

## **Determination of Asymmetric Wholesale Access Prices: Case of Turkish Mobile Communications Market**

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**Abstract:** Regulating and determining the mobile wholesale access prices or interconnection charges is one of the effective remedies of national authorities on SMP mobile network operators. This study endeavours to explain the use of asymmetric wholesale access pricing regulation by national telecom network regulators to eliminate inequalities between mobile operators that are caused by exogenous factors and try to guess the further price regulations of Information and Communication Technologies Authority (ICTA) in Turkish mobile communications market. As the policy maker in European Union, the Commission recommends the use of symmetrical charges if there is not any justification that necessitates asymmetry. Hence, NRAs plan to implement symmetric wholesale prices for all of the operators after a transitory period of asymmetries. It is found that the trend of MTRs in Turkish mobile communications market indicates ICTA's tendency to implement symmetrical interconnection charges in coming years parallel to European Commission recommendations.

**Key words:** Wholesale price, Turkish mobile, mobile operators, ICTA, network, telecom industry

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### **INTRODUCTION**

In the last decades, the development of mobile telecommunications services has extended significantly in all countries. The mobile telecommunications industry has changed from a traditional monopoly into a highly competitive market as a result of liberalization stream. National telecom authorities use some regulatory remedies in order to create or improve sustainable competition environment in the mobile telecommunication services markets which will at last provide consumer welfare.

The Recommendation 2007/879/EC of European Commission (EC) on relevant product and service markets within the electronic communications sector basically defines 7 relevant markets (the number of markets was 18 in the previous recommendation 2003/311/EC) and one of them is wholesale call termination in independent mobile networks. Market analysis of regulators implies that individually there are separate call termination markets for terminating calls on each operator's network in the relevant market.

Also operators have 100% market share and so monopolistic position in individual markets. In other words, each of them has a Significant Market Power (SMP) in the market of wholesale voice call termination provided by them. Therefore, SMP operators are restricted by some regulatory obligations. Regulating and determining the mobile wholesale access prices or interconnection charges is one of the effective remedies

of national authorities on SMP mobile network operators. By setting these rates asymmetrically, National Regulatory Authorities (NRAs) target to eliminate inequalities between mobile operators that are caused by exogenous factors such as sequential entries, differences in licence fees paid and spectrum technologies used. However, asymmetries may direct operators to behave inefficiently. In literature, there are contrasting arguments concerning the pros and cons of asymmetric access price regulations.

While some studies support symmetric price regulations others, reveal the strengths of asymmetry. As the policy maker in European Union, the Commission recommends the use of symmetrical charges if there is not any justification that necessitates asymmetry. Hence, NRAs plan to implement symmetric wholesale prices for all of the operators after a transitory period of asymmetries.

In most of European countries, interconnection charges are determined as symmetrical or a glidepath plan that brings movement towards symmetry is announced. On the other hand, ICTA, Information and Communication Technologies Authority, also have been using asymmetric wholesale price regulations as a remedy to provide sustainable competition among mobile telecommunications market players since 2004. The asymmetry level has decreased from year to year and in the long-term regulator seems planning to set symmetric rates. In this study, firstly I will focus on

access pricing and call termination terminologies in mobile telecommunication networks. Secondly, I will mention to the rationale behind the implementation of asymmetric Mobile Call Termination Rates (MTRs) on mobile operators by referencing related literature studies. The arguments for and against the use of asymmetry will be explained. Then, I will give some information on the common position of European countries and the current situation in Turkish mobile communications market. Finally in the discussion and conclusion part of the study, different possible regulation alternatives are provided for ICTA regarding the further regulation of wholesale access prices.

## MATERIALS AND MTHODS

### Access pricing and call termination in mobile networks:

Each operator pays to other operators to be connected to their networks. Access to the network of an operator by another means providing interconnection services between the operators. Interconnection is required between networks so that subscribers connected to one network can communicate with those connected to others (Peitz *et al.*, 2004). In order for customers of different networks to be able to call each other, telecommunications networks including mobile networks, need to be connected to one another.

