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Edmond Baranes*, Laurent Benzoni** and Cuong Hung Vuong***

How Does European Termination Rate Regulation Impact Mobile Operator Performance?

This paper presents an empirical study of the impacts of mobile termination rate (MTR) regulation on European mobile operator performance. It examines the effects of both glide path and asymmetric regulation on incumbents as well as new entrants to this market using a dynamic econometric model accounting for internal and cross performance effects. The study provides strong supportive evidence for current MTR regulation in Europe.

The European mobile industry has evolved recently via service providers emerging in national markets due to liberalisation. It is well known that more players can contribute to market competitiveness, resulting in a gradual decline in retail prices and in more services offered. Also, having more mobile network operators (MNOs) is associated with network interconnection, i.e. mobile users can be connected to any other subscriber (any to any). However, the call originating operator must compensate the network operator for call termination via mobile termination rates (MTRs). Furthermore, with only a few MNOs (with infrastructure) in mobile markets, retail markets are competitive, whereas MTRs set by MNOs are not considered naturally competitive and hence as requiring appropriate regulation.¹ More precisely, European MTR regulation contains three rationales. First, as MNOs are designated as having significant market power for call termination there is a need for regulation. Second, in practice, it is evident in Europe that MNOs set excessive MTRs which are much higher than the actual costs of terminating calls.² Finally, the “raising rivals’ costs” strategy provides MNOs with an incentive to inflate MTRs (and is detrimental to final consumers and small MNOs). Consequently, with the European regulation framework in 2002, National Regulatory Authorities (NRAs) regulated MTRs by capping the level of MTRs set by MNOs. Furthermore, due to the magnitudes of initial MTRs, NRAs only gradually lowered the caps to cost-oriented caps. This approach is called glide path regulation.

In reality, there are few infrastructure-based MNOs in European national markets, with different network sizes

due to spectrum limitations. Generally, small networks can result from late entry, while large network operators are often former incumbents. For this reason, European regulators treat MTRs depending on the MNO market position. In particular, NRAs allow an entrant to set higher MTRs than incumbent operators, although the gap between MTRs is gradually reduced over time (asymmetric regulation).

The efficacy of both glide path and asymmetric regulation in the wholesale markets is subject to debate.³ Glide path regulation is often criticised by economists who are of the opinion that high MTRs intensify competition as an operator gains an additional consumer that provides higher MTR revenue.⁴ Furthermore, in the presence of externalities (on both sides of the market) in the mobile industry, total welfare is maximal when prices for a multi-product

- 1 In fact, both retail market prices and MTRs were subject to regulation at the beginning of liberalisation. However, with the new communication framework in 2002, only MTRs remain regulated.
- 2 European Commission: Draft Commission Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU, Brussels, June 2008.
- 3 Surveys of economic theory on access pricing include M. Armstrong: The Theory of Access Pricing and Interconnection, in: M. Cave, S. Majumdar, I. Vogelsang (eds.): Handbook of Telecommunications Economics, 2002, North-Holland; M. Armstrong, J. Wright: Mobile Call Termination, in: The Economic Journal, Vol. 119, No. 538, 2009, pp. F270-F307; P.W.J. de Bijl, M. Peitz: Dynamic regulation and entry in telecommunications markets: a policy framework, in: Information Economics and Policy, Vol. 16, No. 3, 2004, pp. 411-437, Elsevier; I. Vogelsang: Price Regulation of Access to Telecommunication Networks, in: Journal of Economic Literature, American Economic Association, Vol. 41, No. 3, 2003, pp. 830-862; J. Laffont, J. Tirole: Competition in Telecommunications, Cambridge 2000, MIT Press.
- 4 J. Gans, S. King: Using “Bill and Keep” Interconnection Arrangements to Soften Network Competition, in: Economic Letters 71, No. 3, 2001, pp. 413-420.

