



Identifying the root causes of differences in the quantitative model findings on the price, investment and quality effects of European 4-to-3 mergers

HTE Radiotelecommunications Department
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Agenda

- Research Question, Findings and Originality
- Introduction: fragmented market challenge, competitiveness, competition, 4 to 3 mergers
- Literature on Single Market, Merger regulation w Remedies
- Literature on horizontal Merger cases in Europe, focus latest UK and Spain
- Research methodology and analytical model framework
- Findings on quantitative models for price, profitability, investment, return and quality
- Finding & conclusion: synthetization of empirical model outcomes

Disclaimer

This study was written by Gábor Földes. Views are the author's own and do not necessarily represent the concluded position of VOIS (Vodafone Intelligent Solutions) on particular matters. The research received no financial grant.

Paper

[Elsevier SSRN](#)

Research Question, Findings and Originality

Research Question

- understand and identify *root causes* on the differences of consumer *price*, operator *investment* and service *quality* assessments related 4 to 3 (mobile) mergers in the EU

Research gap

- Significant number of researches published on one or more impact elements,
- mainly in „two parallel truth” exists on the debate w/o cross communication or reference

Research method

- Systematic literature review, qualitative analysis
- Policy/theoretical framework, case studies and empirical quantitative models

Findings & Novelty

- Collect all *major argumentation both from supporting and opposing sides* into one paper
- Paper attempts to set-up an apple-to-apple comparison of different quantitative models to provide a harmonized consensus

Problem: Europe competitiveness is shrinking – in telecoms also, Regulation is the resolution vs the root cause

The Debate

- *Competitiveness backlog to developed markets*
- *Resolution: more competition (Vestager) vs more cooperation (Breton, Letta, Draghi)*



Digital Single market

- M&A: cross border and within border
- Operators, size: fewer and larger
- Competition by traditional physical infrastructure versus virtualization decouples service & infra

- No evidence that more concentrated national markets lead to better outcomes,
- Contrary: less competitive national markets, more fragmented single market

EC report from Letta & Draghi

- *Letta*: integration of the European telecoms market, bigger is better
- *Draghi*: lack of economies of scale, underinvestment in innovative activities, decrease merger control and encourage consolidation within industry

- *Prevent such mergers*: could raise prices, decrease choices for consumers, and hinder innovation by reducing competitive pressure
- *Competitiveness* : optimum of scale and affordability

Competition regulation background, Merger control and Conditional clearance with remedies

Merger control

- Merger Control, 2004
- Horizontal merger Guidelines, 2004, revision starts in 2025

