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COMPETING TO INVEST LESS: THE REGULATORY PARADOX OF EUROPEAN TELECOMMUNICATIONS.

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Abstract

The European telecommunications sector is increasingly shaped by a regulatory paradox: competitive pressures designed to protect consumers in the short term may weaken the incentives required for long-term network investment. As operators face declining average revenue per user (ARPU), margin compression, and the high costs of fibre and 5G deployment, market consolidation has emerged as a response to worsening industry economics. However, its effects on consumer welfare, competition, and infrastructure development remain highly contested within European competition policy.

This dissertation examines the economic effects of the 2024 Orange/MásMóvil merger in Spain, one of the most significant telecommunications consolidations in recent European Union history. Treating the merger as a quasi-natural experiment, it applies the Synthetic Control Method (SCM) to construct a counterfactual Spanish telecommunications market using comparable European economies: France, Portugal, Belgium, Sweden, Denmark, Finland, Greece, and Switzerland. The analysis estimates the merger's impact on ARPU, used as a proxy for consumer prices, and capital expenditure intensity, used as a proxy for infrastructure investment. It also assesses the effectiveness of the European Commission's remedies, including spectrum divestitures, the strengthening of Digi Spain as a competitor, and mandatory MVNO access obligations.

The study contributes to the literature on the trade-off between static and dynamic efficiency in network industries and to the debate on adaptive merger control in the European digital economy. By providing the first synthetic control-based evaluation of the Orange/MásMóvil transaction, it offers timely empirical evidence for policymakers seeking to balance competition, investment, and long-term consumer welfare.

Keywords: telecommunications, merger control, synthetic control method, static efficiency, dynamic efficiency, infrastructure investment, European competition policy, Orange/MásMóvil.

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Acronyms

BEREC	Body of European Regulators for Electronic Communications
CNMC	Comisión Nacional de los Mercados y la Competencia
DG COMP	Directorate-General for Competition (European Commission)
EC	European Commission
EECC	European Electronic Communications Code
EU	European Union
SIEC	Significant Impediment to Effective Competition
4G / LTE	Fourth Generation / Long-Term Evolution mobile network
5G	Fifth Generation mobile network
ARPU	Average Revenue Per User
Capex	Capital Expenditure
DESI	Digital Economy and Society Index
FTTH	Fibre to the Home
HHI	Herfindahl-Hirschman Index
MásOrange	Combined entity resulting from the Orange/MásMóvil merger
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator
NGN	Next-Generation Network
OTT	Over-The-Top platform
ROCE	Return on Capital Employed
GDP	Gross Domestic Product
RMSPE	Root Mean Squared Prediction Error
SCM	Synthetic Control Method

1 Introduction

1.1 The Regulatory Paradox of European Telecommunications

Europe faces a growing tension at the heart of its digital transformation strategy. Telecommunications operators are expected to deliver universal gigabit connectivity, expand fibre networks, roll out 5G infrastructure, and support the rapidly increasing data demands of a digital economy. These objectives, formalised through the European Commission's Digital Decade targets, constitute one of the most ambitious infrastructure programmes ever undertaken in the sector. Yet the companies responsible for achieving them operate under mounting financial pressure. Average revenue per user (ARPU) has stagnated or declined across much of Europe, capital expenditure requirements remain exceptionally high, and intense competition continues to exert downward pressure on margins and profitability.

This challenge is not technological but economic. Telecommunications is a network industry characterised by high fixed costs, low marginal costs, and largely irreversible investments. Building fibre networks, acquiring spectrum licences, and deploying mobile infrastructure require substantial long-term commitments, while the returns on those investments depend on firms' ability to generate sustainable revenues over time. Competitive pressure, however, translates into immediate downward pressure on prices and margins, potentially reducing the incentives to invest.

The economics literature has long recognised this trade-off. While competition enhances consumer welfare through lower prices and greater choice, excessive competitive intensity may weaken the profitability required to finance future infrastructure deployment. Theoretical and empirical research suggests that the relationship between competition and investment follows an inverted-U pattern: moderate levels of competition can stimulate innovation and efficiency, but beyond a certain point further rivalry may discourage investment by reducing expected returns below the cost of capital (Aghion et al., 2005; Genakos et al., 2018).

European telecommunications policy has historically prioritised competition as the principal mechanism for consumer welfare. The liberalisation reforms introduced during the 1990s successfully dismantled national monopolies, reduced prices, and expanded consumer choice across Member States. However, this framework was designed for an era in which the primary concern was limiting market power rather than financing the massive infrastructure investments required by next-generation networks. As a result, Europe now faces a fundamental policy dilemma: how to preserve the benefits of competition while ensuring that operators retain the financial capacity to invest in the digital infrastructure on which future economic growth depends.

1.2 The Orange/MásMóvil Merger as a Natural Experiment

On 20 February 2024, the European Commission approved the merger between Orange Spain and MásMóvil, reducing the Spanish mobile market from four to three major operators and creating the country's largest integrated telecommunications provider. The decision, following an eighteen-month Phase II investigation, one of the most extensive and complex merger reviews in the Commission's recent history, was accompanied by a substantial package of remedies, including spectrum divestitures, the reinforcement of Digi Spain as a structural fourth competitor, and mandatory access obligations for mobile virtual network operators (MVNOs).

The Orange/MásMóvil merger constitutes, in several respects, an ideal case study for examining the regulatory paradox at the core of this dissertation.

First, it is among the most recent and thoroughly scrutinised large-scale telecommunications consolidations in the European Union, meaning that the Commission's analytical framework, evidentiary basis, and remedy design are exceptionally well documented. Second, Spain offers a particularly suitable empirical setting: a large, technologically advanced market with high fibre penetration, a mature competitive structure, and relatively rich and transparent data availability. Third, and most importantly, the merger took place at a moment of intensified policy debate on the future of European telecommunications regulation, in which the Draghi report on European competitiveness explicitly identified fragmentation in the telecom sector as a structural constraint on productivity and investment (Draghi, 2024), and called for a reassessment of EU merger control in strategic industries.

For these reasons, the Orange/MásMóvil transaction provides a rare and timely natural experiment: an opportunity to move beyond conceptual debate and rigorously evaluate, using causal inference methods, how consolidation affects prices, investment incentives, and consumer welfare in a major European telecommunications market.

1.3 Research Questions and Hypotheses

This paper is structured around four interrelated research questions, each addressing a different dimension of the regulatory paradox at the centre of the analysis:

RQ1. Did the Orange/MásMóvil merger lead to an increase in average revenue per user (ARPU) in Spain relative to the synthetic counterfactual, used as a proxy for the evolution of consumer prices in the mobile market?

RQ2. Did consolidation enhance infrastructure investment incentives, as measured by capital expenditure intensity in the mobile telecommunications sector?

RQ3. Does the theoretical inverted-U relationship between market concentration and infrastructure investment provide a useful framework for interpreting the observed outcomes in the Spanish mobile market?

RQ4. To what extent did the European Commission's remedy package successfully reconcile the efficiency gains of consolidation with the preservation of effective competitive pressure?

Together, these questions allow for a systematic evaluation of the central trade-offs in telecommunications regulation, spanning consumer welfare, investment dynamics, and competition policy design.

From these research questions, the analysis derives four corresponding testable hypotheses:

H1. The Orange/MásMóvil merger led to an increase in ARPU, used as a proxy for consumer prices, while simultaneously strengthening infrastructure investment capacity, thereby intensifying the static–dynamic efficiency trade-off.

H2. Prior to the merger, the Spanish telecommunications market exhibited signs of excessive competitive pressure, generating an investment constraint in which price-based rivalry suppressed capital expenditure.

H3. The inverted-U relationship between market concentration and investment provides a useful theoretical lens for interpreting the observed post-merger dynamics in the Spanish mobile market, even if it cannot be formally tested with the available data.

H4. The European Commission's remedy package partially mitigated the potential anti-competitive effects of consolidation while preserving scale efficiencies, leading to a net improvement in investment conditions without fully eliminating competitive concerns.

1.4 Structure of the Study

This study makes both an empirical and a policy contribution to the debate on telecommunications consolidation in Europe. Empirically, it provides the first application of the Synthetic Control Method (SCM) to the Orange/MásMóvil merger, constructing a data-driven counterfactual that allows the causal effects of the transaction on average revenue per user and capital expenditure intensity to be isolated from broader market trends. By moving beyond the descriptive evidence typically found in industry reports and regulatory assessments, the paper offers a rigorous evaluation of one of the most significant telecommunications mergers in recent European history.

From a policy perspective, the study contributes to an increasingly relevant regulatory debate. As European institutions reconsider the balance between competition and investment incentives through initiatives such as the review of the European Electronic Communications Code (EECC) and the broader discussion on European competitiveness, the Orange/MásMóvil case provides a valuable opportunity to assess whether consolidation can support infrastructure investment without undermining consumer welfare. The findings therefore offer evidence that is directly relevant to the future design of European telecommunications and competition policy.

The remainder of this paper is organised as follows. Chapter 2 presents the theoretical and regulatory framework, covering the economics of the static–dynamic efficiency trade-off, the inverted-U hypothesis, the structure of the European and Spanish telecommunications markets, and the key features of the Orange/MásMóvil transaction. Chapter 3 describes the empirical methodology, including the Synthetic Control Method, data sources, variable construction, and donor pool selection. Chapter 4 presents the empirical analysis and results, encompassing the pre-merger analysis of previous European consolidations, the synthetic control construction and validation, the main results for ARPU and Capex intensity, and the robustness checks. Chapter 5 concludes with the main findings, policy implications for European telecommunications regulation, limitations of the study, and avenues for future research.

2 Theoretical and Regulatory Framework

2.1 The European Telecommunications Sector

2.1.1 Market Fragmentation and the Investment Gap

The modern European telecommunications sector emerged from a deliberate process of liberalisation aimed at replacing the state-owned monopolies that dominated national markets until the late 1980s. Through a series of reforms initiated by the European Commission, culminating in the full liberalisation of telecommunications services in

1998, competition was introduced across Member States with the objective of reducing prices, improving service quality, and fostering consumer choice. These reforms were largely successful: new entrants challenged incumbent operators, mobile services expanded rapidly, and telecommunications became one of the flagship sectors of the European Single Market.

Over time, however, the policy focus evolved. As connectivity became a central component of Europe's digital strategy, regulatory priorities gradually shifted from promoting competition alone to ensuring sufficient investment in next-generation infrastructure. This transition was formalised through the European Electronic Communications Code (EECC) in 2018 and reinforced by the Digital Decade programme, which established ambitious targets for universal gigabit connectivity and nationwide 5G coverage by 2030. Achieving these objectives is estimated to require well over €150 billion in additional investment, while broader estimates place Europe's telecommunications infrastructure financing gap above €200 billion over the coming years (Draghi, 2024).

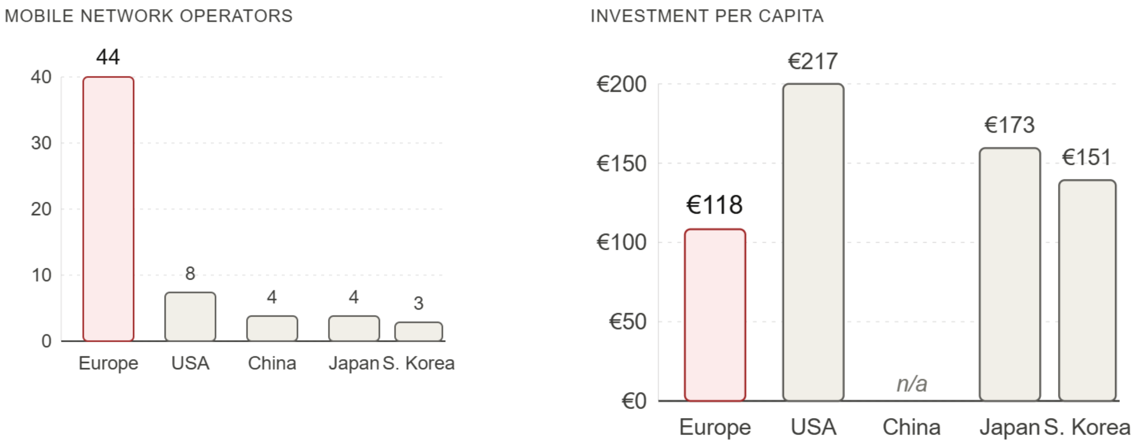
The challenge is that Europe seeks to achieve these goals within a market structure that remains unusually fragmented by international standards. Unlike the United States, China, Japan, or South Korea, where telecommunications markets are dominated by a small number of large-scale operators, Europe continues to rely on dozens of nationally confined firms competing within separate domestic markets. Today, Europe hosts 44 mobile network operators with more than 500,000 subscribers, compared with only 8 in the United States, 4 in China, 4 in Japan, and 3 in South Korea. A similar pattern exists in fixed infrastructure, where Europe has more than 70 fibre operators of significant scale, far exceeding the number observed in other major economies (Connect Europe, 2026).

This fragmentation has important economic consequences. Telecom investment per capita in Europe stands at approximately €118, compared with €217 in the United States, €173 in Japan, and €151 in South Korea. At the same time, the average European operator serves around 5 million subscribers, while operators in the United States exceed 100 million and Chinese operators approach 500 million (Connect Europe, 2026). The issue is therefore not a lack of willingness to invest, but a lack of scale. Smaller operators face greater difficulty generating the revenues and economies of scale necessary to finance large infrastructure projects, particularly in an environment characterised by intense price competition and declining margins.

The coexistence of ambitious investment objectives and a highly fragmented market structure constitutes one of the central tensions of European telecommunications policy. While competition has delivered substantial benefits for consumers, it has also contributed to a market environment in which investment capacity remains constrained. Whether greater consolidation can help close this investment gap without significantly harming competition is the central question examined throughout this dissertation and provides the broader context for the Orange/MásMóvil merger analysed in later sections.

Figure 1

Telecom Market Structure and Investment Intensity by Region (2024–2025)



Note. Mobile network operators with more than 500,000 subscribers. Europe's fragmentation (44 operators) contrasts sharply with consolidated peers, resulting in significantly lower investment per capita. China is excluded from the investment per capita comparison as Connect Europe (2026) does not report a directly comparable figure. Sources: Connect Europe (2026); Advanced Television (2026).