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firm deviate from costs.⁵ In particular, price setting in one market may substantially affect the other market price. This “waterbed effect” is explored in, for example, Schiff⁶ and Genakos and Valletti⁷. Indeed, Genakos and Valletti show that when MTRs are regulated at lower levels, there is a waterbed effect and service prices are higher. With lower MTRs, MNOs derive less interconnection revenue, implying a smaller transfer to the end-user, and so increase retail prices to rebalance profits. The size of the waterbed effect is greatest when the firm’s profit is unaffected as retail prices fully adapt to MTR changes. That is, the firm is “profit neutral” with regard to MTR levels.⁸ Following this direction, Genakos and Valletti⁹ show that OECD MNO profits are only mildly affected by MTR settings, suggesting that the impact of the waterbed is not complete. In the European context, Anderson and Hansen¹⁰ show that the impact of MTR levels on operator profit is insignificant. Accordingly, it appears that glide path regulation may not induce stronger market competition, and that light-hand regulation in wholesale markets should be implemented.

Because of small market shares, new entrant MTRs have a negligible impact on retail prices.¹¹ Furthermore, Peitz¹² argues that asymmetric regulation increases total consumer surplus, and entrant market share and profit. In particular, with sequential MNO market entry, asymmetric regulation is necessary to promote long-term sustainable competition to allow late-entrant “catch up”. While asymmetric regulation is replaced by symmetric regulation in some European countries, there are no clear guidelines as to the time length of sunset clauses for asymmetric regulation.

In summary, while the regulatory setting of MTRs substantially impacts on competitive strategy and market development, current economic arguments are unconvincing for regulatory practices, especially with a paucity of analysis on the effectiveness of European MTR

regulation. Accordingly, this paper evaluates the impact of MTR regulation on European MNO performance: entrant and incumbent. Furthermore, the firm performance indicators employed for the analysis are market share and profitability (EBITDA margin). By estimating a dynamic econometric model using GMM, the study shows that MTR regulation directly positively impacts on the entrant market share, but negatively impacts on incumbent profit. The market share impact is explained by entrants’ incentive to increase customer base to gain scale economies and strengthen market position. Under call termination-based price discrimination in Europe, the profit effect results from stronger competition via European asymmetric regulation. The empirical results also indicate that MTR regulation indirectly raises the entrant profit and hence strengthens sustainable competition between network operators in the long run. Consequently, the study provides evidence supporting current European MTR regulation.

Empirical Approach

European operators are categorised as either incumbents or entrants so as to enable the impact of MTR regulation on these groups to be investigated separately.

Econometric Specification and Estimation Methodology

Next, consider that MNO business performance (e.g. market share or profit) is determined by internal time effects, cross performance effects and MTR regulation.

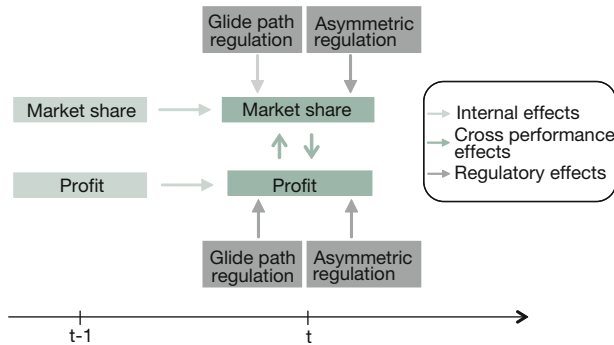
Operators are likely to accumulate business stocks over time.¹³ Hence, MNO business growth is in part based on own performance.

Another firm performance determinant represents the non-systematic relationship between business indicators and the effects possibly due to the firm’s strategic development in Europe’s mobile industry. For example, operators may forego short-run profit to achieve (possibly) long-run market growth. Moreover, with the internal time effects, the relationship within the performance indicator is complex, as it not only affects own values but also other performance indicator future values. For example, higher market share increases the firm’s future share and

5 J. Rochet, J. Tirole: Two-sided markets: a progress report, in: RAND Journal of Economics, Vol. 35, 2006, pp. 645-667.
 6 A. Schiff: The Waterbed Effect and Price Regulation, in: Review of Network Economics, Vol. 7, No. 3, 2008.
 7 C. Genakos, T. Valletti: Testing the ‘Waterbed’ Effect in Mobile Telephony, in: CEIS Tor Vergata Research Paper Series, Vol. 6, Issue 2, No. 110, 2008.
 8 M. Armstrong, J. Wright, op. cit.
 9 C. Genakos, T. Valletti, op. cit.
 10 K. Anderson, B. Hansen: Network Competition: Empirical Evidence on Mobile Termination Charges and Profitability, Working paper, 2007.
 11 R. Dewenter, J. Haucap: The Effects of Regulating Mobile Termination Rates for Asymmetric Networks, in: European Journal of Law and Economics, Vol. 20, No. 2, 2005, pp. 185-197.
 12 M. Peitz: Asymmetric Regulation of Access and Price Discrimination in Telecommunications, in: Journal of Regulatory Economics, Vol. 28, No. 3, 2005, pp. 327-343.