In technical terms, it is named as interconnection. After a network operator interconnected to another network then the generated call in that network is terminated by the interconnected operator. Call termination refers to the service whereby a network completes or terminates a call made to one of its subscribers by a caller on another network (Armstrong and Wright, 2009). Moreover, Ofcom (2009) defines call termination as the process of connecting a telephone call from a user on one network to a user on another network

and wholesale voice call termination as the service provided by a network operator to other providers in order to terminate calls (Fig. 1). Call termination can only be supplied by the network provider to which the called party is connected. There are currently no demand-or supply-side substitutes for call termination on an individual network. Therefore, each network constitutes a separate relevant market and each network operator has a monopolistic position on the market for terminating calls on its own network (ERG, 2008a; Kocsis, 2005). Therefore, operators especially that have considerable market power may be able to foreclose entry by denying to its competitors the access to its network which they require and tend to set high interconnection charges to let other operators to be connected its network (Valletti, 2003).

They desire to keep subscribers to generate on-net calls, hence the benefit of network externality can be expanded. Such operator that controls a bottleneck facility sets a price for access to the facility to extract monopoly profits (Wright, 2002).

Interconnection is not only considered as a structural need for call terminating but also as a competitive strategic feature. Interconnection charges can be used as an anti-competitive tool by operators, thus representing an element to be regulated (Laffont *et al.*, 1998a, b; Armstrong, 2002, 2004; Vogelsang, 2003; Valletti, 2006; Harbord and Hoernig, 2010). Countries vary in whether and how they regulate mobile call termination rates.

In certain countries, such as in Africa and Latin America, MTRs are unregulated and operators are left to negotiate among themselves. This often causes to disputes between small operators and larger ones or fixed incumbent and mobile operators (Bernstein and Mingos, 2010). However in the member, states of European Union, mobile termination rates are regulated by national regulators and regulator targets to set MTRs at cost-oriented levels. In order to create a sustainable

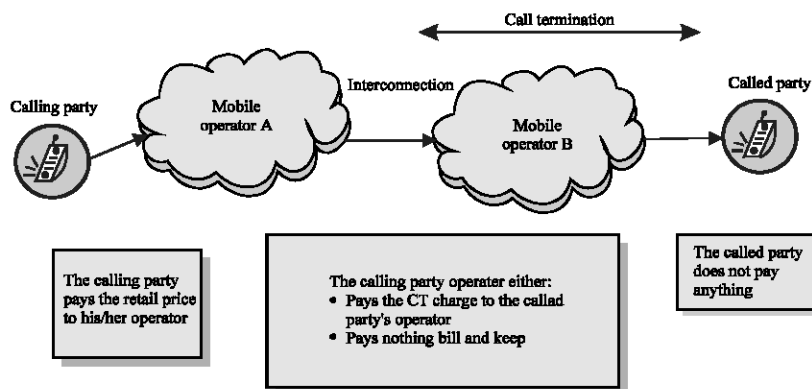


Fig. 1: Call termination in mobile networks, (ARCEP, 2004)

competition environment in the market, NRAs set the level of interconnection rates at the costs of supplying interconnection service by using models suited for countries that are adhered to the guidelines of international organizations such as International Telecommunications Union (ITU, 2010) and ERG (European Regulators Group).

However as Jain (2006) stated, most regulators in developing countries face challenges in setting interconnection prices in the absence of market information on the incumbent's or entrant's costs, competition or demand and cost models.

Consequently, one of the important issues in access pricing regulation is determining the interconnection or call termination charges, especially in the context of a dominant incumbent and the followers. The desirability of an asymmetric regulation has been one of the important subjects in the regulatory debate and it is generally agreed that an asymmetric regulation is somewhat necessary and justified during the transition phase from a monopolistic to a competitive market (Kim and Park, 2007). As a regulatory remedy, determination of asymmetric interconnection charges between operators has been a commonly used method in most of European countries (Di Pillo *et al.*, 2009).

**The rationale of determining asymmetric Mobile call Termination Rates (MTRs):** Asymmetric price regulation can be basically defined as setting different MTRs between operators, generally in favour of late market entrants. According to ERG (2008a), asymmetry refers to charge levels, rather than to differentiation of regulatory remedies e.g., price control versus fair and reasonable. In recommendation study, the European Commission (2009a) recognised that in certain exceptional cases asymmetry might be justified by objective cost differences outside the control of the operators concerned. For example, taking into account differentiated conditions of spectrum allocation (owing to cost differences between the operation of a GSM900 and 1800 network) or encouraging the growth of a new entrant on the market which suffers from a lack of scale due to late market entry, necessitate asymmetric MTRs.