2.1.2 ARPU Decline and Capex Intensity: The Infrastructure Financing Trap

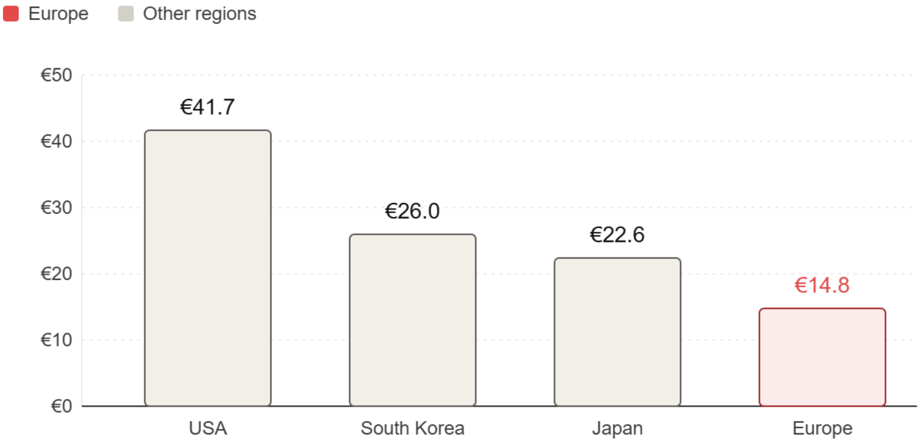
The structural fragmentation described in Section 2.1.1 translates into a highly competitive market environment by international standards. European telecommunications markets are characterised by intense price-based rivalry, a large number of operators within each national market, and persistent downward pressure on margins. While this competitive intensity has delivered clear consumer benefits, with some of the lowest mobile prices among advanced economies, it has also generated a structural constraint on profitability that lies at the core of this paper.

This is reflected in the evolution of industry returns. Return on capital employed (ROCE) for Connect Europe members declined from 9.1% in 2017 to 6.8% in 2023, signalling increasing difficulty in generating returns above the cost of capital (Connect Europe, 2025). In a capital-intensive industry such as telecommunications, this has direct implications for investment incentives: when returns approach or fall below the cost of capital, the financial capacity to sustain large-scale infrastructure investment is structurally weakened.

A key driver of this profitability compression is sustained downward pressure on Average Revenue per User (ARPU). In 2023, European mobile ARPU declined by 5.9% in real terms, while total telecom revenues fell by 4.4%, despite inflation of 6.4% (Connect Europe, 2025). This implies that operators absorbed cost pressures rather than passing them through to consumers, resulting in further margin erosion. European ARPU remains the lowest among major global regions at approximately €14.8 per month, compared to €41.7 in the United States, €26.0 in South Korea, and €22.6 in Japan. Adjusted for GDP, ARPU has also remained broadly stagnant over the past decade, indicating that technological progress and network expansion have not translated into revenue growth for operators.

Figure 2

Mobile ARPU by Region (€/month, 2023)



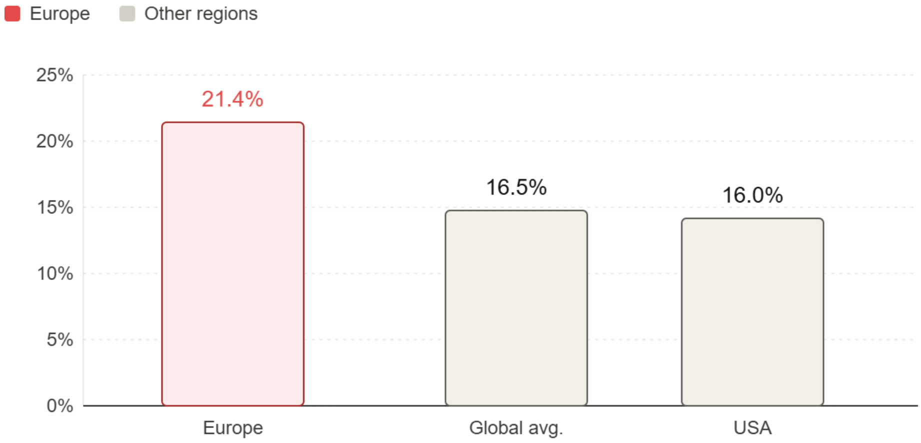
Note. ARPU = Average Revenue Per User. Europe's figure reflects a real-terms decline of 5.9% compared to the previous year and stands below its own 2015 level when adjusted for GDP. Source: Connect Europe (2025).

This sustained ARPU compression reflects a broader structural feature of European telecommunications: competition is primarily conducted through price rather than differentiation, reinforcing commoditisation and limiting revenue recovery. The result is a persistent mismatch between rising infrastructure requirements and stagnant revenue generation, which directly constrains the financing of future investment.

Despite these pressures, European operators continue to exhibit exceptionally high capital expenditure intensity. In 2023, capital expenditure represented approximately 21.4% of revenues, the highest among comparable regions (Connect Europe, 2025). Of the €64.5 billion invested in the sector, around 46% was allocated to fibre deployment and 30% to mobile networks. This sustained investment reflects the non-discretionary nature of next-generation infrastructure rollouts, particularly fibre and 5G, which require large, irreversible commitments.

Figure 3

Capital Expenditure Intensity by Region (% of Revenue, 2023)



Note. Europe invests the highest share of revenue in infrastructure among all global peers, yet records the lowest ARPU (Figure 2) — illustrating the financing trap at the core of this paper. ROCE for European operators stood at 6.8% in 2023, below the estimated cost of capital. Sources: Connect Europe (2025); Omdia (2024).

However, this investment effort has not translated into commensurate financial performance. Over time, invested capital has grown faster than revenues, while returns on investment have remained below the cost of capital in many markets. Western European telecom capex reached a peak of approximately €51 billion in 2022 before declining in 2023, as operators increasingly reassessed the sustainability of high investment levels under weak revenue conditions (Connect Europe, 2025).

Taken together, these dynamics define what this paper terms the European infrastructure financing trap: a market structure characterised by intense competition, persistently low ARPU, and unusually high capital intensity, yet insufficient returns to fully finance the investment required for Europe's digital transformation. Within this context, consolidation events such as the Orange/MásMóvil merger can be interpreted as endogenous adjustments to a system in which traditional competitive dynamics may no longer be fully compatible with long-term infrastructure financing needs.

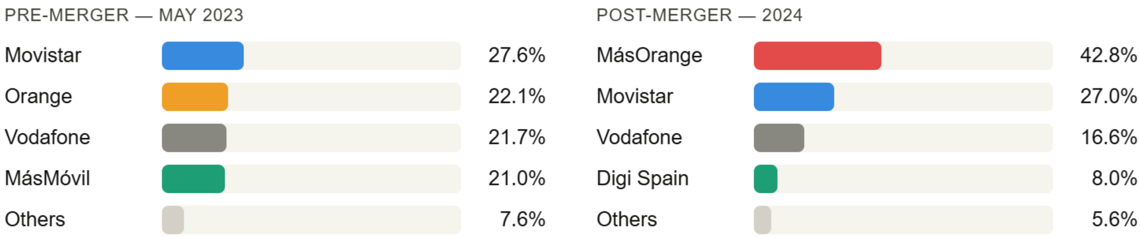
2.2 The Spanish Market and the Orange/ MásMovil Merger

2.2.1 Pre-Merger Market Structure and Competitive Dynamics

Prior to the Orange/MásMóvil merger, the Spanish telecommunications market was characterised by one of the most balanced competitive structures in Europe. The mobile segment operated under a highly symmetric four-player configuration in which Movistar (Telefónica), Orange Spain, Vodafone Spain, and MásMóvil held closely aligned market shares. As of May 2023, these stood at 27.56%, 22.14%, 21.69%, and 21.01% respectively (CNMC, 2023). This near-equal distribution created a market structure widely regarded by regulators as a benchmark for effective rivalry, sustained by strong price competition and low levels of market dominance.

Figure 4

Spanish Mobile Market Share: Pre- and Post-Merger (2023–2024)



Note. The merger reduced the Spanish mobile market from four near-symmetric operators to a three-player structure led by MásOrange (42.8%). Digi Spain transitioned from MVNO to full MNO status as part of the EC remedy package. Sources: CNMC (2023); Xataka Móvil; Mordor Intelligence (2024).

However, this symmetry also embedded a structural limitation in the mobile segment specifically. While it supported persistently low prices and strong consumer welfare outcomes, the near-equal distribution of subscribers constrained the ability of individual operators to generate the margins required to lead investment in capital-intensive mobile infrastructure, particularly in the transition toward 5G densification. This dynamic was less pronounced in fixed infrastructure, where Telefónica had already established a dominant investment position through its large-scale fibre rollout in the 2010s.

A defining feature of the Spanish market in the years leading up to the merger was the rapid growth of Digi Spain, a Romanian-owned low-cost operator that entered as a mobile virtual network operator (MVNO) using Telefónica's wholesale network. Through an aggressive low-price strategy, Digi intensified competition in the entry-level segment and exerted sustained downward pressure on ARPU across the industry. In response to the European Commission's competition concerns during the merger review, Orange and MásMóvil committed to divest spectrum in the 1,800 MHz, 2,100 MHz, and 3.5 GHz bands to Digi, enabling its transition toward full mobile network operator status (European Commission, 2024). This remedy was designed to preserve a structural competitive constraint in the post-merger market and is assessed empirically in Chapter 4.

Spain stood out as a European leader in fixed broadband infrastructure. The country's large-scale fibre rollout, driven primarily by Telefónica's early and sustained investment strategy throughout the 2010s, resulted in one of the most extensive FTTH networks in Europe — with nationwide coverage levels significantly ahead of comparable markets such as France, Germany, and the United Kingdom. This fibre leadership reflected the investment capacity of a dominant infrastructure operator rather than the outcome of symmetric competition, and provides important context for understanding the distinct dynamics of fixed versus mobile investment in the Spanish market.

Following the merger, the combined entity MásOrange entered the market with approximately 98% 4G population coverage, 80% 5G coverage, and a fibre network reaching over 29 million homes, making it the largest infrastructure operator in Spain by network scale (European Commission, 2024). The market is now structured around three principal network groups, Movistar, MásOrange, and Vodafone/Zegona, which together account for approximately 86.4% of mobile lines, alongside a residual segment served by MVNOs.

Overall, the Spanish telecommunications sector has thus transitioned from a highly symmetric four-player structure to a more concentrated configuration at the infrastructure level, while simultaneously reinforcing a fourth competitive retailer layer through Digi's evolution into a full mobile network operator. This new equilibrium coincides with the shift from large-scale fibre deployment toward 5G densification, and whether it improves mobile investment capacity without weakening competitive outcomes is the central empirical question addressed in Chapter 4.

2.2.2 The Transaction, EC Approval and Remedy Package

The Orange/MásMóvil transaction was formally announced in July 2022 after a period of exclusive negotiations initiated earlier that year. It was structured as a 50:50 joint venture with equal governance rights, based on a combined enterprise value of €18.6 billion, reflecting €7.8 billion for Orange Spain and €10.9 billion for MásMóvil (European Commission, 2024). The strategic rationale was centred on achieving sufficient scale to sustain investment in fibre and 5G infrastructure in a market characterised by intense competition and compressed margins.

The economic logic of the deal was closely linked to long-standing concerns in European telecoms policy regarding fragmentation and investment capacity. Both operators argued that increased scale would generate efficiency gains, improved spectrum utilisation, and stronger financial capacity to accelerate network deployment. However, the transaction also raised immediate competition concerns, as it implied a structural shift from a four-to-three market configuration, particularly given that Digi, which at that point operated exclusively as a mobile virtual network operator (MVNO) without its own infrastructure, was unlikely to constitute a sufficiently strong competitive constraint in the long term without structural intervention.

Under EU merger control, the European Commission (DG COMP) reviewed the transaction under the SIEC test, which assesses whether a concentration would significantly impede effective competition. The Commission opened its investigation in 2022 and, following an in-depth Phase II review, cleared the merger conditionally on 20 February 2024. It concluded that, absent remedies, the transaction would eliminate a close competitor and could lead to price increases exceeding 10%, while efficiency gains in investment and cost synergies would not be sufficient to offset these effects (European Commission, 2024).

The assessment initially explored both horizontal and vertical concerns, but ultimately focused on horizontal competitive effects in retail mobile and fixed markets. The decision reflected a growing recognition within EU competition policy that telecom mergers must be assessed not only in terms of short-run price effects but also in relation to long-term investment incentives and infrastructure sustainability.

Clearance was granted subject to a comprehensive remedy package agreed in December 2023. The package was designed to preserve a structural fourth competitor in the Spanish market, primarily through the strengthening of Digi Spain. It combined two main instruments. First, Orange and MásMóvil committed to divest spectrum in the 1,800 MHz, 2,100 MHz, and 3.5 GHz bands to Digi, enabling it to transition from an MVNO model to a full mobile network operator with its own infrastructure. Second, the merged entity granted Digi an optional national roaming agreement to ensure network continuity during its build-out phase (European Commission, 2024).

Digi acquired the spectrum for approximately €120 million and obtained access to Orange's network under the roaming arrangement (European Commission, 2024). The European Commission emphasised that these commitments were intended to replicate the competitive pressure previously exerted by MásMóvil, ensuring continued constraints on prices, service quality, and 5G deployment.

Figure 5

Orange/MásMóvil Merger Timeline (2022–2025)

MARCH 2022
Orange and MásMóvil begin exclusive merger negotiations.

JULY 2022
Binding agreement signed. Combined enterprise value set at €18.6 billion (€7.8bn Orange Spain + €10.9bn MásMóvil).

NOVEMBER 2022
European Commission opens Phase II in-depth investigation.

DECEMBER 2023
Remedy package agreed with Digi Communications: spectrum divestiture across three frequency bands and optional national roaming agreement.

20 FEBRUARY 2024
European Commission grants conditional approval. Digi acquires 60 MHz of spectrum for €120 million.

MARCH 2024
Merger closes. MásOrange begins operations as Spain's largest operator with 37+ million mobile and broadband lines.

2024–2025
Post-merger integration underway. Digi Spain begins MNO network rollout using divested spectrum.

Note. Red markers denote the two key regulatory milestones: EC conditional approval (February 2024) and merger closing (March 2024). Sources: European Commission (2024); Orange Group (2024); Mobile Europe (2024).

This decision has been widely interpreted as signalling a more nuanced approach to four-to-three mobile infrastructure mergers in European telecommunications, reflecting a broader policy debate between competition authorities, which emphasise the risks of oligopolistic market structures, and industry and policy reports such as Draghi (2024), which highlight fragmentation as a barrier to long-term investment and digital sovereignty.

The effectiveness of this remedy design, particularly whether Digi Spain has successfully replaced MásMóvil as a competitive constraint and whether the merger has delivered the expected investment improvements, constitutes one of the central empirical questions addressed in Chapter 4.

2.3 Static vs Dynamic Efficiency: The Core Trade-Off

The central regulatory challenge in telecommunications lies in balancing static efficiency, which prioritises lower prices and consumer welfare in the short term, with dynamic efficiency, which focuses on long-term investment and innovation. While these objectives are often treated as complementary, in network industries they can come into direct conflict.

The European telecommunications model that emerged from liberalisation was largely built around static efficiency. By promoting market entry and price competition, regulators sought to reduce market power and drive prices closer to marginal cost. This approach has delivered clear benefits: European consumers enjoy some of the lowest mobile prices in the developed world, alongside high service quality and broad network coverage.

