POLITECNICO DI TORINO

Collegio di Ingegneria Gestionale

Master's degree
in Engineering and Management

Thesis for the master's degree

Merger Simulations in the Mobile Industry: Methods and Applications

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March 2023

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Abstract

The telecommunications sector plays a key role in the development of a country's economy, especially in an era of complete digitization. Today more than ever, after experiencing the lockdown caused by Covid, we became aware of the importance of these services. The enabling and facilitation of the connection between individuals has gone from being a service to offer trying to minimize the expenses associated with it, to being a key asset to be developed with a view to future progress. In fact, in order to keep up with technological development, the main market players have realized that they must necessarily invest large amounts of money in the network infrastructure.

Also for this reason, in recent years there has been a consolidation of the market witnessed by a large number of requests for mergers and acquisitions in Europe and worldwide. The main regulators have therefore had to work hard to try to avoid possible damage to the collective well-being, analyzing in detail a large number of cases. Studies carried out in recent years have shown that most of the estimates made during the assessment of the merger show a possible general increase in prices, resulting in a reduction in welfare, which is why, often, mergers are only approved by introducing protective measures. Moreover, reanalyzing the same cases several years after the realization of the fusion, comes confirmed like, in the majority of the situations, this leads to having a negative impact on competition. The role of the institutions in trying to protect these effects is therefore fundamental. This task is extremely delicate, since the rules and conditions imposed must be able to preserve the continuous technological development of the sector, without hindering innovation.

Trying to put ourselves in the role of the regulator, we tried to analyze the Thai case of real merger, which occurred recently. Using the necessary approximations, it emerged that the merger could lead to an increase in prices, but that the latter is not critical for the overall wellness.

However, it should be noted that it is extremely complex to obtain perfectly reliable results only using quantitative estimates since the variables to be considered are many. For this reason, the analysis carried out suggests only a potential scenario and should therefore be seen as a useful support in the decision-making process.

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1 Introduction

1.1 Recent changes in the telecommunications industry

The telecommunications sector is currently facing major changes in user behavior and preferences. For a long time, in the past, the focus of this sector has turned out to be the technical correctness of signals transmission and long-distance information, thus allowing users to send messages or make long-range calls. Currently, however, the sector has gone through a period of major transformations and what is mentioned above has become a commodity. Technological development has resulted in the introduction of innovations that have changed people's behavior. The spread of mobile devices (smartphones), of social networks and the presence of increasingly cutting-edge operating systems have meant that the creation of value in telecommunications has switched from the pure transmission of information to the offer of high-speed data traffic and connections. This is possible thanks to high-transmission bandwidths, which require high investment to be obtained. At first, it was thought that following the introduction of smartphones, the implementation of these investments would have allowed telephone operators to increase average revenue per user (the price). Instead, the main consequence has been the facilitation of the market introduction of new services by over the top (OTT) providers. The latter are those media companies that offer services and content directly via the Internet, bypassing traditional distribution systems, such as digital terrestrial or satellite in the case of TV. They provide television, messaging, and voice services without owning dedicated facilities or networks for the transmission of their content, but leveraging the investments made by telephone companies to provide high bandwidths transmissions to users.

The problem for telecommunications companies, therefore, is not only that these providers exploit their investments without participating, but also that in most cases they offer alternative services, able to completely replace traditional ones (eg: Whatsapp has replaced SMS and Skype has significantly reduced the number of traditional calls). Relevant and key role in this progressive shift is to be attributed to the regulator, whose choices have had a strong impact from the point of view of competition and price. Regarding the first, the entry of these OTT providers has never been impeded and the possibility of entering the market has also been granted to MVNO, which are mobile virtual network operators, who offer telephony services without having the necessary network infrastructure, using instead part of the one of a real mobile operator (in figure 1 the progressive increase of the market

value of the MVNO is shown). Related to the second, instead, several impositions were made to limit its value. For example, the maximum value of mobile termination rates, MTR, i.e those tariffs that a telephone operator must pay to another so that its users can call those of the other operator, has been changed and it has been imposed to the companies to offer free roaming service to customers abroad.

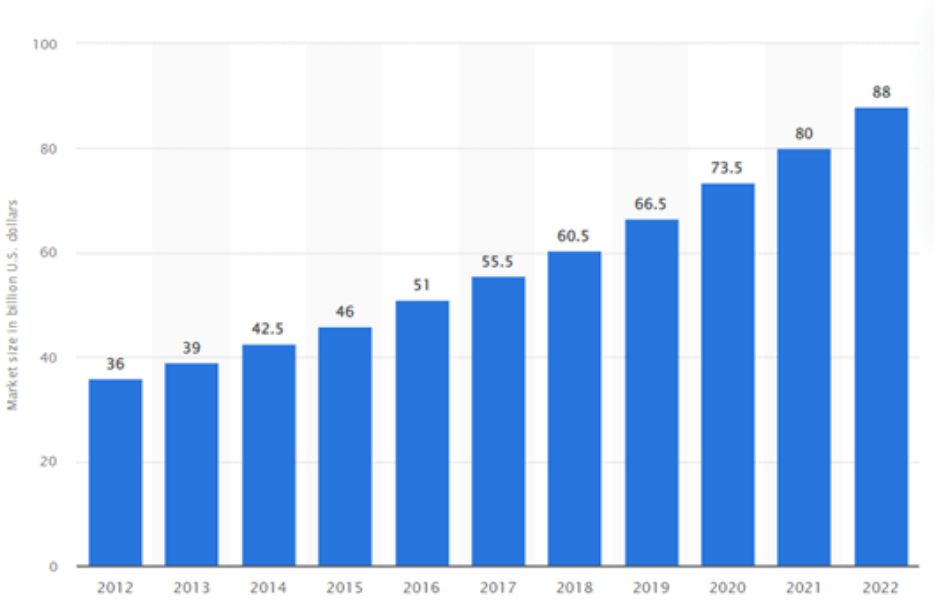

Figure 1: Size of the global MVNO market from 2012 to 2022 (in billion U.S. dollars)

The telephone companies are therefore facing the need to change their strategy and their business model in order to get out of this situation. There are several possible alternatives as a response to the increasing presence of OTT providers. It is in fact possible to accept OTT services, strong in the fact that their use will lead customers to request tariff plans with a greater number of data (thus more expansive); attack or hinder these providers, blocking or making unnecessary the use in the eyes of its customers; develop similar OTT-like services internally or eventually establish a partnership with them, in order to exploit their services and the visibility of their brand.

Despite this, the price will remain the main driver, the primary variable that customers will consider to take their decisions in this area. The increase in competition observed in recent years (with OTT and MVNO) has led to a lower concentration of the market and an even more downward pressure on prices. All this has led to a gradual decrease in the profitability of companies. As shown in the chart below (figure 2), in fact, due to the high investment required (which increases costs) and the fact that the regulator has not allowed to fully offset these costs

through price rises, the difference between ROIC (return on invested capital) and WACC (weighted average cost of capital) is steadily decreasing.

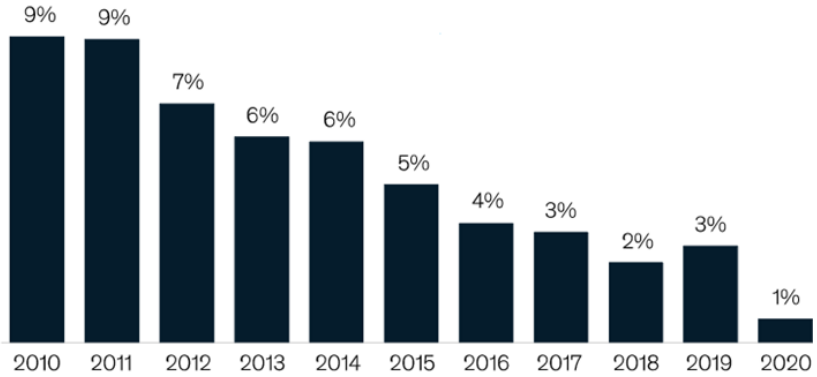

Figure 2: Roic including goodwill minus WACC, %, n=111 global telcos

As a result, one of the solutions most adopted by operators to maintain their economic strength or to achieve growth that can strengthen their market position is the realization of mergers, acquisitions and partnerships. While in the past the operators of the telecommunications world were mainly focused on their business, trying to carry it out neglecting and not taking into account the requests for partnerships with other companies, the situation has now changed and even the major players are more open about the possibility of establishing such strategic agreements. These actions give companies the opportunity to diversify their products or services, generating greater advantages if the two players in question do not have completely overlapping characteristics, but are characterized by some nuances that can distinguish them. In addition, another substantial advantage is the opportunity to expand the customer base in existing markets, thus attempting to increase margins, which are in continuous decline in this sector. This is possible thanks to the aggregation of volumes (which contributes to the significant development of economies of scale and the reduction of the average cost of product development) and the better alignment of prices. The merger between companies, in fact, allows to increase the concentration of the market, reducing its competition and relaxing the high pressure on prices.

1.2 Aim and delimitation

The aim of this report is to complete the detailed analysis of a real merger case in the telecommunications sector. Specifically, we chose to focus and observe more closely the events that are characterizing the Thai landscape nowadays. This represents only the final step made within this elaboration, to which it has been possible to arrive only after having introduced and thoroughly explored some key concepts in this context. In fact, only starting from a theoretical description of the merger's phenomenon and of the relative main instruments of analysis and going through the examination of some real cases already concluded, it has been possible to realize this last chapter. We have not simply listed the formulas used in most of the cases, on the contrary, we have tried to trace their origin, decomposing the expressions to which several authors have come over time, gradually relaxing the initial hypotheses introduced for the development of the "basic" case and re-arranged everything within a single section.
The importance of this type of analysis must be emphasized because the operations of mergers and acquisitions are a tool used by companies in order to gain a competitive advantage over their rivals, which often, however, also damages the final consumer's surplus. For this reason, the goal is to get in the shoes of the regulator, evaluating the correctness of the operation through the classic tools and indices, also applying to the results some strength tests, to verify the stability of the latter.

The project was carried out by treating and describing real applications related to the European area (Germany, Ireland, Austria...), however it is possible to say that the analysis tools exposed are also applicable outside these regions. It is also for this reason, i.e. to prove that they are universal and not limited to a specific area, that it has been decided to investigate in first person the Thai case. This was also possible thanks to the fact that both the professor supervisor and the one who is the co-supervisor of our thesis were working in parallel on a project for the local regulatory authority.

In particular, after this first general introduction and exposition of the work done, in the second chapter, the general economic theory concerning mergers and their influence on the sector and on the overall welfare will be outlined.
In the third chapter, the main quantitative ex-ante evaluation tools, useful to support the regulator's decisions, will be dealt with in detail; there will also be some examples of real cases analyzed by the European Commission.
In chapter four, ex-post case studies of several mergers in recent years will be presented, using the main methods of econometric evaluation.

Finally, in chapter five, the recent Thai merger between True and Dtac will be discussed, trying to apply the methodologies seen in chapter three, in order to estimate the impact of the latter on competition.

2 Theoretical background

2.1 Merger theory

In this section, situations which are initially managed separately by two companies and which, following a particular event, will be jointly managed by a single decision-maker will be analyzed and described. The main tool through which it is possible to have a reallocation of company assets is the Corporate Control Market, a market that allows mergers and acquisitions of control packages between companies. As shown below (figure 3), the merger phenomenon typically has an undulatory trend over time.