13 G. Bijwaard, C. Maarten, M. Emiel: Early Mover Advantages: An Empirical Analysis of European Mobile Phone Markets, in: Telecommunications Policy, Vol. 32, No. 3-4, 2008, pp. 246-261; H. Gruber, F. Verboven: The Diffusion of Mobile Telecommunications Services in the European Union Countries, in: European Economic Review, Vol. 45, No. 3, 2001, pp. 577-588.

Figure 1
The Determinants of MNO Performance Indicators



hence profit via economies of scale. Importantly, such cross effects may differ by MNO.

Finally, the simultaneous MTR regulatory instruments, glide path regulation and asymmetric regulation, are expected to impact firm performance. For the ease of analysis, regulated MTR levels are assumed to be exogenous and instantly impact on MNO business activity. The potential limitations of this assumption concern the endogeneity of the MTR setting; since the final regulatory decision on MTR is often a long process, relevant MNOs might lobby regulators to achieve the more desirable outcomes.¹⁴ Another limitation is the potentially dynamic nature of the European MTR regulatory process, i.e. by anticipating regulatory intervention MNOs are able to adapt market strategy.

The determinants of the firm performance indicator PER_t^p time t have the form:

$$PER_t^p = \sum_{i=1,t-1} \beta_i PER_i^p + \sum_{j=1,t} \beta_j PER_j^q + \beta_k REG_k$$

where $\beta_p, \beta_j, \beta_k$ represent the individual impact coefficients of PER_t^p ; PER_i^p and PER_j^q are either firm market share or profitability.

The right-hand side contains own lagged PER_i^p values (gradual build-up of operator i 's stocks); PER_j^q (an indicator likely linked to other indicators due to the MNO's strategy based on market dynamics and competition); and

REG_k (performances are immediately affected by the MTR regulatory instrument).

Due to data availability¹⁵, the econometric analysis considers only a first-order focus lag structure on firms' performance via the dynamic regression equation:

$$PER_{i,t}^p = \alpha_o + \beta_1 PER_{i,t-1}^p + \beta_2 PER_{i,t}^q + \beta_3 PER_{i,t-1}^q + \beta_4 MTR_{i,t} + \beta_5 AR_{i,t}^{E/I} + \kappa_t + \varepsilon_{i,t}$$

Where $PER_{i,t}^p, PER_{i,t}^q$ are the indicators for either the market share or profit for operator i at time t .

$MTR_{i,t}$ is the glide path regulation index or the MTR level of operator i at time t .

$AR_{i,t}^{E/I}$ is the asymmetric regulation index or asymmetric regulatory benefit for entrants ($AR_{i,t}^E$) or the adverse effects on incumbents ($AR_{i,t}^I$).¹⁶

α_o is the firm's correlated effect while κ_t is a time dummy variable.

$\varepsilon_{i,t}$ are serially uncorrelated disturbances.

Despite the simple form, model specifications adequately account for all the three business determinant groups and allow one to examine strategic relationships between firm performance indicators as well as the impacts of MTR regulation on firm performance. The econometric model includes group and time effects. Additionally, the endogenous and lagged variables are on both sides of the econometric equations to account for the dynamics of firms' performance indicators. Consequently, using traditional estimation methods such as OLS, instrumental or even simultaneous estimation potentially provides biased and inconsistent estimates.