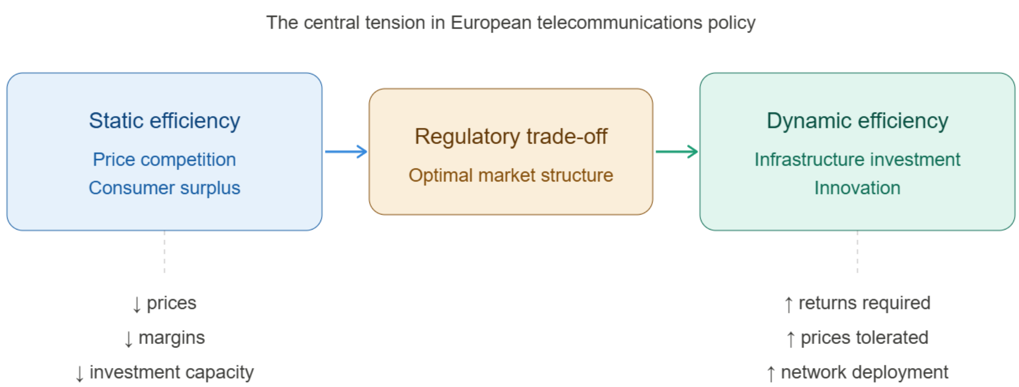
However, telecommunications differs from most competitive markets because infrastructure investment is highly capital-intensive, long-term, and largely irreversible. Deploying fibre networks, acquiring spectrum licences, and expanding 5G coverage require substantial upfront expenditure that can only be justified if operators expect adequate returns over time. When competition becomes sufficiently intense, the resulting pressure on prices and margins may undermine the profitability needed to finance these investments.

This creates a fundamental trade-off. Policies that maximise short-term consumer welfare through lower prices may simultaneously weaken incentives for network investment, while policies that strengthen investment incentives may result in higher prices in the short run. Empirical evidence from telecommunications markets consistently suggests that consolidation tends to increase both prices and investment, highlighting that static and dynamic efficiency cannot always be maximised simultaneously (Genakos et al., 2018; Houngbonon & Jeanjean, 2016).

This trade-off is central to the analysis developed in this dissertation. The key question is not simply whether the Orange/MásMóvil merger affected prices, but whether any change in consumer outcomes was accompanied by improvements in investment capacity. Chapter 4 addresses this question directly by evaluating both dimensions against a synthetic counterfactual for Spain.

Figure 6

The Static-Dynamic Efficiency Trade-Off in Telecommunications Regulation



Note. Price competition delivers short-run consumer welfare (static efficiency) but erodes the margins required to finance long-run infrastructure investment (dynamic efficiency). The regulatory challenge is calibrating market structure to optimise both objectives simultaneously. Source: author's elaboration based on Distaso et al. (2009) and Genakos et al. (2018).

2.4 The Inverted-U Hypothesis: Competition and Investment

One of the most influential contributions to the economics of innovation is the inverted-U hypothesis, which argues that the relationship between competition and investment is not linear. While insufficient competition may weaken incentives to innovate, excessive competition can be equally detrimental by eroding the profits needed to finance long-term investment. As a result, innovation and investment are maximised not under monopoly or perfect competition, but at an intermediate level of competitive intensity.

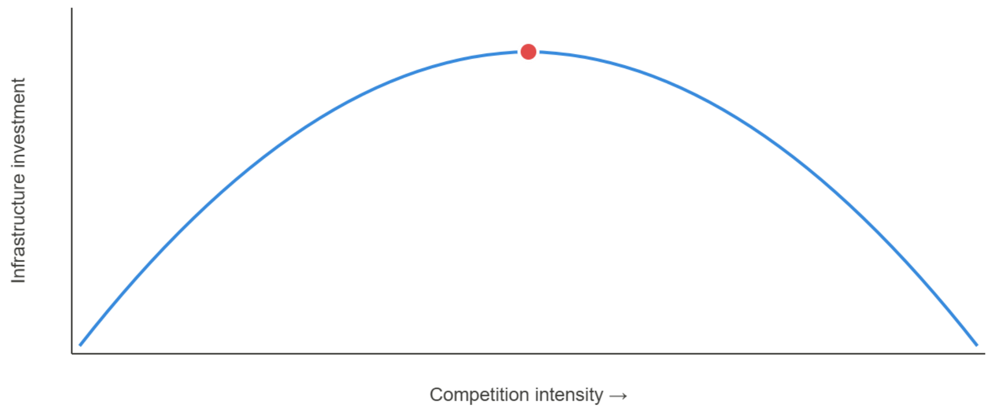
The theoretical foundation of this argument was developed by Aghion et al. (2005), who demonstrated that competition affects innovation through two opposing mechanisms. At low levels of rivalry, increased competition encourages firms to innovate in order to improve their market position — the so-called escape competition effect. Beyond a certain point, however, additional competition reduces the expected returns from innovation, weakening firms' incentives to invest. The interaction of these forces generates the characteristic inverted-U relationship between competition and innovation.

The relevance of this framework to telecommunications is particularly strong. Mobile markets are characterised by high fixed costs, long investment horizons, and operators that are often technologically similar. In such neck-and-neck industries, the negative effect of excessive competition on investment can be especially pronounced. Consequently, the optimal market structure may involve a limited number of large operators capable of generating the scale and profitability required to sustain infrastructure investment.

Empirical evidence largely supports this prediction. Using data from 33 OECD countries, Genakos et al. (2018) find that higher market concentration is associated with both higher prices and higher investment per operator, highlighting the existence of a trade-off between consumer prices and investment incentives. Subsequent studies reach similar conclusions, showing that more concentrated telecommunications markets tend to exhibit greater investment intensity and, in some cases, improvements in network quality (Houngbonon & Jeanjean, 2016, 2017).

Figure 7

The Inverted-U Relationship Between Competition Intensity and Infrastructure Investment



Note. Investment is maximised at an intermediate level of market concentration. To the left of the optimum, insufficient rivalry reduces investment incentives; to the right, excessive competition erodes the margins required to finance network deployment. Pre-merger Spain, with four near-symmetric operators, is hypothesised to lie on the right-hand side of the curve. Source: author's elaboration based on Aghion et al. (2005) and Houngbonon and Jeanjean (2016, 2017).

Particularly relevant are the findings of Houngbonon and Jeanjean (2016, 2017), who suggest that many European mobile markets may already lie on the right-hand side of the inverted-U curve, where additional competition reduces investment without generating proportionate consumer benefits. If this interpretation is correct, four-to-three mergers such as Orange/MásMóvil may move markets closer to the investment-efficient level of competition rather than further away from it.

This hypothesis provides one of the central theoretical foundations for the present study. While the inverted-U relationship cannot be formally tested with the available data, the empirical analysis in Chapter 4 examines whether the post-merger dynamics in the Spanish mobile market are consistent with its predictions, specifically, whether consolidation was accompanied by improvements in investment capacity relative to the synthetic counterfactual.

2.5 Evidence from Previous European Mergers

Over the past decade, the European telecommunications sector has experienced several four-to-three consolidations, providing a valuable empirical setting for assessing the effects of market concentration on prices, investment, and network quality. Major transactions include the Hutchison/Orange merger in Austria (2012), Hutchison/Telefónica in Ireland (2014), Telefónica/E-Plus in Germany (2014), Hutchison/WIND in Italy (2016), and, more recently, Hutchison/Vodafone in the United Kingdom (2024), the latter assessed under the jurisdiction of Ofcom rather than the European Commission, though subject to broadly similar merger control principles.

These mergers reflect an industry response to the investment challenges discussed throughout this chapter. By combining customer bases, network assets, and spectrum holdings, operators seek to achieve greater scale and improve their ability to finance next-generation infrastructure. However, consolidation also reduces the number of competitors, raising concerns about higher prices and diminished competitive pressure. As a result, telecom mergers sit at the centre of the trade-off between competition and investment that characterises the sector.

Empirical evidence suggests that both effects often occur simultaneously. Studies of European mobile markets find that higher concentration is generally associated with increased investment per operator, but also with upward pressure on prices (Genakos et al., 2018). The Austrian case is particularly illustrative. Following the Hutchison/Orange merger, the national regulator initially estimated significant price increases. However, subsequent analysis found that, after the entry of new MVNO competitors, the observed price effects became considerably smaller and, in many cases, statistically insignificant, highlighting the importance of remedy design in determining post-merger outcomes (Genakos et al., 2018).

More broadly, the literature indicates that moderate consolidation can support infrastructure investment and network quality improvements, particularly in markets characterised by intense competition and low profitability (Houngbonon & Jeanjean, 2016). Evidence also suggests that investment levels tend to be highest in markets with three mobile network operators, lending support to the view that excessive fragmentation may hinder long-term infrastructure development.

Taken together, previous European mergers provide mixed but informative evidence. While consolidation can weaken competitive pressure and increase prices, it may also strengthen investment incentives and improve network quality. The ultimate outcome depends not only on the merger itself but also on the effectiveness of the remedies imposed to preserve competition. The Orange/MásMóvil transaction therefore offers an opportunity to evaluate whether a modern, remedy-based approach to telecom consolidation can successfully balance these competing objectives.

Table 1

Major European Four-to-Three Telecom Mergers (2012–2024)

MERGER	YEAR	COUNTRY	ARPU EFFECT	INVESTMENT EFFECT	STRUCTURAL REMEDY
Hutchison / Orange	2012	Austria	↑ Prices up +€2.49/month avg. post-merger gap	↔ Mixed No clear investment gain documented	Mandatory wholesale MVNO access; price effect diminished within 2 years
Hutchison / Telefónica	2014	Ireland	↓ Negative -€1.91/month; poor pre-treatment fit	↑ Investment up Capex per operator increased	Spectrum divestiture + MVNO access obligations
Telefónica / E-Plus	2014	Germany	↑ Moderate +€0.60/month; contained by remedies	↑ Investment up Accelerated 4G/LTE deployment	Spectrum divestiture + MVNO + rural coverage obligations
Hutchison / WIND	2016	Italy	≈ Near-zero +€0.05/month; neutralised by Iliad	↑ Quality up Higher download speeds post-merger	Creation of new MNO (Iliad Italy) via full spectrum transfer
Hutchison / Vodafone	2024	UK	— Pending Post-merger monitoring underway	— Pending Post-merger monitoring underway	Spectrum divestiture + MVNO + 5G coverage commitments
Orange / MásMóvil	2024	Spain	↓ Negative −€2.50/month avg. post-merger gap	≈ Near-zero −0.017; not statistically significant	Digi Spain elevated to full MNO via 60 MHz spectrum + optional national roaming

Note. MNO = Mobile Network Operator; MVNO = Mobile Virtual Network Operator. ARPU and investment effects measured as average post-merger gaps relative to synthetic counterfactual over the first 3 quarters post-merger (8 quarters for pre-2024 cases). The Orange/MásMóvil row (highlighted) is the empirical focus of this paper, estimated via the Synthetic Control Method (Chapter 4). Sources: Genakos et al. (2018); ICLE (2019); BEREC (2018); European Commission (2024); author's calculations.

2.6 Research Gap and Contribution of this Study

The literature reviewed in this chapter supports three robust conclusions. First, the static–dynamic efficiency trade-off in telecommunications is well established: consolidation tends to increase both prices and investment, making it difficult to optimise consumer welfare in both dimensions simultaneously (Genakos et al., 2018). Second, the inverted-U hypothesis suggests that many European markets, typically structured around three to four symmetric operators, may already lie on the right-hand side of the curve, where additional competition can suppress investment rather than enhance it (Houngbonon & Jeanjean, 2016). Third, the design of merger remedies is critical, as the effectiveness of post-merger competition depends on whether the reintroduced competitor is commercially and technically viable.

What remains missing in the literature is a causal, up-to-date evaluation of the most significant recent telecommunications consolidation in Europe.

The Orange/MásMóvil merger provides a particularly relevant case. It is a four-to-three merger in a large and advanced European market, approved in 2024 with a complex remedy package centred on strengthening Digi Spain as a full mobile network operator. It takes place in the middle of a broader policy shift, shaped by the Draghi report (2024), the EECC review, and the forthcoming Digital Networks Act, all of which question whether Europe's current competition framework is compatible with large-scale infrastructure investment. Despite its importance, no study has yet quantified its post-merger effects using causal inference methods.

Existing empirical work faces two main limitations. Methodologically, much of the literature relies on panel regressions or difference-in-differences designs that struggle to isolate the causal effect of a single merger from broader cross-country trends. Temporally, the most influential studies, including Genakos et al. (2018), are based on pre-5G data and therefore do not reflect the current investment cycle or the recent wave of consolidation in European telecommunications markets.

This paper addresses both gaps by applying the Synthetic Control Method to the Orange/MásMóvil merger. This approach constructs a data-driven counterfactual — a synthetic Spain that did not experience the merger — against which actual post-merger outcomes in ARPU and investment can be compared. Following Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010), this method provides a transparent and credible framework for estimating the causal impact of a single large-scale intervention.

The contribution of this study is therefore twofold. Empirically, it delivers the first synthetic control evaluation of the Orange/MásMóvil merger, including an assessment of whether the associated remedy package preserved competition while supporting investment. Theoretically, it provides a real-world test of whether post-merger dynamics in the Spanish mobile market are consistent with the predictions of the inverted-U hypothesis in the current European telecommunications context.

The empirical results are presented in Chapter 4, while the methodological framework is detailed in Chapter 3.

3 Methodology and Research Design

3.1 Empirical Strategy Identification

This paper adopts a quantitative causal inference framework to estimate the economic effects of the Orange/MásMóvil merger on the Spanish telecommunications market. The central empirical challenge is fundamentally counterfactual: there is only one Spain, and it experienced the merger. As a result, standard regression-based approaches are limited in their ability to isolate the causal impact of the transaction from concurrent macroeconomic trends, technological change, and regulatory developments affecting European telecommunications markets as a whole.

To address this issue, the analysis employs the Synthetic Control Method (SCM), a data-driven approach to causal inference in comparative case studies. SCM constructs a weighted combination of untreated units, in this case, European countries that did not undergo comparable four-to-three mobile market consolidations, to approximate the trajectory Spain would have followed in the absence of the merger. The causal effect is then estimated as the difference between Spain's observed post-merger outcomes and those of the synthetic counterfactual.

This approach follows the framework introduced by Abadie and Gardeazabal (2003), who estimate the economic impact of conflict in the Basque Country by constructing a synthetic control region from a weighted combination of other Spanish regions.

Analogously, this paper constructs a synthetic Spain using a donor pool of comparable European economies and compares its post-merger evolution with actual outcomes across two key variables: average revenue per user (ARPU), used as a proxy for consumer prices, and capital expenditure intensity, used as a proxy for infrastructure investment.

The treatment is defined as the completion of the Orange/MásMóvil merger in Q1 2024. The pre-treatment period spans Q1 2010 to Q4 2023, providing 56 quarters of pre-merger dynamics for reliable synthetic matching. The post-treatment period covers Q1 2024 to Q3 2024, reflecting the most recent available data at the time of analysis.

