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**Conference Paper**

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

ITS 33rd European Conference 2025: "Digital innovation and transformation in uncertain times", Edinburgh, UK, 29th June – 1st July 2025

**Provided in Cooperation with:**

International Telecommunications Society (ITS)

*Suggested Citation:* Földes, Gábor (2025) : Identifying root causes in the difference of European 4 to 3 mergers related quantitative model findings on price, investment and quality effects, ITS 33rd European Conference 2025: "Digital innovation and transformation in uncertain times", Edinburgh, UK, 29th June – 1st July 2025, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/331269>

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ITS 33<sup>rd</sup> European Conference 2025  
30<sup>th</sup> June – 1<sup>st</sup> July 2025, Edinburgh, UK

## **Identifying root causes in the difference of European 4 to 3 mergers related quantitative model findings on price, investment and quality effects**

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### **Abstract**

EU Digital Decade 2030 connectivity targets require from operators to provide full broadband fixed and mobile population-based coverage. There is a common agreement on detected investment GAP, however the resolution plans are diverging. In order to stimulate investments, operators argue for more cooperation (horizontal mergers) among operators to improve economies of scale, while regulators advocate for more competition to force investment race. The *aim of the paper* to focus on how economies of scale can be improved by a horizontal merger and what size of the risk may occur from constrained competition that partially may offset efficiency benefits at total social welfare level.

The *research question* is set to understand and identify root causes in the differences of consumer price, operator investment and service quality assessments related 4 to 3 (mobile) mergers in the EU.

The *methodology of the paper* is that based on qualitative research on competition policy aspects initiates snowballing approach for systematic literature review and critical assessment of academic papers applying quantitative researches on Europe-wide and decades-long database for regression and DiD (Difference in Differences Model) Fixed panel model analysis. The hypothesis is that the differences in findings of quantitative models might be more transparent and understandable if relevant modelling assumptions and data specifications are explicitly expressed on which scenario the finding is relevant and valid.

The *novelty* of the paper is to attempt to set-up an apple-to-apple comparison of different quantitative models, by adding validity criteria and the relevance of the sample-based finding for the whole data population.

**Keywords:** telecom mobile operators, horizontal mergers, competition, consumer prices, 5G network investments

**Disclaimer:** This paper was written by Gábor Földes. Views are the author's own and do not necessarily represent the concluded position of Vodafone / Vantage Towers on any particular matters. The research received no financial grant.

## 1. Introduction

One of the most significant current discussions in European telco economics is how to close 5G coverage GAP towards both EU Digital Decade 2030 target and to peers: US, China, South Korea and Japan. The approach is not clear what is the relation and causality between *competition* versus *competitiveness*: competition in the obstacle or trigger the competitiveness in the way to catch-up other developed countries.

Analysys Mason research, published in State of Digital Communications 2025 report (ETNO – Connect Europe, 2025) showed that still in 2024 Europe had the lowest coverage by at least one 5G mobile operator and in the share of 5G among mobile connections. Service quality, proxied by downlinked speed also lag behind peer nations, despite European operators invest more, as capital intensity (CAPEX/Sales) ratio increased to 20%, compared to 15% by peers. The contradiction of the parallel more investments and lower service level roots in the European fragmented market structure, resulting lack of economies of scale, asset utilization and cost efficiency. Thus, capital markets undervalue operators and Stoxx Europe 600 Telecommunications Index is slipping back.

Under this framework *International Telecommunications Society (ITS)* organized the *33rd European regional conference in 2025* with the research question how 5G roll-out can be accelerated despite of significant infrastructure investments. My research contributes to 5G network rollout subtopic, and my *research question* focuses on to what we learn from diverging finding approach of quantitative models on post-merger or merger simulation analysis.

The *basic problem* is that even academic level quantitative models have significant difference in findings. In case of consumer price impact, it varies from no or insignificant to significant increase levels. The operator investment related findings alter from higher to neutral investment impact. The service quality, mainly download speed related model outcomes are diverging from better to worse network experience.

My paper *methodology* outlines a theoretical background of the competition policy aspects, including horizontal mergers, remedies and latest cases. Based on the theoretical focus point on price, investment and quality assess academic quantitative models.

The *novelty* of the paper to draw attention of divergent findings even empirical quantitative academic post-merger analysis and try to harmonize learning from model findings.

The *main research finding* of the paper that in certain European markets the return on investment is not sustainable that may allow competition or even cooperation, horizontal merger with appropriate hybrid mixture of structural and behavioral remedies.

This paper is organized as follows: *Section 2* provides an overview of literature on European competition policy, merger regulation with remedies and latest horizontal merger cases. *Section 3* describes the research methodology on qualitative analysis assessment. *Section 4* compare empirical quantitative models on price, profitability, investment, return and quality measures. *Finally, section 5* draws conclusion.

## 2. Literature review on Competition policy aspects

The European regulation reaches to a crossroad in recent years, as Europe's competitiveness slightly slipping back in ranking of nations. In the view of single market, competition policies and its application there are different views how to get back on social welfare growth trend. One party calls for change towards deregulation that may stimulate investments and competitiveness, while the other insist on preserving consumer welfare from lower prices due to fierce competition that will trigger innovative investments in the future also.

The literature review covers the cornerstones of single market, European Commission, competition regulation overview on this debate.

### 2.1. Digital Single market

Single Market was launched in 1993 with the aim of making the European Union (EU) the world's most competitive economic region. In spite of several successes in competitiveness, three decades later the aim of a true single market in digital communications is incomplete.

*Operators* call for attention that in competing nations (eg., US, China) scaled operators drive the competitiveness, but Europe's telecoms market is fragmented of three to four smaller operators across 27 member states, without any true pan-European operator. They see the reasons in regulation, designed many decades ago, based on connectivity served via traditional physical infrastructure, owned by monopoly operators. This outdated approach is not fitting for current technological and market circumstances, when *virtualization* replaces physical infrastructure by software and cloud-based applications and it has enabled "delaying" effect, where communications services are decoupled from networks. Altogether current regulatory landscape prevents European operators from competing fairly with global players that reducing their ability to innovate, diversify and scale their networks and services. This contributes to poor investment environment, discourage to deploy advanced digital infrastructure and services.