In fact, asymmetric charges in favour of smaller operators, allow higher expected profits in the short term for new entrant and in the long term results a more intense competition to the benefit of consumers. In other words in certain circumstances, it may be appropriate for a regulator to allow asymmetric termination rates. In such circumstances, asymmetric MTRs contribute to dynamic efficiency and let new entrants to invest more in networks hence, favour infrastructure based competition. The

spectrum allocation licences that permit operators to build mobile networks around the country are awarded sequentially. Thus, it automatically generates first and late entrant players in the market. It is generally accepted that the mobile communications market where licences have frequently been granted sequentially is characterised by first mover advantages (Dewenter, 2007).

First mover advantages stem from early adoption by users, allowing a firm to capture a large market share early on. Thus, by the time competitors can enter the market, the first-mover will have already established advantages in brand-loyalty or awareness as well as cost advantages in distribution and/or infrastructure systems (Benzoni and Geoffron, 2007). Studies also support this view. For example, Bijwaard *et al.* (2005) concludes that depending on specific entry conditions, it seems fair to conclude that the first entrant may still gain a large market share and that subsequent entrants encounter more difficulties in gaining market share.

In another study, for the Swiss regulatory authority which compares the development of the Swiss telecommunications market with the rest of Europe, the WIK Consult also stated that a sequential award of mobile licences negatively impacts competition dynamics because of major disadvantages of later entrants (especially, linked to network coverage and to the high switching costs for business customers of early entrants) compared to early entrants (Benzoni and Geoffron, 2007). Several factors have been identified which put late market entrants at an economic disadvantage in supplying mobile telecommunication services including:

- The cost advantages of early entry due to economies of scale, favourable selection of base station sites and favourable access to spectrum
- Switching costs faced by consumers moving from an established operator
- Price-induced network effects whereby the price differential between on-net calls and off-net calls makes it attractive to consumers to use the network with the larger subscriber base (Peitz, 2003)

Furthermore, Dewenter (2007) states that first mover cost advantages typically result from structural advantages, such as economies of scale and learning curves, higher degrees of advertising appeal or better access to input markets. Therefore, as Peitz (2005) stated the late entrants initial position with respect to coverage, installed consumer base, quality of service and reputation is different to the incumbent's position. This creates asymmetric market environments. The solution to eliminate the potential negative effects of asymmetric

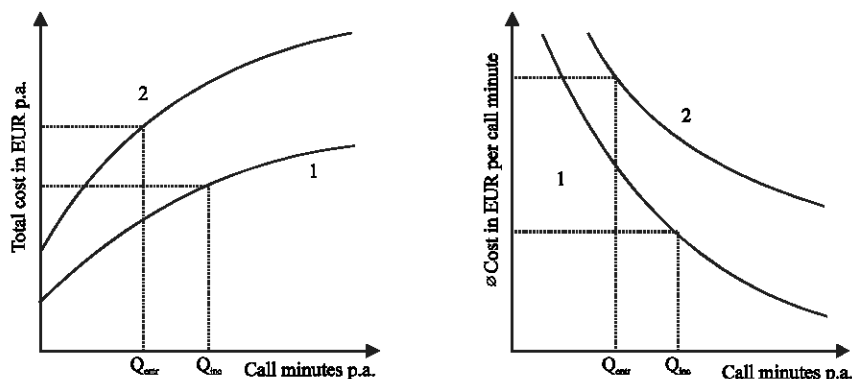


Fig. 2: Cost differences between GSM900 and GSM1800 mobile networks (Ewwes Conclut, 2007), 1: Cost associated with 900 MHz-network, 2: Cost associated with 1800 MHz -network with same geogarithcal coverage as 900 MHz-network

market on competition can be to apply asymmetric price regulation in order to try and address the imbalances in the mobile market. One form this can take is to allow smaller operators to charge higher MTRs, at least for a period until they gain economies of scale. Another issue that justifies the application of asymmetric access price regulations in mobile telecommunication sector is the use of differentiated conditions of spectrum allocation. Exogenous cost differences may arise where spectrum assignments have not taken place using market-based mechanisms but on the basis of a sequential licensing process where for example, later entrants mainly receive GSM1800 technology licences while the first entrants did GSM900 by paying much higher licence fees (Haucap, 2007).