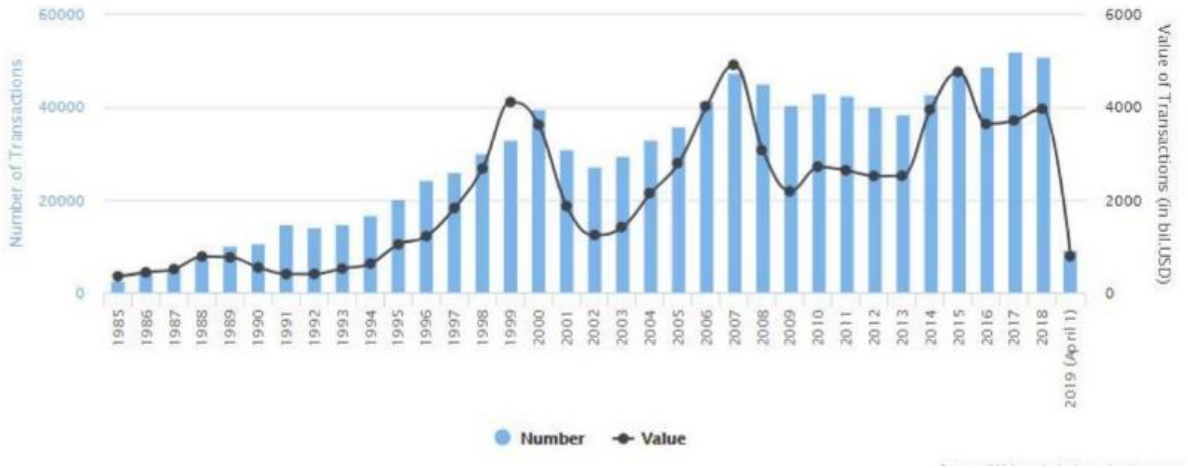

Figure 3: Number and value of merger and acquisition between 1985 and 2019 (April)

Each wave is linked to a particular historical event or moment of euphoria that pushed companies to merge. Looking at the image, for example, we see a period of progressive peak between 1994 and 2001. This is due to the decline in interest rates, combined with the growing popularity represented by economies of scale and the fact that during the years' 90 Western economies have been the protagonists of the longest period of expansion since the World Wars. As a result, the reaction of companies to the growing demand has been the intensification of the number of M&A. This has led to numerous technological changes and to the realization of most of the largest M&A deals in history. The end of this wave came rather abruptly, in the year 2000, with the bursting of the internet bubble. Another example is the one emerged between the years 2004 and 2007, in which, thanks to loosened antitrust rules and innovation regarding credit derivatives, a new wave of mergers has been realized. Developed largely due to increasing globalization and shareholder demands, it ended following the 2007 economic crisis.

This type of operation leads to an internal reduction in the number of participants on the market and, consequently, also has effects on competition, inducing changes in prices, quantities and profits made. Typically, it is good practice to try to encourage the transfer of production assets from individuals with poor administration and management skills to others with greater abilities, capable of developing efficiencies that can lead to an improvement in overall well-being.

Horizontal mergers, i.e., those relating to companies operating on the same market, cause some effects on the market itself. The main one concerns the increase in market power. Specifically, considering a duopoly in which the two competing companies (in relation to a homogeneous product) decide to merge, a reduction in the overall quantities produced will be observed. In fact, these will pass from being equal to $Q_d = Q_1 + Q_2$ to being Q_m (monopolistic quantity), which is, by definition, lower than the duopolistic quantity. Consequently, this variation will also have an impact on the overall prices, which will become the monopoly prices $p_m > p_d$, thus reducing the overall welfare (effect shown in figure 4).

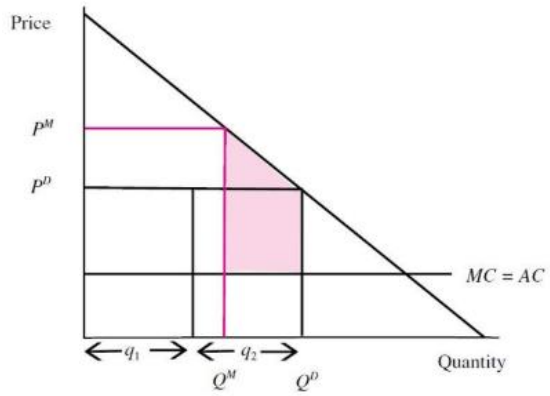

Figure 4: Competitive issue due to merger between duopolies

Observing that, when in an oligopoly with N firms, K firms merge, $N' = N - K + 1$ remain on the market and given the demand and production functions:

$p = \alpha - \beta(Q_1 + Q_2)$ and $C = c_i q_i$

The formula that allows us to observe the overall reduction in surplus, if $K = 2$ symmetrical firms merge, turns out to be:

$$\Delta S(N) = -\frac{(\alpha - c)}{2\beta}\frac{(1 + 2N)}{(1 + N)^2 N^2}$$

This negative effect on total welfare is the greater the smaller the number of initial companies on the market (it is worse if two companies merge in a duopoly, than in an oligopoly with 7 companies). Furthermore, the presence of β as a denominator indicates that as the elasticity of demand increases, the negative variation on the surplus decreases.

The example just seen analyzes the case in which there are symmetrical firms, with a linear cost function and in which the costs C remain unchanged following the merger. In this scenario, there are three direct consequences:

- If, following the merge, no benefits are obtained in terms of production efficiency (effect observable through a decrease in the marginal cost of production), this determines a decrease in the quantities produced by the merging parts.
- Following the merger of two companies, the non-merged parties increase their level of production (this effect is since their reaction functions are strategic substitutes), but the total quantity placed on the market is lower than the initial one.
- If the merged parties do not benefit, in terms of efficiency, thanks to the merge, they will still have an increase in profit. This occurs in the face of a decrease in overall welfare, which in turn is determined by a loss of consumer surplus.

However, it can usually be expected that thanks to mergers and acquisitions there will be a reorganization of production assets, which leads to a consequent cost efficiency. If the cost structures of the merged entities were asymmetrical, the closure of the plant characterized by lower efficiency would be observed, obtaining a lowering of the average production cost. Or again, economies of scale and efficiencies could be generated, allowing a post-merger production cost lower than the minimum of the two individual costs of the pre-merge companies. In general, there are two possible cases:

- The reduction in production costs is so high that it is possible to set lower prices, creating surplus for both the consumer and the company. To make this possible, the post-merger production cost must be lower than the lower of the two pre-merge costs.
- There is a significant cost reduction, but it is not enough to bring down prices. In this case, the firm's surplus would increase, but the one of the consumers would decrease.

The latter is the most frequent case and gives rise to the Williamson trade-off (shown in figure 5):

B represents the increase in firms' surplus, while A represents the decrease in the one of the consumers. The trade-off between A and B allows us to understand how overall welfare evolves following the merger. If $B - A > 0$, then surplus has been created, vice versa, if $B - A < 0$, then surplus has been destroyed and no value has been generated.

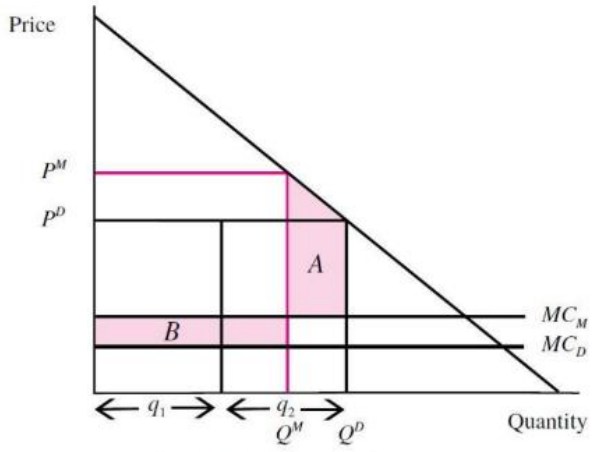

Figure 5: Williamson tradeoff

In order to obtain an overall surplus increase, necessary but not sufficient condition is that the average cost of production of the entire market, not only of the K firms participating in the merger, must be reduced. Given that the optimal response of the companies that do not participate in the merger is to increase the quantities produced, the merge will also have an impact on their strategic choices. Therefore, since the general average cost of production is a weighted average of the individual values characterizing the firms, their choices must also be taken into account before any conclusions can be drawn. In fact, a merge operation could be useful and advantageous in terms of general surplus even if there is no cost reduction of the parties directly involved in the merger. For example, if the merger were to take place between two small and inefficient companies, this would lead to a decrease in their joint production, which would have a lower impact on the overall average cost, which, instead, would be affected to a greater extent by the other companies operating, which might be more efficient.

The Farrel-Shapiro formula allows us to analyze the overall surplus variation following a merge:

$$\Delta\, Collective\ Surplus = \Delta\pi_{mf} + \sum \Delta\pi_{nmf} + \Delta CS$$

The first term represents the internal effect of the merge (π of merging firms), i.e., the increase in surplus of the merged companies (term always positive), the second and the third instead take the name of external effect (it is necessary to try to limit

the negative impact of this last effect in order not to destroy surplus. It depends on π of non-merging firms and on Δ consumer surplus). If there is a decrease in the general average cost of production, all three addendums would have a positive impact and an increase in welfare would be obtained. If, on the other hand, we are in the case of Williamson trade-off, the third addendum would have a negative impact.

It is possible to summarize what has been expressed so far through an example. Considering three companies operating on an oligopolistic market, characterized by the following demand functions and unit costs:

$$p = 1 - Q \text{ and } \begin{cases} c_1 = 0.1 \\ c_2 = 0.35 \\ c_3 = 0.4 \end{cases}$$

And supposing that firm 2 and 3 merge, managing to produce at a unit post-merger cost of $c_{23} = 0.35$, researching the pre and post merge equilibrium, the following results are obtained.

As expected, the optimal response to the merger by firm 1 (the one outside the merge) is to increase the quantities produced, vice versa, the new entity formed after the merger, will decrease the quantities realized. This happens because, following the merger, firm 23 produces with marginal cost equal to what firm 2 had before the merge, which means that there has not been an improvement in efficiency of a size sufficient to push the company to increase production volumes. Furthermore, by inserting the quantities into the demand functions and deriving the prices, we can observe that these have increased. This means that it is the case of the Williamson trade-off, in which the consumer surplus has decreased, in favor of an increase in the firm's surplus. Overall welfare, however, appears to have increased, so the direct effect generated by the delta surplus of the enterprises involved in the merge, added to the delta profit recorded by the uninvolved enterprise, is higher than the negative contribution of the shortfall in the consumer surplus.

2.2 **Performance conduct structure.**

We have seen how merge changes profoundly the strategic choices of the players and the market structure. In the following section we want to examine how historically the regulator examined the reference sector, to safeguard the overall wellness. To be able to understand the dynamics of the sector, the bodies in charge used to use the “Structure-Conduct-Performance” approach. Where the structure

substantially indicates the number of companies and their concentration, the conduct relates to the strategic choices of the companies and the performance is linked to the economic results.

Starting from the latter, a useful tool that will then be discussed in the following sections is the so-called Lerner Index:

$$L_i = \frac{p - c_i'(q_i)}{p}$$

It measures the ability to extract rent (price minus marginal cost) in relation to the price.

In the simple monopoly case, this indicator is equal to the inverse of the price elasticity of demand:

$$\frac{\partial \pi}{\partial q} = p - c'(q) + q\frac{\partial p}{\partial q} = 0$$
$$\rightarrow L = \frac{1}{\epsilon_p}$$

In the oligopolistic case instead (considering the Cournot model since Bertrand's case is trivially $L = 0$) the indicator assumes a different value, linked to the market share of the single α_i firm:

$$\frac{\partial \pi_i}{\partial q_i} = p - c_i'(q_i) + q_i\frac{\partial p}{\partial q} = 0$$
$$\rightarrow L_i = \frac{\alpha_i}{\epsilon_p}$$

Consequently, it is also possible to calculate an average market Lerner index, calculated as the weighted average on the market shares of the Lerners of the companies belonging to the sector:

$$\bar{L} = \sum_{i=1}^{N} \alpha_i L_i = \frac{1}{\epsilon_p}\sum_{i=1}^{N} \alpha_i^2 \quad (1)$$

The structure, as mentioned above, was instead measured using concentration indicators, so that they included not only the number of competing firms but also the inequalities between them. Since 1980, the search for an indicator that summarize these two pieces of information started; it was mainly based on market shares and on three fundamental principles:

- Anonymity: if two companies exchange market shares, the indicator must remain unchanged.
- Transfer: if the vector of market shares changes as a result of a transfer of shares from a smaller company to a larger one, the indicator must increase.
- Symmetry: in the case of a symmetrical sector (firms with the same shares) the indicator should decrease as the number of firms increases.