Substantive test

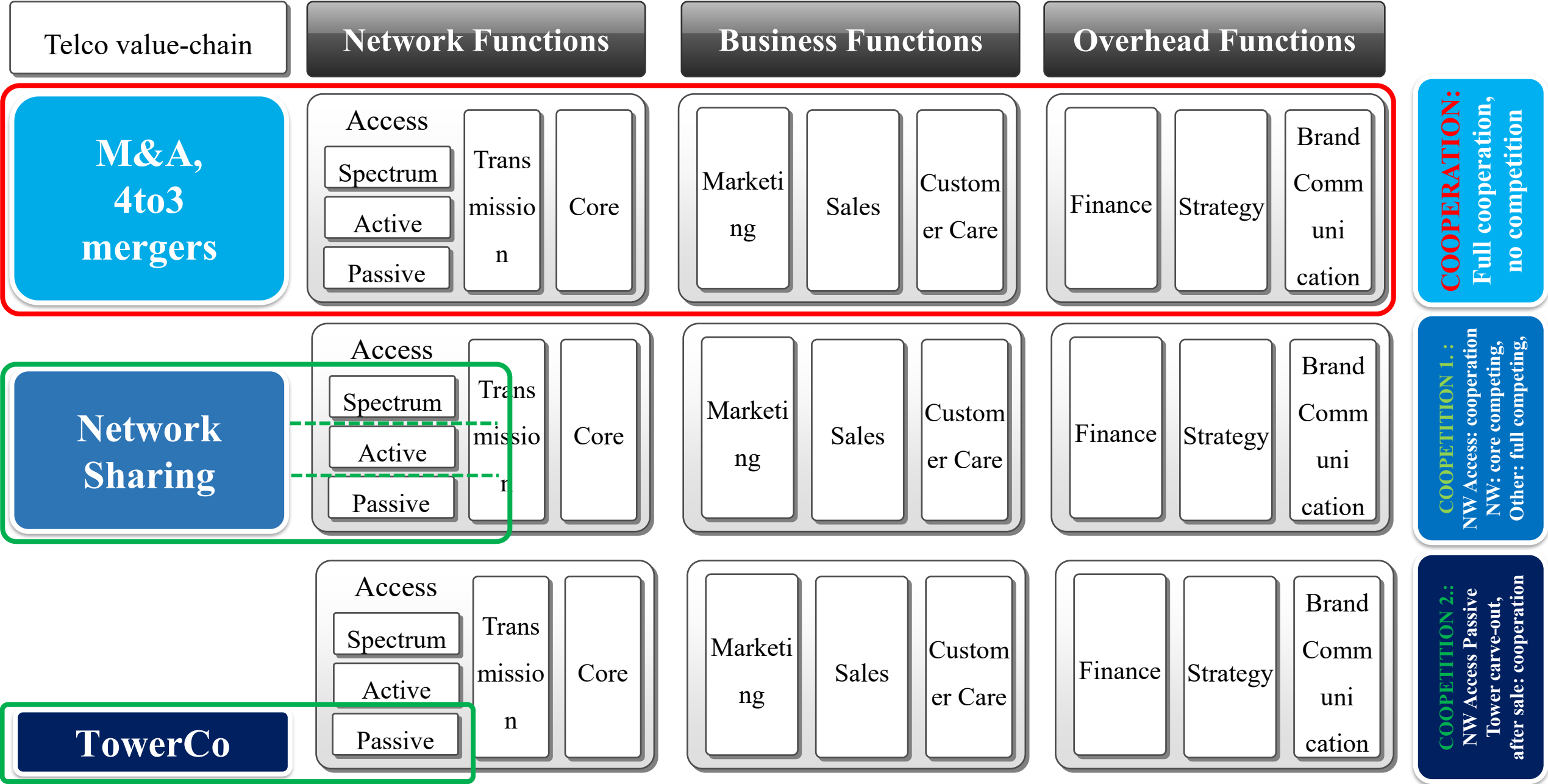
- *Dominance test*: position itself not contrary, just behavior: the abuse of individual and collective dom.
- *Significant Impediment of Effective Competition (SIEC) test*: to intervene in gap cases, such mergers arising in oligopolistic markets, but not arising single or collective dominance issue, cornerstone of the concentration control