For example in Turkey, 1st 2 entrants (Turkcell and Telsim) purchased the GSM900 licences to operate mobile networks during 25 years by paying 500 million US dollars each in 1998. However in 2001, the 3rd and 4th entrants (Aria and Aycell merged in 2004 and renamed as Avea) are awarded with GSM1800 licences and both of entrants paid 2.5 billion US dollars for 25 years concession rights. On the other hand, Ewers Consult (2007) and Chalopin (2007) point out that higher costs of service provision result from network operation in the GSM1800 standards rather than the GSM900 standards (Fig. 2). Due to the better propagation characteristics of the 900 MHz spectrum in urban areas that generates the most of total network construction costs fewer base stations are needed to ensure indoor coverage than is the case with the 1800 MHz spectrum. Therefore, GSM1800 operators are facing higher unit costs in certain areas than operators with a GSM900 allocation. This relative cost disadvantage decreases as the market shares of the later entrants grow by increasing their capacity needs (European

Commission, 2009b). Similarly, Ofcom concludes that there are disadvantages for 1800 MHz user mobile operators but only during the first years of operation and not in the long run (Lundborg *et al.*, 2005). Smaller mobile network operators are typically the latecomers (3rd or 4th movers) in the national market for mobile services. At the time when the latecomer entered the market, just 1800 MHz spectrum might have been available whereas incumbent operators typically obtained frequencies in the 900 MHz spectrum. Moreover, late entrant purchased the GSM1800 which requires higher initial investment amounts by paying much higher fees for licences. Therefore, regulators prefer asymmetric price regulations at least for a period until GSM1800 network operators eliminate cost disadvantages.

In spite of the supportive arguments regarding, the use of asymmetric price regulations on mobile network operators, also there are some drawbacks such as possible increase of off-net tariffs of the more efficient mobile and fixed operators, lower incentives to invest and innovate, risk of inefficient entry. In asymmetric price regulations, smaller operators have higher termination charges than the efficient first entrants. Therefore, off-net tariffs of first entrants tend to be higher because they pay higher wholesale charges to terminating operators. However, practical observations indicate that there is a confusing relationship between termination rates and retail prices.

For example, Genakos and Valletti (2008) analysed a panel of >20 markets. They estimate a model that retail prices and provider profits are functions of regulation and termination rate differences across the national markets. They find out a significant negative relationship between termination rates and retail prices. On the other hand concerning the efficiency losses, it is well known that

there are two efficiency losses which may emerge in an asymmetric market situation. The first one is allocative efficiency losses which is associated with the exercise of market power through increasing prices to consumers. The 2nd one is productive inefficiency which a dominant firm has an incentive to produce but which is also below the social optimum production amount (Waverman and Schankeman, 1997; Valletti, 2006). Therefore, allowing asymmetric termination rates differences over a too long period of time can encourage operators to behave inefficiently such as limited incentives to cost minimization and be detrimental to competition and welfare.

ERG (2008b) insists that in the long run symmetric mobile termination rates may contribute to enhancing economic efficiency (limiting allocative and productive inefficiencies), investment, innovation, regulatory certainty and lastly, overall welfare. Therefore, the European Commission (2009a) has also emphasised the fact that an operator entered the market later and that it therefore has a smaller market share can only justify higher termination rates for a limited transitory period. The persistence of a higher termination rate would not be justified after a period long enough for the operator to adapt to market conditions and become efficient over time and could even discourage smaller operators from seeking to expand their market share.

Although, the supporting and opposing arguments of asymmetric price regulations that are theoretically explained as above, some empirical economic studies may reach to the different results. For example, Peitz (2005), Kim and Park (2007) and Lee *et al.* (2010) show that asymmetric access price regulation with a cost-based access price for the incumbent and an access mark-up for the entrant is more successful than cost-based symmetric access price regulation applied to incumbent and entrant, also De Bijl and Peitz (2002, 2004) reached to conclusion that asymmetric regulation brings higher consumer surplus due to lower price and is the source of higher entrant market share and profit. Social welfare is lower but not very notably, hence asymmetric regulation can be seen as the best device to promote competition.