The family of indicators that respects these three principles is the following:

$$CI = \sum_{i=1}^{N} \alpha_i f(\alpha_i) \quad f' > 0$$

Where f is any function, the important thing is that it is increasing. The simplest and most widely used is $f(\alpha) = \alpha$, which leads to the definition of the Herfindhal Hirschmann index (HHI), more simply called Herfindhal index.

$$HHI = \sum_{i=1}^{n} \alpha_i^2$$

This index is widely used not only thanks to its simplicity of calculation, but also because the relationship above (1) becomes nothing more than

$$\bar{L} = \frac{HHI}{\epsilon_p}$$

This demonstrates how strongly the performances are correlated to the structure: at equilibrium, firms make average profits directly proportional to the concentration (HHI) and inversely proportional to the elasticity of demand with respect to the price (ϵ_p).

As a first approximation, this underlines how the profits are the greater the more the market is concentrated and the more rigid the demand is.

The HHI is often multiplied by 1000 and particular thresholds are defined: between 0 and 500 the market is not very concentrated, while if it exceeds 2000 the competition is at great risk, and it is necessary to intervene. Sometimes this index carries a subscript "k" as it is calculated not on all the companies present in the market but only on the first " k" in terms of market share. The reason lies in the fact that companies with very low market shares do not influence the value that much. The antitrust, therefore, up to the 90' is always intervened considering this indicator and considering a one-way influence between the three elements mentioned above (structure-conduct-performance). This paradigm, however, failed miserably for several reasons: first, the relationship is not unidirectional, performance may very

well affect the structure as potential entrants who see large average profits in a sector will be pushed in and this will change the structure. Or again, poor performance by two companies on the market could push the latter to merge. Secondly, sectors are profoundly different from each other, so it is impossible to think of using a single decision-making tool for all. For these reasons, recently the approach used by regulator changed and the evaluation of cases shifted to a method based on the upward pricing pressure that can be generate after a merge, instead of focusing on concentration and market shares.

3 Pre-merge evaluation: tools and methods

3.1 GUPPI

3.1.1 Theoretical derivation

Bertrand solves a model in which the price is fixed, chosen by the oligopolist, trying to determine consequently the unknown quantities (decision-making variable). According to Bertrand, each firm sets a price p_i and, consequently with respect to this, will decide its own level of production. In this model, the demand function is defined piecewise and not continuous, consequently, the profit function will not be derivable and the players' reaction functions will not be determined analytically but will be obtained graphically.

Specifically, by calling $d(p)$, the demand received by a certain firm as a function of the established price, then:

$$d_i(p_i, p_j) \begin{cases} 0 \; if \; p_i > p_j \\ d^{tot}(p_i)/2 \; if \; p_i = p_j \\ d^{tot}(p_i) \; if \; p_i < p_j \end{cases}$$

The hypotheses applied for the treatment of this case envisage having companies in competition with respect to a single homogeneous product, which will be chosen by the consumer only on the basis of the price imposed, and that the model is static.

Considering the payoff function of the i-th player $\pi_i = p_i d_i(p_i, p_j) - c d_i(p_i, p_j)$, the goal is to identify the reaction functions.

In the initial stretch, where the rival firm's price is lower than the marginal cost of production, the best response is to set a price higher than c (marginal cost), in this way it is sure not to make sales with negative profit (at a lower price than cost). In case $p_2 = c$, then it is indifferent to set a price p_1 greater than or equal to c; if $p_1 = c$, then the firm under consideration also starts to sell, but the profit remains null because it sells at marginal cost, vice versa if $p_1 > c$ it continues not to sell any units (it is inefficient to fix $p_1 < c$ because it would mean conquer the whole market, offering a lower price compared to the rival, but recording losses for every unit sold). On the other hand, by analyzing the case $p_2 = \bar{p}$, with $\bar{p} > c$, then surely the strategy that foresees to fix $p_1 > p_2$ has to be excluded, because demand would not be attracted and there would be zero sales. The two possible alternatives foresee the possibility of fixing $p_1 = p_2$, thus obtaining half of the total demand, or fixing $p_1 < p_2$, obtaining the totality of the demand. In the first case, a higher contribution margin would be generated, compared to a lower overall demand (half of the total

demand); in the second case, on the other hand, there would be a lower contribution margin, but the totality of the market would be obtained. Generally, the second hypothesis is to be preferred, in fact, reducing the price by an infinitesimal compared to the rival in order to obtain double the expected demand leads to a greater profit. This technique is called undercutting and doing so allows to obtain the reaction function of player 1, compared to player 2, according to Bertrand. This is possible up to a limit price value, p_m (monopoly price), a maximum taxable price for consumers, above which there is no point in going, because it would lead the consumer to drastically reduce the level of demand, action that, consequently, would also significantly reduce the profit of the enterprise.

It is possible to operate identically to find the reaction function of player 2, with respect to player 1 (the result does not change, being a symmetrical game). At this point, by graphically representing the two reaction functions, it is possible to identify a single point of equilibrium, that is $p_1^* = p_2^* = c$. This point is called the Nash-Bertrand equilibrium (figure 6).

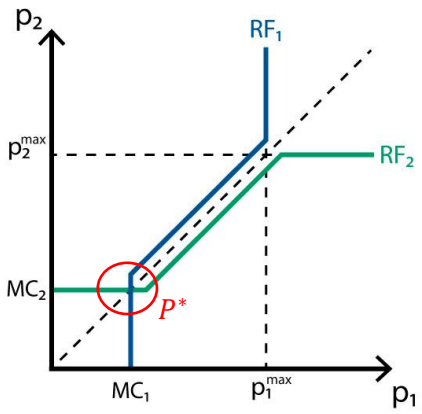

Figure 6: Equilibrium in Bertrand's competition

Subsequently, an attempt was made to broaden this scenario, extending it to the case of differentiated products. This was possible through what is known as the Spence model for non-address differentiation. Specifically, assuming to be in a context with K firms, each of which produces its own variety of a certain product. It is also assumed to have a homogeneous consumer with a CES (constant elasticity of substitution) utility function that is valid for all consumers and equal to the one of an average consumer.

$$U(y, q_1, \dots, q_k) = y + \alpha \sum_{k=1}^{K} q_k - \frac{1}{2}\gamma \sum_{k=1}^{K} (q_k)^2 - \frac{1}{2}\eta \left(\sum_{k=1}^{K} q_k \right)^2$$

Where y indicates the individual consumption of a homogeneous numerary good and q_k indicates the consumption of the k-th variety of the product. α, γ and η are

positive demand parameters, such that higher values of α and lower values of γ and η increase the demand for the differentiated product with respect to the numerary, for a given budget value ψ. By removing the central addend, the utility function would be that typical one of a homogeneous product, which, derived and set equal to p, would represent the classical method for determining the equilibrium price. For this reason, the central addendum is the focal point of this model, which makes the problem specific for the case of differentiated product. In fact, it is noted that for the same total quantity, the utility perceived by the consumer turns out to be much greater if the consumption is low concentrated. This indicates the fact that consumers are not only driven to buy the cheapest product, but that they think about differentiation and derive greater benefit by buying different goods.

Considering this utility function U and the presence of a budget constraint, the optimum is obtained by inserting the constraint in the function and deriving. This operation determines the demand function, which therefore turns out to be:

$$p_i = \alpha - (\gamma + \eta)q_i - \eta q_j$$

By inverting this equation, we obtain an analogous one to identify the quantities:

$$q_i = a - bp_i + dp_j$$

Where:

$$a = \frac{\alpha}{(2\eta + \gamma)};\ b = \frac{\eta + \gamma}{\gamma(2\eta + \gamma)};\ d = \frac{\eta}{\gamma(2\eta + \gamma)}$$

For the sake of simplicity, it has been considered the case in which there are only two companies on the market. At this point, it is possible to search for the Nash-Bertrand equilibrium, in the case of differentiated products, by systematizing the profit functions for the two firms considered, deriving them and imposing equality to zero.

If at this point the two companies merge, it should be analyzed in detail how this balance could change. In particular, the two companies affected by the merger, before this event, compete on the reference market and consequently are able to steal sales from each other. For simplicity we consider firm 1 and firm 2, where 1 uses a particular variable, called z, to cannibalize sales from 2. Following a change in z, the quantities q_1 sold by firm 1 will increase, but this will also have an impact on firm 2, which will see its quantities decrease. Should the merger occur, the two firms could be considered as two separate divisions, but they maximize profits jointly. Consequently, they will have to take into account that, if they use variable z to increase their sales, this would have a negative effect on the other division and this effect would be forfeited by the merged firm. If, for example, we consider

company 1, the incentive to use this variable would be held back in a similar way to what would be obtained by imposing a tax on quantities of value:

$$-\pi_B{}'(z) \Big/ q_1{}'(z)$$

Where the numerator represents the change in profit on 2 following a change in z, compared to the increase in quantity that would occur using z.

In the Bertrand model mentioned above, the strategic decision variable (the aforementioned z) is the price. At equilibrium, firm 1 supplies product 1 at price p_1 and firm 2 supplies product 2 at price p_2. The marginal costs are $c_1$and c_2 respectively. Once the merger has taken place, the two new divisions 1 and 2 of the merged company want to maximize joint profits, consequently the previously established equilibrium will change. In a decentralized way, the possible internal cannibalization between divisions will be taken into account given a price reduction by inserting the tax described above in the profit functions of the two divisions. The tax that 1 must take into account is given by $\bar{T}_1 \equiv \left|\frac{d\pi_2}{dq_1}\right|$ That is, the loss of profit that division 2 would have if, infinitesimally, 1 increased its quantities sold. At this point it is possible to express the equation in this way: $\bar{T}_1 \equiv \frac{d\pi_2}{dq_2}\left|\frac{dq_2}{dq_1}\right|$ (2).

The second term is called Diversion Ratio (D_{12}).and it measures the impact that the increase in sales of product 1 has on the sales of product 2. This term can be seen as the percentage of sales captured by substitute products, following a price increase of the item in question. It can be calculated as $\frac{\Delta q_2}{\Delta q_1} = \frac{\varepsilon_{21} q_2}{\varepsilon_1 q_1}$, where ε_1 represents the elasticity of demand with respect to the price of the product 1 and ε_{21} is the cross elasticity between product 2 and product 1. The higher the value of this indicator, the higher the substitution rate among the products considered.

The first term, instead, represents what happens to 2's profit if the quantities sold of product 2 increase by one unit. In this case, the increase in profit would be given precisely by the margin $(p_2 - c_2)$.
So, equation (2) can be rewritten as: $\bar{T}_1 = D_{12}(\bar{p}_2 - \bar{c}_2)$ (3) and it's possible to arrive at a similar equation also for division 2: $\bar{T}_2 = D_{21}(\bar{p}_1 - \bar{c}_1)$. These taxes are defined on the basis of the optimal pre-merge price and are called "first round taxes" as the actual value will then come out after a series of iterations of this type: insertion of the tax, calculation of new prices, recalculation of new taxes with new prices and quantities, until convergence is reached. In Bertrand's case, we know that the price variable is a strategic complement (the optimal response to an opponent's price increase is in turn a price increase). For this

reason, the iterative process will lead to an increase in equilibrium prices. A simple demonstration is provided below.