To deal with this issue, the dynamic GMM estimation for panel data, as proposed by Arellano and Bond¹⁷, is applied. Specifically, potential bias is treated by using all lagged differences as the valid instruments, and only the glide path regulation variable ($MTR_{i,t}$) is considered strictly exogenous. The asymmetric regulation index is, however, not treated as strictly exogenous because of the link with MTR levels, and asymmetric regulation and glide path

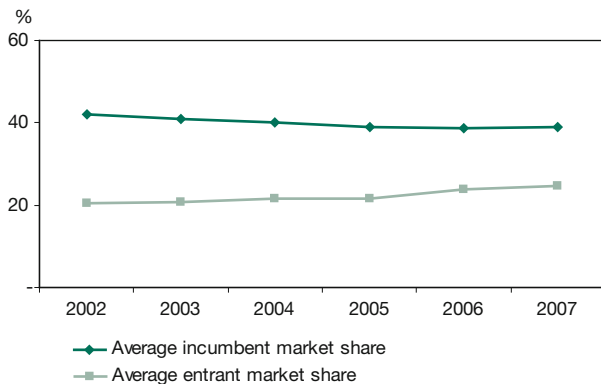
14 In Europe, Edwards & Waverman study factors affecting the MTR setting: G. Edwards, L. Waverman: The Effects of Public Ownership and Regulatory Independence on Regulatory Outcomes, in: Journal of Regulatory Economics, Vol. 29, 2006, pp. 23-67.

15 Indeed, because the data is limited to six periods, and nineteen (incumbent) and twenty-five (entrant) cross-sections, only a small number of observations are applicable to more complex modelling. (See the descriptive statistics in the box at the end of this article.)

16 For construction details and intuition, see the following subsection.

17 M. Arellano, S. Bond: Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, in: Review of Economic Studies, Vol. 58, No. 2, 1991, pp. 277-297.

Figure 2
The Market Share of the Average Entrant and the Average Incumbent



Source: Quantifica.

regulation may be linked by regulatory decisions by the same NRA. Finally, the dynamic GMM estimation method is appropriate since the panel data contains many cross-sections and few time periods.

Data and Variable Definitions

The data cover forty-four European MNOs for 2002-2007 and are provided by QUANTIFICA¹⁸ and published in reports on the implementation of European regulatory packages available on the European Commission's website. To account for heterogeneity, European MNOs are categorised in incumbent and entrant groups. The incumbent group is comprised of all former monopoly operators and early entry operators with high market shares. Other operators belong to the entrant group. MNO names and data descriptive statistics are shown in the box at the end of this article.

Firm Performance Indicators

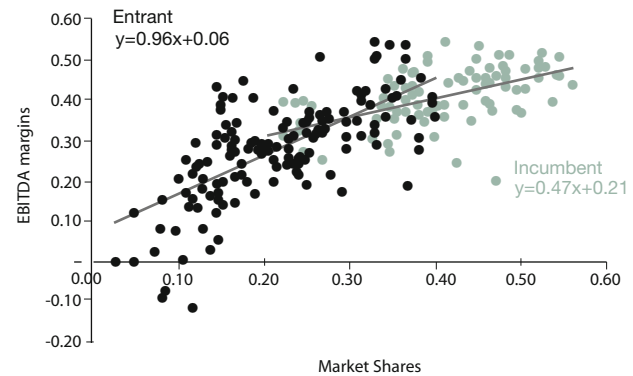
Based on received analysis, the most appropriate indicators for assessing firm performance are market share and profit.

Market share(s): Market share is an important criterion in assessing firm performance, especially in industries exhibiting strong network effects and economies of scale. Furthermore, in Europe, operator shares have increased over time and entrants often have lower market shares due to late market entry.¹⁹ Indeed, Figure 2 confirms that despite a five per cent increase from twenty per cent in

¹⁸ Data on demand are from www.quantifica.fr.

¹⁹ G. Bijwaard et al., op. cit.

Figure 3
The Relationship between Firm Market Shares and EBITDA Margins



Source: Quantifica.

2007, the average late entrant still had a significantly lower market share than the average incumbent in 2007.

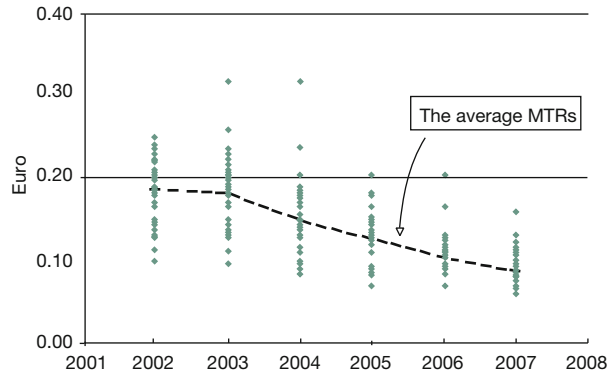
Profitability: As discussed above, European MNO market share and profitability are likely endogenous. For example, higher market shares allow MNOs to reap greater profit due to the importance of fixed network investment costs and of economies of scale. In the business context with financial constraints, higher profit provides more financial leverage to gain additional market share. Figure 3 shows the relationship between market share and profit, as well as heterogeneity between the operator groups regarding performance. Entrants are generally smaller than the incumbents in profit and market share. Furthermore, the linear relationship between profit and market share is positive and is relatively flatter for the incumbent group (0.47 compared to 0.96 for the entrant). This suggests that profitability and market shares might be bi-directionally linked depending on the operator positioning. Nevertheless, the systematic relationship between the indicators is explored empirically below.