Operators call regulators to accept mergers between companies in one national market, since they consider that cross-border mergers do not create sufficient scale, causing investment gap in Europe, that EC estimated €174 billion towards connectivity goals by 2030.

On the regulatory side *Margrethe Vestager* from European Commission Directorate General for Competition (EC DG-Comp) dismisses the idea that fewer, larger operators would lead to better market results. She emphasized that consolidation is likely to weaken competition in national markets and even fragment single market. According to Vestager no evidence supports that more concentrated national markets lead to better outcomes, even the contrary, it might lead to less competitive national markets and more fragmented single market.

*Massimo Motta* also does not believe in Europe would greatly benefit from an EU-wide telecoms market. He argues that reducing barriers to competition in the internal market is key to deliver better outcomes for consumers and to strengthen Europe's innovativeness and competitiveness. Consolidation via cross-border mergers could bring benefits to European businesses and consumers that is not hindered by existing merger rules. However he disagrees to apply for within border mergers a broader, EU-wide market definition, that redefine and de-

concentrate the relevant market, thereby making within border mergers seems no longer problematic based on new EU -wide relevant market definition. (Duso *et al.*, 20234)

Due to diverging expectations on Single Market, EU launched a Single Market strategy consulting in 2025.

In the next part EC related approaches will be summarized.

## **2.2. European Commission reports (Breton, Letta, Draghi) and assessments**

Single Market Commissioner *Thierry Breton* launched the debate over a potential deregulation of the EU's telecommunication sector in 2023. *EC* published a white paper on digital infrastructure of telecommunications and opened a public consultation in February 2024. (European Commission, 2024a). On political side Letta then Draghi reports are signing consensus on status quo is unsustainable and clear the urgency of the challenge.

### **Letta Report**

Prime Minister *Enrico Letta* advises integration of the European telecoms market, as the lack of it in electronic communications sectors contributes to Europe's declining competitiveness. He confirms that focus instead of national should go to EU in order to compete with companies from the US, China, or India. The report identifies the European dimension as the relevant market for telecommunication operators, where consolidation and grow in scale could be permitted. Overall, the white paper shows the direction towards market deregulation. (Letta, 2024)

Diasgreements related to the path to a single telecoms market is for competition policy to actively help EU firms scale up. More generally, Letta's broader presumption that the EU should try to create more megafirms, his suggestion that, at least in some cases, "bigger is better".

### **Draghi report**

Report aims to help to stay competitive and maintain EU leadership globally. The vision to create conditions where businesses thrive, the environment is protected, and everyone has an level playing field to success.

Draghi identifies the lack of economies of scale in EU telecommunication, outdated competition policy, insufficient spectrum allocations and imbalances in digital ecosystems as key driver for Europe's fall behind. The report identifies major obstacles, such as underinvestment in innovative activities. Therefore the report calls for a step change in competition policy and regulation. The report's main recommendation for telecoms markets is to decrease merger control and encourage consolidation within industry, referring that larger operators could boost investment in network infrastructure. In order to that, telecoms markets should be defined at the EU level and moreover innovation and investment commitments should be assessed w greater weight in EU merger clearance rules. Altogether the report argues for Europe could greatly benefit from the creation of a truly European-wide telecoms market. (Draghi, 2024)

### **Opposing views**

*Margarete Vestager* stressed that consolidation is likely to weaken competition in national markets and fragment the single market, opposing views suggesting mergers could make the industry more efficient. She underlines that EU's approach to prevent mergers that the competition authority believes could raise prices, decrease choices for consumers, and hinder innovation by reducing competitive pressure on companies to advance. She emphasizes that EU's interest of keeping its market competitive, favoring the broader economy and consumer interests over the consolidation goals of individual companies

*Massimo Motta* and other competition economists say Draghi report rightly recognizes the availability, affordability, and quality of telecoms services are a key driver of European competitiveness, but the recommendations on telecoms are not well-grounded. (Duso *et al.*, 2024)

Motta underline that retail prices for fixed & mobile telecoms services are lower in Europe than in other parts of the world, and in particular in US. They say that *affordable prices* are also contributes to *Europe's competitiveness*, because telecom is a key infrastructure used by every single citizen and every business and if prices were to increase, or due to less innovative investment, infrastructure fall behind the state of the art, the competitiveness gap might be widened. They draw the attention that Draghi report does not explicitly define what "competitiveness" means, but end-user prices also belongs to that.

They refer many empirical evidence show that telecoms mergers lead to higher prices and are unlikely to boost investment that, like the report by Lear *et al.* (2024) identified the role additional operator on the market in case prices (proxied by Average Revenue Per User, ARPU) or investment that will be shown in details is Section 4.

They call the attention that despite Draghi report suggest merger approval with investment commitments as a condition, this is a basic example of a behavioral remedy that might be difficult to be enforced. More details on merger clearance and remedies are discussed in the next section.

## **2.3. European merger control, horizontal merger guidelines and remedies**

The principal aim of merger control to preserve and promote competition in Single Market and prevent mergers that harm competition. In telecommunication industry if merger may harm consumers, competition authorities can mitigate this by imposing commitments that address mergers potential anti-competitive effects, such as higher prices, lower investment, or reduced innovation. Massimo Motta published detailed description of competition policy, including mergers, horizontal merges and potential anti-competitive effects. Merged firm can unilaterally (non-coordinated) exercise market power and raise prices, or can apply pro-collusive (coordinated) actions that might substantial lessen the competition and raise prices (Motta, 2003a)

### **Horizontal merger guidelines**

The Horizontal Merger Guidelines (HMG) part of the Merger Guidelines, published in 2004, provide guidance on the Commission's practice when assessing the impact of mergers on

competition within the legal framework of the EU Merger Regulation. (European Commission, 2004b). Ivaldi and Verboven conducted a research to quantify the effects from horizontal mergers in European competition policy (Ivaldi & Verboven, 2005).

Operators urge EC to change the substantive approach taken so far in the analysis of horizontal mergers, together with a review of the guidelines on horizontal mergers to ensure they remain fit for the challenges ahead. They hope gain enough scale to compete in global and digital markets. For the telecoms industry specifically, she called for greater recognition of the long-term benefits of mergers, as opposed to the current focus on “short-term price effects” for consumers. Indeed, the Commission has been resistant to in-market mergers it fears could restrict competition. They suggest a reconsideration of the methodology used to determine price effects; factoring in wider economic benefits of mergers – for example, she cited evidence of a link between broadband take-up and GDP growth; and avoiding merger remedies that usher in new entrants to already competitive markets.

