game. Therefore, by definition: $0 \le \alpha \le 1$.)

$$\boldsymbol{\pi = \pi_1 + \alpha \times \pi_1 + \alpha^2 \times \pi_1 + \cdots + \alpha^n \times \pi_1} \quad \text{(Equation 1)}$$

Such an expression corresponds to the sum total of the terms of an infinite reason geometric progression α, which can be calculated by means of the following expression:

$$\boldsymbol{\pi = \frac{\pi_1}{(1-\alpha)}} \qquad \boldsymbol{; \alpha = \{\mathbb{R} \, / \, 0 \le \alpha < 1\}} \quad \text{(Equation 2)}$$

According to this logic, the game could be represented as per Table **Erro! Fonte de referência não encontrada.** (the composition of π_{E1} and of π_{E2} would occur according to Equation 2: $\pi_{E1} = R_{E1} + \frac{R_{E1}}{(1-\alpha)}$; $\pi_{E2} = R_{E2} + \frac{R_{E2}}{(1-\alpha)}$), which consists in a

FUTURE|SRJ
FUTURE STUDIES RESEARCH JOURNAL:
TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific editor: James Terence Coulter Wright
Evaluation: Doublé Blind Review by SEER/OJS
Revision: Grammatical, normative and of layout

reproduction of the game presented in the previous section, however with payoffs adjusted to the infinite repetition condition.

Table 2: Payoff matrix of the infinitely repetitive game

		Other companies	
		High prices	Low prices
Dominating company	High prices	(π_{E1}, π_{E2})	(π_{E3}, π_{B1})
	Low prices	(π_{B1}, π_{E3})	(π_{B2}, π_{B3})

Source: author

π_{E1} and π_{E2} are the results traditionally presented by Brazilian mobile telephony carriers. The differences between π_{E1} and π_{E2} can be explained by the scale advantage of the dominating company.

The carrier that reduced its tariffs before the competitor adopted the same strategy would obtain expressive market share gains since inferior tariffs satisfy in a more efficient manner the maximizing condition of the consumer´s utility. This strategy would result in payoff R_{B1} at the game´s first round, a value that exceeds that of other possibilities.

As of the assumption that companies are capable of monitoring prices practiced by their competitors (for example, by means of promotional campaigns directed to consumers), they shall respond to tariff reduction according to the Tit-for-Tat model (behavioural replica (Besanko et al., 2006), in which the players start the game at t=0 cooperating and for each t, adopt the strategy of the other player in round t-1 (Kreps, 2003)), making the sets of strategies {low prices, high prices} and {high prices, low prices}unstable equilibriums (the instability of these balances would be immediate, assuming that portability would entirely eliminate exchange costs. However the possibility of there being other exchange costs on the market might retard instability but would not be able to eliminate it).

According to this logic, tariff reduction effected by any carrier would shift the Nash balance of the set of cooperative strategies to that corresponding to

competition between companies: {low prices, low prices}. Such a balance calls for analysis per two scenarios, once the calculation of payoffs differ according to the manner in which equilibrium was established.

In scenario 1, competitive balance is impacted by means of the simultaneous reduction of tariffs by all companies. In this context, the value of the game for the dominating carrier could be expressed by (as long as the discount rate is not too high. Should α tend to 1, one has: $\lim_{\alpha \to 1} \pi = +\infty$, if R>0 or $\lim_{\alpha \to 1} \pi = -\infty$, if R<0):

$$\Pi_{B2} = \frac{R_{B2}}{(1-\alpha)}$$

The value of the game for the remaining companies, in turn, would constitute:

$$\Pi_{B3} = \frac{R_{B3}}{(1-\alpha)}$$

As discussed, $\Pi_{B2} > \Pi_{B3}$.

In scenario 2, competitive balance is impacted as a reply of the carriers to the reduction of tariffs by a competing firm. In this case, since companies behave according to the Tit-for-Tat strategy, the obtaining of competitive balance as a reply to the strategy of opponents must be analysed under the perspective of two sub scenarios, which result in different payoffs.