Remedies

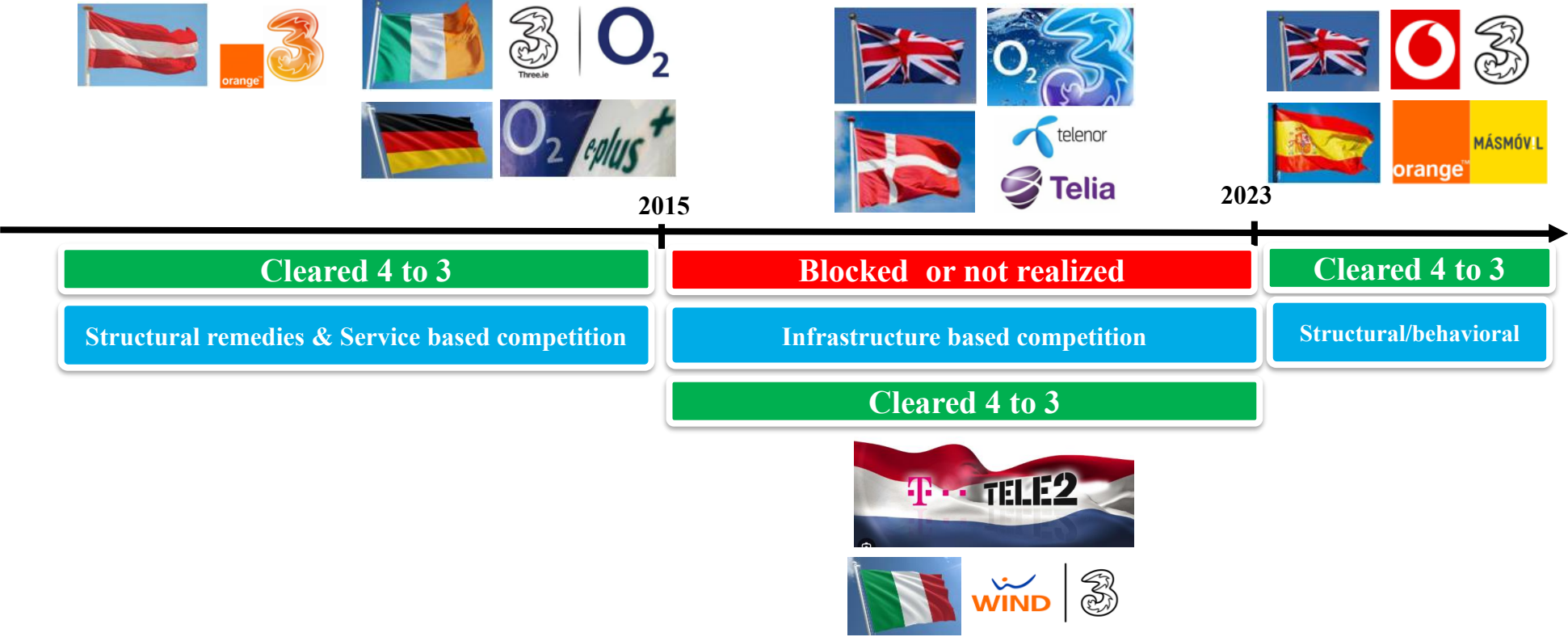
- *Structural*: aim to reshape the market by creating or strengthening a competing entity (eg. divestiture)
- *Behavioral*: imposing restrictions or obligations on the merged entity's future conduct to mitigate potential harm to competition. (eg., non-discrimination commitments, price controls, investment commitments)
- Behavioral remedy, like investment commitments, which is notoriously difficult to enforce, monitor or change-back
- *Hybrid*: address both the immediate structural issues and for future the potential anti-competitive conduct

Alternatives for blocked mergers

Source: Author's own summary



Overview on horizontal mergers in Europe since 2012: majority realized



Periodically slight changes in competition policy approaches on service versus infrastructure-based competition preference and related remedies

Recent horizontal merger approvals: UK long list of behavioral remedies, being the most controversial part of the decision whether can be enforced

Cases



Player rank: # 3, # 4
Approved: in Dec 2024, by CMA

Delivery of joint network plan:

- GBP 11bn self-funded *infrastructure investment committed* altogether for 8 years with milestones at 3 and 5 yrs
- In 12 months from completion deliver the highest level *Network Sharing* (Multi-Operator Core Network, *MOCN*, active sharing including spectrum, eg 1800MHz also for increased coverage and capacity and customer experience).
- By 2034: *roll-out of integrated network (25-30k sites)*, in line with Vodafone and UK government strategy by *5G Standalone (SA)* technology (with 99% population coverage) for lower latency. enhanced speed and capacity, network slicing option, improved reliability and support massive IT and critical communication.

Related to network management Vodafone undertake further commitments also related to existing network sharing partners, Virgin Media Telefonica O2 (VMO2):

- *revision of network sharing agreement* with VMO2
- *Spectrum sell* to VMO2

Time limited customer protection (for 3 years, till network commitment reached)

- Retail customers: *Capping selected mobile tariffs and data plans* (including “social tariffs”) to protect customers from short-term price increase.
- Wholesale customers (MVNOs): *Offering pre-set prices and contract terms for wholesale services*, to protect competition among mobile virtual network operators.



Player rank: # 3, # 4
Approved: in Feb 2024, by EC DG Comp

- *Structural remedy: divest spectrum* from MásMóvil portfolio to Digi from there frequency bands (2 mid bands from 1800 and 2500 MHz and 1 high band 3500 MHz) in order to enable Digi to rollout its own mobile network.
- *Behavioral remedy: enter into optional national roaming* agreement that Digi can decide whether to call the option.

Remedies

Research methodology for empirical model assessment

Assessed models

- research covers *empirical, mainly quantitative models* (fixed effects panel models, Difference in Differences models, multivariate reg.)
- large scale *backward-looking post-merger analysis*, and just few forward-looking merger simulations are referred.