After more than 20 years the EC launched the current review of these guidelines will serve to update the assessment framework for mergers in light of new market realities, but the primary mission of EU merger control will remain the same: preserving a vibrant and competitive internal market that encourages companies to offer to their customers innovative, affordable, and high-quality products. (European Commission, 2025).

### **Meger control elements: substantive test**

The principal element of the merger control is the *dominance test*. The fact that a corporate holds a dominant position is not in itself contrary to EU competition rules, just when the behavior refers to abusing with it. A dominant undertaking has a “special responsibility” not to engage in conduct that may distort competition. Treaty on the Functioning of the European Union (TFEU) Article 102 prohibits the abuse of individual and collective dominance. The first step in the assessment of market power is the relevant market defined that determines the boundaries of competition between firms, both in terms of products/services that they supply and geographic areas where they operate, to calculate its market share or consider the potential of new entry. The process of defining a relevant market begins by establishing the closest demand-side substitutes to the product/service on which the investigation focuses.

In 2004 for replacement and supplement of dominant test, the *Significant Impediment of Effective Competition (SIEC) test* in merger control was introduced with aim to intervene in gap cases, such mergers arising in oligopolistic markets, but not arising single or collective dominance issue. Since that SIEC and dominance tests being the most commonly used ones. Since that SIEC test has more effects-based approach and it became the cornerstone of the concentration control. (Röller *at al.*, 2006)

Article 2 of the EU Merger Regulation (European Commission, 2004a) sets forth the SIEC test that assess whether a concentration would significantly impede effective competition, as a result of the creation or strengthening of a dominant position in the market or a substantial part of it. Concentrations will be allowed unless they lead to a significant impediment of competition. The SIEC test goes beyond the concept of dominance. The SIEC test captures transactions that do not necessarily create or strengthen a dominant position but still cause an impediment to competition, as the merging firms are able to raise prices, and thus exercise market power, without coordination and without holding the largest market share in the market). The creation

and strengthening of a dominant position is no longer a prerequisite for prohibiting the transactions as long as a healthy post-merger competitive environment exists.

### **Conditional clearance with remedies: structural and/or behavioral**

In merger control, structural remedies involve changing the market structure to address competition concerns, while behavioral remedies focus on the future conduct of the merged entity. (Motta et al, 2003b)

*Structural Remedies* aim to reshape the market by creating or strengthening a competing entity, often through the divestiture of assets. Structural remedies modify the allocation of property rights and create new one. It might include divestiture of an entire ongoing business, or can just a partial one, sale of specific assets, or separation of certain product lines.

*Behavioral Remedies* involve imposing restrictions or obligations on the merged entity's future conduct to mitigate potential harm to competition. The non-structural remedies set constraints on the merged firms' property rights, like might consist of engagements by the merging parties not to abuse of, or might consist of contractual arrangements such as compulsory licensing or access to intellectual property. Behavioral remedies might cover obligations to provide access to essential facilities, non-discrimination commitments, price controls, restrictions on certain business practices or even investment commitments.

*Hybrid remedy* is the combination of structural and behavioral remedies is a This approach allows authorities to address both the immediate structural issues and for future the potential anti-competitive conduct. Structural remedies are generally preferred for their permanence and ability to create a new competitor, while behavioral remedies can be more flexible but may be difficult to monitor and enforce.

Motta and other competition economists often discourage behavioral remedy, like investment commitments, which is notoriously difficult to enforce. Market conditions change over the time, making agreed investments either too large or too low. They consider such remedies fail to restore competition permanently, requiring constant monitoring. Even more, if the merged entity openly failed to meet its investment commitments, the competition authority might impose penalties, but it is unlikely that de-merger were ordered due to its economic and social costs. (Duso et al., 2024)

For concrete case can be mentioned the Hutchinson 3G / Orange merger in Austria, where the behavioral remedy could not be realized as there was no new market entrant interested in the spectrum and the wholesale terms. Finally the remedy became ineffective and failed to restore competition.

There are further alternatives for efficiency if merger not cleared or if the participants not accept the conditions and remedies.

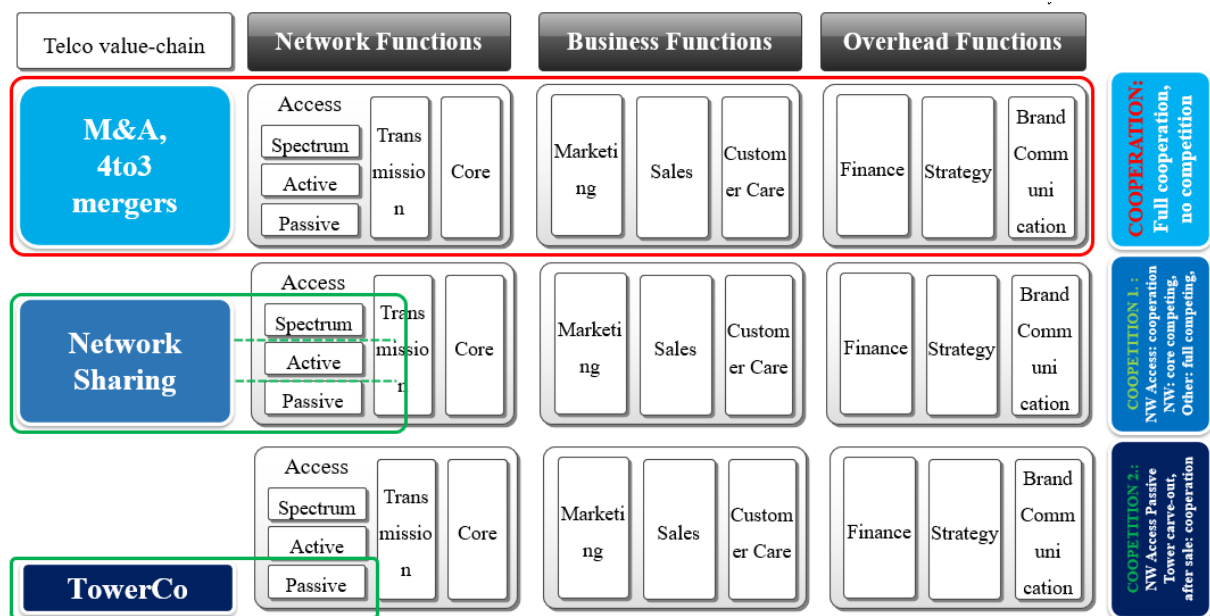
### **Alternatives for blocked mergers**

In case of horizontal merger blocked or potential participating operators aim limited cooperation then the *horizontal production agreement* (mobile network sharing) can be an alternative form to improve economies of scale, cost efficiency and asset utilization.