3.4.2.1 The dominating carrier lead the reduction of tariffs

Tariff reduction conducted by the dominating company would shift the Nash balance of the game of the cooperative set to the unstable set {low prices, high prices}. In this round, the company would obtain the highest game result since it would benefit from the greater market share.

However, in the subsequent rounds, the other carriers would respond to this strategy by menos of tariff reduction, shifting the Nash balance to the {low prices, low prices} set, corresponding to competition between companies.

Therefore, the result of the game for the dominating company could be expressed by:

$$\Pi_{B2} = R_{B1} + \frac{R_{B2}}{(1-\alpha)}$$

On the other hand, the results of the other carriers would be:

$$\Pi_{B3} = R_{E3} + \frac{R_{B3}}{(1-\alpha)}$$

Given that $R_{B2} > R_{B3}$ e $R_{B1} > R_{E3}$; $\Pi_{B2} > \Pi_{B3}$.

3.4.2.2 The other companies lead the tariff reduction

As in scenario 2, even if tariff reduction is not started by the dominating company, its payoff shall be superior to that of the other companies. In this case, it is understood that the dominating company, given it holds lower costs, might respond to the price reduction strategy of competing companies in a more aggressive manner since the leadership of costs would allow for a price reduction of greater magnitude. The result expected for the dominating company, according to this hypothesis, would be (if price is close to cost, R_{B2} tends to zero and thus the result of the game $\Pi_{B2} = R_{E3}$):

$$\Pi_{B2} = R_{E3} + \frac{R_{B2}}{(1-\alpha)}$$

The other operators, that is, the companies that started the reduction of tariffs would present the following result:

$$\Pi_{B3} = R_{B1} + \frac{R_{B3}}{(1-\alpha)}$$

Supposing that the dominating company replied aggressively to the reduction of prices, the permanent component of the composition of the game value of the other companies would be negative, ultimately culminating, in the carrier with the lowest financial capacity leaving the market.

Even if the reply of the dominating carrier weren't aggressive, Π_{B2} would be greater than Π_{B3}, despite R_{B1} being superior to R_{E3}, since the perpetuity of the

FUTURE SRJ
FUTURE STUDIES RESEARCH JOURNAL:
TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific editor: James Terence Coulter Wright
Evaluation: Doublé Blind Review by SEER/OJS
Revision: Grammatical, normative and of layout

dominating company supersedes that of the other companies, given its scale advantage.

Assuming that companies are rational and profit maximizers, they shall select strategies based on the value of the infinitely repeated game. According to this logic, all companies would maximize their results by means of the high price practice and would respond to the strategy of the firm that reduced its tariffs first with similar reductions, a fact that would shift the Nash balance of the game to that corresponding to competition.

Should the company that started price reductions not be the dominating firm, there would be a risk (such risk would constitute a "believable, visible and tactic threat". Visibility would occur given the hypothesis that carriers know the segment´s cost structure and thus would be capable of inferring the dominating company´s scale advantages) that this company might respond to the competitor´s action in an aggressive manner, culminating in considerable loss for the segment.

Thus companies would chose to practice high tariffs, a set of strategies that constitute a Nash balance in the repeated model, resulting in the implicit coalition between companies.

3.4.3   Determination of balances: results of the Brazilian market

The previous sections presented two analysis methods of market balance, each resulting in distinct pricing strategies. Next, these strategies shall be compared to the results presented in the Brazilian mobile telephony market. The analysis of results shall be conducted according to the perceptions of the consulted specialists.