3 key meta studies

- EC, 2024: Protecting competition in a changing world, Exploring aspects of the state of competition in the EU – GSMA fixed panel
- GSMA (Bahia& Castells), 2023: The dynamic effects of competition on investment: the case of the European mobile communications
- Compass Lexecon, 2023: Do Four-to-Three Mobile Mergers Harm Consumers? A Review of Post-Merger Effects and Concentration

Research subject

- merger analysis, 4 to 3 mergers, impact of new entrant (e.g., 3 to 4 move), three or four Mobile Network Operator (MNO) market, market concentration analysis (higher or lower concentrated markets, based on HHI approach).

Extended Analytical framework

#	Impacted fields	Description & considerations
1.	End-user price	<i>Directly from service basket prices</i> (rarer) <i>Indirectly from ARPU</i> , containing not only price rise/decrease impact, but also usage volume or even quality combined impacts
2.	Operators EBITDA impact	<i>Revenue based profitability</i> measured by EBITDA/sales margin, containing revenue and OPEX impacts
3.	Operators CAPEX incentives	<i>Investment aspects</i> , measured by following approaches: investment intensity: CAPEX/sales, Unitary CAPEX per user, country investment level
4.	Operators ROCE impact	<i>Return on Investment</i> that mid and long term should exceed cost of capital (WACC)
5.	End-user quality perception	Mainly <i>download or upload speeds</i> are measured.

1., End-user price impact: neutral or slight increase

EC papers

- *higher concentration is associated with higher prices that expressed by one more additional MNO reduces ARPU by 9% in EU*
- *between 2009-2019 3 MNO prices were constantly at least slightly higher on the 3 MNO markets than on the 4 MNO markets*

GSMA paper

- *vast major part of the time 3 MNO markets were cheaper, MNOs had lower level of ARPU*

Lexecon paper

- *mergers had little impact on prices, typically having no effect at all, or caused just temporary increase in prices for some customers*
- *mergers led to either no change in the rate of decline in MNOs' average revenue per GB (proxy for quality-adjusted prices) or accelerated*

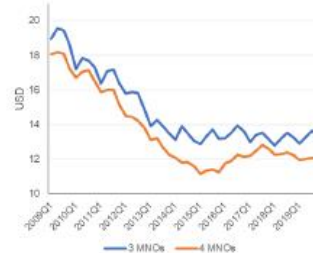
Other papers

- *Increase:* Genakos et al. (2018) +20% per 10%p HHI increase, Csorba and Papai (2015) just from 3rd year, Valletti (2023)
- *Mixed:* Hounghonon and Jeanjean, (2019) data plans decreased by 20%, voice plans increased, Aimene et al. (2019)
- *Flat:* Affeldt and Nitsche (2014), Csorba and Papai (2015) for the first 2 years found no statistically significant price change

Supplementary considerations

EC

Figure 54: Evolution of ARPU in European countries based on the number of MNOs

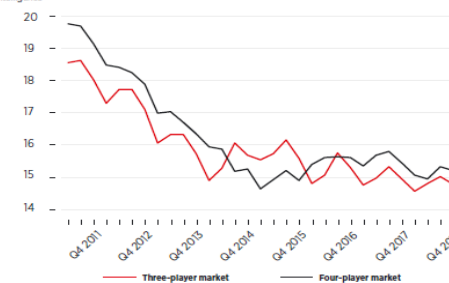


Source: Lear et al. (2024). Grouping based on countries with a constant number of MNOs over the period

GSMA

Figure 12

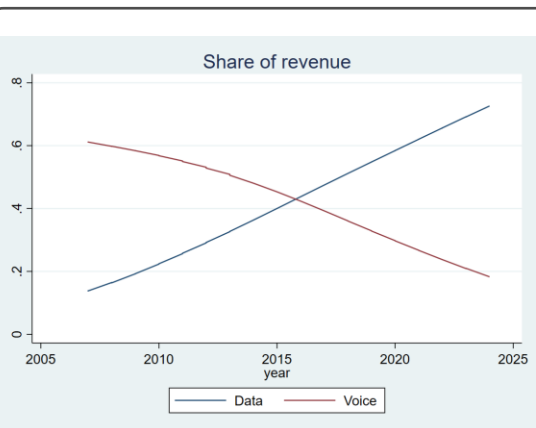
ARPU levels also decreased during the 4G era
Average revenue per user, Euros
Source: GSMA Intelligence



- ARPU analysis, acknowledged just proxying end-user basket price impact, further elements: service quality and usage volume
- ARPU increase: not certainly equal with price raise, quality also might have improved, that pulls-up the used volume (eg GB)