The EC published in 2011 the applicability of horizontal cooperation guideline related to the Article 101 of TFEU to regulate cooperation agreements, like mobile network sharing. It focuses first on whether the cooperation has an anticompetitive effect. Article 101(1) TFEU prohibits agreements that have as their object or effect the prevention, restriction or distortion of competition within the internal market (European Commission, 2011).

The Figure 1. shows for mobile operators the value chain and cooperation forms.

**Figure 1: Overview on operators' initiatives to improve scale**



Source: Author's own summary

*Horizontal mergers* have the highest savings potential unquestionably, as the company's total cost base is addressable.

*Mobile Network sharing* related addressable cost base is the Network Technology function, which accounts for approximately almost 50% of total company OPEX and more than 75% of total company CAPEX. The savings potential depends on the scale of the sharing. Based on literature findings from academic and consultancy studies, if active assets are also shared approximately at least 10%point higher savings can be reached top on passive asset sharing's 20-25% savings level. (Földes, 2023)

In spite of these findings above, *TowerCo asset separations* are vast major limited to passive asset, where the addressable cost base is the lowest and some one third of savings potential scoped out, compared active asset network sharing.

Related to competition policy assessment Motta and Tarantino studied the prices and investment impact of the network sharing between two firms in oligopoly. They considered it as a case of an incomplete merger, in which cooperation only related to the decision on how much to invest for cost reduction, without coordination of prices, Motta and Tarantino found that in general NSAs tend to be better for consumers, than mergers, from social welfare point of view. (Motta & Tarantino, 2021).

This paper focuses on horizontal merger case and the next section provides an overview on key-cases.

## 2.4. European horizontal merger cases w UK and ES focuses

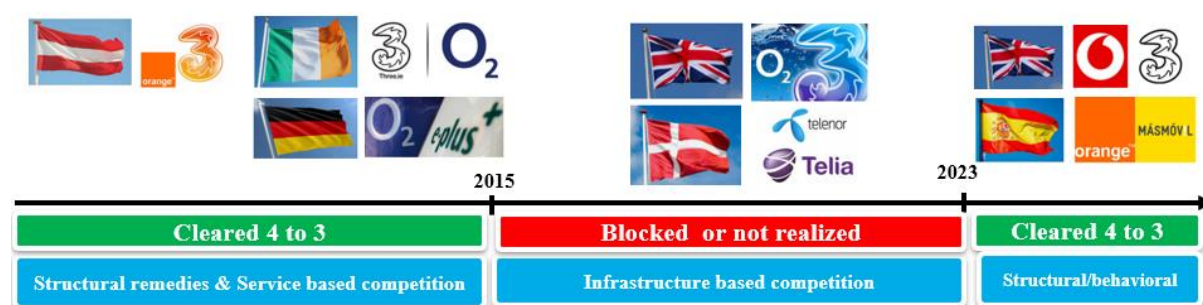
The key concern in economics of horizontal mergers, how to preserve the competition. In telecommunication the straightforward way to maintain the competition is the infrastructure-based competition between parallel networks. The other option is the service-based competition, when operators compete with their services on the same infrastructure, which is the case with Mobile Virtual Network Operator (MVNO) services. In merger control, when the number of independent parallel infrastructure owners are decreasing (moving towards service-based competition), the conditional approval might contain mandatory network open-up (behavioral) or divestiture (structural) remedies.

In European merger control till 2014, conditional approval moved rather to service-based competition with network open-up commitments. In 2012-2014 period EC DG Competition cleared mobile mergers in Austria, Germany, and Ireland, in all cases allowing for the reduction of independent mobile infrastructure operators from 4 to 3 in each national mobile market, but subject to a commitment to open-up for MVNOs to ensure greater competition (Genna, 2023).

From 2015 the assessment has changed, opposing merger proposals reducing the number of mobile operators from 4 to 3, which means that the infrastructure-based competition among independent networks is preferred over service-based competition. This was the case eg. in Denmark, where mergers could not be realized (cooperation remained at network sharing level, as participants not approved the remedies of merger clearance). (Genna, 2023)

The European key- telco mergers summarized in a timeline in Figure 2.

**Figure 2: Overview on operators' initiatives to improve scale**



*Source: Author's own summary*

In recent years 2 major, the UK and Espanol cases were cleared entering into new field of the approval.

### **UK Case: Vodafone / Three merger case approval with behavioral remedies**

Vodafone UK and Three UK are the 3rd and 4th largest mobile telecommunications operators based on number of subscribers. In June 2023, they announced their plans to combine their activities in form of Joint Venture (JV), controlled by Vodafone in 51% and Vodafone has the right after 3 years to buy-out Three related 49%. The UK Competition and Markets Authority (CMA) cleared the transaction after a Phase II investigation, conditional upon network investments and customer protection measures. (Gov.uk, 2024a, Gov.uk, 2024b)

The final set of remedies showing new behavioral remedy elements that may open similar approaches in EU:

- *CMA accepted investments commitments* by the parties, controlled by Office of Communications (Ofcom). This is a landmark decision, a pilot as regulators disprefer such kind of remedies.
- *CMA imposed retail tariffs obligations*. Direct retail price interventions are rare, but not unprecedented (cleared Dutch mobile merger between T-Mobile and Tele2).
- *CMA obliged a mobile wholesale offer, including price and conditions*, for the benefit of MVNOs. This is a return to the older practice of the EC like in Germany and Austria up to 2014.