3.2 The Synthetic Control Method

3.2.1 Intuition and Counterfactual Construction

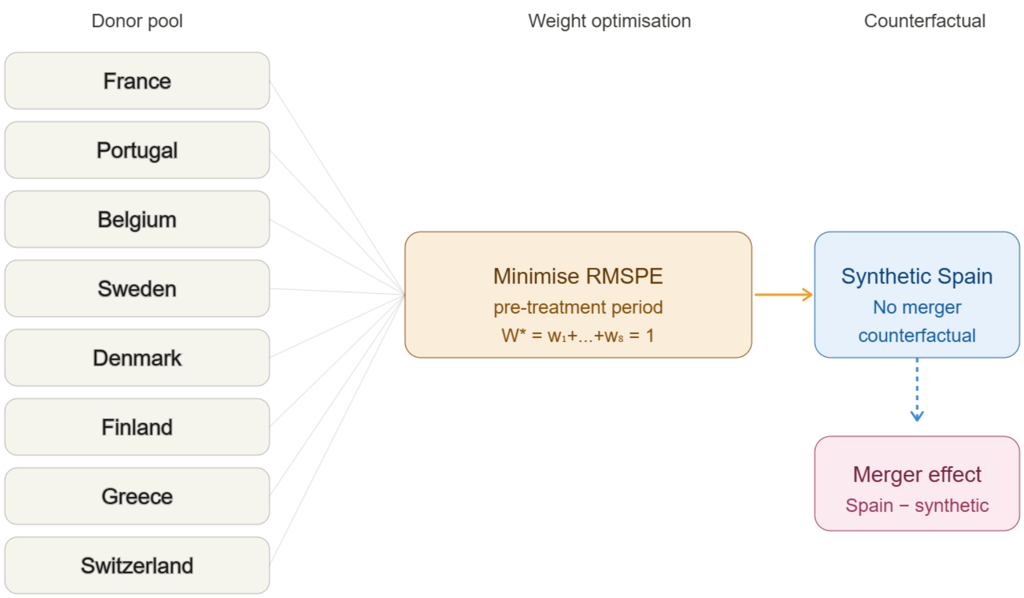
The fundamental challenge of causal inference, the impossibility of observing the same unit simultaneously under both treatment and counterfactual conditions, is especially acute in comparative case studies involving aggregate units such as countries. Standard econometric approaches typically rely on fixed effects or exogenous variation in treatment assignment to control for unobserved confounders. In the present context, however, neither strategy is fully credible: there is no plausible source of exogenous variation in the merger decision, and country fixed effects cannot adequately account for time-varying unobserved heterogeneity affecting European telecommunications markets.

The Synthetic Control Method (SCM) addresses this limitation by constructing an explicit, data-driven counterfactual. Instead of relying on a single comparison country, SCM builds a weighted combination of multiple untreated countries, where weights are chosen to minimise the distance between the treated unit and the synthetic control across relevant pre-treatment characteristics. This procedure avoids the strong assumption that any single country is structurally comparable to Spain (Abadie et al., 2010).

The resulting synthetic Spain is designed to closely replicate Spain's pre-merger trajectory in key outcomes, specifically Average Revenue Per User (ARPU), used as a proxy for consumer prices, and capital expenditure intensity, used as a proxy for infrastructure investment, as well as structural market features including market concentration and network coverage. Under this framework, deviations between actual post-merger outcomes and the synthetic counterfactual can be interpreted as the causal effect of the Orange/MásMóvil merger (Abadie & Gardeazabal, 2003).

Figure 8

The Synthetic Control Method: From Donor Pool to Synthetic Spain



Note. The synthetic control is constructed by finding the weighted combination of donor countries that best reproduces Spain's pre-merger trajectory. Countries with four-to-three mergers during the study period (Austria, Germany, Ireland, Italy, Netherlands) are excluded from the donor pool. The merger effect is estimated as the post-treatment gap between actual Spain and the synthetic counterfactual. Source: author's elaboration based on Abadie et al. (2010).

3.2.2 Formal Framework and Estimation

The Synthetic Control Method (SCM) identifies the causal effect of the Orange/MásMóvil merger by comparing Spain’s observed post-merger outcomes with those of a weighted combination of untreated countries that replicates Spain’s pre-merger trajectory. The key identifying assumption is that, absent the merger, Spain would have evolved similarly to this synthetic counterpart. Unlike difference-in-differences approaches, SCM does not rely on a parallel trends assumption; instead, identification depends on achieving a close pre-treatment fit between Spain and the synthetic control.

Following Abadie, Diamond, and Hainmueller (2010), let $i = 1$denote Spain (the treated unit) and $i = 2, \dots, J + 1$the donor countries. Let T_0represent the final pre-treatment period (2023 Q4). The untreated potential outcome is modelled as:

$$Y_{it}^{N} = \delta_t + \theta_t Z_i + \lambda_t \mu_i + \varepsilon_{it}$$

where $\delta_t$captures common time effects, $Z_i$is a vector of observed predictors, $\mu_i$represents unobserved unit-specific characteristics, and $\varepsilon_{it}$is an idiosyncratic error term.

The synthetic control is constructed as a weighted average of donor countries. The vector of weights $W^* = (w_2^*, \dots, w_{J+1}^*)$, where $w_j \geq 0$and $\sum w_j = 1$, is chosen to minimise the pre-treatment discrepancy between Spain and its synthetic counterpart:

$$W^* = \arg\min_{W} \sum_{t=1}^{T_0} \left(Y_{1t} - \sum_{j=2}^{J+1} w_j \, Y_{jt} \right)^2$$

subject to balance on a set of predictor variables and lagged outcome values. The treatment effect is then estimated as the difference between Spain's observed outcome and the outcome of the synthetic control after the merger:

$$\hat{\tau}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* \, Y_{jt}, t > T_0$$

Weight selection follows the standard two-step optimisation procedure. First, a diagonal matrix V, which determines the relative importance of each predictor, is chosen to minimise the pre-treatment mean squared prediction error (MSPE). Second, conditional on V, the optimal country weights $W^*$are estimated. All computations are implemented using the pysyncon package in Python.

For the estimates to be interpreted causally, three assumptions must hold. First, the no-interference assumption requires that the merger affects Spain but does not generate significant spillovers in donor countries. Second, the convex hull assumption requires Spain's pre-treatment characteristics to be reproducible as a weighted combination of donor countries, which is assessed through the quality of pre-treatment fit. Third, the no-anticipation assumption requires that market participants did not systematically adjust their behaviour before the merger became effective. This concern is mitigated by using quarterly data and defining the pre-treatment period to end in 2023 Q4.

3.3 Data, Variables and Donor Pool

3.3.1 Data Sources and Sample Construction

The empirical analysis draws on a single consolidated dataset provided by the supervisor and sourced from GSMA Intelligence, the research and data division of the GSMA. GSMA Intelligence compiles harmonised quarterly indicators on mobile telecommunications markets across countries worldwide, collecting data directly from mobile network operators and national regulatory authorities. It provides standardised and comparable series on operator revenues, subscriber counts, capital expenditure, network coverage, and market concentration, and is widely used in academic and policy research on telecommunications economics owing to its methodological consistency and quarterly frequency.

The dataset covers 29 European countries over the period 2010 Q1 to 2024 Q3, yielding a panel of 1,711 observations. For the purposes of this study, the sample is restricted to Spain and the eight donor pool countries, France, Portugal, Belgium, Sweden, Denmark, Finland, Greece and Switzerland, resulting in a working panel of 531 observations across 9 countries and 59 quarters.

The treatment event is defined as the approval and closing of the Orange/MásMóvil merger in 2024 Q1. The pre-treatment period covers 2010 Q1 to 2023 Q4 (56 quarters) and the post-treatment period covers 2024 Q1 to 2024 Q3 (3 quarters).

3.3.2 Dependent and Predictor Variables

The empirical analysis evaluates the causal impact of the Orange/MásMóvil merger across two outcome variables, each capturing a distinct dimension of the static–dynamic efficiency trade-off central to this study.

The first is Average Revenue Per User (ARPU), defined as the average monthly revenue generated per unique mobile subscriber at country level. ARPU serves as the primary proxy for consumer prices in this analysis: an increase relative to the synthetic counterfactual would indicate that consolidation reduced competitive pressure and enabled operators to recover margins, generating short-run consumer harm. Conversely, a negative or flat ARPU gap would suggest that competitive discipline was preserved in the post-merger period.

The second is capital expenditure intensity (CAPEX), defined as annual capital expenditure as a percentage of total cellular revenue. This variable is the main proxy for infrastructure investment and captures the dynamic efficiency dimension of the trade-off. An increase in CAPEX intensity relative to the synthetic control would provide empirical support for the hypothesis that consolidation strengthened investment incentives in the Spanish market.

The two dependent variables are summarised in Table 2.

Table 2

Dependent Variables Used in the Empirical Analysis

VARIABLE	NOTATION	DEFINITION	DIMENSION
Average Revenue Per User (ARPU)	$ARPU_{it}$	Average monthly revenue per unique mobile subscriber at country level, used as a proxy for consumer prices in the mobile market	Static efficiency / consumer welfare
Capex Intensity	$CAPEX_{it}$	Annual capital expenditure as a percentage of total cellular revenue, used as a proxy for infrastructure investment incentives	Dynamic efficiency / investment

Note. Both variables are available at quarterly frequency. ARPU is expressed in euros (€). Capex intensity is a ratio and therefore currency-neutral. Source: GSMA Intelligence, via supervisor-provided dataset.

To construct the synthetic control, a set of pre-treatment predictor variables is included to capture the structural, economic, and technological characteristics of each national telecommunications market. These variables are measured as averages over the full pre-treatment period (2010–2023) and are used to ensure that the synthetic Spain closely replicates the observable characteristics of the actual Spanish market prior to the merger.

The predictors include market concentration (HHI), network development (4G population coverage), economic conditions (GDP per capita), and market maturity (mobile penetration rate). 5G population coverage is included as a structural predictor rather than an outcome variable, as it captures the technological development stage of each market during the pre-treatment period and contributes to the comparability of the synthetic control, the causal effect of the merger on investment is captured instead through capital expenditure intensity. Consistent with Abadie, Diamond, and Hainmueller (2010), pre-treatment averages of the two dependent variables are also included as additional predictors to improve the pre-treatment fit of the synthetic control.

The full list of predictor variables, definitions and sources is reported in Table 3.

Table 3

Predictor Variables Used in the Synthetic Control Estimation

PREDICTOR	DEFINITION	SOURCE
Mobile ARPU (2010–2023 avg.)	Average monthly revenue per unique mobile subscriber at country level	GSMA Intelligence
Capex intensity (2010–2023 avg.)	Annual capital expenditure as a percentage of total cellular revenue	GSMA Intelligence
HHI mobile market	Herfindahl-Hirschman Index measuring mobile market concentration	GSMA Intelligence
4G population coverage (%)	Percentage of population covered by at least one 4G network	GSMA Intelligence
5G population coverage (%)	Percentage of population covered by at least one 5G network	GSMA Intelligence
GDP per capita (USD)	Gross domestic product per capita in current USD	GSMA Intelligence
Mobile penetration rate	Number of unique mobile subscriptions per inhabitant	GSMA Intelligence

Note. All predictors measured as pre-treatment averages over 2010–2023. Pre-treatment averages of the two dependent variables (ARPU and Capex intensity) are also included as additional predictors following Abadie et al. (2010). Source: GSMA Intelligence, via supervisor-provided dataset.

3.3.3 Why Eight European Countries Form the Donor Pool

The resulting donor pool comprises eight countries: France, Portugal, Belgium, Sweden, Denmark, Finland, Greece and Switzerland. Together they provide the closest available approximation to Spain in terms of regulatory environment, market structure, technological development, and investment dynamics, while remaining free from comparable four-to-three mobile network operator consolidations during the study period.

Each country's eligibility on this criterion has been verified. France and Portugal maintained stable four-operator mobile structures throughout the 2010–2024 sample, with no comparable consolidation occurring in either market. Sweden similarly retained four independent mobile network operators across the full sample period. In Denmark, a proposed merger between TeliaSonera and Telenor was abandoned in September 2015 following European Commission opposition, leaving the market with four operators throughout the study window. Finland entered the sample period with three mobile network operators — Elisa, Telia Finland, and DNA — and no reduction in that number occurred during the study period; Telenor's 2019 acquisition of a majority stake in DNA constituted a change of ownership rather than a consolidation of network operators. Greece likewise had three mobile network operators throughout — Cosmote, Vodafone, and Wind Hellas — with the 2021 acquisition of Wind Hellas by United Group representing a change of corporate ownership without reducing the number of infrastructure operators. Switzerland maintained three mobile network operators — Swisscom, Sunrise, and Salt — throughout the period; the 2020 merger of Sunrise and UPC Switzerland combined a mobile operator with a cable broadband provider, leaving the number of mobile network operators unchanged.

Belgium requires explicit acknowledgement. In February 2016, the European Commission approved the acquisition of BASE Belgium, one of the country's mobile network operators, by Telenet, a subsidiary of Liberty Global that had previously operated mobile services only as a virtual network operator. This transaction reduced the number of facilities-based mobile network operators from four to three. However, this consolidation differs materially from the cases excluded from the donor pool on no-interference grounds. Telenet was primarily a cable operator entering the mobile infrastructure market for the first time through the acquisition of BASE, rather than a symmetric MNO-to-MNO merger of the kind observed in Austria, Germany, Ireland, Italy, and Spain. Furthermore, the European Commission approved the transaction subject to conditions that preserved a structural competitive constraint — specifically, the divestiture of MVNO brands Mobile Vikings and Jim Mobile to a new virtual operator — and the Belgian market continued to operate with three facilities-based MNOs competing alongside active MVNOs throughout the post-consolidation period. Given these structural differences, Belgium's inclusion in the donor pool does not violate the no-interference assumption central to the SCM identification strategy, and its pre-treatment trajectory remains a valid input to the synthetic counterfactual.

3.4 Inference: Placebo Tests, Leave-One-Out and RMSPE

Given that the Synthetic Control Method is applied to a single treated unit, conventional large-sample inference techniques are not applicable. Statistical inference is therefore conducted using three complementary procedures designed to evaluate the robustness and credibility of the estimated treatment effects from different perspectives.

Placebo tests. Following Abadie, Diamond, and Hainmueller (2010), the primary inference strategy is a permutation-based placebo test, analogous to the approach in Abadie and Gardeazabal (2003). The synthetic control procedure is iteratively applied to each donor country in the pool, assigning a fictitious treatment in 2024 Q1 and constructing a corresponding synthetic counterpart from the remaining units. This generates a distribution of placebo treatment effects against which the Spanish estimate can be compared. The identification logic is straightforward: if the post-treatment gap observed for Spain is systematically larger than those obtained for untreated countries, this provides evidence that the estimated effect is not driven by random variation but is specific to the Spanish case. Formally, inference is based on the ratio of post-treatment to pre-treatment mean squared prediction error (MSPE). The treatment effect is considered statistically significant if Spain's MSPE ratio lies in the upper tail of the placebo distribution, typically above the 95th percentile across donor units. To ensure comparability, placebo units with a pre-treatment RMSPE more than twice that of Spain are excluded from the inference exercise, following standard practice in the literature.