Pre-merge, profits of the two firms are defined as:
$\pi_1 = (p_1 - c_1)(a - bp_1 + dp_2)$
$\pi_2 = (p_2 - c_2)(a - bp_2 + dp_1)$.
As the result of the optimization of the two different firms, at equilibrium, prices are the following:

$$p^*_{1\,pre} = \frac{2ab + da + dbc_2 + 2b^2c_1}{4b^2 - d^2}$$

$$p^*_{2\,pre} = \frac{2ab + da + dbc_1 + 2b^2c_2}{4b^2 - d^2}$$

Post-merger, new divisions include in their profit function taxes on quantities T_1 and T_2:

$$\pi_1 = (p_1 - c_1 - T_1)(a - bp_1 + dp_2)$$

$$\pi_2 = (p_2 - c_2 - T_2)(a - bp_2 + dp_1)$$

And new equilibrium prices are:

$$p^*_{1\,post} = \frac{2ab + da + db(c_2 + T_2) + 2b^2(c_1 + T_1)}{(4b^2 - d^2)}$$

$$p^*_{2\,post} = \frac{2ab + da + db(c_1 + T_1) + 2b^2(c_2 + T_2)}{(4b^2 - d^2)}$$

It is simple to notice that prices raised up.

For this reason, the element discussed before (3), can be also called upward pricing pressure 1 (UPP1), and it is a measure of the value re-internalized in the new firm.
$UPP_1 = D_{12}(p_2 - c_2)$.
The UPP, normalized in respect to the price, therefore expresses a percentage margin which is precisely called gross upward pricing pressure index (GUPPI).
$GUPPI_1 = \frac{D_{12}(p_2 - c_2)}{p_1}$. (4)
At this point it is possible to estimate the variation in prices as:

$$\Delta p = \frac{dbT_2 + 2b^2T_1}{4b^2 - d^2}$$

Collecting T:

$$\Delta p = T_1 \left[\frac{db\frac{T_2}{T_1} + 2b^2}{4b^2 - d^2} \right]$$

Dividing both terms by $p^*_{1\,pre}$ it is possible to arrive to the percentage variation:

$$\frac{\Delta p}{p_{1\,pre}} = GUPPI_1 \left[\frac{db\frac{T_2}{T_1} + 2b^2}{4b^2 - d^2} \right]$$

By inverting the formula, it is possible to isolate the GUPPI:

$$GUPPI = \frac{\Delta p}{p^*_{1\,pre}} \left[\frac{4b^2 - d^2}{db\frac{T_2}{T_1} + 2b^2} \right]$$

As just shown, the GUPPI represents a simple approximation of the percentage price increase. In fact, the latter has been isolated before the bracket and is multiplied by a term which is a function of some parameters of demand. This last term, in most cases, turns out to be < 1, so, the GUPPI tends to underestimate the real price increase.

This indicator was proposed in the 2010 Horizontal Merger Guideline, a collection of techniques, practices and policies aimed at evaluating the impact of mergers and acquisitions on market competition and global well-being, suggested by the Department of Justice and the Federal Trade Commission. The expression (4) shows that the higher the margin (the proxy for market power) and the higher the diversion ratio (which underlines the consumer's inclination to change from one firm to another), the greater is the push to increase prices.

Thanks to its simplicity and immediacy of its understanding, it is used as indicator to calculate the percentage increase in prices. In particular, in the simplified case of linear demand, constant marginal costs, and symmetrical firms, the percentage price increase is given by:

$$\frac{\Delta p}{p} = \frac{D(p - c)}{2p(1 - D)}$$

Where D indicates the generic value of the substitution rate (diversion ratio) between the products of the two firms (since they are symmetrical, it is not necessary to insert the subscript relative to D, they have the same substitution rate). It can therefore be noted that this equation can also be expressed as:

$$0.5 * \frac{GUPPI}{(1-D)} \qquad (5)$$

3.1.2 ***Multiproduct instance***

So far, a simplified hypothesis has been used: the two firms that are about to merge supply only one product to the market each, but it is possible to extend the model to the multi-product case.
Considering this instance, the GUPPI is indexed by product (j) and can be calculated as follows:

$$GUPPI_j = \frac{1}{p_j^{pre}} \left(\sum_{i \in J_{Other\ Party}} (p_i^{pre} - mc_{j'}) DR_{ji} \right)$$

Considering a company that wants to merge, the sum indicates the value of the diverted sales of the j-th product compared to the i-th products supplied by the company with which the merger is being realized. The whole is normalized for the pre-merge price of the j-th product, considering for simplicity identical the marginal cost of product j for the two firms.
The term DR_{ji}, on the other hand, indicates the substitution rate between the product supplied by the company in question and the one supplied by the potential new partner.

$$DR_{ji} = -\frac{\partial q_i(p^{pre})}{\partial p_j^{pre}} \Big/ \frac{\partial q_j(p^{pre})}{\partial p_j^{pre}}$$

It can therefore be noted that for the calculation of the GUPPI (mono or multiproduct makes no difference), only the margins and the diversion ratio between products are required as input data.
Operationally, margins can be approximated with the difference between total revenues and OPEX for a certain product. Diversion ratios, instead, can be obtained in three main ways:

- Collect useful data during the company's core business. In particular, customers who decide to change company or product should be asked, which one they intend to switch to, or new customers should be asked which product types or which company they previously referred to.

- Based on demand estimates. In cases where it is possible to obtain detailed information regarding prices and quantities, it is possible to calculate the direct and cross elasticity for the products in question and therefore also to obtain the DR.
- Using questionnaires. Since the first two approaches can often be complex or very uncertain, in most cases, these are achieved by directly asking users which company or product they would like to switch to, if they should change.

3.2 CMCR

This acronym stands for compensating marginal cost reduction and the indicator is used to highlight how much the marginal costs of a certain post-merge product must decrease, thanks to the presence of efficiencies, to exactly compensate for the incentive to increase its price after the merger. In other words, the goal is to understand at what level of marginal costs the pre-merger price will still bring a Bertrand-Nash equilibrium after the merger.
Some various interpretations and formulas allow to mathematically understand how this index is calculated. Specifically, the CMCR can be considered simply as a GUPPI that also incorporates the feedback effects between the prices of the two merging firms. Where feedback effect means the fact that a certain company, during its process of choosing an optimal price, not only takes into consideration its operating parameters but also includes the potential strategic choices that will be made by competitors on the market.
It is possible to understand this by looking at the formula. It is characterized by three terms:

- The first directly represents the GUPPI $\left(D_{21}M_2\frac{p_2}{p_1}\right)$, where M is the percent unit margin.
- The second represents the first round of feedback effects from firm 2 $(D_{12}D_{21}M_1)$
- The third, denominator, represents the higher order iterations to the feedback effects between firm 1 and firm 2 $(1 - D_{12}D_{21})$

$$CMCR_1 = \frac{D_{12}M_2\frac{p_2}{p_1} + D_{12}D_{21}M_1}{1 - D_{12}D_{21}}$$

A further plausible interpretation is the one that sees the use of this indicator to estimate which variations should be introduced so that, post-merge, there will not

be any negative effects for the consumer. Consequently, it is possible to consider this aspect not only in terms of cost reduction but also in terms of quality improvement, which is obtainable thanks to the development of efficiencies after the merger between companies. These improvements would lead customers to have a greater willingness to pay. In this way, they would not be harmed by the typical price increase of the products that occurs following a merge, therefore the overall wellness would not be affected in any way.
However, there may be no impact on consumer welfare, also if the CMCR is intended as the subsidy that should be given to the merged companies so that they do not raise their prices after the merger. In this way, there would be no impact on the price and the consumer would keep his utility unchanged.
Up to now, possible interpretations and mathematical considerations have been explained, for the sake of simplicity, in relation to two companies that are implementing a merger process and that will launch only one product on the market each, but it is possible to expand the model also considering the multiproduct case. Before arriving at the final formula, it is necessary to take a step back, starting from the profit functions of the companies present on the market:

$$\pi_f(p) = \sum_{j \in J^f} (p_j - mc_j) q_j(p)$$

The profit of the generic firm f is obtained by applying the sum, on all the products belonging to the portfolio J_f of the firm, of the margin, multiplied by the quantities sold of the product j belonging to J_f
Subsequently, deriving this function from the price p_f, we obtain the effect of a price variation of p_f, given certain price values also imposed by the other operating firms $(p - j)$, on the profit function of the firm, obtaining:

$$f_j(p_j, p_{-j}) = q_j(p) + \sum_{j' \in J^f} (p_{j'} - mc_{j'}) \frac{\partial q_{j'}(p)}{\partial p_j}$$

It can be seen how a price change on p_j made by the firm has a triple effect on profit:

- First, it increases it proportionally to the quantity q_j sold.
- Secondly, it reduces the demand itself (effect having an impact dependent on the elasticity of demand), thus decreasing profits in proportion to the contribution margin (which is equal to the markup as there are no fixed costs in the Bertrand model).

- The third effect is again positive for the company since this price increase increases the demand for the other products offered by the company itself (those that are considered direct substitutes for product j), consequently leading to an increase in profit proportional to the markup of the other products.

At equilibrium, the firms aim to maximize profit, which mathematically translates into the imposition of the condition of equality at zero of the previous function, thus obtaining the first order conditions.
Subsequently, systematizing these equations for all firms, we obtain:

$$q(p) + (\Theta * \nabla(p)')(p - mc) = 0$$

In this equation, $q(p)$ is a $J \times 1$ dimension vector that reports the demands for each product j. Θ is named "product ownership matrix", which is the matrix (of size $J \times J$) whose element ij is equal to 1 if the product i and the product j are supplied by the same company and 0 otherwise. This matrix is multiplied element by element with the transposition of the Jacobian matrix of the first derivatives, to consider the fact that the effect of price variation is applied only to the products of the firm itself and not to those offered by the others.
By inverting the equation, we then arrive at the equilibrium price vector:

$$p = mc - (\Theta * \nabla(p)')^{-1} q(p)$$

Prices will be given by the marginal cost obtained at equilibrium, to which the markup must be added, which depends on the elasticity of demand for the price and the cross-elasticity concerning the other products (the lower the first, the higher the second, the greater the markup).
By simply inverting the previous formula, we can isolate and find the marginal cost of compensation:

$$mc^{comp} = p^{pre} + (\Theta^{post} * \nabla(p^{pre})')^{-1} q(p^{pre}) \qquad (6)$$

Since this value represents the amount of what the marginal costs of a certain post-merge product must be to compensate for the incentive to increase its price, within this formula, the price to be considered is always the pre-merge one, because the goal is to have the price unchanged after the merge. However, this analysis assesses the situation following the merger, therefore the post-merge “product ownership matrix” must be used. The reason lies in the fact that products that were made by different companies before the merger can be made by the same one after the merger.

This value allows us to calculate the CMCR, considering it as the difference between the marginal cost of the product j pre-merger and the marginal cost of compensation obtained. It is also always possible to obtain the % value of this index, comparing it to the theoretical marginal cost for the product j :

$$CMCR_j = mc_j - mc_j^{comp}$$

$$CMCR_j^{\%} = \frac{mc_j - mc_j^{comp}}{mc_j}$$

As for the GUPPI, in order to calculate this indicator, it's only needed information on the diversion ratio and the margins of the companies involved. There is no need for information and assumptions on the change in the form of demand due to price changes.

3.3 **Merger simulation models**

In addition to the indicators seen so far, it is possible to try to predict through specific models, what would happen to prices and quantities if the merger took place, therefore going to do a real simulation. To do this, two main approaches can be adopted: the calibrated based model and the demand estimation model.

3.3.1 ***Calibrated based model***

These models are closely correlated with the indicators seen previously, as they use the same information to be able to estimate the price: margins and diversion ratios. It has already been highlighted in the chapter of GUPPI how it is possible to calculate in a very simple way an estimate of the percentage increase in price in the case of symmetrical firms.
Through a particular model called IPR (Indicative price rise), it is possible to demonstrate that, even in the most generic and common asymmetric cases, in which firms do not have the same replacement rates, the calculation of the percentage price increase is obtainable through the GUPPI. This method is based on two main assumptions: firms that do not merge will keep the same price and demand must be considered as linear. Each firm, before the merge, maximizes its profits by looking for the optimal price (Bertrand), considering however that the quantities sold by itself (the demand) depend not only on the price applied by the firm i but also, on the one chosen from all the others.