Remedies in details can be grouped to network related and customer related (last are time constrained)

Delivery of joint network plan:

- GBP 11bn self-funded infrastructure investment committed altogether for 8 years with milestones at 3 and 5 years
- 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 existisng 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.

The clearing of the merger gained both positive and negative interpretations and expectations on competition, investment and quality from stakeholders.

### ***Positive expectations:***

#### *Increased competition:*

Merger creates new force, a stronger player in UK mobile, with the scale to drive more intense competition across both the retail and wholesale markets. CMA anticipates a competitive response from BT/EE and VMO2 by way of further network investment, lower pricing, or improved customer service, as a result of Vodafone–Three’s proposed network investment plan and rivals with invest in their own networks as a competitive measure. Now UK will now have three converged players seeking to bring their mobile and fixed infrastructure closer together, both at a physical technology and at the customer/tariff level. BT/EE was considered as “slow mover”, while VMO2 considered “less innovative” and now CMA hopes the merger might encourage them improve their customer perception.

#### *Increased investment:*

Vodafone-Three committed GBP 11 bn self-funded infrastructure investment programme to build the UK’s biggest and best network, aimed at delivering 5G Standalone to 95% of the UK population by 2030, and 99% by 2034.

#### *Improved quality:*

One on hand New advanced 5G Standalone network will bring vastly superior network, faster speeds, greater reliability and enhanced capacity for handling ever-increasing data demand. On the other hand the MOCN network sharing with spectrum sharing itself improves the quality via increased capacity from increased, even doubled spectrum.

Altogether CMA considers the merger is likely to boost competition in the long term in both retail and wholesale markets and result in significant increases in mobile network quality in the UK.

### ***Negative expectations:***

#### *Increased prices:*

Mobile prices will go up - dramatically and disproportionately so for smaller businesses and lower-income individuals across the UK. that will be not off-set by improvement in network speed, quality or investment. The CMA’s merger simulation estimates that, post-merger, Vodafone customers will see an annual bill increase of 2.6% and Three’s 5.5%. The total additional annual cost to UK consumers is estimated to be around £216m. However, the CMA noted that its merger simulation did not consider the implications of the merger on the mobile

virtual network operator (MVNO) market and/or efficiency improvement. From wholesale aspect MVNO Sky and Tesco say that only from the wholesale remedy hoped that sustainable wholesale competition will emerge.

#### *Limited extra investment:*

BT/EE warned the merge might discourage, as if it took any steps to improve its network coverage of capacity, the merged rival entity will be able to move quickly to make this investment unprofitable, by parallel investment. The CMA's final report referred a research that shows the majority of consumers are not willing to pay more for a better service, raising questions about return on investment from a most advanced 5G SA network. CMA also acknowledged that 5G SA business cases are immature at present, and deploying the technology is "challenging due to the uncertainty" of a return. The original network sharing cases are also considered a bottleneck, as Vodafone is tied with VMO2 on the Beacon agreement and Three is a JV partner with BT/EE on Mobile Broadband Network Limited (MBNL), that means both merger parties have access to commercially sensitive information about its rivals, albeit ring-fenced from retail operations.

#### *General concern of Behavioral remedies*

There is general concern on potentially unprecedented and unworkable *behavioral remedies*. It creates additional bureaucracy (CMA + Ofcom) by need of *monitoring*. Behavioral remedies do not deal with the *source of the competition problem*, fail to *restore competition* permanently, unlikely could be reverted if commitment not met and it is usually ineffective. Over time, market conditions change, making previously agreed investment levels either too large or too low.

Overall there is potential risk in, there will be higher prices to consumers, without any meaningful boost to investment or network quality.

### **Spanish Case: Orange / MásMóvil case approval with hybrid structural& behavioral remedies**

The other current case is the announced Spanish merger between Orange and MásMóvil that was in depth investigation by DG Competition.

Orange is a full mobile network operator, while MásMóvil is a hybrid mobile network operator, as it relies on its own mobile network, which does not cover the entire Spanish territory, and on a national roaming agreement with Orange to provide retail mobile services. The other are two MNMOs on the market are Telefónica and Vodafone. There are also several MNVNOs, from, which Digi is the largest one in Spain.

The EC carried-out an in-depth investigation based on that identified that:

- the merger itself would *restrict the competition* in retail mobile services market.
- the *merged entity becomes the largest operator* by customer number,
- *eliminates a close and important competitor* as MásMóvil attracted significant amount of customers from Orange.
- *retail price increase* simulated to be above 10%

- efficiency impact would not off-set *anticompetitive concerns*, therefore remedies were set.

Based on the investigated competition concerns the following commitments (hybrid remedies) were set to Orange and MásMóvil:

- 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.

Overall, in this case the number of independent infrastructure owners planned to be decreased from 4 to 3, when DG Competition preset such approval conditions that created the opportunity of 3 to 4 market development. The approval condition ruled in the Spanish MásMóvil-Orange merge in 2024, was the divestiture of valuable mid-band spectrum (structural remedy) and national roaming option in their network (behavioral remedy, altogether hybrid remedies), in which the beneficiary was the Romanian-based Digi's Spanish MVNO subsidiary to develop its own 4<sup>th</sup> MNO business (European Commission, 2024a).

### 3. Research methodology and analytical model framework

This *study outlines* analytical framework to compare, summarize and harmonize quantitative model findings on merger activities in the telecommunication sector.

This study utilizes *hermeneutics* to evaluate and expand existing knowledge on merger impact on social welfare via price, investment and quality key dimensions. It follows Paterson and Higgs (2005) argumentation of hermeneutics as research approach, which is the theory and practice of interpretation and as a strategy of knowledge creation. A hermeneutic spiral is created to make complex phenomenon ready to exploration, interpretation and understand it more fully. As hermeneutic research, based on existing theories, literature, and insights mainly quantitative researches develops a new analytical framework to create a structured approach to answer the research question.

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

The *concrete subject of the research* is three key-papers, that are also itself meta studies, covering several previous research findings.

The *baseline paper is the EC published* “Protecting competition in a changing world” (European Commission, 2024c) that refers the “Exploring aspects of the state of competition in the EU” research part on telecommunications industry (Lear et al., 2024), that will be called “EC papers” in this study going forward. It builds on GSMA Intelligence data on market structure and market outcomes in 29 countries (of which 23 are EU member states) for the period from 2009 to 2019.