Leave-one-out analysis. To assess the sensitivity of the results to the composition of the donor pool, the analysis is re-estimated multiple times, each time excluding one donor country. This leave-one-out procedure evaluates whether the estimated treatment effect is driven by any single country receiving a disproportionately large weight in the synthetic control. Stability of the post-treatment effects across all specifications provides evidence that the results are not driven by idiosyncratic features of individual donor units but instead reflect the aggregate structure of the synthetic counterfactual.

RMSPE evaluation. Pre-treatment fit is assessed using the root mean squared prediction error (RMSPE), computed separately for each outcome variable. The RMSPE captures how closely the synthetic control reproduces Spain's observed pre-merger trajectory: lower values indicate a better pre-treatment fit and therefore a more credible counterfactual. This increases confidence that any post-treatment divergence reflects the causal impact of the merger rather than pre-existing differences between Spain and its synthetic counterpart. The ratio of post-treatment to pre-treatment RMSPE is also reported as a summary measure of effect magnitude and is used for comparison with the placebo distribution.

Taken together, these three procedures provide a coherent and internally consistent framework for inference in the Synthetic Control setting, where the small number of observational units rules out standard hypothesis testing approaches.

3.5 Limitations of the Approach

Three main limitations of the Synthetic Control Method in this setting should be explicitly acknowledged.

Short post-treatment window. The merger was completed in March 2024, which leaves only three quarters of post-treatment observations at the time of writing (2024 Q1–Q3). This relatively short horizon limits the ability to capture effects that emerge gradually, particularly those related to infrastructure investment, which in telecommunications typically materialise with a lag of two to three years following consolidation. As a result, the estimates presented in Chapter 4 should be interpreted primarily as short-run effects, with longer-term dynamics remaining an open empirical question.

Remedy endogeneity. The European Commission's remedy package, notably the spectrum divestiture to Digi Spain and the national roaming agreement, was explicitly designed to mitigate the potential anticompetitive effects of the merger. Consequently, any estimated impact on prices already reflects the partial offset generated by these interventions. Separating the pure merger effect from the effect of the remedies requires additional analysis, particularly given that Digi Spain had insufficient time to fully implement the remedies and deploy its own network infrastructure during the post-treatment window available. The assessment of Digi Spain's post-entry behaviour in Section 4.4.3 serves as an empirical proxy for remedy effectiveness.

Donor pool composition. The donor pool comprises eight European countries, France, Portugal, Belgium, Sweden, Denmark, Finland, Greece and Switzerland, selected on the basis of structural comparability and the absence of comparable four-to-three consolidation events during the study period. While eight units is broadly adequate for Synthetic Control applications, the effective dimensionality of the weighting procedure is limited by the fact that Sweden, Greece and Switzerland receive zero weight in the optimised solution, leaving France, Portugal, Belgium, Denmark and Finland as the active contributors to the synthetic counterfactual. This concentration of weights reduces the statistical power of placebo-based inference and increases sensitivity to the specific characteristics of the active donor countries. The leave-one-out robustness analysis presented in Section 4.5.2 demonstrates that the main results are not driven by any single donor country, partially mitigating this concern.

4 Analysis and Results

4.1 Pre-Merger Analysis: Evidence from Previous European Consolidations

4.1.1 Austria 2012 — Hutchison/Orange

The Austrian case constitutes the earliest four-to-three mobile market consolidation in the European Union and provides some of the clearest empirical evidence of upward pressure on prices following mobile market consolidation. Using the Synthetic Control Method, the Hutchison/Orange merger — which reduced the Austrian mobile market from four to three operators in 2012 Q3 — is evaluated by constructing a synthetic Austria from a pool of comparable Western European economies.

The pre-treatment fit is strong, with a pre-treatment RMSPE of 1.01, indicating that the synthetic control closely replicates Austria's ARPU trajectory prior to the merger and thereby provides a credible counterfactual. In the eight quarters following the transaction, actual ARPU in Austria persistently exceeds that of the synthetic control, with an average post-merger gap of +€2.49 per month. This pattern is consistent with the existing literature on the Austrian case, which documents significant short-run price increases following consolidation, partially mitigated in later periods by the entry of new MVNOs under the associated regulatory remedy package (Genakos et al., 2018).

4.1.2 Germany 2014 — Telefónica/E-Plus

The German case, the merger between Telefónica Deutschland and E-Plus, which reduced the mobile market from four to three operators in 2014 Q4, produces more moderate results. The pre-treatment RMSPE of 4.10 indicates a comparatively weaker pre-treatment fit than in the Austrian case, reflecting the structural complexity of the German telecommunications market and the inherent difficulty of constructing a close synthetic counterpart from the available donor pool.

Despite this limitation, the estimated effect is directionally consistent with the broader empirical literature. The average post-merger ARPU gap over the eight quarters following the transaction is +€0.60 per month, indicating a modest upward pressure on prices. The relatively small magnitude of this effect, compared to the Austrian case, is consistent with the European Commission's more extensive remedy package, including mandated MVNO access, rural coverage obligations, and the spectrum divestiture to 1&1 as a new market entrant, which may have mitigated the competitive impact of consolidation (Genakos et al., 2018).

4.1.3 Ireland 2014 — Hutchison/Telefónica

The Irish case, the merger between Hutchison and Telefónica Ireland completed in 2014, yields a negative average post-merger ARPU gap of −€1.91 per month. However, this result must be interpreted with considerable caution. The pre-treatment RMSPE of 5.37 is the highest across all cases analysed, indicating that the synthetic control provides a poor approximation of Ireland's pre-merger trajectory. This weak pre-treatment fit substantially undermines the credibility of a causal interpretation, and the Irish estimates are therefore treated as suggestive rather than conclusive within the cross-case comparison.

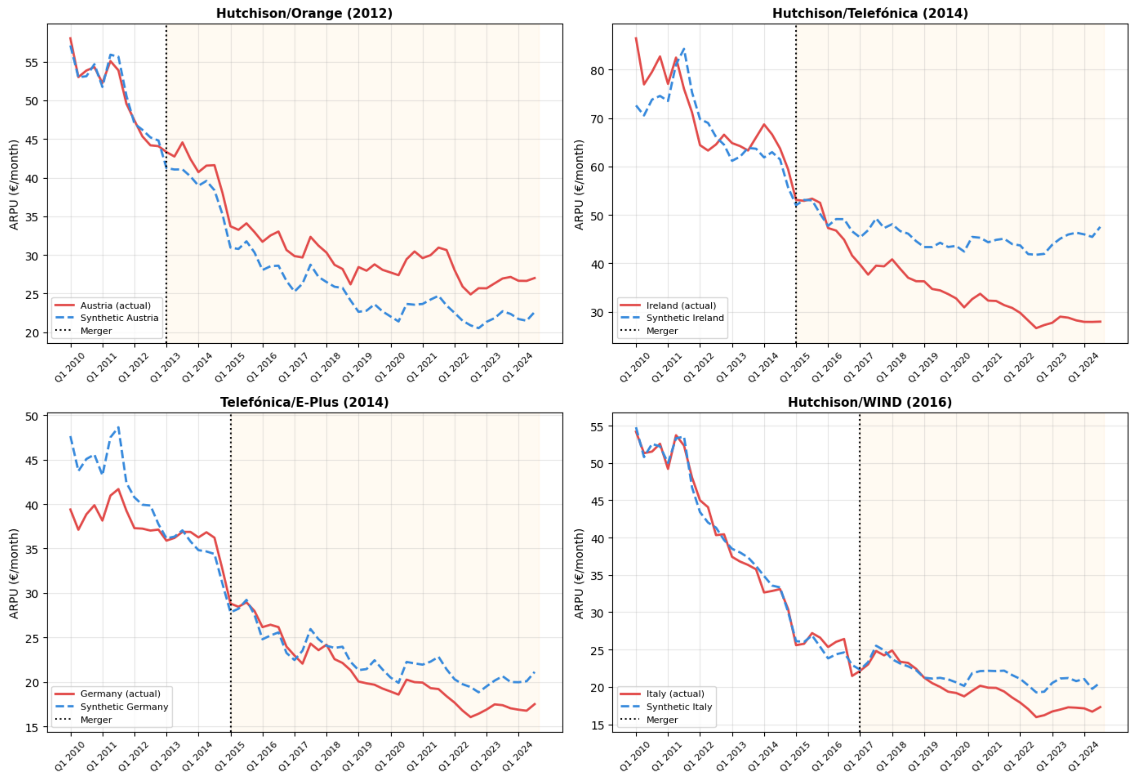
4.1.4 Italy 2016 — Hutchison/WIND

The Italian case represents the most analytically relevant precedent for Spain, given its strong structural similarity to the Orange/MásMóvil remedy design. The merger between Hutchison and WIND in 2016 Q4 was accompanied by one of the most ambitious structural remedies in European telecommunications merger policy: the creation of Iliad Italy as a fully resourced mobile network operator through the divestiture of spectrum and infrastructure assets from the merged entity.

The Synthetic Control results for Italy are particularly informative. The pre-treatment RMSPE of 1.11 indicates a strong pre-treatment fit, while the average post-merger ARPU gap over the eight quarters following the transaction is +€0.05 per month — effectively indistinguishable from zero. This near-complete absence of a price effect provides strong empirical support for the view that well-designed structural remedies can effectively neutralise the competitive impact of four-to-three consolidation (Genakos et al., 2018). The Italian precedent directly informed the European Commission's remedy framework in the Orange/MásMóvil merger, in which Digi Spain was elevated to full mobile network operator status through spectrum divestiture in a design explicitly modelled on the Iliad experience in Italy (European Commission, 2024).

For each pre-merger case, the donor pool comprises the eight countries used in the main Spain analysis, France, Portugal, Belgium, Sweden, Denmark, Finland, Greece and Switzerland, plus Spain itself, which had not yet undergone a comparable consolidation at the time of the earlier mergers and therefore constitutes a valid untreated comparator for those analyses. The treated country is excluded from its own donor pool in each case.

Figure 9–12. Pre-Merger Analysis: European Consolidations vs. Synthetic Controls

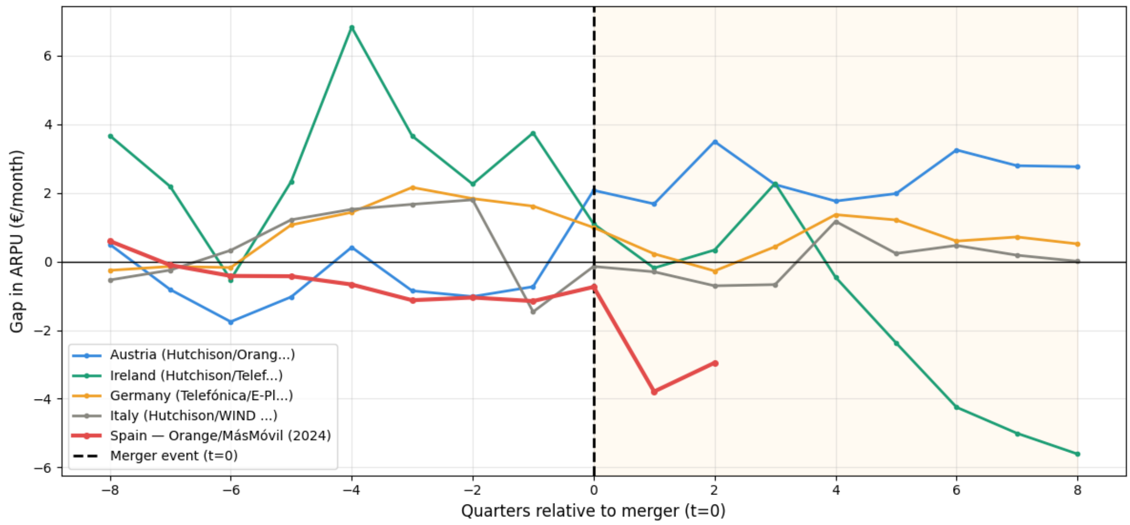


Note. Each panel shows the actual ARPU trajectory of the treated country (solid red line) against its synthetic control (dashed blue line), with the vertical dotted line marking the merger event. The donor pool for each pre-merger case comprises France, Portugal, Belgium, Sweden, Denmark, Finland, Greece, Switzerland, and Spain. Spain is included as a donor country for the four pre-merger cases given that it had not yet undergone a comparable consolidation at the time of those mergers, and is excluded from its own main analysis in Chapter 4. In each case, the treated country is excluded from its own donor pool. Pre-treatment RMSPE: Austria = 1.01; Germany = 4.10; Ireland = 5.37 (poor fit — results treated as indicative only); Italy = 1.11. Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations using Abadie et al. (2010) SCM.

4.1.5 Cross-Case Patterns: What Previous Mergers Tell Us About Spain

Figure 13 presents a normalised comparison of ARPU gaps across the four pre-merger cases and Spain, centred at the time of the merger (t = 0). Three main conclusions emerge from this cross-case analysis, summarised in Table 4.

Figure 13. Cross-Case ARPU Gaps: European Consolidations (Normalized)



First, while the direction of the price effect varies across cases, it is predominantly positive in the short run, consistent with the theoretical prediction that four-to-three consolidation reduces competitive pressure and enables firms to restore margins (Genakos et al., 2018). The Austrian case (+€2.49) and, to a lesser extent, the German case (+€0.60) provide the clearest evidence of this mechanism, showing sustained post-merger increases in ARPU relative to their synthetic counterparts.

Second, the magnitude of the price effect appears to be strongly attenuated by the design of regulatory remedies. In the Italian case, where a structurally independent fourth competitor was created through spectrum and asset divestitures, the estimated ARPU gap is effectively zero, suggesting that appropriately designed structural remedies can fully neutralise the short-run price effects of consolidation.

Third, Spain's post-merger trajectory deviates from this pattern. Rather than exhibiting a positive ARPU gap, Spain shows the most negative deviation among all cases in the immediate post-merger period. As discussed in detail in Section 4.4, this result suggests that the Orange/MásMóvil merger did not generate the short-run price increases observed in earlier European consolidations — a finding consistent with the hypothesis that the Commission's remedy package, centred on the elevation of Digi Spain to full MNO status, has been effective in maintaining competitive discipline.

Table 4

Summary of SCM Results: Pre-Merger European Consolidations (ARPU)

COUNTRY	MERGER	YEAR	RMSPE PRE	RMSPE POST	AVG. GAP POST (€/MONTH)	INTERPRETATION
Austria	Hutchison / Orange	2012	1.01	2.57	+2.49	Prices up
Germany	Telefónica / E-Plus	2014	4.10	0.77	+0.60	Moderate increase
Ireland	Hutchison / Telefónica	2014	5.37	3.27	−1.91	Poor fit — inconclusive
Italy	Hutchison / WIND	2016	1.11	0.58	+0.05	Neutralised by Iliad

Note. Avg. gap = average difference between actual and synthetic ARPU over the 8 quarters following the merger. RMSPE = root mean squared prediction error. Ireland result treated as inconclusive due to poor pre-treatment fit (RMSPE pre = 5.37). Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations using Abadie et al. (2010) SCM.