As discussed, the implementation of numeric portability was only finalized in March 2009, in São Paulo. Graph 2 exposes an estimate of the average price of the wireless minute in São Paulo.
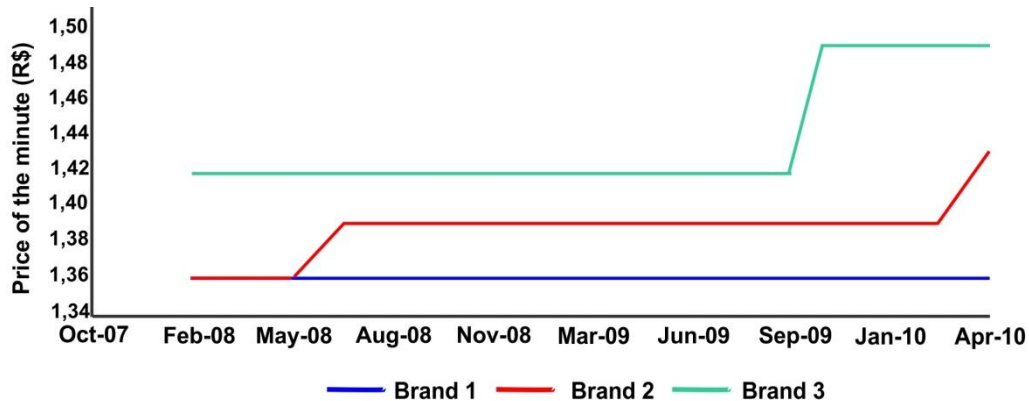
Graph 2: Average price of the wireless minute
Source: Fipe (2010)

One notices that the nominal average price of the minute practiced by Brand 1 remained stable, whilst the values charged by Brands 2 and 3 presented elevations close to 3% and 5%, respectively.

So as to conduct a more precise comparison between tariffs practiced along time, a deflated by the IPC index mobile bill was utilized, exposed by Graph 3 and which reflects the variation of telephonic tariffs in São Paulo.
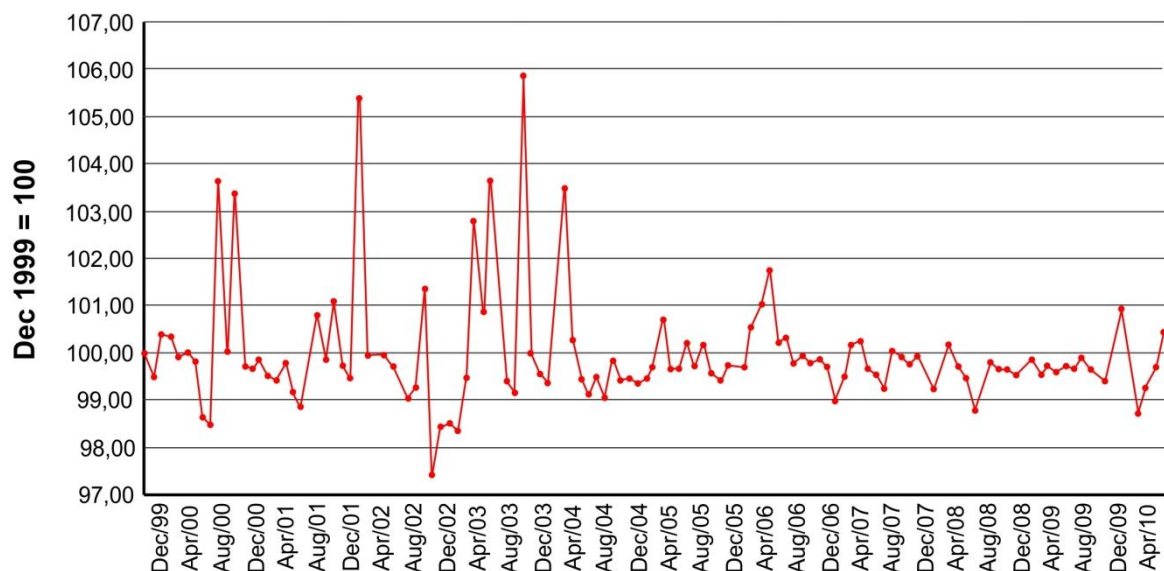
Graph 3: **Deflated mobile bill**
Source: Fipe (2010)

One notices that praticed prices remained close to 100, varying very little during the period comprised between January 2007 and April 2010, since they were close to the relative inflation horizon of the analysis. It is important to emphasize however the presence of variations in the series which exceeded or were inferior to inflation practiced, however, in low magnitude.