Regulatory Indicators

To regulate MNO termination rates, European NRAs often simultaneously use glide path and asymmetric regulation instruments. Hence in evaluating the effectiveness of MTR regulation, both regulatory indicators are employed in the econometric model.

Glide path regulation (MTR): The objective of European glide path regulation is to gradually lower the MTRs of MNOs toward the cost of interconnection. Indeed, the European Commission's recent regulatory draft recommends that European NRAs set a single MTR for all

Figure 4
The Setting of MTRs in Europe



Source: European Commission.

national infrastructure MNOs.²⁰ Furthermore, the data illustrates that there is a decreasing dispersion in the MTR levels between firms during the period. However, a downward trend is observed (see Figure 4). Typically, MNOs usually set MTRs at capped levels and hence the MTRs at operator level are suitable to proxy for European glide path regulation.

Asymmetric regulation (AR): Asymmetric regulation is an efficient regulatory instrument to assist entrants to “catch up” with incumbents and hence intensify sustainable long-term competition among infrastructure MNOs. Conventionally, asymmetric regulation benefits entrants while adversely impacting on incumbents. Furthermore, depending on market position and practical MTR implementation, the effect of asymmetric regulation on an MNO may be beneficial or adverse. Although there is no systematic methodology, a good asymmetric regulation indicator should reflect the MNO’s impact on European MNOs. With this in mind, the asymmetric regulation indicator for operator *i* in the entrant group at *t* is:

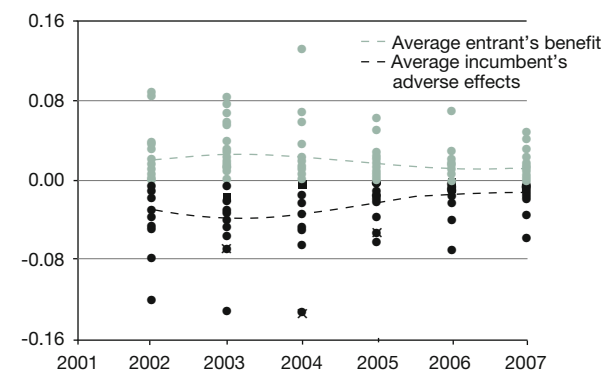
$$AR_{i,t}^E = \sum_j \left[MTR_{i,t} - MTR_{j,t} \right] \frac{\alpha_{i,t}}{\alpha_{j,t}}$$

where $\alpha_{i,t}$ and $\alpha_{j,t}$ are, respectively, operators’ *i* and *j* market shares, where operator *j* is the incumbent operator(s) and any earlier entrant operator than *i*, and $MTR_{i,t}$ and $MTR_{j,t}$ are the termination rates of operators *i* and *j*, respectively.

The asymmetric regulation indicator for an incumbent represents the adverse effect of asymmetric regulation.

²⁰ European Commission, op. cit.

Figure 5
Average Asymmetric Regulation Index



Source: Quantifica and the European Commission.

The construction of the asymmetric regulation index for incumbent *i* at *t* is:

$$AR_{i,t}^I = \sum_j \left[MTR_{i,t} - MTR_{j,t} \right] \frac{\alpha_{i,t}}{\alpha_{j,t}}$$

where $\alpha_{i,t}$ and $\alpha_{j,t}$ are, respectively, the market shares of operators *i* and *j*, where operators *j* are entrants.²¹

Generally, the $AR_{i,t}^E$ index is non-negative while $AR_{i,t}^I$ has non-positive values. The value range indicates that asymmetric regulation benefits entrants but harms incumbents. Precisely, the higher an entrant index ($AR_{i,t}^E$) value, the greater is the entrant benefit, while higher incumbent index or lower $AR_{i,t}^I$ absolute values indicate smaller incumbent adverse effects.