The *second paper is the GSMA published* paper on “The dynamic effects of competition on investment: the case of the European mobile communications industry” (Bahia & Castells, 2023) that research was made very similar dataset (own GSMA panel data for 2011-2021period). In study this paper referred as “GSMA paper”. It contains a solid summary on previously published merger researches.

From *other papers* the most relevant is the by *Compass Lexecon* published “Do Four-to-Three Mobile Mergers Harm Consumers? A Review of Post-Merger Effects and Concentration Studies” that is meta study covering large amount of academic and non-academic analysis. (Wickens et al., 2023). In this study this paper referred as “Lexecon paper”.

Remaining other category papers are collected by the *snowballing method* followed the recommendation of Wohlin (2014). The sampling technique worked as chain-referral non-probability sampling, in which principal theoretical literature provided referrals to find further samples required for a holistic research study. From tentative set of papers the inclusion and exclusion was identified by both backward and forward snowballing based on reference list and abstracts. This technique played a significant role to identify the reference-map on merger analysis. The literature review adopted in line with recommendation of Tranfield (2003) and Anand et al. (2022) to collect, classify and summarize relevant papers in a form of systematic literature review. Emphasizes were put on Elsevier’s Scopus robust database (covers majority of Web of Science) journal articles that had higher quality due to double blind peer-reviews. Finally search findings were ranked by citations and publication date. Altogether 20 papers were involved in “other paper” analysis.

The *subject of the research is related to merger impact analysis* that have the following most common forms: merger analysis, 4 to 3 merger, impact of new entrant (e.g., 3 to 4 move), three or four Mobile Network Operator (MNO) market, market concentration analysis (more or less concentrated, higher or lower concentrated markets, based on Herfindahl-Hirschman Index, HHI approach).

The designed extended analytical framework goes beyond the most common price-investment-quality framework and brings in profitability and return on investments aspects additionally to better understand magnitudes of corporate decision makings on this field. The analytical framework outlined in Table 1.

**Table 1. Analytical framework for merger impact assessment**

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

*Source: Author's own summary*

Each part of the analytical framework is covered by chapter in the Section 4 on merger impact analysis.

## 4. Impact analysis of horizontal mergers in European telecommunication sector

This section covers the analysis part of the merger impacts on price, profitability, investment, return and quality dimensions. The analysis follows the order set in previous methodology section: starts with EC papers, followed by GSMA paper and finally other papers checked on enlarging considerations in each element of the analytical framework.

### 4.1. End-user price impact

In competition economics the basic assumption is that by mergers, decreasing number of service providers, increasing concentration the end-user retail or wholesale prices going up, that decreases the social welfare.

*EC papers* suggest a confirmation on this assumption, based on ARPU analysis, acknowledged just proxying end-user basket price impact, but widely accepted approach. Their finding is that higher concentration is associated with higher prices that expressed by one more additional MNO reduces ARPU by 9% in EU. They draw a chart reflecting that between 2009-2019 3 MNO prices were constantly at least slightly higher on the 3 MNO markets than on the 4 MNO markets. (Lear *et al.*, 2024)

The GSMA paper on very similar panel dataset with common GSMA origination however shows slightly different picture: vast major part of the time three player markets were cheaper, MNOs had lower level of ARPU, compared to four player market. (Bahia & Castells, 2023)

The Lexecon paper meta study found based on several reviewed post-merger analysis that mergers had little impact on prices, typically having no effect at all, or caused just temporary increase in prices for some customers. The other observation is that, mergers led to either no change in the rate of decline in MNOs' average revenue per GB (used as a proxy for quality-adjusted prices) or even accelerated the decline. (Wickens *et al.*, 2023)

Lexecon commented on the Mobile Telecoms Sections of the EC's Report on the State of Competition in the EU paper. (Padilla *et al.*, 2024a). They called the attention that the ARPU increase in case of 4 to 3 merger not certainly equal with price raise, as on hand the quality also might have improved, that on the other hand pulls-up the used volume (eg GB), contributing as second and third factor to ARPU increase.

Other papers reflect wide variety on price impacts:

- (1) Genakos *et al.* (2018) experienced with price increase (20% per 10%p HHI increase), Csorba and Papai (2015) just from 3<sup>rd</sup> year, Valletti (2023) simulated higher prices into Vodafone UK – Three UK merge, and Elliot *et al.* (2023) structural model for France showed the lower concentration-lower price (implicitly higher concentration, higher price) relationship,
- (2) Hounghonon (2015), Hounghonon and Jeanjean, (2019) measured mixed changes: data plans decreased by 20%, voice plans increased, Aimene *et al.* (2019) data plans decreased by 42%, voice plans increased by 49%, while
- (3) Affeldt and Nitsche (2014), Csorba and Papai (2015) for the first 2 years found no statistically significant price change, and Koutroumpis and Masselos (2024) found

operators entered into full sale mergers did not report ARPU decrease, compared to network sharing, who did.

- (4) Aguzzoni et al (2018) mixed directions reported after Hutchinson 3G merger in Netherlands (increase) and in Austria (decrease)
- (5) Special category is Rewheel reports that reported even extreme prices increases (Rewheel, 2024), but mainly niche customer group relevant bucket segments and due to further methodological concerns more than 20+ academics signed a warning letter related to their published analysis (Dippon et al., 2024), therefore and later chapter Rewheel's analysis are not mentioned.

Summing-up the majority of the studies show neutral or slightly increasing impact for end-user prices in case of 4 to 3 mergers.

In the Vodafone UK - Three UK merger clearance, the 3-year temporary retail and wholesale price related behavioral remedies aimed to exclude any potential harm that might jeopardizes social welfare,

## **4.2. Operators EBITDA impact**

The revenue based profitability, The Earnings Before Interest, Tax, Depreciation and Amortization (EBITDA) shows the difference of revenue and Operating Expenditure (OPEX), before investment related depreciation and other cost elements. For the operators the healthy EBITDA margin is around 30-40% at industry average and this is one of the key performance indicators that incentivize operators market behavior.