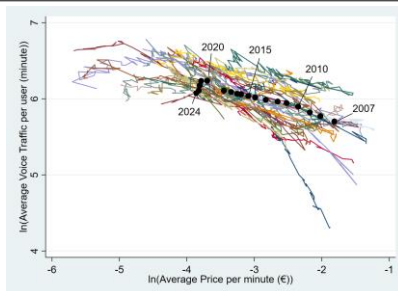
1.1, Even more: ARPU mix became data driven, negatively correlating w price

ARPU mix

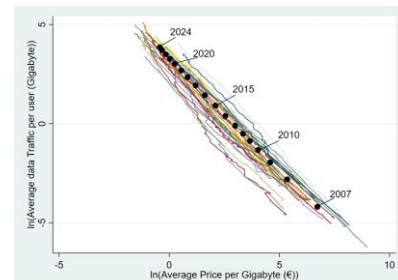


Price elasticity

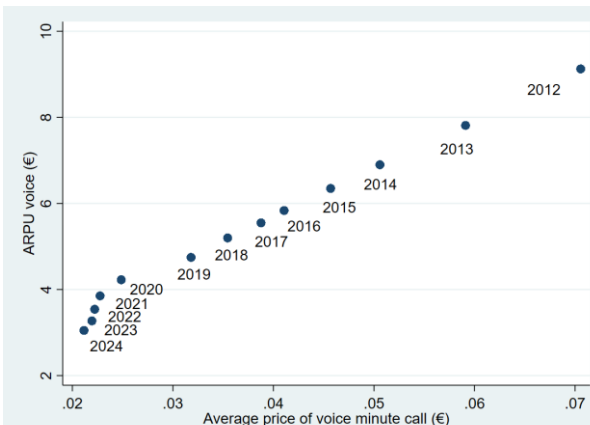
Voice



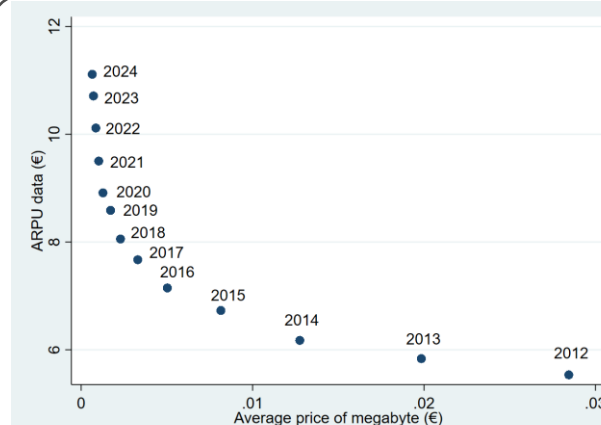
Data



Voice (Minutes)



Data (Gigabyte)



Revenue dominance shifted
from voice to data

Data is more elastic, than voice
(data price decrease triggers
much higher usage increase)

Voice part of ARPU positively
correlate w price.
(higher ARPU resulted
from higher prices)

Data part of ARPU negatively
correlate w price.
(higher ARPU resulted
from lower unit price triggered
higher usage)

2., Operator's EBITDA profitability impact: increase

EC papers

- Does not cover

GSMA
paper

- on 3 MNO market the *EBITDA margin is constantly higher by some 10%point in 30-40% range* between 2011-21
- no price increase, the significantly higher EBITDA margin source only the synergy driven efficiency savings can be.

Lexecon
paper

- own *merger simulation* related to Vodafone UK – Three UK merger and handled *separate cases when cost efficiency improvement* was assumed, resulted *lower price increase*

Other
papers

- Koutroumpis and Masselos (2024) had an observation that *operators' profitability (EBITDA) significantly, by 8.6 percent increased* in a more concentrated market, compared network sharing, that did not report profitability increase.