Figure 5 illustrates the average values of the asymmetric regulation indexes for entrants and incumbents for 2002 through 2007. In particular, these data suggest symmetry and convergence to zero between the asymmetric regulatory indicators. This effect is due to the adoption of symmetric regulation in some European countries (e.g. Sweden from 2005) and the narrower MTR differentials. Also, this trend may reflect regulatory rationales when setting the level of asymmetry with respect to the MTR margins in Europe, as in the case of France.²²

²¹ Some European nations have two operators in the incumbent group. These data reveal that the MTRs of both operators are rarely different throughout the period examined. Hence, the asymmetric regulation index for an incumbent only accounts for MTR asymmetry between the incumbent and entrants in the same market.

²² ARCEP, décision 08-1176, available at: http://circa.europa.eu/Public/irc/info/ecctf/library?l=/france/adopted_measures/fr20080812/08-1176pdf/_FR_1.0_&a=d.

Estimation Results

The estimation results are reported for both MNO groups: Table 1 for incumbents and Table 2 for entrants. Furthermore, the Sargan test of over-identified restrictions shows that the instrumental set is valid. First, the relationship between the firm performance variables (both internal and cross effects) is analysed. Second the direct impact of MTR regulation on firm performance is determined. Finally, the indirect impact of MTR regulation due to the endogeneity between the performance indicators is explored.

Incumbent Group

Table 1 indicates that incumbents' profit and market shares are impacted only by own lagged variables, but not other performance variables. This result reflects the dynamic growth of European mobile telephony, as operators are likely to accumulate market share and profit, i.e. own lagged variables are decisive for the current values. Furthermore, Table 1 shows that the own lagged market share coefficient (0.81) is close to unity, while the lagged profitability coefficient (0.13) is closer to zero. This finding suggests that the incumbent shares are highly predictable from past values and that other exogenous variables have only a minor impact on share values.

This finding does not hold for incumbent profits. In accordance with Figure 3, which demonstrates the relatively flat relationship for the incumbent group, there is an insignificant relationship between the performance indicators in Table 1.

Additionally, the direct consequences of MTR regulation, comprised of glide path and asymmetric regulation variables, on incumbent performance are presented in Table 1. "Profit neutrality" is supported by the insignificant impact coefficient of the MTRs on incumbent profitability.

Moreover, Table 1 also indicates that asymmetric regulation reduces incumbent profit (estimated coefficient 0.57) and might be explained by asymmetric MTRs' resulting in an increase in incumbents' wholesale costs, thus negatively affecting total profit.²³ Nevertheless, since European MNOs can discriminate final prices based on call termination (on-net and off-net price discrimination), and because of incumbent profit neutrality, wholesale costs due to asymmetric MTRs are likely recovered from retail revenues. Another possibility is that European asymmetric regulation induces stronger competitive pricing strategies

²³ This is clearly seen in traditional theoretical models which assume balanced calling patterns.

Table 1

The Estimation Results for the Incumbent Group

EBITDA margin	Coefficients	Market share	Coefficients
EBITDA margin lagged 1	0.13 (0.09)**	Market share lagged 1	0.81 (0.12)***
Market share	-0.11 (0.21)	EBITDA margin	0.004 (0.05)
Market share lagged 1	0.41 (0.23)	EBITDA margin lagged 1	0.011 (0.08)
Glide path regulation	0.29 (0.25)	Glide path regulation	-0.25 (0.19)
Asymmetric regulation	0.57 (0.30)***	Asymmetric regulation	0.07 (0.15)

Notes: The standard errors are in brackets. (***), (**) and (*) are the significance levels at 5%, 10% and 15% respectively.

among MNOs²⁴, damaging incumbents' performance. Moreover, as incumbent market shares are relatively stable, European asymmetric regulation is likely to reduce incumbent profit. Should firms partially control the relationship between market share and profit, these empirical results imply that incumbents must spend greater financial effort (e.g. by lowering service price or increasing handset subsidies) to compete and retain market share under asymmetric regulation.