To this effect it is known that carriers conduct promotions destined to increment sales in periods close to Mothers Day, Fathers Day and Christmas. It is thus supposed that the points that exceed inflation were in some months prior to these events so as to allow companies to conduct promotions which in turn would justify the negative variations in relation to inflation. On average, during this period, the mobile bill remained slightly below inflation (99,69).

In addition to this fact, the mobile bill during the last decade, i.e., during the period comprised between January 2000 and April 2010, varied between 105,86 in October 2003 and 97,42 in November 2002, presenting an 99,96 average and a standard deviation of 1,2. One thus notices that the mobile bill presented a convergence trend in relation to inflation since the average presented itself very close to inflation and the standard deviation was not very high, regardless of the presence of outliers in the series, such as the maximum and minimum values presented.

One can further notice there is a major variance, primarily during the period comprising the months of December 1999 and April 2004, na interval that corresponds to the re-structuring of the segment. As discussed, the setor. Conforme já discutido, PMS was introduced by Anatel in the year 2000 and took effect as of 2001, a period during which a very accentuated variation on mobile bills ocurred. Between 2002 and 2004, auctions relative to the ocupation of the newly formed bandwidths were conducted, corresponding to the entry of the new carriers, TIM and Claro, on the market. During this period, one can verify a greater reduction on mobile bills which reflected an increment in competition between companies given the entry of new players. This fact also reflected a considerable reduction in the concentration of the segment, as indicated by the Herfindahl-Hirschman index, exposed in Graph 1.

In subsequent periods however, the variation became less expressive reflecting the trend of establishing balance in prices practiced by the segment. As exposed, there was no indication of tariff reductions after the implementation of numeric portability in Brazil since the average mobile bill remained very close to its historic trend. To this fact, one may add the price raise that might be verified in October and November 2009 and in April 2010, periods that came after the introduction of this new ruling.

This evidence contradicts the results foreseen by the Bertrand Model however confirmed the results foreseen by the second methodology, which considers the inifinite repetition of the Prisoner Dillema model and evidences maintance of cooperative balance.

One of the reasons that justify the contradiction between the results observed and the competitive balance in the establishing of prices relates to the presence of information asymmetries between carriers and consumers. To this effect, the opinion of market specialists indicate that the absence of comparative charts between post-paid plans sold by carriers, as occurs with banking tariffs, preventing consumer comparison of the values and benefits offered by each carrier, thus not justifying competition based on tariff reduction. For these specialists, numeric portability shall provide non monetary benefits to consumers such as improvement in the quality of customer services.

Another surprising aspect in relation to portability mentioned by market specialists relates to the fact that the number of subscriptions to portability remained far below carrier expectations. According to the Valor Online (2009), until May 2009, only 0,5% of Brazilian mobile and wireline carrier subscribers requested portability. Still according to Valor Online (2009), subscription is hindered by customer perception that services present low quality.

The need for the implementation of other rulings preceding portability was further emphasized so as to allow for greater effectiveness of this policy. To this effect, special mention is made to the existence of a "wholesale" tariff, i.e., a tariff negotiated between mobile telephony carriers concerning the connection of

calls between the different networks. Such a tariff was considered far too high, resulting in high prices to the consumer.

Another aspect that deserves special mention in the portability context refers to carrier market shares. According to Porter (1998), slow growth of an industry makes competition a market share game for companies seeking expansion, unlike the accelerated growth context where better results can be obtained exclusively with the expansion of the industry. Although the mobile telephony segment still presents a relatively accelerated growth, the belief is that along time, such growth rates shall gradually reduce as the market becomes saturated.

Thus, keeping in mind that expansion constitutes a fundamental factor in as much as the segment´s competitiveness is concerned, one may infer that numeric portability shall increment carrier dispute for market share. Such a fact might occur by means of the offering of improved quality services according to the perception of the consulted market specialists.