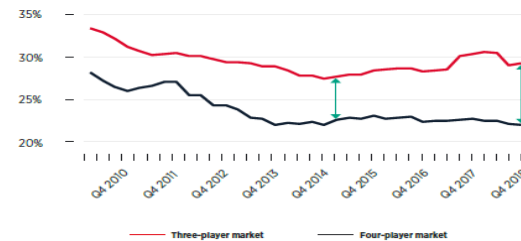
Supplementary
considerations



Figure 7

Margins Improved in three-player markets from 2015, enabling greater investments*

EBITDA margin
Source: GSMA Intelligence



- EBITDA: revenue based profitability, EBITDA margin normal range 30-40%, Revenue minus OPEX calculated
- Compass Lexecon, 2023: Do Four-to-Three Mobile Mergers Harm Consumers? A Review of Post-Merger Effects and Concentration

3., Operator's CAPEX investment impact: slight increase or neutral

EC papers

- meaningful *negative relationship* between *country-level CAPEX* and concentration
- entrance of *one more additional MNO* increases *market-wide CAPEX* by 9%.

GSMA paper

- *CAPEX/sales* data shows that since higher scale 4G rollout from 2014-2015, become constantly higher the 3-player market investments, on average 2-4%point higher in 15-20% range, inverted U relationship between concentration (HHI) and CAPEX per operator spent.

Lexecon paper

- no direct research findings on investment
- country-wide investment indicator is the most appropriate one due to in case of more operators, non-variable costs duplicated,

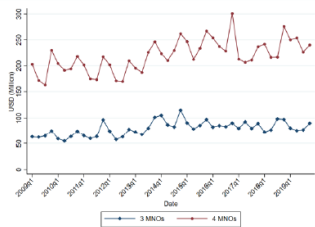
Other papers

- *Increase*: Genakos et al., 2018, *rise in concentration increases investment per operator*, 4 to 3 merge: per operator by 19.3%.
- *Inverted U-turn impact* was identified by Hounghonon and Jeanjean (2016) and Hounghonon and Jeanjean, (2019)
- *Stable country CAPEX* was the finding by CERRE