Finally, since there is no reported impact of incumbent market share on profit, and vice versa, the indirect impact of MTR regulation on incumbent performance is not clear. This is not the case for the entrant group. In conclusion, the results demonstrate that the relationship between profit and market share for European incumbents is weak, and asymmetric regulation could result in stronger competition across the European mobile industry, which might then negatively impact on incumbent profit.

Entrant Group

Table 2 provides the estimation results for the entrant group. Similarly to incumbents, entrants gradually build performance (see the coefficients of 0.32 and 0.35 for own lagged variables of EBITDA margins and market shares, respectively). Additionally, entrant current market shares and lagged variables increase EBITDA margins with respective impacts of 0.62 and 0.42. Clearly, economies of scale and the high irreversibility of (initial) fixed costs in the mobile industry are important.

²⁴ M. Peitz, op. cit.

The endogenous impact of entrants' profit on market share is, however, more complex. In particular, a per cent increase in the current EBITDA margin raises entrants' financial capacity to gain an additional 0.27 per cent of market share. A per cent decline in the EBITDA margin (first order lag) increases entrant market share by 0.7 per cent, i.e. due to the increased future market share an entrant must increase current expenditure, e.g. increase marketing expenditure or lower service prices to attract subscribers.

The impact of European regulations is also shown in Table 2. Broadly speaking, MTR regulation increases entrant market shares but not profit. In particular, glide path regulation increases entrant market share by 0.32 per cent (per cent reduction in the regulated MTR). Glide path regulation increases entrant attractiveness as its off-net call price can be set lower (raising rivals' costs strategy). Moreover, from a dynamic viewpoint, profitability should depend more on the retail market as interconnection revenue from the fixed network is lower when MTRs fall, and hence an entrant is more incited to increase its share to make network usage efficient.

Regarding the impact of asymmetric regulation, the estimation results show that only entrant market shares increase (by 0.47 per cent) in response to a percentage increase in the entrant asymmetric regulation indicator (AR_{it}^E). This outcome presents strong evidence in support of Peitz²⁵ who shows that asymmetric regulation directly increases entrant profit, and that entrants might rely on the benefit from higher MTRs and not from competing with the incumbent. This result, however, suggests that any advantage from higher MTRs is immediately transferred to final consumers to increase the entrants' competitive position. The result is not surprising since entrants often have a strong incentive to enhance market shares (to achieve economies of scale for example), and asymmetric regulation provides appropriate financial conditions. For this reason, the direct impact of asymmetric regulation on the entrant profit is insignificant.

It is worth noting that the indicator of asymmetric regulation depends both on the magnitude of relative MTRs and market shares, and thus a higher indicator value does not necessarily imply allowing entrants to set higher MTRs. Rather, this can also be achieved via greater entrant share.

Table 2 reports indirect impacts of MTR regulation on entrant performance. Clearly, there is no indirect effect caused by asymmetric regulation indicators on the incum-

²⁵ Ibid.

Table 2
The Estimation Results for the Entrant Group

EBITDA margin	Coefficients	Market share	Coefficients
EBITDA margin lagged 1	0.32 (0.005)***	Market share lagged 1	0.35 (0.05)***
Market share	0.62 (0.13)***	EBITDA margin	0.27 (0.03)***
Market share lagged 1	0.42 (0.26)*	EBITDA margin lagged 1	-0.07 (0.02)***
Glide path regulation	0.19 (0.20)	Glide path regulation	-0.32 (0.09)***
Asymmetric regulation	-0.02 (0.29)	Asymmetric regulation	0.47 (0.21)***

Notes: The standard errors are in brackets. (***) (** and *) are the significance levels at 5%, 10% and 15% respectively.

bent market shares because of the insignificant relationship between profitability and market share. However, this is not the case for entrants, with MTR regulation having an indirect effect on profit. Specifically, a percentage reduction in MTRs via glide path regulation increases entrant shares by 0.32 per cent, and profits by 0.2 per cent (as the entrants' impact coefficient for market share on profitability is 0.62). Similarly, the indirect impact of asymmetric regulation on the EBITDA margin is 0.29. This value is calculated from the product of the impact of asymmetric regulation on entrant market share (0.47) and a percentage increase in entrants' market share on profit (0.62).

Policy Discussions

Based on the estimation results presented above, several interesting issues in economics and regulatory policy are discussed in the following.