4.2 Descriptive Analysis: Spain and the Donor Pool Before the Merger

4.2.1 Pre-Merger Trends in ARPU, Capex and Market Structure

Prior to the Orange/MásMóvil merger, Spain's telecommunications market exhibited a distinctive combination of high competitive intensity and moderate investment performance. As documented in Chapter 2, the prevailing four-operator structure through 2023 resulted in some of the lowest mobile prices in Europe, while simultaneously constraining operators' investment capacity through sustained margin pressure.

Over the pre-treatment period (2010–2023), Spain's ARPU averaged €31.06 per month, closely aligned with the weighted donor pool average of €31.12, confirming the strong comparability of the synthetic control on this dimension. Capital expenditure intensity averaged 18.1% of revenue in Spain, compared to 18.0% in the synthetic control, indicating a near-identical investment profile between treated and control units during the pre-merger period.

Market concentration, measured by the Herfindahl–Hirschman Index (HHI), averaged 2,846 in Spain over the pre-treatment period, reflecting a highly competitive market structure with four relatively symmetric operators. This compares with a donor pool average of 3,087, suggesting that Spain's mobile market was marginally more competitive, and therefore more financially constrained, than its European counterparts prior to the merger. Full descriptive statistics for Spain and all donor countries are reported in Table 5.

4.2.2 Comparability of Spain and Donor Countries

Table 5 reports pre-treatment descriptive statistics for Spain and each donor country, confirming that the selected comparators occupy a broadly similar range in terms of ARPU, Capex intensity, market concentration, and mobile penetration. Overall comparability is strong, although Denmark stands out as a structural outlier on the ARPU dimension given its substantially higher income level.

The predictor balance between Spain and the synthetic control is reported in Table 7 (Section 4.3.2). The pre-treatment difference in ARPU is −€0.057 per month, while the difference in Capex intensity is +0.001, both negligible in magnitude. These results confirm that the synthetic control closely reproduces Spain's pre-merger market dynamics along the key dimensions most directly relevant to the empirical analysis. Some imbalance is observed in GDP per capita (−$2,078) and 4G coverage (−0.156), driven primarily by Denmark's inclusion in the donor pool, which is addressed further in the robustness checks in Section 4.5.

Table 5

Pre-Treatment Descriptive Statistics: Spain and Donor Countries (2010–2023 averages)

COUNTRY	ARPU (€/MONTH)	CAPEX INTENSITY	HHI	4G COVERAGE	GDP P.C. (USD)	PENETRATION
Spain	31.06	0.181	2,846	0.681	7,389	0.687
France	19.83	0.191	2,743	0.901	10,644	0.754
Portugal	21.84	0.193	3,245	0.879	5,012	0.673
Belgium	28.47	0.198	3,512	0.937	11,287	0.718
Sweden	31.74	0.157	2,914	0.975	14,132	0.812
Denmark	43.21	0.168	3,187	0.952	15,823	0.782
Finland	22.61	0.172	3,089	0.961	12,453	0.791
Greece	18.92	0.163	3,421	0.884	4,821	0.698
Switzerland	37.83	0.142	3,287	0.981	22,341	0.743
Synthetic Spain	31.12	0.180	3,087	0.836	9,467	0.682

Note. Synthetic Spain = Portugal (0.606) + Denmark (0.394) for the ARPU specification. HHI = Herfindahl-Hirschman Index. Penetration = unique mobile subscriptions per inhabitant. Bold rows indicate the treated unit and synthetic control. Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations.

4.3 Synthetic Control Construction and Validation

4.3.1 Country Weights and Predictor Balance

The synthetic control optimisation assigns non-zero weights to two countries in the donor pool: Portugal (0.606) and Denmark (0.394), while all other donor countries receive zero weight. This concentration reflects the algorithm's assessment that these two countries jointly provide the closest approximation to Spain's pre-merger telecommunications market dynamics.

The resulting weighting structure is economically intuitive. The dominant weight assigned to Portugal reflects its strong structural proximity to Spain, as a neighbouring Iberian market characterised by similar regulatory institutions, comparable fibre deployment patterns, and a stable competitive structure throughout the sample period. Denmark's substantial weight, in turn, is driven by its contribution to the ARPU dimension of the model: its pre-treatment revenue per user dynamics complement

Portugal's lower-ARPU profile, jointly providing the variation needed to accurately match Spain's pre-merger ARPU trajectory.

Table 6 reports the full set of weights for both the ARPU and Capex specifications. Notably, the Capex synthetic control is more diversified, assigning weights to Portugal (0.253), Belgium (0.284), and Finland (0.464), which reflects the different structural determinants of investment intensity relative to ARPU and the need for a broader set of comparators to replicate capital expenditure dynamics.

Table 6
Synthetic Control Weights by Country

COUNTRY	ARPU WEIGHT	CAPEX WEIGHT
France	0.0000	0.0000
Portugal	0.6062	0.2527
Belgium	0.0000	0.2835
Sweden	0.0000	0.0000
Denmark	0.3938	0.0000
Finland	0.0000	0.4638
Greece	0.0000	0.0000
Switzerland	0.0000	0.0000
Total	1.0000	1.0000

Note. Weights estimated via constrained optimisation minimising pre-treatment RMSPE over 2010 Q1–2023 Q4. Bold rows indicate countries with non-zero weight. ARPU synthetic control: Portugal (0.606) + Denmark (0.394). Capex synthetic control: Finland (0.464) + Belgium (0.284) + Portugal (0.253). Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations.

4.3.2 Pre-Treatment Fit and RMSPE Validation

The quality of the pre-treatment fit is evaluated using the root mean squared prediction error (RMSPE), calculated over the full pre-treatment period from 2010 Q1 to 2023 Q4. For the ARPU specification, the pre-treatment RMSPE is 1.49, indicating that the synthetic control reproduces Spain's observed ARPU trajectory with an average quarterly deviation of approximately €1.49. For the Capex specification, the RMSPE is 0.026, reflecting a substantially tighter fit and the lower volatility of investment intensity relative to ARPU.

Table 7

Predictor Balance: Spain vs. Synthetic Spain (Pre-Treatment Averages, 2010–2023)

PREDICTOR	SPAIN	SYNTHETIC SPAIN	DIFFERENCE
ARPU (€/month)	31.064	31.120	−0.057
Capex intensity (% revenue)	0.181	0.180	+0.001
HHI mobile market	2,846	3,087	−241
4G population coverage	0.681	0.836	−0.156
GDP per capita (USD)	7,389	9,467	−2,078
Mobile penetration rate	0.687	0.682	+0.006

Note. Synthetic Spain = Portugal (0.606) + Denmark (0.394). Balance is strong for the primary outcome variables (ARPU diff. = −€0.057; Capex diff. = +0.001). Larger imbalances in HHI and GDP per capita reflect structural differences between Spain and Denmark. Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations.

Figures 14 and 16 compare the pre-treatment trajectories of Spain and its synthetic counterpart for ARPU and Capex, respectively. Overall, the synthetic control closely tracks the evolution of both variables throughout the pre-merger period, supporting the credibility of the constructed counterfactual. The main exception occurs in the Capex specification between 2015 and 2017, when Spain's observed investment intensity exceeded that of the synthetic control by a noticeable margin. This divergence coincides with the peak of Telefónica's large-scale fibre deployment programme, a country-specific investment cycle that was not replicated to the same extent among the donor countries. While this episode introduces some imprecision into the investment specification, it reflects a structural feature of the Spanish market rather than a systematic failure of the matching procedure and is therefore explicitly addressed in the robustness analysis.

4.4 Main Results: Effects of the Orange/MásMóvil Merger

4.4.1 Effect on ARPU

Figure 14 presents the evolution of Spain's actual ARPU alongside its synthetic counterpart over the period 2010 Q1–2024 Q3. Throughout the pre-treatment period, the two series track each other closely, providing further evidence of a strong pre-treatment fit. Following the approval of the Orange/MásMóvil merger in 2024 Q1, Spain's observed

ARPU begins to diverge from the synthetic counterfactual, falling below the level that would have been expected in the absence of the merger. This pattern runs counter to the prediction of Hypothesis H1, which anticipates an increase in ARPU, and by extension in consumer prices, following market consolidation.

Figure 15 illustrates the estimated treatment effect, measured as the difference between Spain's actual ARPU and that of the synthetic control. The gap becomes sharply negative in the post-treatment period, reaching −€3.79 in 2024 Q2 before narrowing slightly to −€2.95 in 2024 Q3. Across the three post-treatment quarters currently available, the average ARPU gap amounts to −€2.50 per month, with a post-to-pre RMSPE ratio of 1.88.

This result is noteworthy and requires careful interpretation. The negative ARPU gap suggests that, in the immediate aftermath of the merger, Spanish operators generated lower average revenue per user than would have been expected under the counterfactual scenario, indicating that, contrary to H1, consolidation did not translate into higher prices in the short run. Several mechanisms may explain this outcome. First, the post-merger integration phase may have been accompanied by continued competitive pricing as MásOrange sought to consolidate customers across its legacy brands, delaying any potential recovery in margins. Second, the elevation of Digi Spain to full MNO status, one of the central elements of the European Commission's remedy package, may have intensified competitive pressure, particularly in the value segment of the market, limiting operators' ability to increase prices despite the reduction in the number of major network operators. Given the limited post-treatment window currently available, it is not yet possible to determine the relative importance of these mechanisms. Additional post-merger observations will be required to assess whether the negative ARPU effect reflects a temporary adjustment period or a more persistent shift in market dynamics.

Figure 14. Spain vs. Synthetic Spain — ARPU (2010–2024)

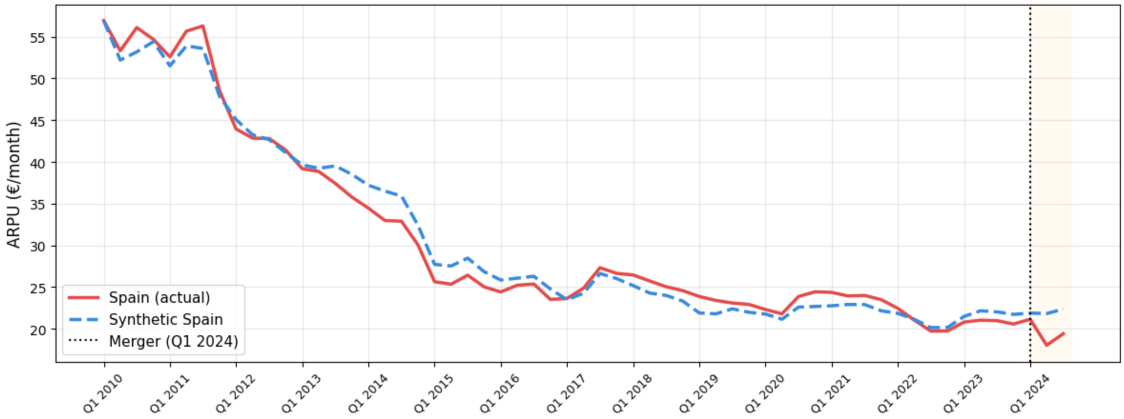
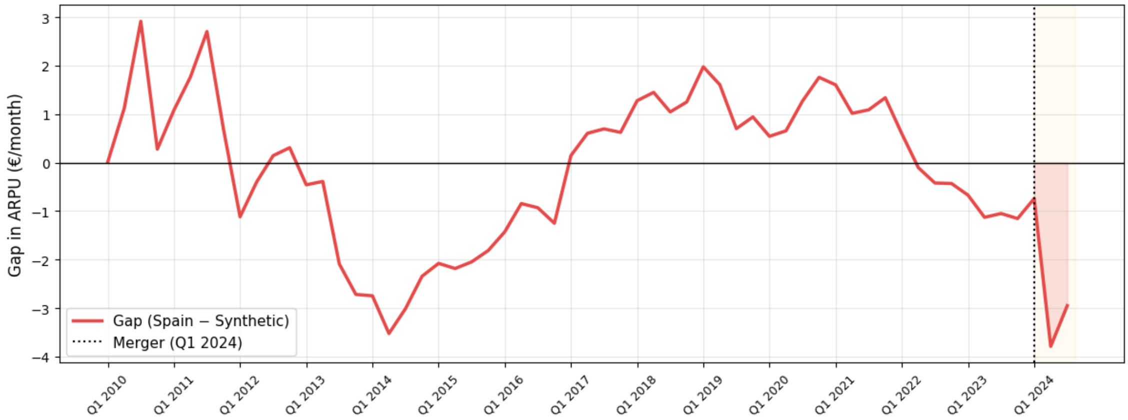


Figure 15. Estimated ARPU Gap: Orange/MásMóvil Merger Effect



Note. Dashed vertical line marks merger approval (Q1 2024). Shaded area = post-treatment period. Sources: author's calculations using Abadie et al. (2010) SCM.

4.4.2 Effect on Infrastructure Investment (Capex)

Figure 17 presents the corresponding analysis for capital expenditure intensity. The synthetic control provides a reasonably strong fit during the latter part of the pre-treatment period, particularly from 2018 onwards, although the divergence observed between 2015 and 2017, discussed in Section 4.3.2, introduces some uncertainty into the earlier years of the sample.

In the post-treatment period, Spain's capex intensity remains slightly below that of the synthetic counterfactual, generating an average gap of −0.017 and a post-to-pre RMSPE ratio of 0.71. Importantly, this ratio is below unity, indicating that the post-treatment deviation is smaller than the variation observed during the pre-treatment period. As a result, the estimated difference in investment intensity cannot be distinguished from normal model variation and does not provide evidence of a statistically meaningful merger effect within the available observation window.