However, Dewenter and Haucap (2005) has argued based on an analysis of MTRs for 48 European mobile operators between 2001 and 2003 that asymmetric regulation of the larger operators will induce the smaller operators to increase their termination rates even higher which could result in welfare loss. They argue that smaller operators tend to charge higher termination rates than larger operators, even if there are no differences in costs. The argument goes that consumers are generally ignorant about the termination rates of individual operators and are

only influenced by the average MTR across all operators. This average figure reflects the relative traffic volumes terminating on each operator's network and so the MTRs of the smaller operators carry less weight. Since, a small operator's impact on the weighted average price is quite minor they have greater discretion to increase their prices significantly without a major reduction in demand (Curien, 2007). Dewenter and Haucap (2005) conclude that if MTRs are to be regulated, a symmetrical solution should be applied to both small and large operators although, it does not necessarily imply that their termination rates should be at the same level insofar as late entrants face cost disadvantages due to exogenous factors. Furthermore, Valletti (2006) implies that a policy of setting asymmetric price controls is likely to be to the detriment of customers in the longer term. Less efficient firms will have no incentive to become efficient.

This is because they will see no need to compete with the better ones. Worse than that efficient firms will see no need to innovate and become even more efficient. Hence, there will be less innovation in cost-reducing activities and prices which are expected to reflect costs in the industry will not move down quickly. At the end the ultimate losers will be customers as a whole.

**Common position in European countries and moving towards symmetry:** The European Commission increasingly invites national regulatory authorities to implement symmetric termination rates and there has been a clear trend towards decreasing and more symmetrical termination rates over the last few years (GSMA, 2010). As of January 2010, symmetric mobile call termination rates are already in place in 14 (out of 25) European countries (Czech Republic, Estonia, Lithuania, Finland, Malta, Poland, Slovakia, Sweden, Greece, Hungary, Luxembourg, Portugal, Slovenia and Spain).

In a further 5 countries, a glidepath has been set to achieve symmetry over the next few years (Bulgaria, Denmark, Ireland, Italy, UK). In addition, 6 countries (Austria, Cyprus, France, Germany, Norway and Romania) announced national policy is in favour of symmetry but they have not been implied an exact policy concerning the schedule of symmetric MTRs (ERG, 2008b; Cullen International, 2010). On the other hand, average MTR level in EU shows a significant decreasing trend over last years as shown in Fig. 3.

By October 2008 average, MTRs dropped by 32.4-8.55 eurocents compared to the 12.65 eurocents in October 2005. The Commission considers indeed that the termination rates should normally be symmetric and so that asymmetry requires an adequate justification. Therefore, the Commission encourages national regulators to determine glidepath to bring symmetric a to

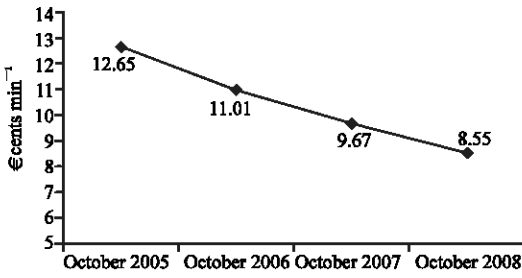


Fig. 3: Trend of average MTRs in EU member states

MTRs in the country. GSMA (2010) defines glidepath as regulated price control where regulators require operators reduce prices over time rather than forcing an immediate move to the cost-orientated levels.

This allows operators time to plan for the decreased revenue that is earned from mobile termination services and offers stability rather than a one-off shocking decrease if the difference between the existing MTR and the cost-orientated MTR is great (Lundborg *et al.*, 2005). Having a glide path can be seen as a way to allow smaller or less efficient operators time to grow their market share or improve efficiency so they are able to compete effectively once the MTRs are reduced at a cost-orientated level.

European Commission (2009a) finds it reasonable to envisage a timeframe of 4 years (from the date of entry of the operator concerned) for phasing out asymmetries in mobile markets.

If the actual presence of late entrants in the market is taken into consideration, regulators have to announce shorter timeframes in glidepaths to implement symmetric MTRs such the UK has used 4 years control period and Spain has had a 3 years glidepath that moves MTRs to symmetric values.

Eventually, due to ongoing regulatory intervention to align MTRs with costs of efficient operator, it is expected that MTRs and asymmetry levels between operators will continue to drop across the European countries. In the recommendation study, the European Commission (2009a) declares hope to see symmetrical mobile termination rates in all member countries by the end of 2012.