The revenue part is directly connected to prices, in particular is proxied by ARPU, as the sum of them is the revenue. Therefore price related competition policy considerations directly linked to Revenues as an EBITDA lifting factor. However operators OPEX related considerations much rare become part of the competition researches. On one hand it is strange as operators reportedly do the mergers for (cost) synergies and efficiency improvements, but on the other hand it is very difficult to be measured without company insider data.

The EC papers focusing on rather social welfare related impacts, and not the operators financial trends, therefore neither profitability, nor cost synergy and efficiency considerations captured.

The GSMA paper nevertheless reports the revenue-based profitability and shows that on a three player market the EBITDA margin is constantly higher by some 10%point in 30-40% range between 2011-21. (Bahia & Castells, 2023) As they stated no price increase related to 4 to 3 merger, the significantly higher EBITDA margin source only the synergy driven efficiency savings can be.

Lexecon introduced its own merger simulation related to Vodafone UK – Three UK merger and handled separate cases when cost efficiency improvement was assumed lower price increase impact was calculated for the merging operators and the entire market. Lexecon underlined that in CMA merger simulation no cost efficiency improvement was calculated (probably expected as an upside above the main case).

From 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 to those retail operators entering into only network sharing, that did not report profitability increase.

Summing-up the revenue-based profitability with high probability increases due to 4 to 3 mergers, however in competition analysis not put a special attention to model it.

### 4.3. Operators CAPEX incentives

The second cornerstone of competition economics is investment related implications of 4 to 3 mergers. The basic assumption is that mergers have no investment increasing impact, therefore it is further dimension where there is no positive contribution to social welfare.

The investment assessment has 3 main forms, all has advantages and disadvantages:

*Investment intensity*, which is the CAPEX/sales per operator measure, that implicates how much part of the revenue is reinvested in formula form. CAPEX/sales indicator has 3 main aspects recommended to be considered:

- (1) In practical how much of the profit (revenue minus operating cost) is reinvested. So, if the profitability is higher, then operators are more encouraged to reinvest a certain part of it, they probable see more return potential on it.
- (2) The CAPEX/Sales measure is they key indicator set for companies' total investment with the current range of 15-20% per annum.
- (3) If companies managed to reach a scale, improve asset utilization that might decrease certain Network domains (e.g., Radio Access Network, RAN) investment need that is upto approved capex/sales ratio is filled-up by other projects (scope in increase in certain segment higher scale rollout, or reinvest into core segment or even into IT. So, a network sharing or mergers do not equal with an automatic CAPEX decrease.

*Unitary Investment*, like *CAPEX/user* is an alternative measure. The CAPEX in mobile telco driven by sites, but users data demand and its capacity and coverage implications indirectly influence it. However the KPI can be distorted by geographical landscape and /or population distribution. In larger counties the CAPEX/user can be lower due to higher portion of rural areas. In larger countries more likely to have 4 operators, than only three.

*The total country investment (CAPEX)* is the third widely used measure. At macro economical level it is important indicator how much investment happening and the goal to keep or increase it. However at company level the scale in investment and the asset utilization are key factors to meet the expected return on investment. Therefore not sure whether advantageous to have high level of investment into parallel under used asset with no or late return on it, that might discourage operators from investment, so might imply a social welfare loss.

Based on these considerations the reinvestment ratio which seems to be the best measure to capture telco operators' investment incentives and less biased or monitoring unrationed, therefore unwanted trends. In telco economics all them appears, as follows.

*EC papers* suggest a confirmation on basics assumption, their finding is a meaningful negative relationship between country-level CAPEX and concentration. (Lear, 2024). This finding rooted in that 4-MNO markets had constant significantly higher (around doubled) investment than 3-MNO markets between 2009-2019. They added that entrance of one more additional MNO increases market-wide CAPEX by 9%. The unitary CAPEX per user was the other applied indicator that despite showed is constant slightly highly CAPEX/user on 3 MNO market it was assessed an artificial biased impact. (European Commission, 2024c). The argumentation was that there may be systematic differences between the two groups. In particular, the 4-MNO group contains larger countries (eg., Spain) where non-variable elements of the network costs can be spread over more user. Investment per user in 3-MNO countries may be higher, due to they are smaller markets with few users.

The *GSMA paper* applied CAPEX/Sales CAPRX/user measures, but more focus on prior one. *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. (Bahia & Castells, 2024) This reflects that on more concentrated market operators foresees more stable and higher return on investment, therefore more Business Cases reach the break-even point and get approval for execution. There is no sign that efficiency on investments would decrease the investment level. For *country level CAPEX* they reported no difference between 3 or 4 player markets. The other finings is the *inverted U relationship* between concentration (HHI) and CAPEX per operator spent. The highest investment level is suggested in 3000-4000 range, mainly (17.5% CAPEX/sales peak ratio at around 3500-3600 HHI), which is the characteristics of 3-MNO markets, while around 2500 16.5% CAPEX/Sales ratios was reported (difference is 1%p between 2500 versus 3500 HHI).

The *Lexecon paper* had do direct research findings on investment level, but they added a relevant comment in Padilla et al. (2024a) in the response paper to EC findings. They called the attention that country-wide investment indicator is the most appropriate one due to in case of more operators, larger amount of non-variable costs are duplicated, which redundancy could have been spent for quality improvement.

Other papers had diverging findings.

- (1) *Investment increase* was found by Genakos et al., 2018, showing that a rise in concentration increases investment per operator, and a hypothetical 4 to 3 merger increases investment per operator by 19.3%., but at country-level aggregate CAPEX did not observe any significant effect. Abate et al. (2020) also report higher capex level per operator, and Bryson et al. (2023) found that larger operators had higher CAPEX/sales investment performance in the EU.
- (2) *Inverted U-turn impact* was identified by Hounghonon and Jeanjean (2016) and Hounghonon and Jeanjean, (2019)
- (3) *Stable country CAPEX* was the finding by CERRE (2015)
- (4) *Lower investment* were reported by Valletti (2023)
- (5) a *special, but relevant approach* was published by Faccio and Zingales (2022), based on that no evidence was found on higher degree of competition leads to less investment

Summing-up the majority of the studies show neutral or at least slightly increase in CAPEX/Sales per operators, and stable or slightly decreasing impact on country-wide CAPEX in case of 4 to 3 mergers.