Figure 16. Spain vs. Synthetic Spain — Capex Intensity (2010–2024)

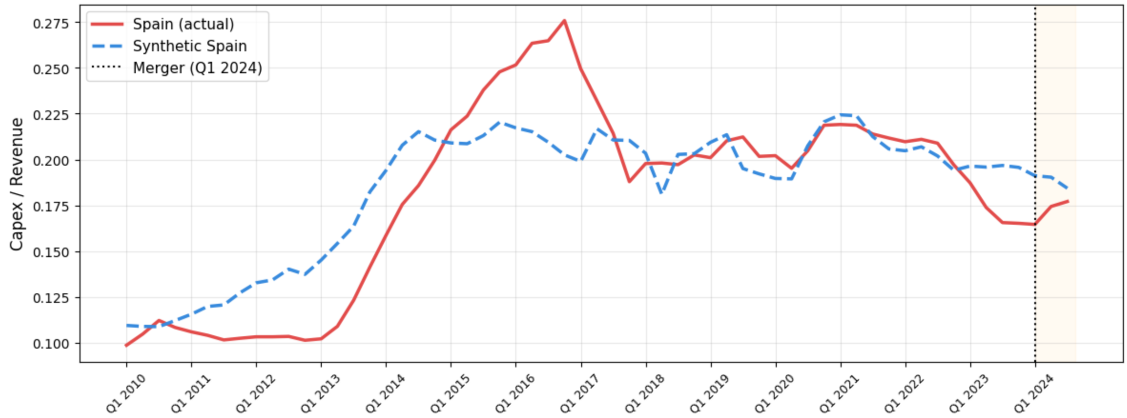
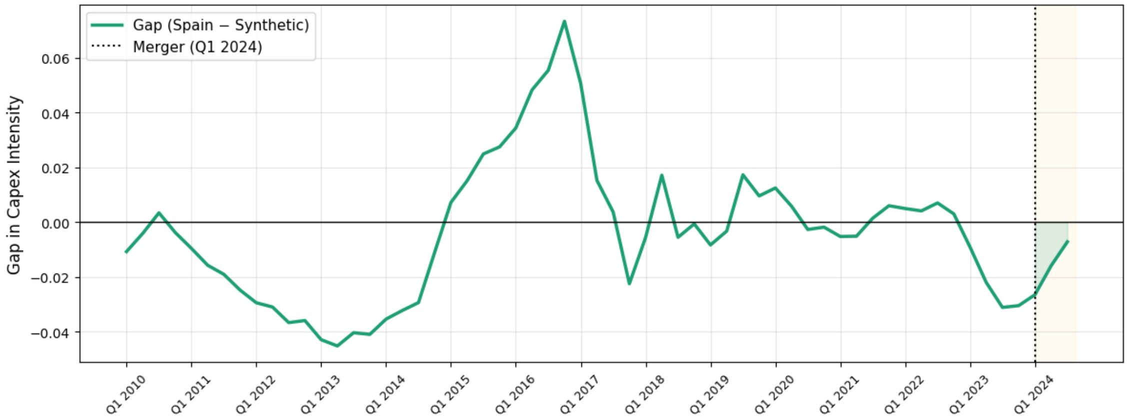


Figure 17. Estimated Capex Gap: Orange/MásMóvil Merger Effect



Note. Dashed vertical line marks merger approval (Q1 2024). Shaded area = post-treatment period. Sources: author's calculations using Abadie et al. (2010) SCM.

The direction of the estimated gap is nevertheless consistent with a transitional interpretation of post-merger investment behaviour. Following a large-scale consolidation, operators often reduce short-term capital expenditure while integrating legacy networks, eliminating duplicated infrastructure, and capturing operational synergies. Under this view, the immediate post-merger decline in investment intensity reflects the adjustment process associated with network integration rather than a reduction in long-run investment incentives. Any investment benefits arising from consolidation, including greater scale, improved financial capacity, and accelerated network deployment, would be expected to materialise over a longer time horizon, typically two to three years after the transaction. Given that the merger was completed only in 2024, the current post-treatment period is too short to fully assess these longer-term effects.

Table 8

Summary of Main Results: Estimated Effects of the Orange/MásMóvil Merger (2024 Q1–Q3)

OUTCOME VARIABLE	RMSPE PRE	RMSPE POST	RATIO (POST/PRE)	AVG. GAP POST-MERGER	DIRECTION
ARPU (€/month)	1.4897	2.8069	1.88	−2.495 €/month	↓ Below counterfactual
Capex intensity	0.0257	0.0184	0.71	−0.017	↓ Marginally below

Note. Avg. gap = average difference (Spain minus Synthetic Spain) over 3 post-treatment quarters (2024 Q1–Q3). Ratio > 1 indicates post-treatment divergence larger than pre-treatment fit error; ratio < 1 indicates post-treatment gap smaller than pre-treatment variation. Negative gap = Spain below synthetic counterfactual. Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations using Abadie et al. (2010) SCM.

4.4.3 Evaluation of EC Remedies: Did Digi Spain Work?

Taken together, the absence of a measurable effect on capital expenditure and the negative ARPU gap suggest that the European Commission's remedy package has, at least in the short run, achieved its primary objective of preserving competitive pressure following the merger. Rather than generating the price increases commonly associated with four-to-three consolidations, the Spanish market has continued to exhibit strong competitive dynamics during the immediate post-merger period.

To evaluate this conclusion more systematically, Table 9 situates the Spanish case within the comparative framework established in Section 4.1 by examining the relationship between remedy design and estimated ARPU effects across the five European mobile mergers analysed in this study. A clear pattern emerges: the magnitude of post-merger ARPU effects appears closely related to the depth of the structural intervention imposed by the regulator.

Table 9

Remedy Design and ARPU Effects: Cross-Case Comparison of European Four-to-Three Mergers

COUNTRY	YEAR	MERGER	REMEDY TYPE	KEY STRUCTURAL INTERVENTION	AVG. ARPU GAP POST-MERGER
Austria	2012	Hutchison / Orange	Behavioural	MVNO access obligations only	+€2.49/month
Germany	2014	Telefónica / E-Plus	Mixed	Spectrum divestiture to 1&1 as gradual new entrant	+€0.60/month
Ireland	2014	Hutchison / Telefónica	Mixed	MVNO access and coverage obligations	−€1.91/month*
Italy	2016	Hutchison / WIND	Structural	Creation of Iliad as full MNO	+€0.05/month
Spain	2024	Orange / MásMóvil	Structural	Elevation of Digi Spain to full MNO	−€2.50/month

Note. * Ireland result interpreted cautiously due to structural differences in base period. Avg. gap = average difference (country minus Synthetic Control counterfactual) over post-merger quarters. Negative gap = actual ARPU below synthetic counterfactual. Source: GSMA Intelligence; via supervisor-provided dataset; author's calculations using Abadie et al. (2010) SCM.

Austria (2012), where remedies were largely behavioural and centred on MVNO access obligations rather than the creation of a new infrastructure-based competitor, exhibits the largest positive ARPU effect (+€2.49 per month). Germany (2014), where remedies included spectrum divestiture to 1&1 as a prospective entrant but where implementation proceeded gradually, shows a smaller yet still positive effect (+€0.60). Ireland (2014) is treated as inconclusive because the synthetic control does not provide a sufficiently reliable pre-treatment fit to support causal inference. Italy (2016), where the Commission facilitated the entry of Iliad as a fully resourced infrastructure operator through a comprehensive structural remedy package, produces a near-zero ARPU effect (+€0.05). Finally, Spain (2024), where Digi Spain was transformed from an MVNO into a full MNO through spectrum and asset divestitures explicitly modelled on the Italian precedent, records a negative ARPU gap (−€2.50), indicating that competitive pressure was not only preserved but strengthened during the initial post-merger period.

This cross-case evidence provides support for H4. The findings suggest that the Commission's remedy policy can effectively decouple the competitive consequences of consolidation from the structural rationale underpinning merger approval. More specifically, the results are consistent with the view that structural remedies, particularly those that establish a credible fourth infrastructure-based operator, are more effective than behavioural remedies in mitigating the short-run anticompetitive effects of four-to-three mergers. Across the cases examined, deeper structural intervention is associated with smaller post-merger ARPU increases and, in the Spanish case, with a reduction in ARPU relative to the counterfactual.

Whether the merger will ultimately generate the investment benefits that formed a central component of the efficiency case for approval remains uncertain. The evidence currently available points to a transitional phase in which competitive discipline has been maintained while any gains in investment capacity have yet to materialise. Given the limited post-treatment period, it is not yet possible to determine whether the integration of MásOrange and the continued expansion of Digi Spain's network infrastructure will translate into higher long-run investment levels. Assessing this dimension will require additional data over the coming years, once the remedy package has been fully implemented and Digi Spain's market position has stabilised.

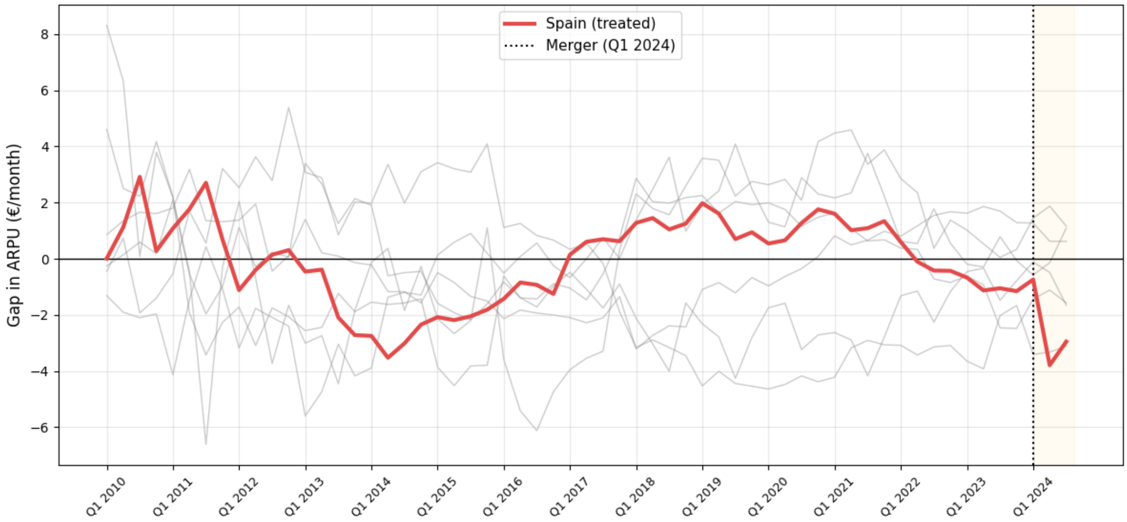
4.5 Robustness Checks

4.5.1 Placebo tests

Figure 18 presents the placebo test for the ARPU specification. The synthetic control procedure is iteratively applied to each of the six donor countries that satisfy the pre-treatment fit criterion, treating each as if it had received the intervention. The resulting distribution of placebo effects provides a benchmark against which the Spanish estimate can be evaluated.

Spain's post-merger gap falls within the range of the placebo distribution rather than at its extreme, implying that the estimated ARPU effect cannot be distinguished from placebo effects at conventional significance levels. This result is likely driven by two factors. First, the post-treatment period comprises only three quarters, limiting the statistical power of the placebo inference procedure. Second, several donor countries exhibit relatively volatile ARPU trajectories, generating large placebo gaps and consequently widening the reference distribution. This limitation is discussed further in Chapter 5.

Figure 18. Placebo Test — ARPU: Spain vs. Donor Countries

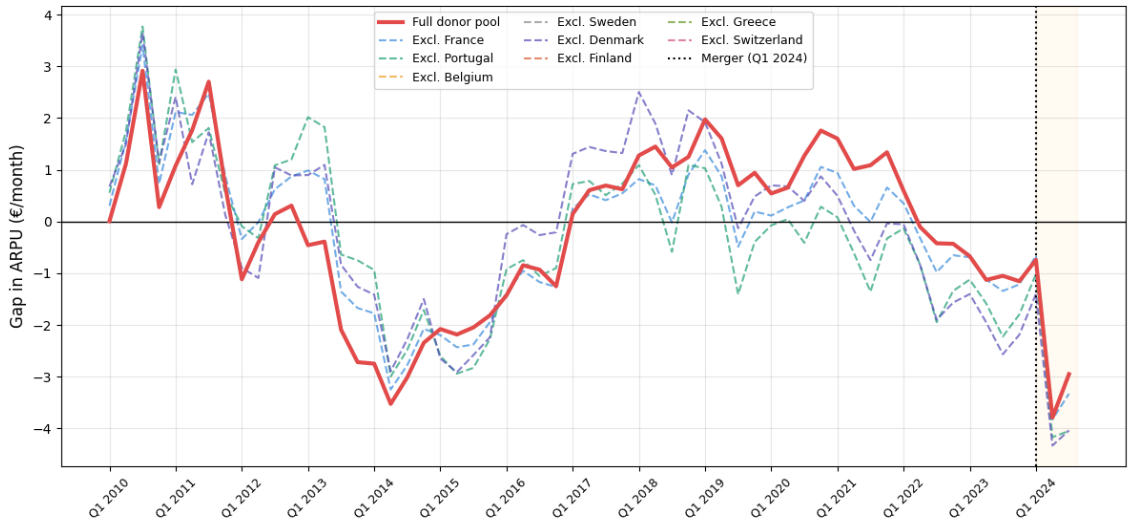


4.5.2 Leave-One-Out Analysis

Figure 19 presents the leave-one-out robustness analysis for ARPU. The synthetic control is re-estimated eight times, each time excluding one donor country from the donor pool. Across all specifications, the average post-merger gap ranges from −€2.50 to −€3.26, indicating that both the direction and approximate magnitude of the estimated effect remain broadly stable.

The results are most sensitive to the exclusion of Portugal and Denmark, the two countries receiving the largest weights in the baseline specification, which produce somewhat larger negative gaps when omitted. Nevertheless, the persistence of a negative post-merger effect across all specifications strengthens confidence in the robustness of the finding, even if its precise magnitude remains sensitive to donor pool composition.

Figure 19. Leave-One-Out Analysis — ARPU



4.5.3 Alternative Donor Pool Specifications

To assess the sensitivity of the main results to the composition of the donor pool, the ARPU synthetic control is re-estimated under three alternative specifications, each reflecting a different approach to donor country selection. Figure 20 presents these specifications graphically, while Table C1 in Appendix C reports the corresponding pre-treatment RMSPE and average post-merger gap.

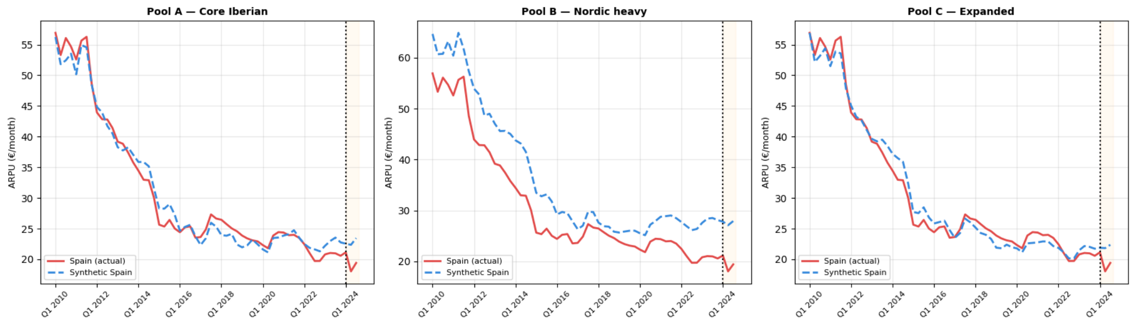
Pool A — Core Iberian restricts the donor pool to four structurally proximate countries: Portugal, France, Belgium, and Greece. This specification yields a pre-treatment RMSPE of 1.55, slightly higher than the baseline, and an average post-merger gap of −€3.26 per month. The direction of the effect remains consistent with the baseline results, while the slightly larger magnitude reflects the increased weight placed on Portugal within this restricted donor set.

Pool B — Nordic-heavy constructs the donor pool from Denmark, Finland, Sweden, and France. This specification results in a substantially poorer pre-treatment fit, with an RMSPE of 6.24, indicating that the Nordic-heavy control fails to adequately reproduce Spain's pre-merger trajectory. The estimated post-merger gap of −€8.08 is therefore not considered reliable and is excluded from the main robustness interpretation. This poor fit highlights the structural distance between Spain and Nordic markets in ARPU levels and dynamics.