Supplementary considerations

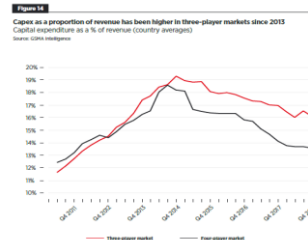
EC

Country CAPEX



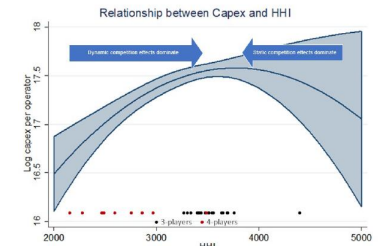
GSMA

CAPEX/Sales %



GSMA

Inverted U

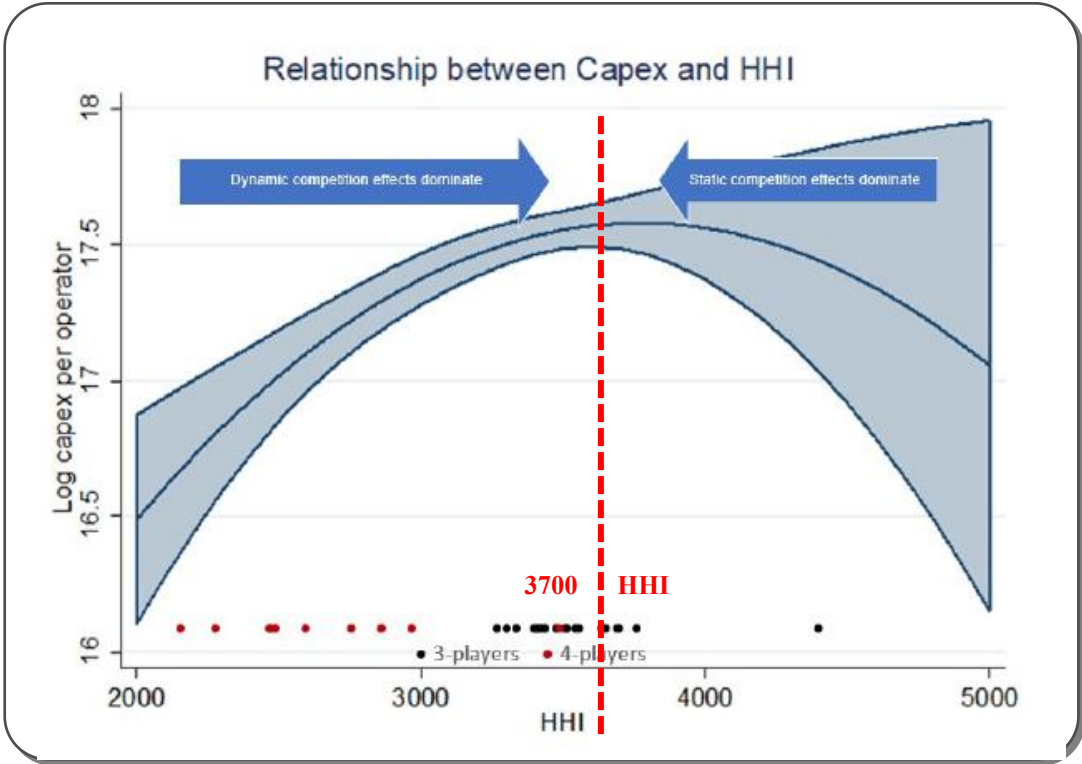


Investment measures:

- Investment intensity, *CAPEX/sales per operator*, range of 15-20%, how much of the profit (revenue minus operating cost) is reinvested
- Unitary Investment, like *CAPEX/user* is an alternative measure, distorted by geographical landscape and /or population distribution
- The *total country investment* (CAPEX) is the third widely used measure, biased by duplication, redundant spare capacity

3.1, Concentration & Investments: no linear, but inverted U-turn relationship

Concentration (HHI) & Investment



Concentration (HHI) per EU markets

Table 1: EU Countries by number of operators and HHI⁹⁰

3 MNOs	HHI	4 MNOs	HHI
BULGARIA	3370	POLAND	2551
FINLAND	3382	SPAIN	2676
NETHERLANDS	3386	ROMANIA	2811
GERMANY	3442	FRANCE	2831
CZECHIA	3447	DENMARK	2856
AUSTRIA	3494	SWEDEN	2952
HUNGARY	3517	SLOVAKIA	3023
ESTONIA	3565	ITALY	3036
PORTUGAL	3583	SLOVENIA	3167
LITHUANIA	3603		
BELGIUM	3624		
IRELAND	3633		
LATVIA	3683		
CROATIA	3714		
GREECE	3761		
CYPRUS	3963		
LUXEMBOURG	3994		
MALTA	4040		

Lower market concentration (Herfindahl–Hirschman Index), e.g. 4 MNO market
does not coupled with the highest investment, measured by CAPEX per operator

Source: François Jeanjean, Orange , ITS Europe 2025 Conference
Ciriani, S., & Jeanjean, F. (2025). Is Draghi report really wrong about telecoms? (An overview of academic papers on telecom market structure and mergers).
Aghion, P., Bloom, N., Blundell, r., Griffith, R., and Howitt, P. [2005]. Competition and innovation: An inverted-U relationship
Bahia, K., & Castells, P. (2023). The dynamic effects of competition on investment: the case of the European mobile communications industry
Bourreau, M., Shortall, T., Maxwell W., [2020c]: Cooperation between firms to deploy very high capacity networks

HHI (Herfindahl–Hirschman Index) : calculated by adding up squared market share of individual firms 14

4., Operator's ROCE return impact: the main decision-making factor

EC papers

- Does not cover

GSMA
paper

- Does not cover

Lexecon
paper

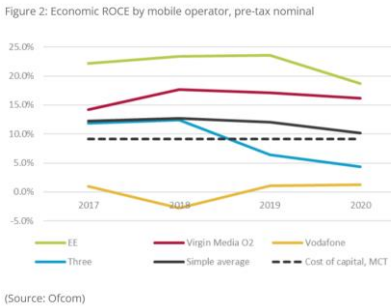
- Does not cover directly
- Padilla et al. (2024b) conducted report on *merging laggards*, arguing that *not only merging parties* can take the advantage of the merger, but also *strengthen competition*, as merged operators became a *financial viable competitor*

Other
papers

- Ofcom published a panel dataset between 2017-2020 for the UK market containing all MNOs ROCE and min. return (WACC) relation.

Supplementary
considerations

Ofcom



Vodafone



- **ROCE**: asset-based profitability measured towards cost of capital (*WACC*) , **ROCE should exceed WACC for long term**
- **Final strategic-financial merger related decisions driven** by ROCE and relation to WACC: buy (merger: Vodafone UK- Three UK) or if impossible then decide to sell (demerger: Vodafone Spain, Vodafone Italy).