In the Vodafone UK - Three UK merger clearance, the other behavioral remedy related to investment commitment to ensure no potential decrease in investment might jeopardizes social welfare.

### **4.3. Operators ROCE impact**

The essence of return on investment was mentioned already related to profitability and investments. Return on Capital Employed (ROCE) is a kind of asset based profitability in which the return (mainly EBITDA like profit) is compared to accumulated investments (CAPEX). ROCE is measured towards cost of capital, the Weighted Average Cost of Capital (WACC), which is kind of alternative cost, so ROCE should exceed WACC for long term in order to worth to invest for the owners of the telecommunication companies into telecom business compared to other investment opportunities. So, the final decisions making point is the ROCE and relation to WACC for the operators, when they make a decision buy (merger: Vodafone UK- Three UK) or if impossible then decide to sell (demerger: Vodafone Spain, Vodafone Italy).

This ROCE consideration similarly or even more not part of competition economics that might be rooted in different, more complex and less trivially available dataset. None of the key paper (EC, GSMA, Lexecon) covered it.

However the UK National Regulatory Authority (NRA), the telco sector regulator Ofcom published a panel dataset between 2017-2020 for the UK market containing all MNOs ROCE and the expected minimum return (WACC) relation. This analysis made it clear that Vodafone's ROCE was always much under WACC (around 9%), even around 0, in one year under it. The other interesting finding was that Three UK's ROCE started decline from 2018, approaching to Vodafone level. VMO2 and BT/EE ROCE were much over the WACC, showing healthy business operators. Based on this research the rational and compelling need of merging laggards, Vodafone UK and Three UK became clear. Padilla et al. (2024b) conducted report on merging laggards, arguing that on only merging parties can take the advantage of the merge, but also strengthen competition as merged operators became a financial viable competitor that increases social welfare.

The other case showing the importance of ROCE and WACC relation merger questions was the step change at Vodafone after new management set-up in 2023. They launched a clear and transparent communication in investor relation financial report, when for each and every local market the relation of ROCE and WACC was indicated, and on markets with lower ROCE than WACC actions were taken (merger in UK, demerger in Spain and Italy) to stop loss-making businesses, even the group level topline streamlined to profit making markets.

Summing-up, return on investment plays a triggering role on 4 to 4 mergers or even demergers.

### **4.2. End-user quality impact**

The third cornerstone of competition analysis is the level of service quality in order to avoid service degradation as a potential harm of 4 to 3 mergers. The service quality is measured by mainly data relevant download, in some cases additionally by upload speed. The base assumption in competition policy that due to decreasing competition and investment pressure the service quality is deteriorated.

The EC papers has no explicit finding on quality impact just in indirect form rooting in decreasing country-wide investment that may decrease service quality

The GSMA paper indicates a service quality improvement, reportedly from 2016, when 4G LTE based real mobile broadband perception widespread. They say that in the 4-MNO markets with higher HHI, operators can provide higher download speed by 10 Mbps in 50-70Mbps range. (Bahia & Castells, 2023). The GSMA paper suggest that from cost efficiency driven higher profitability enables higher investment that has a positive quality improvement effect.

The Lexecon paper meta study experienced improved mobile service quality by extending network coverage and increasing download speeds (Wickens et al., 2023)

Other papers majority reports also:

- (1) *neutral or positive impacts* for the quality related to mergers. Elliot et al. (2023) develop a structural model of demand and supply in which a trade-off emerges between concentration, prices, and quality of the service. The finding was that lower concentration (4- MNO like market) reduces prices but also quality (measured by connection speed. Related to French mobile market, she argued that, while consumer surplus is maximized when six MNOs in the market, total welfare can be maximized with three MNOs, due to quality impact. Similar positive finding had Wellman. (2019), that increase in concentration increases network quality and Abate et al. (2020) also, that more concentration leads to higher download speed.
- (2) *Negative impact* stated only by Valletti 2023, in relation with warned Rewheel study
- (3) Also Faccio and Zingales (2022) has special statement, based on that no evidence found on higher degree of competition leads to lower quality.

Summing-up the quality implications of 4 to 3 mergers are dominantly positive, reporting higher download speed, therefore improving social welfare.

## 5. Conclusion and recommendation

The European fragmented national markets call for action to improve competitiveness for economies of scale, asset utilization and cost efficiency. Regarding the optimal solution there are divergent views, whether increase in competition or increase in cooperation could promote better competitiveness to close the gap to other developed countries in telecommunication metrics.

The necessity of the Digital Single Market urged by some representatives of the European Commission side, however EC competition economists raise their concerns. The merger regulation and guideline in place for 20 years and overhaul calls for strategic consultations. Dominance and SIEC tests are the pillars of merger assessments, based on that cleared or blocked. The cleared regulatory decisions are often issued with condition, containing structural (mainly divestiture), behavioral (investment and pricing) remedies. Recent approvals on merger request from Spain and UK showing, in particular the UK case dominated by behavioral remedies that there is a slight movement towards improving competitiveness.

The aim of the paper to collect, compare, summarize and add further considerations (hermeneutics method) to divergent literatures with different views on merger impacts related to prices, investments and quality that enlarged with profitability and return aspects.

EC paper on GSMA fixed panel database, the GSMA research itself and Compass Lexecon meta study and with snowballing method the incorporated journal articles with empirical quantitative models are the scope of the systematic literature review.

The main finding in the analytical framework structure is that for 4 to 3 mergers that concentration increase cause no or limited statistically significant increase in end-user prices. The operators' revenue-based profitability, the EBITDA margin showing increases in 3 -player market, driven by scale and synergy led cost efficiency. The operators' investments in form of CAPEX/Sales per operator showing also slight increase in more concentrated markets, but country level investments stagnated or slightly decreased, that can be rational to remove unnecessary duplications in case of mergers. Higher profitability and higher reinvestment form that promotes service quality improvements for download speeds that the dominant finding of the papers. This paper calls attention to the importance of return on investment (ROCE), that should exceed cost of capital (WACC) in mid and long-term, and it is the number one strategic-financial driver of operators on merger or demerger decisions.

In that latest 4 to 3 merger approval remedies for Vodafone UK and Three UK aimed to impact the pricing and investment, indirectly service quality focus areas to exclude any potential harms for social welfare.

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