4 FINAL CONSIDERATIONS

The Brazilian mobile telephony segment presented several changes along time. The permission for new carriers to, in 1996, operate and the privatization of Telebrás, in 1998, constituted the main events in as much as the restructuring of the segment, which presented deconcentration, is concerned. In this context, Anatel was set up as a regulatory agency performing activities which were fundamental to the establishing of a new, more competitive model.

Competition between the new operators lead to many investments in infrastructure allowing for more efficient addressing of the demand for telephonic services and eliminating the need for access waiting lists. Furthermore, rivalry brought about by segment desconcentration gave rise to significant improvements in the technical quality of services and pricing policies.

However, regardless of the large quantity of mobile accesses in Brazil, surveys conducted in 2008 revealed that prices practiced on this market were

the highest amongst 154 researched countries. Thus, despite having been essential to the universalization of telephonic services, the segment´s restructuring was insufficient to ensure competitive prices for the consumer, particularly given the high costs of changing carriers.

Numeric portability, as exposed, constituted a practice that was recently implemented in Brazil by Anatel with views to significantly reducing these costs of changing carriers, complementing the measures relative to the restructuring of the segment in as mcuh as benefots for consumers is concerned. Results expected by Anatel consisted of encouraging competition, tariff reduction and improvement in the quality of customer services.

As foreseen by the infinitely repetitive Prisoners Dillema Model, numeric portability did not encourage tariff reduction and thus, did not constitute to date an incentive for price competition between carriers which poses as an inconsistency in relation to what took place on international markets.

Institutional aspects such as those exposed by market specialists may have favoured cooperation between carriers as per the model proposed in this study. To this effect, the introduction of portability contradicted Anatel´s objectives in relation to this policy, i.e., it did not promote the expected impacts.

Thus the suggestion to introduce new rulings, primarily destined to encourage greater transparency in pricing policies practices by the carriers, complementing numeric portability and the restructuring of the segment.

BIBLIOGRAPHY

Agência Nacional de Telecomunicações. *Revista da Anatel.* (2000)*.* Recovered on November 20, 2009, from http://www.anatel.gov.br/Portal/exibirPortalNivelDois.do?acao=pesquisarPubli cacao&ano=2000&codItemCanal=779&especialidadeSelecionada=&especieSel ecionada=&mes=&pastaSelecionada=999.

Agência Nacional de Telecomunicações. Anatel. (2009). Perguntas frequentes sobre a portabilidade numérica, 2009. Recovered on July 1, 2010, from http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroP ublicacao=239915&assuntoPublicacao=Portabilidade%20Numérica%20&camin

hoRel=Cidadao-Telefonia%20Móvel-Portabilidade&filtro=1&documentoPath=239915.pdf.

Besanko, D. et al. (2006). *A economia da estratégia* (3a ed). Porto Alegre: Bookman.

Carrocher, N. & Zirulia, L. (2005). Switching costs, consumers' heterogeneity and price discrimination in the mobile communications industry. Working paper, *166*, CESPRI, Università Commerciale Luigi Bocconi.

Chen, S. & Hitt, L. M. (2002). Measuring switching costs and the determinants of customer retention in internet-enabled businesses: a study of the online brokerage industry. *Information Systems Research*, *13 (3)*, pp. 255-274.

Dubé, J. P., Hitsch, G. & Rossi, P. E. (2006). Do switching costs make markets less competitive? Working paper, University of Chicago.

Eaton, B. C. & Eaton, D. F. (1999). *Microeconomia* (3a ed). São Paulo: Saraiva.

Folha Online. Portabilidade numérica no Brasil começa em 1º de setembro*.* Recovered on April 28, 2009 from http://tecnologia.uol.com.br/dicas/ultnot/2008/08/21/ult2665u374.jhtm.

Folha Online. Nova tecnologia Celular - banda A*.* Recovered on April 1, 2009 from http://www1.folha.uol.com.br/folha/dinheiro/smp-bandaa.shtml.