In this context, assuming no fixed costs, firm i's profit is given by the product between the contribution margin and the quantities sold.

$$(p_i - c_i)q_i(p_i, p_{-i})$$

The condition of the first order, therefore, leads to being able to approximate the derivative of the quantities with respect to the price applied by firm i as the ratio between the pre-merge quantities and the contribution margin.

$$\frac{\partial q_i(p_i^0, p_{-i}^0)}{\partial p_i} = -\frac{q_i(p_i^0, p_{-i}^0)}{p_i^0 - c_i} \equiv -\frac{q_i^0}{p_i^0 - c_i} \qquad (7)$$

The merged firm, at this point, is faced with the choice of the two prices p_1 and p_2 for the products that were once supplied by the two separate firms. The profit function will then be:

$$(p_1 - c_1)q_1(p_2 - c_2)q_2$$

And by optimizing from p_1, the following first-order condition is obtained:

$$(p_1 - c_1)\frac{\partial q_1}{\partial p_1} + (p_2 - c_2)\frac{\partial q_2}{\partial p_1} = -q_1$$

At this point, substituting in the equation the diversion ratio:

$$D_{12} \equiv -\frac{\partial q_2/\partial p_1}{\partial q_1/\partial p_1} = -\frac{e_{21}q_2}{e_{11}q_1}$$

It is possible to express it as:

$$p_1 - c_1 - (p_2 - c_2)D_{12} = -\frac{q_1}{\partial q_1/\partial p_1}$$

By maintaining the linearity assumption of demand, it is possible to state that the substitution rate and the variation of demand to the price are constant and independent of the price level. Substituting then the equation (7) and rewriting the post-merge prices as a pre-merge price plus a price differential Δp leads to the following equation:

$$p_1^0 - c_1 + \Delta p_1 - (p_2^0 - c_2 + \Delta p_2)D_{12} = \frac{(p_1^0 - c_1)q_1}{q_1^0}$$

From which it is possible, by dividing both sides by p_1 pre-merge, to obtain:

$$\frac{\Delta p_1}{p_1^0} - \frac{p_2^0 - c_2 + \Delta p_2}{p_1^0} D_{12} = \frac{p_1^0 - c_1}{p_1^0 q_1^0} (q_1 - q_1^0) \qquad (8)$$

Again, thanks to the assumption of linearity, it is possible to calculate the difference in the quantities sold of the product 1 before and after the merger, which is obtainable by multiplying the infinitesimal variation of quantity Q_2, given by the price variation p_1, with the actual Δp_1, plus the infinitesimal variation of the quantity Q_1, given the price change of p_2, multiplied by Δp_2:

$$q_1 - q_1^0 = \frac{\partial q_1}{\partial p_1} \Delta p_1 + \frac{\partial q_1}{\partial p_2} \Delta p_2$$

From which, again using the definition of the diversion ratio, it is therefore possible to derive:

$$q_1 - q_1^0 = -\frac{p_1^0 q_1^0 \Delta p_1}{(p_1^0 - c_1) p_1^0} + \frac{p_2^0 q_2^0}{p_2^0 - c_2} D_{21} \frac{\Delta p_2}{p_2^0}$$

At this point it is possible to substitute this equation in the equation (8) in order to obtain:

$$2\frac{\Delta p_1}{p_1^0} - \left(\frac{p_2^0}{p_1^0} D_{12} + \frac{(p_1^0 - c_1) p_2^0 q_2^0}{(p_2^0 - c_2) p_1^0 q_1^0} D_{21} \right) \frac{\Delta p_2}{p_2^0} = \frac{p_2^0 - c_2}{p_1^0} D_{12}$$

Similarly, it is possible to proceed with the optimization with respect to p_2, obtaining a second equation, which, when put together with the one above, will lead to the definition of the following percentage increase in price:

$$\frac{\Delta p_1}{p_1} = \frac{2D_{12}\frac{p_2 - c_2}{p_1} + D_{12}D_{21}\frac{p_1 - c_1}{p_1} + \frac{(p_1 - c_1)^2 q_2}{(p_2 - c_2) p_1 q_1} (D_{21})^2}{4 - 2D_{12}D_{21} - \frac{(p_2 - c_2) q_1}{(p_1 - c_1) q_2} (D_{12})^2 - \frac{(p_1 - c_1) q_2}{(p_2 - c_2) q_1} (D_{21})^2}$$

Sometimes it is necessary to estimate only one substitution rate since the mixed partial derivatives of the quantities concerning the price are equal and consequently, D_{21} it is equal to:

$$D_{12}({}^{\partial q_1}/_{\partial p_1})/({}^{\partial q_2}/_{\partial p_2})$$

It is reasonable doing this assumption in the case of customer goods, where it is instead proven that these variations are the same, except for the income effect, which, however, is often negligible in this type of analysis. In this specific case, the equation is therefore attributable to:

$$\frac{\Delta p_1}{p_1} = \frac{D_{12}(p_2 - c_2) + D_{12}D_{21}(p_1 - c_1)}{2(1 - D_{12}D_{21})p_1} = \frac{GUPPI_1}{2} \times \frac{1 + \frac{p_1 - c_1}{p_2 - c_2} D_{21}}{1 - D_{12}D_{21}}$$

In this way, it has been demonstrated that, even in the case of asymmetric firms, it is possible to calculate the percentage increase in prices deriving from a merge with the same information necessary for the calculation of the GUPPI.
It is immediately evident how this relationship is attributable to $\Delta p_1/p_1 = CMCR_1/2$, because the effect on the price is given by the pass-through rate multiplied for the savings that should be had in terms of marginal costs. The pass-through rate is a multiplier that defines the transfer on the price of a saving or an increase in marginal costs. Take for example a firm that reduces its costs by 10%, if the index is equal to 1, there would be a price reduction of 10%. Since non-merging firms do not react to price changes in this model, this rate is equal to $\frac{1}{2}$ (monopoly).
It is also underlined that, in the specific case in which the firms are symmetrical (and therefore have the same D), this price increase can be traced back to (5)
Then, it's also possible to complicate the model by relaxing some of the assumptions seen previously.
For example, if we wanted to consider the reactions (and therefore the price changes) of the other companies on the market that do not take part in the merger, the vector of the percentage price increase would be given by:

$$\frac{\Delta p}{p} = \nabla_p(c)\frac{\Delta c}{p}$$

Where the term on the right is the CMCR vector multiplied by the Jacobian matrix of pass-through rates.
Finally, a further variant of the model in which demand is no longer considered linear but has constant elasticity with respect to the price has been analyzed. In this case, it can be shown that the percentage change in prices is given by the same expression whether the firms are symmetrical or not.
Shapiro, in 1996, first derived the formula of the symmetric case:

$$\frac{\Delta p_1}{p_1} = \frac{D_{12}M_2\frac{p_2}{p_1} + D_{12}D_{21}M_1}{1 - D_{12}D_{21} - M_1 - D_{12}M_2\frac{p_2}{p_1}}$$

Subsequently, considering the more general asymmetric case, the maximization of the profit of the first pre-merge firm leads to the obtaining of the first Lerner equation $L = 1/\varepsilon_1$, where ε_1 represents firm 1's elasticity of demand.

Post-merger, joint profit maximization leads to: $L_1^* = \frac{1}{\varepsilon_1} + D_{12}^* L_2^* \frac{P_2^*}{P_1^*}$

The elasticity continues to be the pre-merge one, because of the assumption about the isoelastic demand.

Slutsky symmetry implies that $\frac{\partial x_j}{\partial p_i} = \frac{\partial x_i}{\partial p_j}$ for $i, j = 1,2$.

From the definition of cross elasticity, it follows that $\frac{\partial x_j}{\partial p_i} = \varepsilon_{ij}\frac{X_j}{p_i}$ where ε_{ij} represents the cross elasticity from i to j. Using these two formulas, the following equations are obtained:

$$\frac{q_2}{q_1} = \frac{\varepsilon_{21}}{\varepsilon_{12}}\frac{p_1}{p_2}$$

$$D_{12} = \frac{\varepsilon_{12}}{\varepsilon_1}\frac{q_2}{q_1} = \frac{\varepsilon_{21}}{\varepsilon_1}\frac{p_1}{p_2}$$

The first equation arises from the definition of the diversion ratio, whereas the second follows the first. Since ε_1 and ε_{21} are constant:

$$D_{12}^* = D_{12}\frac{p_2}{p_1}\frac{p_1^*}{p_2^*}$$

Substituting this in the initial formula, using $(p_1 - c_1)/p_1 = 1/\varepsilon_1$ from the first order condition pre-merge and rearranging the following expression is obtained:

$$\frac{p_1^* - c_1}{p_1^*} = \frac{p_1 - c_1}{p_1} + D_{12}\frac{p_2^* - c_2}{p_2^*}\frac{p_2}{p_1}$$

The same goes for firm 2.

Solving this system of equations for p_1^*, using $p_i/c_i = 1/(1 - M_i)$, and rearranging, it can be obtained the price increase equation given above. As in the symmetrical case of Shapiro, it is defined correctly only if the diversion ratio is small enough, so $\Delta p_1/p_1$ it remains non-negative.

It can be seen how, in the isoelastic case, the percentage price variation is greater than in the linear case. This is the simple consequence of the value of the pass-through rate, which in this specific instance is greater than 1. Often, this is taken

into consideration as a pessimistic scenario in the analyzes carried out by the regulator.

3.3.2 ***Demand estimation model***

This type of merger simulation aims to analyze what would happen, in the event of a merger, to the demand for the affected products. In order to achieve this objective, it is necessary to estimate the demand from an econometric point of view. The Horizontal Merger Guideline recommends this type of evaluation only and exclusively if the quantity and quality of the data available allow to work with the statistics, otherwise, it could bring to completely misleading results.
In the more general model, called "full logit", each product is seen as a bundle of characteristics (among which there is also the price), perceived and evaluated by the consumer differently in terms of utility. The utility of the consumer i in choosing product j decreases as the price p_j increases in proportion to a coefficient defined as α. Moreover, this also changes with the variation of the other product characteristics (the vector x), in proportion to the coefficient vector β. The term ξ_j, on the other hand, concerns everything that is not strictly observable in terms of characteristics for product j. Finally, there's also an error term that follows an extreme-valued distribution.

$$\mu_{ij} = -\alpha_i p_j + x_j'\beta_i + \xi_j + \varepsilon_{ij} = \delta_j + \mu_{ij} + \varepsilon_{ij}$$
$$\delta_j \equiv -\alpha p_j + x_j'\beta + \xi_j, \;\; \mu_{ij} \equiv -\sigma^p p_j v_i^p + \sum_k \sigma^k x_j^k v_i^k,$$
$$\alpha_i \equiv \alpha + \sigma^p v_i^p, \; \beta_i^k \equiv \beta^k + \sigma^k v_i^k.$$

This utility can be expressed by separating two main elements: the first one is δ_j, the average utility, the same for each consumer, consequently having average α and β parameters and the second one, μ_{ij}, the specific utility that depends on the preferences of the individual consumer.
In the case in which this deviation from the average value does not exist, the model takes the name of "simple logit", in which each consumer has the same preferences and the same sensitivity to price. There is also a more complex but still simplified model compared to the full logit, defined as "nested logit". In this case, all the customers have the same price sensitivity, but the marginal utility differs from one to another for a categorical variable. Each product is associated to a category ("nest") according to its characteristics and it is precisely the group to which the product belongs that defines its usefulness for the customer. If on the one hand, the

full logit is the most complete model, it is good to underline that it is not always possible to have all the necessary data available to be able to carry out an accurate simulation. The simple logit is instead of immediate application, but one might think that it simplifies too much, thus leading to estimates that do not reflect reality. For this reason, the nested one is very often used, as in the case of Telefonica / E Plus.
In the more general model, to arrive at an estimate of the demand parameters, it is necessary to proceed with a regression, which is possible only after having estimated the value of the market shares.
Following what is described in the article of Berry et al. (1995) it is possible to obtain the forecast of the market share by integrating on the distribution of marginal utilities the probability of choice of the product j by the consumer i:

$$s_j(\delta, \sigma) = \int s_{ij} dF\,(\delta, \sigma)$$

Where the probability is expressed as:

$$s_{ij} = \frac{exp(\delta_j + \mu_{ij})}{1 + \sum_{j'} exp(\delta_{j'} + \mu_{ij'})}$$

Still referring to Berry's econometric model, it is therefore possible to express the average utility by equating the predicted share to the observed one and thus obtain the alpha and beta parameters by linearizing the terms and proceeding with the regression.