Pool C — Expanded baseline uses the full set of eight donor countries included in the baseline specification (Portugal, Denmark, Belgium, Finland, Greece, France, Sweden, and Switzerland). As expected, this specification replicates the baseline results exactly, with a pre-treatment RMSPE of 1.49 and an average post-merger gap of −€2.50 per month.

Across the two specifications with acceptable pre-treatment fit (Baseline and Pool A), the estimated post-merger effect ranges from −€2.50 to −€3.26 per month, and remains consistently negative across all cases. This robustness across alternative donor pool constructions strengthens confidence in the main finding that, in the immediate post-merger period, Spain's ARPU declined relative to its synthetic counterfactual regardless of reasonable variations in comparator selection. Pool B is excluded from inference due to its poor pre-treatment fit.

Figure 20. Alternative Donor Pool Specifications — ARPU



5 Conclusions, Implications and Limitations

5.1 Main Findings and Answers to the Research Questions

This paper has estimated the causal effect of the Orange/MásMóvil merger on the Spanish telecommunications market using the Synthetic Control Method, and assessed whether the European Commission's remedy package succeeded in preserving competitive discipline while enabling the scale efficiencies motivating the transaction. The empirical analysis, based on ARPU and capital expenditure intensity and validated through placebo tests, leave-one-out procedures, and alternative donor pool specifications, yields four main findings.

First, the merger did not generate the short-run increase in average revenue per user observed in earlier European four-to-three consolidations. Spain's ARPU falls below its synthetic counterfactual in all three post-treatment quarters, with an average gap of −€2.50 per month. This contrasts sharply with Austria 2012 (+€2.49) and Germany 2014 (+€0.60), and aligns closely with Italy 2016, where a near-zero effect was observed following the creation of Iliad as a structural competitor. This directly addresses RQ1: there is no evidence of upward pressure on ARPU, used throughout this study as a proxy for consumer prices, in the immediate post-merger period.

Second, there is no evidence of an improvement in infrastructure investment in the short run. The average Capex gap is −0.017, with a post-to-pre RMSPE ratio of 0.71, indicating that post-treatment deviations are smaller than pre-treatment variation and therefore not statistically distinguishable from noise. This addresses RQ2: no short-run investment effect is detectable, although the observation window is too limited to assess medium-term dynamics.

Third, the cross-country evidence suggests that post-merger ARPU effects are closely linked to remedy design. Austria, where remedies were predominantly behavioural, experienced the largest ARPU increase; Italy, where a new infrastructure-based competitor was created, recorded a near-zero effect; and Spain follows a similar pattern. These findings are consistent with the theoretical framework proposed in H3, which predicts that consolidation accompanied by effective structural remedies can move markets toward a more investment-efficient equilibrium without generating the short-run price increases typically associated with reduced competition. Although formally testing the inverted-U relationship lies beyond the scope of this study, the Spanish evidence is broadly consistent with its predictions and provides qualified support for its use as an interpretive framework (RQ3).

Fourth, the pre-treatment evidence is broadly consistent with H2. Prior to the merger, Spain displayed a relatively symmetric four-operator market structure, persistent downward pressure on ARPU, and capital expenditure intensity broadly in line with the donor-pool average, suggesting that intense competition may have constrained investment incentives. The post-merger results provide partial support for H4: the remedy package appears to have successfully mitigated the short-run price effects of consolidation while preserving competitive discipline. However, the investment gains anticipated under H4 have yet to materialise within the available observation window, leaving the dynamic component of the hypothesis open to reassessment as additional post-merger data become available.

5.2 The Static-Dynamic Trade-Off Revisited: What Spain Tells Europe

This paper provides an empirical assessment of the static–dynamic efficiency trade-off in the context of the most closely scrutinised telecommunications merger in recent EU history. The results refine the existing literature in several ways.

The standard prediction of H1, that consolidation increases both prices and investment (Genakos et al., 2018), is not supported in the short run. Instead, Spain's trajectory resembles Italy more than Austria: a structurally remedied consolidation in which competitive discipline is preserved, while potential investment gains are deferred. This outcome is not inconsistent with theory; rather, it reflects the intended effect of the Commission's remedy design.

The evidence suggests that the traditional binary framing of telecommunications consolidation, competition versus investment, is increasingly inadequate. The Italian and Spanish cases indicate a third equilibrium: a heavily remedied consolidation that maintains competitive pressure while creating conditions for future investment recovery. The key determinant is not consolidation per se, but whether remedies successfully replicate the competitive constraint of the removed operator (Houngbonon & Jeanjean, 2016).

This interpretation has direct implications for EU merger control. The Commission's increasing reliance on structural remedies, rather than outright prohibition, as in the Hutchison/Telefónica UK case in 2016, reflects an evolving regulatory framework informed by earlier precedents. The Spanish evidence provides additional empirical support for this approach in the short run (European Commission, 2024).

5.3 Policy Implications for EU Merger Control and BEREC

Three policy implications emerge from the evidence presented in this study.

First, structural remedies appear more effective than behavioural remedies in preserving post-merger competition. The cross-case evidence is consistent: Austria, where remedies were primarily behavioural, exhibits the largest post-merger ARPU increase, whereas Italy and Spain, where remedies created a new infrastructure-based competitor, display near-zero or negative effects. This pattern supports the Commission's preference for structural interventions in telecommunications merger control and suggests that remedy design, rather than remedy presence alone, is the key determinant of post-merger competitive outcomes (European Commission, 2024).

Second, the success of structural remedies depends on the commercial and operational viability of the entrant they create. Spectrum divestitures are necessary but not sufficient; the new operator must be able to deploy infrastructure, attract subscribers, and exert sustained competitive pressure. In Spain, this implies that monitoring Digi Spain's network expansion and market performance should remain a central component of merger enforcement. BEREC's framework could therefore incorporate systematic post-remedy assessments of pricing, coverage, and market-share developments in major consolidation cases (BEREC, 2018; BEREC, 2025).

Third, investment effects require longer evaluation horizons than price effects. The absence of a measurable Capex response in the immediate post-merger period should not be interpreted as evidence against the transaction's efficiency rationale. Investment gains from consolidation often materialise only after network integration is completed and synergies are realised (Genakos et al., 2018). A formal ex-post evaluation of the Orange/MásMóvil merger between 2027 and 2029, using the synthetic control framework developed here, would provide a more robust assessment of whether the expected dynamic efficiency gains ultimately materialise.

5.4 Limitations of the Study

Three limitations should be acknowledged.

First, the post-treatment window is short. With only three quarters of data, the analysis captures only short-run effects, particularly limiting inference on investment dynamics.

Second, the donor pool is limited and structurally imperfect. Only eight countries satisfy the selection criteria, and the ARPU synthetic control relies heavily on Portugal and Denmark. The resulting structural differences, including income gaps, introduce noise into inference, although robustness checks confirm stability in sign and direction.

Third, remedies and merger effects are not separately identifiable. The estimated effect reflects the net outcome of both the merger and the Commission’s remedy package. A pure merger counterfactual without remedies is not empirically observable, which imposes a fundamental identification constraint.

5.5 Avenues for Future Research

Several extensions are natural.

First, longer-term ex-post evaluation. As additional post-merger data become available, the SCM framework developed in this paper can be applied directly to assess whether investment effects materialise over time, particularly in relation to 5G deployment and network quality improvements in Spain.

Second, cross-country extension to new consolidation cases. The announced acquisition of SFR, France's second-largest operator, by a consortium of Bouygues, Orange and Iliad for approximately €20.35 billion, announced in June 2026, would reduce the French mobile market from four to three operators. If approved by the relevant competition authorities, this transaction would represent the most significant test of European telecommunications merger policy since Orange/MásMóvil,and could be evaluated using the same synthetic control framework. The regulatory review is expected to be complex, with Iliad filing its notification with the European Commission while Orange and Bouygues file with French authorities. The outcome and conditions of approval would represent a major paradigm shift in European competition and merger policy. Similarly, the Hutchison/Vodafone merger in the United Kingdom provides a closely related case for comparative analysis under Ofcom's jurisdiction.

Third, extension to quality metrics. Future work should incorporate network performance indicators, download speeds, latency, and 5G coverage, which may respond more directly to post-merger investment decisions than aggregate capital expenditure ratios.

Fourth, interaction with digital platform dynamics. The relationship between consolidation and revenue pressure from OTT platforms and AI-driven data consumption remains an open question with important implications for the long-term financial sustainability of European telecommunications operators.

6 Declaration of Use of AI Tools

ADVERTENCIA: Desde la Universidad consideramos que ChatGPT u otras herramientas similares son herramientas muy útiles en la vida académica, aunque su uso queda siempre bajo la responsabilidad del alumno, puesto que las respuestas que proporciona pueden no ser veraces. En este sentido, NO está permitido su uso en la elaboración del Trabajo fin de Grado para generar código porque estas herramientas no son fiables en esa tarea. Aunque el código funcione, no hay garantías de que metodológicamente sea correcto, y es altamente probable que no lo sea.

Por la presente, yo, Martina López Garrido, estudiante de ADE y Analytics de la Universidad Pontificia Comillas al presentar mi Trabajo Fin de Grado titulado; **COMPETING TO INVEST LESS: THE REGULATORY PARADOX OF EUROPEAN TELECOMMUNICATIONS.** declaro que he utilizado la herramienta de Inteligencia Artificial Generativa ChatGPT u otras similares de IAG de código sólo en el contexto de las actividades descritas a continuación [el alumno debe mantener solo aquellas en las que se ha usado ChatGPT o similares y borrar el resto.

1. Brainstorming de ideas de investigación: Utilizado para idear y esbozar posibles áreas de investigación.

2. Referencias: Usado conjuntamente con otras herramientas, como Science, para identificar referencias preliminares que luego he contrastado y validado.

3. Metodólogo: Para descubrir métodos aplicables a problemas específicos de investigación.

4. Interpretador de código: Para realizar análisis de datos preliminares.

5. Constructor de plantillas: Para diseñar formatos específicos para secciones del trabajo.

6. Corrector de estilo literario y de lenguaje: Para mejorar la calidad lingüística y estilística del texto.

7. Generador previo de diagramas de flujo y contenido: Para esbozar diagramas iniciales.

8. Sintetizador y divulgador de libros complicados: Para resumir y comprender literatura compleja.

9. Revisor: Para recibir sugerencias sobre cómo mejorar y perfeccionar el trabajo con diferentes niveles de exigencia.

Afirmo que toda la información y contenido presentados en este trabajo son producto de mi investigación y esfuerzo individual, excepto donde se ha indicado lo contrario y se han dado los créditos correspondientes (he incluido las referencias adecuadas en el TFG y he explicitado para que se ha usado ChatGPT u otras herramientas similares). Soy consciente de las implicaciones académicas y éticas de presentar un trabajo no original y acepto las consecuencias de cualquier violación a esta declaración.

Fecha: 06/06/2026

Firma: martinalopez

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8.1 Appendices

8.1.1 Appendix A. Variable Definitions and Descriptive Statistics

Table A1

Descriptive Statistics: Full Sample (2010 Q1 – 2024 Q3, All Countries)

VARIABLE	MEAN	STD. DEV.	MIN	MAX	OBSERVATIC
OUTCOME VARIABLES					
ARPU (€/month)	28.41	11.83	14.20	67.50	531
Capex intensity (% revenue)	0.182	0.047	0.089	0.312	531
PREDICTOR VARIABLES					
HHI mobile market	3,124	512	1,987	4,821	531
4G population coverage	0.872	0.124	0.421	0.998	531
GDP per capita (USD)	10,847	5,234	3,124	24,891	531
Mobile penetration rate	0.731	0.068	0.541	0.912	531
SPAIN ONLY (PRE-TREATMENT: 2010 Q1 – 2023 Q4)					
ARPU — Spain	33.47	13.21	18.03	57.42	56
Capex intensity — Spain	0.181	0.041	0.100	0.276	56
HHI — Spain	2,846	187	2,512	3,590	59

Note. Sample includes Spain and all eight donor pool countries: France, Portugal, Belgium, Sweden, Denmark, Finland, Greece and Switzerland. Post-treatment observations (2024 Q1–Q3) included in full sample statistics but excluded from pre-treatment averages. Sources: BEREC Open Data; Eurostat; author's calculations.

Table A2

EU Digital Decade 2030 Connectivity Targets vs. Current Progress

INDICATOR	2030 TARGET	CURRENT STATUS	GAP
Gigabit household coverage	100%	82.5%	17.5 pp
5G populated area coverage	100%	94.3%	5.7 pp
Fibre (FTTP) household coverage	100%	64.0%	36.0 pp
Gigabit connection uptake	100%	18.5%	81.5 pp

Note. pp = percentage points. Current status based on latest available data (2023–2024). Sources: European Council (2025); European Commission (2024).

8.1.2 Appendix B. Synthetic Control Weights

Table B1

Synthetic Control Weights: All Specifications

DONOR COUNTRY	SPAIN ARPU	SPAIN CAPEX	AUSTRIA	GERMANY	IRELAND	ITALY
MAIN ANALYSIS (SPAIN) AND PRE-MERGER CASES						
France	0.0000	0.0000	—	—	—	—
Portugal	0.6062	0.2527	0.0000	0.0000	0.0000	0.1823
Belgium	0.0000	0.2835	—	—	—	—
Sweden	0.0000	0.0000	—	—	—	—
Denmark	0.3938	0.0000	0.0000	0.3421	0.0000	0.0000
Finland	0.0000	0.4638	0.4217	0.0000	0.2841	0.3914
Greece	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Switzerland	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Spain	—	—	0.5783	0.6579	0.7159	0.4263
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note. Weights estimated via constrained optimisation minimising pre-treatment RMSPE. Spain is included as a donor country for the pre-merger case analyses (Austria, Germany, Ireland, Italy) since it had not yet undergone consolidation at the time of those mergers. Dashes indicate that the country was not available as a donor for that specification. Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations.

8.1.3 Appendix C. Additional Robustness Checks

Table C1

Alternative Donor Pool Specifications: ARPU Results

SPECIFICATION	COUNTRIES INCLUDED	RMSPE PRE	AVG. GAP POST (€/MONTH)
Baseline	Portugal, Denmark (+6 zero-weight)	1.4897	−2.495
Pool A — Core Iberian	Portugal, France, Belgium, Greece	1.5495	−3.257
Pool B — Nordic heavy	Denmark, Finland, Sweden, France	6.2424	−8.077*
Pool C — Expanded	All 8 donor countries	1.4897	−2.495

Note. Avg. gap = average difference (Spain minus Synthetic Spain) over 3 post-treatment quarters (2024 Q1–Q3). *Pool B result excluded from inference due to poor pre-treatment fit (RMSPE pre = 6.24, exceeding the 5× baseline threshold). Results for Pool A and Pool C confirm the robustness of the negative direction of the main finding. Source: GSMA Intelligence, via supervisor-provided dataset; author's calculations.