**Turkish case:** In Turkish mobile telecommunications, market Turkcell and Telsim (Vodafone now) started to provide cellular mobile telephony services in 1994 as first entrants. In 2000, two new GSM 1800 licenses were issued. One of the licenses were awarded to Is-Tim, a company which began offering GSM services in March 2001 under Aria brand name and the other GSM 1800 license was awarded to Turk Telekom. Turk Telekom began offering GSM services on December 14, 2001,

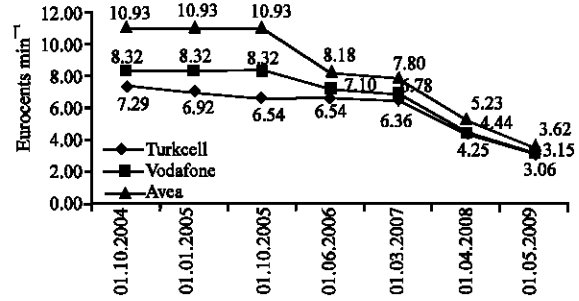


Fig. 4: Trend in MTRs

Table 1: Changes in MTRs

Implementation dates	Level of MTRs (€ cent min <sup>-1</sup> )		
	Turkcell	Vodafone	Avea
01.10.2004	7.29	8.32	10.93
01.01.2005	6.92	8.32	10.93
01.10.2005	6.54	8.32	10.93
01.06.2006	6.54	7.10	8.18
01.03.2007	6.36	6.78	7.80
01.04.2008	4.25	4.44	5.23
01.05.2009	3.06	3.15	3.62

ICTA (2009)

through its brand Aycell. In February 2004, Is-Tim and Aycell merged to form Tt and TIM which is owned by Turk Telekom (40%), Telekom Italia Mobile (40%) and Isbank (20%). TT and TIM operated under the brand name of Avea. About 7 years delay (1994-2001) of any rivals entrance to the market provide excessive first mover advantages to Turkcell and Telsim besides covering high income and corporate subscribers groups that compose target consumer profile for the mobile operators. The market shares of 3 mobile operators are Turkcell: 56%, Vodafone: 25% and Avea: 19%. The distribution of market shares represents the high concentration in market, hence ICTA uses different regulatory remedies to create a sustainable competition in mobile telecom market.

One of them is determining asymmetric MTRs in favor of Vodafone and Avea since, 2004 (Fig. 4 and Table 1) that are the lowest rates after Cyprus and Sweden in EU nowadays (ERG, 2008a, b). As stated by European Commission (2009b) low termination rates facilitate low retail call charges and higher consumption. The decreases in MTRs of mobile operators in Turkey results low off-net tariffs and approximately >100% increase in annual mobile traffics (Fig. 5). For example, the latest entrant Avea generated unlimited call to any networks tariff, boomed the annual traffic of Avea nearly 3 times in 2008-2009 that starts low-priced tariff packages war in Turkish mobile market. Moreover, beside that by the effects of number portability choice Avea has gained a positive balance of approximately 750.000 customers while Turkcell lost nearly 500.000 and Vodafone 250.000 in the last 12 months.

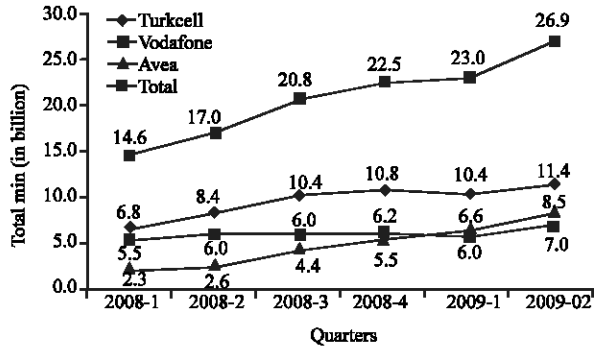


Fig. 5: Trend in mobile network traffic in Turkey (ICTA, 2009)

### DISCUSSION

To sum up, access pricing regulations are one of the important and commonly used remedies of national regulatory authorities. According to economic theory, symmetric MTRs contribute to enhance static economic efficiency (limiting allocative and productive inefficiencies), investment and innovation and finally global welfare but put forward the risk of market exit for the less efficient operators. In spite of the fact that asymmetric MTRs encourage entry, contribute to dynamic efficiency and favour competition but may result an increase in off-net tariffs of the efficient operators, lower incentives of incumbents to invest and innovate and bring risk of inefficient entry.

At the first years of introduced competition after a long monopoly stage, by setting MTRs asymmetrically telecom regulators aim to eliminate the effects of exogenous factors that may distort competition, so lessen consumer welfare. However, asymmetric wholesale prices may encourage market players to operate inefficiently that may damage the sustainable competition environment target.