3.4 **Comparison of indicators**

In this section, the main purpose is to analyze what are the strengths and the main differences between the indicators dealt with in the previous chapters.
IPR is a tool that considers the feedback effects, moreover, it can be used to predict price increases, taking into account the impact of a possible reduction in marginal costs. To do this, in the multiproduct case, it is sufficient to replace the value of the pre-marginal cost with the post value in the equation (6). It can also extend its application by evaluating the presence of obtainable improvements in terms of quality. However, the approach depends on the functional form of the demand. If it is linear, the quality improvements become equivalent to the analysis carried out with reduced marginal costs.
This index aims to linearly estimate the effect on prices using the pass-through rate. It is certainly more accurate than the others but requires that all data available to the regulator be consistent with the model assumptions and well specified.

Furthermore, given that the pass-through rate is highly dependent on the form of demand and is very complex to estimate, it is often assumed that the demand is linear for simplicity, leading to conservative estimates of price trends.
Regarding the CMCR, it is considered better than the GUPPI as it has the same advantages (no assumptions on the form of the demand are necessary and the margins of the non-merged companies are not needed) but incorporates the feedback effects, considering the possible decisions taken by competitors on the market. Furthermore, in the multi-product case, this indicator takes into consideration the fact that a reduction in the marginal cost of product j, through a consequent increase in margins, also influences and has feedback on the first-order conditions of the other products.
Since the CMCR is a GUPPI that includes the feedback effects, one might think that it also measures the "competition tax" that is actually to be imposed as a result of a merger. In reality, as previously expressed, this is not the case. The CMCR is a measure calculated ex-post, representing the subsidy that should be given to the merged companies so that they do not raise their prices after the merge. The best indicator to use for estimating this tax is the TOC (tax on competition). About this, it can be used to represent the percentage increase in prices as:

$$\frac{\Delta p}{p} = \rho\, TOC \qquad (9)$$

Or alternatively:

$$\frac{\Delta p}{p} = \rho^{*} CMCR$$

Where ρ^{*} indicates the post-merge pass-through rate.
Employing simple mathematical steps, it is therefore possible to express the TOC in such a way as to make it directly comparable with the other two indicators. It is nothing more than a UPP post-merge normalized for the pre-merge price and can therefore be expressed as:

$$TOC = D\frac{p^{*}-c}{p} \qquad (10)$$

Next, it is possible to insert the equation (10) into (9) reworking and get:

$$\frac{p^{*}-p}{p} = \rho D\,\frac{p^{*}-c}{p}$$

$$\frac{\Delta p}{p} = \frac{\rho D M}{1-\rho D}$$

$$TOC = \frac{DM}{1 - \rho D}$$

Moving on to quantitative analysis, it is possible to order the indicators just described from the lowest to the highest.
The GUPPI does not consider the feedback effects between the merging companies and the pass-through rate. Neglecting the impact of the first variable always leads to underestimating the price increase since the feedback effects are a component that increases the forecast on prices. The second, on the other hand, has a variable impact depending on the form of demand and the assumed value. Specifically, when the convexity of demand is low (pass-through rate less than one), the effect reduces the magnitude of the price increase and therefore the two excluded variables offset each other. Conversely, if the convexity of demand is high (pass-through rate greater than one), the effect would increase the estimated prices. The two effects would add up, thus amplifying the overall underestimation. For this reason, in general, GUPPI can be considered as a lower bound in the absence of specific information on the form of the demand function.
The CMCR is a GUPPI to which an always positive term is added and which is divided by another factor having values always between zero and one. Consequently, in numerical terms, it is always greater than the previous index.
Finally, moving on to the analysis of the IPR, its relationship with the CMCR is variable and dependent on the value of the pass-through rate. If the latter takes a value greater than one, then, $IPR > CMCR$, vice versa, in cases where this value is lower than 1, then $IPR < CMCR$. In the latter case, it is also necessary to define the relative relationship with the GUPPI (because previously, being $IPR > CMCR$, it will consequently also be always greater than the GUPPI). Under the symmetry assumption, $GUPPI = D \cdot M$, while $IPR = (D \cdot M)/\big(2 \cdot (1 - D)\big)$. So, the first is greater than the second if and only if $D \leq 1/2$, assumption which is valid in any type of symmetrical model except for the monopoly case. Therefore, if there are at least two firms on the market, the relationship between the indices is as follows*:*

$$IPR < GUPPI < CMCR < IMS$$

Where IMS stands for isoelastic merger simulation time analyzed in the third section.
The economic relationship between the indicators illustrated before and the first order condition for the profit maximization is shown below (figure 7).

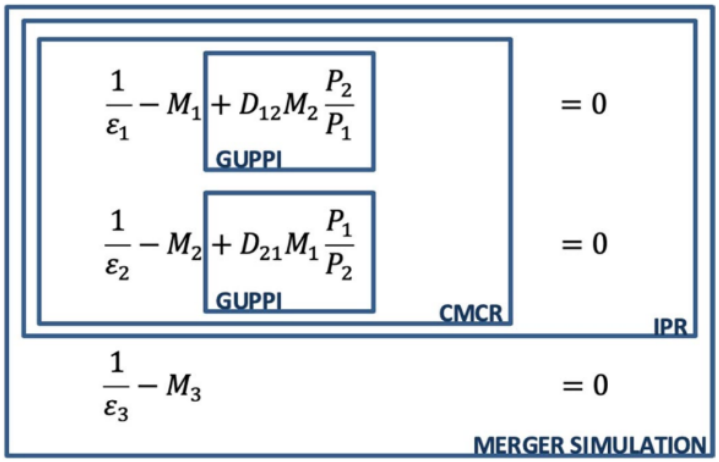

Figure 7: Composition of the different indicators

Furthermore, it is possible to evaluate the precision and adequacy of the use of GUPPI, CMCR, and TOC, as regards the approximation of the parameter of interest, that is $\Delta p/p$.
The ordering of these indicators is dependent on the value of ρ, that is the pass-through rate. In detail, if ρ is lower or at most equal to $1/(D+1)$ then the hierarchy will be:

$$\frac{\Delta p}{p} \leq GUPPI < TOC < CMCR$$

For values included between $1/(D+1)$ and 1 (extremes excluded), on the other hand, the order will be:

$$GUPPI < \frac{\Delta p}{p} < TOC < CMCR$$

Finally, with high pass-through rates (greater than or equal to 1), the order is as follows:

$$GUPPI < CMCR \leq TOC \leq \frac{\Delta p}{p}$$

In summary, if the demand has a high convexity ($\rho \geq 1$), the GUPPI will tend to strongly underestimate the price increase. CMCR and TOC are equivalent and coincide with the percentual price increase in the limit case ρ = 1, while they are both affected by error if ρ exceeds this threshold, underestimating the real value.
On the other hand, if it were less than 1, all the indicators, except for the GUPPI where the effect varies according to the pass-through rate, would overestimate the price increase.

3.5 Application of the method: the Telefonica / E-Plus case

In the second half of 2014, in Germany, the acquisition of E-Plus by Telefonica took place. In the period before the merger, there were four MNOs on the market and the two involved in the merger were third and fourth in size. The merger was notified to the European Commission in October 2013 and authorized by the latter on the 2nd of July 2014, bringing the new entity to first place for market share.

As extensively described throughout all section 2, there are several indicators and methodologies capable of estimating the possible post-merger price increase. For the calculation, specific input data such as diversion ratio, margins etc. are required. The next section describes the methods by which these values were derived and the price increase estimates obtained, studying two market segments, pre-paid and post-paid separately. Finally, section 2.5.2 will describe the results obtained through the econometric estimate of the demand.

3.5.1 ***Calibration model***

Two sources were used to estimate the cross-elasticity between product i and product j: The main one, the MNPs provided by the companies, or rather the "port-out" requests of one's telephone number from one MNO to another. In particular, cross-elasticity is estimated as the number of port-out requests from firm i to firm j divided by the total number of port-out requests for firm j. The second source comes from a 2012 survey provided by the parties, as the MNP does not give information on which segment the lost customer will choose (pre or post-paid). Using this hybrid approach, it was possible to construct the matrix of cross-segment elasticities which provides for each product on each segment the diversion ratio from firm i to firm j, including also the "cross segment" elasticities.

Two different approaches were used to estimate the UPP: the first approach, the less conservative one, uses the contribution margins, estimated based on the data provided by the MNOs. The second approach, on the other hand, uses incremental margins, deducting the incremental costs deriving from OPEX and CAPEX from the contribution margin. The study is based on the data provided by Telefonica regarding the elasticity of these costs concerning the variation in the number of customers, as only this MNO has provided estimates of avoidable costs in the long term in the event of a 10% reduction in customers. This estimate was necessary for

the calculation of the incremental costs deriving from a potential increase in customers.

To estimate the prices, the ARPU was taken into consideration, i.e. the average return per user, representing the price of a single bundle of telephone services offered by each company in each segment.

In the basic scenario, which is the one that uses the contribution margins, the method foresees an increase in prices in a range between 12% and 20% for the pre-paid segment and between 4% and 6% for the post-paid segment. In the sensitivity scenario, which instead uses incremental margins, the percentage increase in price was estimated in a range between 9% and 15% for the pre-paid segment and between 5% and 8% for the post-paid segment. Actually, the first estimates made by the regulator were slightly higher; previous values were calculated after a review of the method carried out by the commission, as the two companies involved had expressed doubts regarding the correctness of the results. Despite the changes made, the method suggests that an average price increase is very likely, given the elimination of competition between Telefonica and E-plus.

*3.5.2 **Demand estimation model***

For the construction of this model, it was decided to approximate a single price for each existing tariff. The value was obtained considering how much the individual consumer would have spent in a month using fixed quantities of voice, data, and messages, as it would have been difficult to do otherwise since there would have been different rates for each type of service. The customer share by rate was defined as the ratio between the number of new and retained customers of the rate divided by 110%, as it was considered that a small part of customers does not adopt either pre-paid or post-paid.

To estimate the pre-merge demand, the data provided by the MNOs regarding the so-called “contestable customers” were used, i.e. customers who are close to a tariff change or provider change. Mainly the data regarding the market shares of this type of customer provided by Telefonica were considered.

Also in this case, the first results obtained were reviewed after the complaints brought forward by the two companies. Despite the changes made, the demand estimation model predicted a price increase for Telefonica above 10% and an increase in the average price in the market in a range between 4% and 8%.

3.5.3 ***Conclusions***

Looking overall at the values obtained, the commission remained rather cautious about the possibility of a merger. Although the estimates are certainly affected by some errors and other elements of influence that have nothing to do with the merger, it is clear that the results indicate potential damage to the competition. The reliability of what emerged is also strengthened by the fact that both approaches used lead to consistent results between them, even though the process to be followed to arrive at the outcome is completely different. For this reason, the commission has decided to approve the merger but introducing several remedies that could have limited the anti-competitive effect, which will be explored in section 4.2.3 where the case will be analyzed ex-post.