The waterbed effect shows that changing MTRs can affect mobile prices, which is detrimental to subscribers. Specifically, MNOs retain their profit with lower regulated MTRs by charging higher retail prices.²⁶ However, since European MNOs are heterogeneous in market positioning and business strategy, waterbed effects may not arise globally when there is glide path regulation. Indeed, the analysis shows that, by accounting for heterogeneity, profit neutrality is likely to apply to incumbents, but not entrants. Clearly, our study shows that European entrant MNOs can indirectly increase their profit via glide path regulation. Thus, glide path regulation supports entrant price reduction strategy to gain market share and is an

²⁶ C. Genakos, T. Valletti, op. cit; K. Anderson, B. Hansen, op. cit.

appropriate regulatory instrument to promote infrastructure-based competition among European MNOs.

Asymmetric regulation which applies to service providers is widespread in telecommunication markets.²⁷ Our paper shows that the implementation of asymmetric regulation in setting MTRs in the European mobile industry indirectly boosts entrant profitability because of their success in acquiring more market shares coinciding with the “sustainable long-term competition” objective. Furthermore, this finding eliminates the possibility of rent-seeking behaviour and implies that entrants spend efforts to compete for new customers under asymmetric regulation.

Conversely, the analysis shows that asymmetric regulation has only a modest negative impact on incumbent profitability; but since incumbent profitability is neutral

27 See, for example, Y. Chou, K. Liu: Paradoxical Impact of Asymmetric Regulation in Taiwan’s Telecommunications Industry: Restriction and Rent Seeking, in: *Telecommunications Policy*, Vol. 30, 2006, pp. 171-182; and R. Crandall, J. Sidak, H. Singer: The Empirical Case Against Asymmetric Regulation of Broadband Internet Access, in: *Berkeley Technology Law Journal*, Vol. 17, No. 3, 2002, pp. 953-987.

with regard to MTR levels, the lower incumbent profitability is possibly a response to stronger market competition among asymmetric MNOs. Hence, a sunset clause on current European asymmetric regulation is not recommended based on these findings.

Conclusion

This paper empirically studies the impacts of MTR regulation in European mobile telephony. By dividing MNOs into groups and based on the relationship of firm performances, the econometric results show that there is little risk from current MTR regulation for the incumbent operators, while MTR regulation positively impacts the entrant operators. To summarise: market shares and profitability are bi-directionally linked, and this relationship is closer for entrants. Second, MTR regulation boosts entrant market share and modestly affects incumbent profitability. Third, there is no supporting evidence of rent-seeking behaviour by entrants. Finally, entrant profit is higher as a result of increased market share. Subsequent empirical study will provide intuitive reasons for potential intervention in setting the MTRs in European wholesale markets.

Incumbent Operators and Descriptive Statistics

T-Mobile Germany	Cosmote	Telia Sweden
Vodafone Germany	Vodafone Ireland	Vodafone UK
KPN Mobile	Tim Italy	O2 UK
Mobilkom	TMN	Vodafone Netherlands
Proximus	Vodafone Portugal	Vodafone Greece
Telefonica	Orange France	
Sonera	SFR	

	AR	MTR	Market Share	Profitability
Mean	-0.02	0.13	0.40	0.40
Maximum	0.02	0.26	0.56	0.54
Minimum	-0.13	0.06	0.21	0.20
Std. Dev.	0.03	0.04	0.09	0.07
Observations	109	109	109	109
Cross-sections	19	19	19	19

Entrant Operators and Descriptive Statistics

O2 Germany	Elisa	Optimus
Eplus	Amena	Tele2 Sweden
Orange Netherlands	Vodafone Spain	Telenor Sweden
Telfort Netherlands	DNA	Orange UK
T-Mobile Netherlands	Bouygues	T-Mobile UK
One	Wind Hellase	Mobilstar
T-Mobile Austria	O2 Ireland	Base
Telering	Meteor	
Wind	Vodafone Italy	

	AR	MTR	Market Share	Profitability
Mean	0.02	0.15	0.22	0.28
Maximum	0.13	0.32	0.40	0.54
Minimum	-0.01	0.06	0.03	-0.11
Std. Dev.	0.02	0.05	0.09	0.12
Observations	140	140	140	140
Cross-sections	25	25	25	25