5., End-user quality, download speed impact: improvement

EC papers

- EC papers has no explicit finding on quality impact
- *Indirectly: form rooting in decreasing country-wide investment that may decrease service quality*

GSMA paper

- They say that in the 3-MNO markets with higher HHI, operators can provide *higher download speed by 10 Mbps in 50-70Mbps range*.
- suggest that from cost *efficiency driven higher profitability enables higher investment* that has a *positive quality improvement effect*

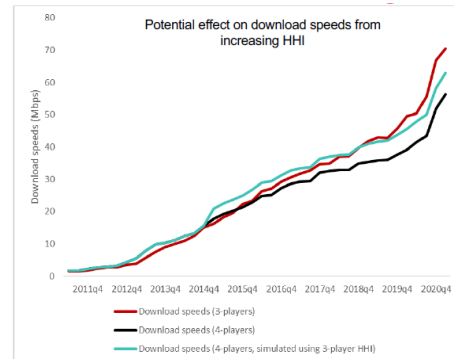
Lexecon paper

- meta study experienced *improved mobile service quality* by extending *network coverage* and increasing *download speeds*

Other papers

- Increase: Elliot et al. (2023) The finding was that lower concentration (4- MNO like market) *reduces prices but also quality*
- Increase: Wellman. (2019), *increase in concentration increases network quality*, Abate et al. (2020): more concentrated, higher DL speed
- Negative impact stated only by Valletti 2023, in relation with *warned Rewheel study*

Supplementary considerations

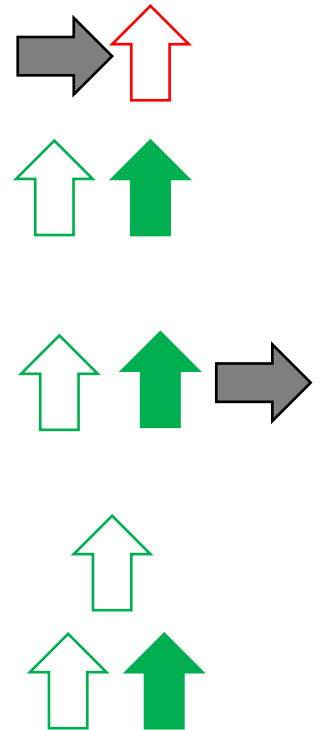


- service quality in order to avoid service degradation as a potential harm of 4 to 3 mergers.
- *service quality is measured* by mainly data relevant download, in some cases additionally by upload speed.

Conclusion on 4to3 merger impact on triggering fields of social welfare effect: net impact encouraging, operators' incentives are key

Attempted „one truth” synthesis

#	Impacted fields	Synthetized Findings
1.	End-user price	<ul style="list-style-type: none"> ▪ <i>No or limited statistically significant increase.</i> ▪ <i>Data-usage dominant ARPU</i>, if any potential increase, rather driven by higher usage enabled by falling unit prices, than price increase.
2.	Operators EBITDA impact	<ul style="list-style-type: none"> ▪ <i>EBITDA margin showing increase</i> in 3-player market. ▪ Drivers: <i>rather scale and synergy led cost efficiency</i>, than price increase driven revenue growth
3.	Operators CAPEX incentives	<ul style="list-style-type: none"> ▪ <i>CAPEX/Sales per operator: slight increase</i>, as higher profit (EBITDA) allows higher reinvestment. ▪ Country level investment: stagnate or slightly decrease (<i>removed redundancy</i>). ▪ <i>Inverted U-shape relationship between market concentration and investment.</i> ▪ Pro-competitive mergers exist, in particular between <i>laggers</i>.
4.	Operators ROCE impact	<ul style="list-style-type: none"> ▪ <i>Landmark strategic-financial driver</i> of operators' decision on merger or demerger cases. ▪ Return on investment should exceed cost of capital in long term
5.	End-user quality perception	<ul style="list-style-type: none"> ▪ Higher profitability and higher reinvestment enable <i>quality improvement</i> (download speed)



A panoramic view of Edinburgh, Scotland, at dusk. The city's historic architecture is illuminated by warm lights, contrasting with the cool blue tones of the twilight sky. The Edinburgh Castle sits prominently on a hill in the center, while the tall, dark spire of St. Giles' Cathedral is visible on the left. On the right, the illuminated clock tower of St. Martin's Church stands out. The overall atmosphere is serene and historic.

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Thank you for your attention!

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