3.6 Hutchison 3G/Telefonica Ireland Case

This case concerns the events in Ireland in 2014 and describes the acquisition of Telefonica by Hutchison. At that time there were four different telephone operators on the market: Hutchison, Telefonica, Vodafone and Meteor. The first was the Irish detachment of the multinational conglomerate Hutchison Whampoa and was considered a disruptive operator by the European Commission, due to its competitive price push. It was the fourth force both in terms of market share and in terms of revenues, however, thanks to highly innovative promotions and ideas, it was growing with respect to both these indicators, counterbalancing the progressive decline of Telefonica. The latter appeared to be the second largest operator in terms of market share and revenues and operated on Irish soil through two subsidiaries: O2 and 48 (which was mainly used for the category of customers between 18 and 22 years). Regarding Vodafone, it entered the market in 2001 following the acquisition of Eircom and succeeded in gaining the role of market leader over the years. Despite the progressive decline in market share, this company has managed to keep its revenues stable thanks to its strong brand and an ARPU higher than the one of the other competitors. Finally, the last active operator is Meteor, which is nothing more than the market entry by Eircom, four years after (2005) the acquisition by Vodafone against it. This operator appeared to be the only one offering 4G services to its customers and had implemented a network sharing agreement with O2 in order to split the infrastructure. The operation was announced in 2013 and then made official by the commission on the 28th of May 2014.

3.6.1 ***Preliminary analysis and first round of results***

As 2012 is the last year before the merger for which valid and complete data are available, the analysis was carried out with reference to them. In addition, since only MNP (mobile number portability) information is available for the voice section, the results should be attributed to this segment.

As in the previous case, the number of port-out requests reported by operators was used to estimate the diversion ratio and, also thanks to information about margins and the use of ARPU as a price approximation, The European Commission has managed to calculate the value of some indicators, such as IPR, GUPPI and CMCR for a baseline and a sensitivity scenario. Both the supporting elements, the progress of the analysis and the results obtained are very similar to those described in the previous description of the German case.

After conducting the appropriate analysis, the commission published the first round of results: in the basic scenario (the one based on the contribution margins), it has been highlighted an increase in prices in a range between 14% and 24% for the pre-paid segment and between 9% and 11% for the post-paid segment. In the sensitivity scenario (which instead uses incremental margins), the percentage increase in price was estimated in a range between 9% and 17% for the pre-paid segment and between 6% and 7% for the post-paid segment.

3.6.2 ***Notifying parties claims, second round of results and conclusions***

After the release of these results, the notifying parties, not convinced of what has emerged, replied. They questioned several points which in their view had led to overstate the forecast for price increases. In particular, among the most relevant points, it should be noted that they claimed that the commission had ignored the possibility that the parties involved could enter into competition on the quality of the services offered, with a consequent quality repositioning. Moreover, they note the fact that it should also not consider the possible switching between a segment to another as price driven, because unlikely hypothesis. Finally, it is reported that the number of contestable customers belonging to the pre-paid segment is underestimated. Indeed, the commission considered only new customers as disputable, considering that the entire customer base already owned by a company was not open to possible switches.

As a result of the exposure of these claims, the commission has revised its analysis admitting that it has underestimated the number of contestable customers,

considering plausible that every month also a part of the existing pre-paid customers can evaluate alternative offers, thus increasing the total value. In addition to this, it recalculated the values for the analysis indicators also considering the cross segment switching null and setting an outside good diversion ratio of 20%. This last amendment was introduced to take into account the fact that a certain portion of customers could just stop using the mobile phone and the offers proposed to them because of the excessive increase in prices. Although such a high value is unlikely to be recorded, in this way it is possible to avoid considering the demand as purely inelastic (initially it was not considered the possible exit from the market of some customers) and is able to introduce a strong precautionary measure. Finally, the commission remained rigid on the first point exposed earlier. In fact, it considered a possible repositioning by brands as extremely expensive both economically and in terms of time, therefore very unlikely to achieve in the short term.

After these adjustments and modifications to the model, the second round of results was published. Despite the changes made, an increase in the average price in the market in a range between 3% and 6% has emerged, considering both the predicted price increase by Telefonica (above 10%) and rivals' reaction. However, as in the previous case, the effects seem to be significant and, that's the reason why the merge has been approved with remedies. They will be described and analyzed in the section 4.2.4.

3.7 Further elements of analysis

Up to this point, the analysis has been focused on the price, as it gives precise indications about the possible negative effects of a merger. However, it is good to consider additional variables that come into play. The following discussion tries to include in the evaluation of a possible merger also the effects that this could have on innovation and product quality.

The key aspect to be considered is the fact that companies also innovate to try to steal sales from competitors; this implies a strong impact of the merger on the amount of R&D expenditure of the merged company, as there is less needed to invest in order to be more competitive. Several articles have tried to model what happens after the merger about investments in innovation. In particular, the article by Motta and Tarantino analyzes the possible scenarios deriving from a merger, considering innovation as a deterministic concept. By modeling the choices of companies as a simultaneous game at a single stage where prices and investments are decided, was reached a decrease of the latter for the merged company, because

they follow the quantities sold, which clearly decrease as a result of the price increase.

Federico et al, on the other hand, model the problem stochastically but arrive at quite similar results. In this case, the model is a two-stage competitive game where, in the first place, the amount of investments is decided and then also the price is fixed. However, since the outcome of the investment is uncertain, this uncertainty is also taken into consideration in determining the future incremental margins, by modeling the success or failure of the expenditure made using a probability function.

The paper demonstrates how the effect of merging on innovation is driven by two factors. The first is linked to the negative externality that is created when one company innovates and therefore tends to steal customers from the other. With the internalization of this post-merge externality, there will certainly be less incentive for the merged company to spend on R&D. The second, called “price coordination”, concerns the possibility of coordinating prices by the merged companies, thus increasing profits. If pre-innovation profits are higher than post-innovation profits thanks to this coordination, there is even less incentive for merged firms to innovate. This effect depends very much on the demand form. In the study carried out this impact was always positive, thus going to counterbalance the first (externality).

Finally, the article by Denicolò and Polo expands the model described in the previous paper by considering also the potential efficiencies at the R&D level. It is noted how, if the cost function of R&D is sufficiently convex, it is possible to eliminate inefficiencies, by merging the R&D into a single research center to avoid duplication of economic efforts. This aspect would lead companies to have more incentive to innovate.

However, the analysis is not completely general for three reasons:

- The model presents the assumption of collusion between all firms, which leads to no competition effect on the price.
- Only mergers that lead directly to monopoly are considered.
- The impact of merging on innovation is considered separately, not including what happens to prices.

To conclude, Bourreau takes up Federico's article, trying to formalize it and bring it back to different classic models of the industrial economy, but also considering a variant in which the R&D of one firm leads to an increase in the demand of the other, thus generating a positive externality. Clearly, in this case, there will be an incentive for the merged firm to increase its R&D spending.

The impact of a merger on innovation can therefore be summarized in 5 fundamental points:

- It cannot be said a priori that the merger will lead to an increase in R&D spending, deriving from the increase in prices.
- There is no point in excluding R&D from the analysis just because it is an uncertain process.
- The two effects (externality and price coordination) can counterbalance each other if the second is positive and does not affect R&D spending, but the first is much more likely to prevail over the second.
- The analysis must always be done on an overall level. Even if it were true that the merger leads to greater expenditure on R&D and innovation, it is not certain that the beneficial effects of this aspect on the consumer can offset the competitive damage deriving from the consolidation of the market.
- The cases in which innovation is made to steal sales must always be distinguished from those in which for some form of synergy or spillover the innovation increases the rival's demand. It is always up to the merging parties to prove that the merger will lead to greater efficiency.

The aspects concerning quality, on the other hand, can be taken into consideration by using the following model.
Assume that, after the merge, there is an increase in quality for products 1 and 2 respectively supplied by the two merging companies. The quality increases and the demands of the two products are called respectively V_1, V_2 and q_1, q_2. The latter will depend on the price and on this increase, which augment the willingness to pay of the consumer. The profit of the new entity will then be given by:

$$\pi = q_1(\hat{p}_1, \hat{p}_2)(\widehat{p_1} + V_1 - c_1) + q_2(\hat{p}_1, \hat{p}_2)(\widehat{p_2} + V_2 - c_2)$$

Where are $\hat{p}$ the hedonic prices defined as price minus the increase in quality and c_1 and c_2 are the marginal costs which are considered constant. Thus, maximizing concerning $\widehat{p_1}$ it can be obtained the following first-order condition:

$$\frac{\hat{p}_1 - c_1}{\hat{p}_1} - \frac{1}{\hat{\varepsilon}_1} + \frac{V_1}{\hat{p}_1} - \widehat{D_{12}}\frac{\hat{p}_2 + V_2 - c_2}{\hat{p}_1} = 0$$

Where $\overline{\varepsilon}_1$ is the elasticity of demand X_1 with respect to $\widehat{p_1}$.
By exploiting the definition of the Lerner index (expressing it as a margin with respect to the price or as the inverse of the elasticity), it is therefore possible to simplify the first two terms and arrive at the following equation*:*

$$V_1 = \widehat{D_{12}}(\widehat{p_2} + V_2 - c_2)$$

By following the same steps to $\widehat{p_2}$, it is obtained an analogous equation and by solving the system we arrive at the equation that allows to estimate the percentage increase in quality in reference to the price.

$$\frac{V_1}{\hat{p}_1} = \frac{\widehat{D_{12}}\widehat{M_2}\frac{\widehat{p_2}}{\widehat{p_1}} + \widehat{D_{12}}\widehat{D_{21}}\widehat{M_1}}{1 - \widehat{D_{12}}\widehat{D_{21}}}$$

3.8 **Summary and future vision**

To summarize, it is not possible to use only and exclusively market shares and market concentration to understand whether a horizontal merge can be harmful, harmless, or even positive for competition and common well-being. The quantitative tools seen above must also be taken into consideration, always paying attention to the quality of the data: if for market shares, it is much easier to have data on sales as companies are obliged to transparency in financial statements, the necessary inputs for indicators and models seen previously are not always easily available. Furthermore, quantitative estimates will always be affected by particular limitations, as some elements that should be taken into consideration are not always mathematically modellable or cannot be inserted into a formula. Indeed, as regards the instruments described above, they do not take into account some dynamic effects of the market, which could mitigate the price effect of a merger. For example, if we consider that there are few barriers to entry in the given market, the entry of a new entrant will be facilitated and this will have an impact on prices. In addition, the effects of possible repositioning of products should also be considered. Finally, it should be emphasized that in the last ten years the empirical evidence has shown that often horizontal mergers in situations of oligopoly lead to price increases, once again underlining how fundamental the role of the regulator is.
For this reason, we have tried to clarify the main quantitative methods available, which must be used as a tool to guide the choices of the authorities. However, they must not be applied mechanically in every situation, but decisions must always be integrated with all the other quantitative and qualitative information available, considering the competitive context.

4 Post-merge evaluation

4.1 Tools and methods used

In this section they will be described, from a theoretical point of view, the two main approached used in the evaluation of a merger years after it happened. Those methods are broadly utilized by antitrust authorities and academics when they try to understand if a merger led to competitive issues.

4.1.1 Difference in differences method

This approach was introduced in 1978 by Ashenfelter and later dealt with by Card in 1985. Since the 2000s, it has been used to analyze and make ex-post merger evaluations. Specifically, it is used to compare changes and price levels in the countries which have been involved in the merge (treated country) with those which characterize a group of other external countries where there has been no merger (control group).

For this approach to be applied, two hypotheses must be valid:

1. The price change over time observed for the control group must approximate with good precision the change that would have been achieved in the treated country if the merge had not taken place. Consequently, these countries must be characterized by similar unobserved factors and common trends (this is true in situations like the one shown in figure 8, and false in those similar to what is shown in figure 9).