Therefore, in the long run regulators plan to implement single and symmetric mobile termination rates that are set at the level of efficient mobile operators' cost and contribute to enhancing economic efficiency, investment, innovation, regulatory certainty and at last overall welfare in market.

### CONCLUSION

Consequently, the trend of MTRs in Turkish mobile communications market indicates ICTA's tendency to implement symmetrical interconnection charges in coming years parallel to European Commission recommendations as a negotiating state. So that the cost differences that are

caused by different network technologies, licence fees paid and date of market entry will not be subsidized any more and customers of other operators would not ultimately bear the costs of the inefficient operators.

### REFERENCES

- ARCEP, 2004. Call Termination on Mobile Networks. Autorite de Regulation des Communications, Paris.
- Armstrong, M. and J. Wright, 2009. Mobile call termination. *Econ. J.*, 119: F270-F307.
- Armstrong, M., 2002. Handbook of Telecommunications Economics, Structure, Regulation and Competition: The Theory of Access Pricing and Interconnection. Elsevier Science Publishers, Amsterdam, pp: 320-350.
- Armstrong, M., 2004. Network interconnection with asymmetric networks and heterogeneous calling patterns. *Inform. Econ. Policy*, 16: 375-390.
- Benzoni, L. and P. Geoffron, 2007. Competition and Regulation with Asymmetries in Mobile Markets: Introduction. Quantifica Publishing, Paris, pp: 10-12.
- Bernstein, J. and M. Minges, 2010. Analyst angle: The challenges of mobile termination rates. RCR Wireless News, <http://www.rcrwireless.com/ARTICLE/20100224/OPINION/100229995/analyst-angle-the-challenges-of-mobile-termination-rates>.
- Bijwaard, E.G., M.C.W. Janssen and E. Maasland, 2005. Early Mover Advantages: An Empirical Analysis of European Telecom Markets. Tinbergen Institute, Amsterdam.
- Chalopin, C., 2007. Asymmetric Regulation Applied to Interconnection Charges. Quantifica Publishing, Paris, pp: 62-68.
- Cullen International, 2010. Cross country analysis April 2010: Mobile call termination symmetry and price control. [http://www.cullen-international.com/report/3518/t2942#Table\\_19](http://www.cullen-international.com/report/3518/t2942#Table_19).
- Curien, N., 2007. Competition and Regulation with Asymmetries in Mobile Markets: Foreword. Quantifica Publishing, Paris, pp: 6-10.
- De Bijl, P. and M. Peitz, 2002. New Competition in Telecommunications Markets: Regulatory Pricing Principles. Ministry of Finance, The Netherlands.
- De Bijl, P. and M. Peitz, 2004. Dynamic regulation and competition in telecommunications markets: A policy framework. *Inform. Econ. Policy*, 16: 411-437.
- Dewenter, R. and J. Haucap, 2005. The effects of regulating mobile termination rates for asymmetric networks. *Eur. J. Law Econ.*, 20: 185-197.
- Dewenter, R., 2007. First Mover Advantage in Mobile Telecommunications: The Swiss Case. Quantifica Publishing, Paris, pp: 30-37.