Folha Online. Nova tecnologia celular - 'Modernetes' e aparelhos 'tijolo' marcaram a pré-história da telefonia celular brasileira. Recovered on April 1, 2009 from http://www1.folha.uol.com.br/folha/dinheiro/smp-historia.shtml.

Folha Online, Saiba como foi a privatização da Telebras. Recovered on APril 1, 2009 from http://www1.folha.uol.com.br/folha/dinheiro/ult91u427127.shtml.

Fundação Instituto de Pesquisas Econômicas. Fipe. (2010). *Índice de preços ao consumidor (*Banco de dados).

Friedman, M. (1977). *Capitalismo e liberdade.* São Paulo: Artenova.

Globo. com. (2009). Uso de celular no Brasil é o mais caro entre 154 países, diz estudo*.* Recovered on March 2, 2009 from http://g1.globo.com/Noticias/Economia_Negocios/0,,MUL1023663-9356,00-BRASIL+TEM+TARIFA+DE+CELULAR+MAIS+CARA+EM+LISTA+COM+PAISES.html.

Haucap, J. (2003). Endogenous switching costs and exclusive system applications*. Review of Network Economics, 2* (1), pp. 29-35.

Hess, M. & Ricart, J. E. (2002). Managing customer switching costs: a framework for competing in the networked environment. Research paper, *472*, IESE Business School, University of Navarra.

Klemperer, P. (1987a). Entry deterrence in markets with consumer switching costs. *The Economic Journal, 97*(número), pp. 99-117.

Klemperer, P. (1987b). Markets with consumer switching costs. *The Quarterly Journal of Economics, 102*(2), pp. 375-94.

Klemperer, P. (1995). Competition when consumers have switching costs: an overview with applications to industrial organization, microeconomics, and international trade. *The review of Economic Studies, 62*(4), pp. 515-539.

Kreps, D. M. (2003). *Microeconomics for managers* (1. ed). New York: W.W.Norton & Company.

Lários, A. (2003). *Estudo e construção de cenários para a telefonia móvel celular no contexto brasileiro*. Dissertação de Mestrado em Administração, Escola de Administração da Universidade Federal do Rio Grande do Sul: Porto Alegre, RS, Brasil.

Lyons, S. (2006). Measuring the benefits of mobile number portability. Working paper, Economic and Social Research Institute, Trinity College, Dublin.

Mcguigan, J. R., Moyer, R. C. & Harris, F. H. (2004). *Economia de empresas: aplicações, estratégia e táticas* (9a ed). São Paulo: Pioneira Thomson Learning.

Ministério das Telecomunicações. (2009). *História da telefonia.* Recovered on April 1, 2009 from http://www.mc.gov.br/o-ministerio/historico/historia-da-telefonia.

Porter, M. E. (1998). *Competitive strategy: techniques for analyzing industries and competitors.* New York: The Free Press.

Shi, M., Chiang, J. & Rhee, B. (2006). Price competition with reduced consumer switching costs: the case of "wireless number portability" in the cellular phone industry. *Management Science*, *52*(1), pp. 27-38.

Valor Online. (2009). Portabilidade atrai somente 0,5% dos assinantes das teles. Recovered on July 8, 2009 from http://www.valoronline.com.br/ValorImpresso/MateriaImpresso.aspx?tit=Portabilidade+atrai+somente+0,5%+dos+assinantes+das+teles&codmateria=5570234&dtmateria=18+05+2009&codcategoria=164&tp=931539242&scrollX=0&scrollY=1870&tamFonte=.

Ventura, C. A. A. (2004). *As agências reguladoras e seu papel na reestruturação do setor de telecomunicações: um estudo comparativo da Agência Nacional de Telecomunicações (Anatel) – Brasil e da Federal Communications Commission (FCC) - EUA.* Tese de Doutorado, Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo:SP, Brasil.

Viard, B. V. (2007). Do switching costs make markets more or less competitive?:The case of 0800-number portability. *The RAND Journal of Economics, 38*(1), pp. 146-163.