- Di Pillo, F., L. Cricelli, M. Gastaldi and N. Leviaidi, 2009. Asymmetry in mobile access charges: Is it an effective regulatory measure? *Netnomics*, 10.1007/s11066-009-9043-4
- ERG, 2008a. Common position on symmetry of mobile/fixed call termination rates. European Regulators Group, 28th February 2008, [http://erg.ec.europa.eu/doc/publications/erg\\_07\\_83\\_mtr\\_ftr\\_cp\\_12\\_03\\_08.pdf](http://erg.ec.europa.eu/doc/publications/erg_07_83_mtr_ftr_cp_12_03_08.pdf).
- ERG, 2008b. Symmetry MTR/FTR action plan. European Regulators Group, 13th November 2008, [www.erg.eu.int/.../erg\\_08\\_45\\_action\\_plan\\_to\\_achieve\\_conf ormity\\_with\\_the\\_common\\_position\\_on\\_mtrftr\\_symmetry.pdf](http://www.erg.eu.int/.../erg_08_45_action_plan_to_achieve_conf ormity_with_the_common_position_on_mtrftr_symmetry.pdf).
- European Commission, 2009a. 14th Progress report on the single European electronic communications market, Brussels. [http://ec.europa.eu/information\\_society/policy/ecomm/library/communications\\_reports/annualreports/14th/index\\_en.htm](http://ec.europa.eu/information_society/policy/ecomm/library/communications_reports/annualreports/14th/index_en.htm).
- European Commission, 2009b. Commission recommendation on the regulatory treatment of fixed and mobile termination rates in the EU, Brussels. [http://ec.europa.eu/information\\_society/policy/ecomm/doc/implementation\\_enforcement/article\\_7/explanatory\\_note.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/implementation_enforcement/article_7/explanatory_note.pdf).
- Ewers Consult, 2007. Mobile call termination charges. [http://ewers-consult.com/pdf/mobil\\_en.pdf](http://ewers-consult.com/pdf/mobil_en.pdf).
- GSMA, 2010. The setting of mobile termination rates: Best practice in cost modelling. <http://gsmworld.com/documents/costmodelling.htm>.
- Genakos, C. and T. Valletti, 2008. Testing the waterbed effect in mobile telephony. Tor Vergata University, CEIS Working Paper No. 110, <http://ideas.repec.org/p/rtv/ceisrp/110.html>.
- Harbord, D. and S. Hoernig, 2010. Welfare analysis of regulating mobile termination rates in the UK (with an application to the orange/T-Mobile merger). Market Analysis Ltd., Universidade Nova de Lisboa. <http://mpira.ub.uni-muenchen.de/21515/>.
- Haucap, J., 2007. Asymmetric Regulation of Mobile Termination Rates: Competition and Regulation with Asymmetries in Mobile Markets. Quantifica Publishing, Paris, pp: 54-62.
- ITU, 2010. ICT toolkit-module 2: Competition and price regulation. <http://www.ictregulationtoolkit.org/en/Section.1560.html>.
- Jain, R., 2006. Interconnection regulation in India: Lessons for developing countries. *Telecommun. Policy*, 30: 183-200.
- Kim, S.Y. and M.C. Park, 2007. An Analysis of Asymmetric Access Charge Regulation in Asymmetric Mobile Telecommunication Market. Quantifica Publishing, Paris, pp: 96-112.
- Kocsis, V., 2005. Network Asymmetries and Access Pricing in Cellular Telecommunications. Tinbergen Institute, Budapest, pp: 29.
- Laffont, J., P. Rey and J. Tirole, 1998a. Network competition: I. Overview and nondiscriminatory pricing. *RAND J. Econ.*, 29: 1-37.
- Laffont, J., P. Rey and J. Tirole, 1998b. Network competition: II. Price discrimination. *RAND J. Econ.*, 29: 38-56.
- Lee, J., D.H. Lee and C.Y. Jung, 2010. Asymmetric regulation of mobile access charges and consumer welfare with price regulation. *ETRI J.*, 32: 447-456.
- Lundborg, M., E. Ruhle and F. Schuster, 2005. Access, call origination and voice call termination in mobile networks: A comparison of approaches and consequences arising from the new regulatory framework. *Commun. Strateg.*, 58: 117-139.
- Ofcom, 2009. Wholesale Mobile Voice Call Termination: Preliminary Consultation on Future Regulation. Ofcom, London.
- Peitz, M., 2003. On access pricing in telecoms: Theory and European practice. *Telecommun. Policy*, 27: 729-740.
- Peitz, M., 2005. Asymmetric access price regulation in telecommunications markets. *Eur. Econ. Rev.*, 49: 341-358.
- Peitz, M., T. Valletti and J. Wright, 2004. Competition in telecommunications: An introduction. *Inform. Econ. Policy*, 16: 315-321.
- Valletti, T., 2003. The theory of access pricing and its linkage with investment incentives. *Telecommun. Policy*, 27: 659-675.
- Valletti, T., 2006. Asymmetric regulation of mobile termination rates. [http://www.npt.no/ikbViewer/Content/100464/Vedlegg\\_Telenor.pdf](http://www.npt.no/ikbViewer/Content/100464/Vedlegg_Telenor.pdf).
- Vogelsang, I., 2003. Price regulation of access to telecommunications network. *J. Econ. Literat.*, 41: 830-862.
- Waverman, L. and M. Schankeman, 1997. Asymmetric regulation, asymmetric information and competition in multimedia markets. <http://businessinnovation.berkeley.edu/crtp/publications/asmreg.pdf>.
- Wright, J., 2002. Access pricing under competition: An application to cellular networks. *J. Ind. Econ.*, 50: 289-315.