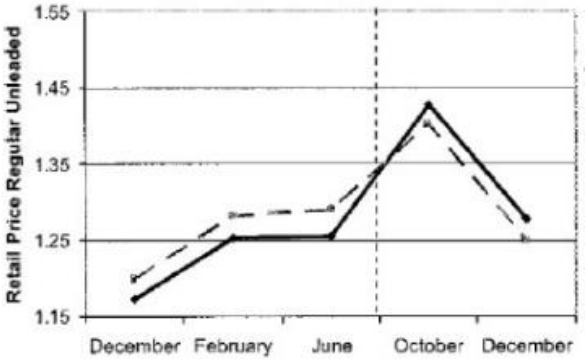

Figure 8: Hypotesis accepted, good approximation of the unobserved factors and trends

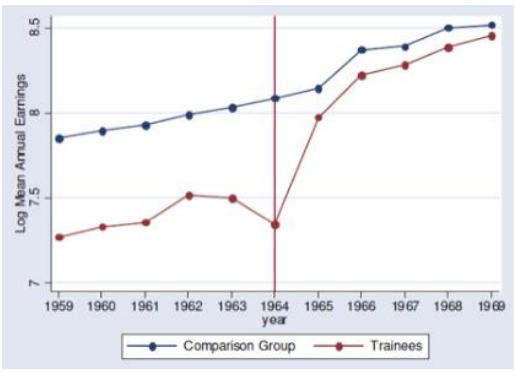

Figure 9: Hypothesis rejected, bad approximation of the unobserved factors and trends.

2. The control group countries chosen should not be affected by spillover effects resulting from the merger in the state under consideration.

Countries that are very similar and which are very close to the country treated will therefore be considered as a control group. Under these conditions, DiD can be obtained as:

$$DiD = \left(p_i^{post} - p_i^{pre}\right) - \left(p_{i'}^{post} - p_{i'}^{pre}\right) \quad (11)$$

Where p_i indicates the prices in the countries treated and $p_{i'}$ those of the countries belonging to the control group. This is a difference between differences, whereby the price variation recorded between pre and post merge in the control countries is subtracted from the similar variation observed in the treated country.

Another applicable formula to use this approach is to obtain the value of DiD by subtracting the observed price difference between the country treated and those of the control group, pre-merge, from the similar difference found between the same countries post-merge (pictured in figure 10).

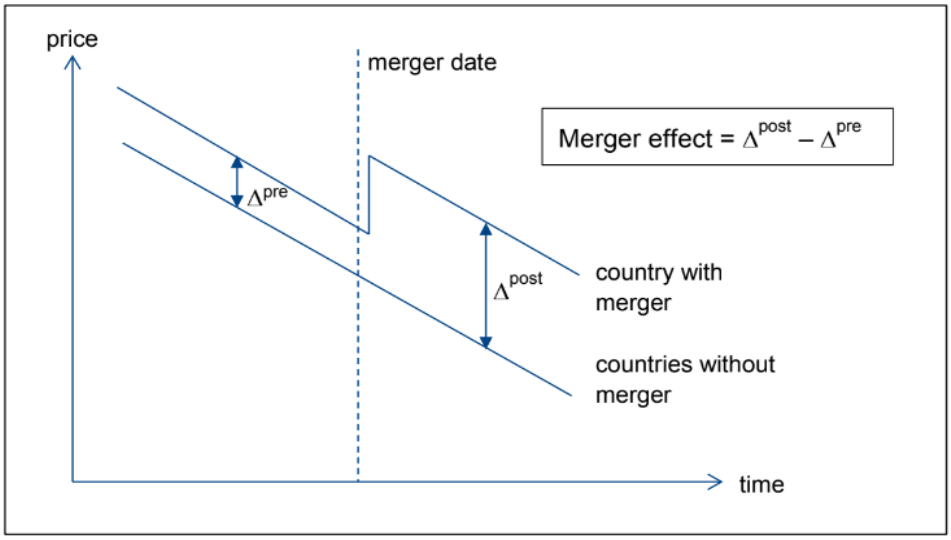

Figure 10: Illustrative example of the DiD approach

In general, for both applications, a positive merger effect means that treatment group prices increased on average compared to those of the control group following the merger, thus indicating a negative effect on competition. The above calculation and illustration say nothing about the significance level of the DiD estimate, hence regression analysis is used.

Considering the general model:

$$y_{i,t} = A_i + B_t + \beta_t I_{i,t} + \varepsilon_{i,t} \quad (12)$$

Where $y_{i,t}$ is the dependent variable representing subject i at the instant of time t. A_i are the treatment/control group fixed effect, B_t are fixed effects based on the specific time instant and $\varepsilon_{i,t}$ is a generic error term, again dependent on the instant of time and on the country. $I_{i,t}$ represents a dummy variable, which takes the value 1 when a specific condition is true and 0 otherwise. This last variable, β_t, is the parameter of interest, which represents the treatment effect in the time period t following the observed event. The regression is needed to determine the value of this parameter, thus understanding if the change in prices over time is due to the simple temporal trend and unobservable effects or if it is attributable to the event itself.

Next, to check the correct estimate of this element, it is possible to use the formula (12) for each of the following cases, obtaining:

- Country belonging to the control group, pre-merge: $E(y_{i,t}|i = Control, t = Before) = A_{Control} + B_{Before}$
- Country belonging to the control group, post-merge: $E(y_{i,t}|i = Control, t = After) = A_{Control} + B_{After}$
- Country belonging to the treatment group, pre-merge: $E(y_{i,t}|i = Treatment, t = Before) = A_{Treatment} + B_{Before}$
- Country belonging to the treatment group, post-merge: $E(y_{i,t}|i = Treatment, t = After) = A_{Treatment} + B_{After} + \beta$

At this point, re-entering these formulas in equation (11), if $DiD \cong \beta$ the correctness is verified.

We can then move on to the specific method for the case under consideration, identifying new variables that were previously incorporated, for simplicity, in the error term:

$$\ln(p_{i,t}) = A_i + B_t + \beta_t I_{i,t} + \delta GDPgrowth_{i,t} + \varepsilon_{i,t} \quad (13)$$

In which $\ln(p_{i,t})$ represents the natural logarithm for a certain group of customers, in country i, at the instant of time t and GDP (gross domestic product) growth is a demand related factor, a time varying control variable. It this case, the dummy variable $I_{i,t}$ takes the value 1 when the merging countries are considered and when t turns out to be equal to the desired time frequency (if you want to observe this value on an annual basis, then I will be worth 1 when the subscript turns out to be equal to 1,2,3 ...). Finally, β_t represents the effects of the merge in the time period t following the merge.

As expressed above, the application of this estimator is allowed and unbiased when the countries considered are characterized by similar unobserved factors and common trends. The hypothesis that the control group and the treated country are subject to similar factors not observable after the merger is not verifiable, however, in line with literature, it is possible to assume that if these nations present the same trends before fusion, then they will also be affected by similar unobservable factors. What instead is testable and analyzed with a greater level of detail is the presence of common trends between the countries used for the application of this indicator. In fact, it is possible to perform a formal test, analyzing the deviation between the price in the treated countries and the average value of the control countries for each quarter. The test evaluates whether the price deviations of the treated country in the pre-merger period follow a different trend than the average price of the control countries. This test is more precise and accurate the greater the time interval, before the fusion, of which the data is available. In some cases, it can be observed that the time varying control variable, GDP, do not explain the totality of the differences between the recorded price trends in the various nations, as these can be affected and dependent on a number of not directly observable effects. Consequently, in cases where this test gives a negative result and the price trend appears to be divergent, country-specific linear coefficients may be introduced to incorporate this share of trend variation where the country under control deviates from the treated country. It is possible to do this under the assumption that, even later on with respect to the merger, there continues to be the same divergence with respect to price trends between the countries considered (diverging trends will continue in the post-intervention periods between the treatment and control groups). If it were not, in fact, the risk would be to obtain results even more subject to bias and errors.

The DiD, in case of country-specific trends, becomes the following:

$$\ln(p_{k,i,t}) = A_i + B_t + \beta_t I_{i,t} + \delta GDPgrowth_{i,t} + \partial_i t + \varepsilon_{i,t,k} \quad (14)$$

In this equation, it is precisely the term ∂it that represents these linear trends specific to each nation and it is simply added to the previous formula, which represents the common base among all countries.

Whereas the specific hypothesis under the basic DiD approach is based on the assumption that the unobserved effects have a similar impact on the treated and control countries in the absence of the merger, in the latter case, the hypothesis is different. By including country-specific linear trends (as in equation (14)), the underlying assumption is that, in the absence of concentration, the logarithm of the price in the treated country would, in the future, follow the same trend as in the pre-merger period.

In general, one of the major problems regarding the application of this formula with specific trends turns out to be the fact that the approximation necessary for the model to give consistent results, is very weak. In fact, assuming that after the merger there will continue to be divergent trends regarding price in the countries considered, it is often not correct. In most cases, in fact, these trends tend to converge, so the inclusion of the term ∂it leads to results affected by bias.

In addition, Bertrand et al in 2004 showed that, not taking into account the possible correlation between the terms used, it could lead to an understatement of the standard errors and therefore to erroneously consider certain results as statistically significant, when they really aren't. For this reason, in order to avoid this, it is important to verify the presence of autocorrelation and heteroschedasticity in the residues.

4.1.2 ***Synthetic control group approach***

The second type of approach used in the ex-post evaluation of a merge is called the synthetic control group. The method, developed by Abadie and Gardeazabal in 2003 and later perfected by Abadie, Diamond and Hainmüller in 2010 and 2014, is a useful alternative to DiD and is used in general when someone want to evaluate the effect that a certain event has had on the element being considered. It is assumed to have a sample of $J + 1$ elements, where $j = 1$ represents the element to be studied and the units from $j = 2$ to $j = J + 1$ are the comparison elements. Just as if we were referring to a clinical trial of a drug, we name the element $j = 1$ as the "treated element" and the other elements as the "control group"; the metaphor is easy to understand, as the "drug" administered to the first element is the event whose effect is to be studied. Still referring to the pharmacological metaphor, it is important that the control group has the same characteristics (age, state of health, sex, etc.) with respect to the treated element; this underline how also in the method under analysis it is important to restrict the control group to those elements that can be associated with the treated element and that are not influenced by external shocks. For example, if we are referring to nations, it will be necessary to choose countries that are similar to each other and that are not influenced by some extraordinary event. At this point we consider different time periods, we define with T_0 the "pre-treatment" periods and with T_1 the "post-treatment" periods. The treated element can be traced back to a series of characteristics that can be well approximated by a combination of the control elements, rather than by the

characteristics of a single element. For this reason, a "synthetic control" is constructed as a weighted average of the units of the group of control elements. Mathematically this translates into a vector $J \times 1$ of weights from w_2 to w_{j+1} associated with each element of the group. Each weight is between 0 and 1 and they add up to 1. To choose the weights, we try to find the combination that best approximates the characteristics of the treated element. To do this, it must be considered that not all the characteristics that are included in the model have the same importance. We define $m = 1 \ldots M$ the elements of the vector M of characteristics. Calling $X_1(M \times 1)$ the vector of characteristics of the element treated before the treatment, we look for that vector of weights W which minimizes the difference $X_1 - X_0 W$ where X_0 represents the matrix $M \times J$ of the pre-intervention characteristics of the control elements. X_{1m}will therefore be the m-th characteristic of the treated element and X_{0m} will consequently be the vector $1 \times J$ of *m-th* characteristics of the various control elements. We associate a weight to each of the *m* characteristics defined as $\upsilon_m$and obtain W^* by minimizing the following sum

$$\sum_{m=1}^{k} \upsilon_m (X_{1m} - X_{0m} W)^2$$

obtaining the synthetic control.

We call Y_{jt} the outcomes that we want to study, for the element *j* in the period *t*. Y_1 is the vector $(T_1 \times 1)$ of the post treatment outcomes for the treated element and Y_0 the matrix $(T_1 \times J)$ of the post treatment outcomes for the control elements. At this point, the estimate of the effect that the treatment has can be calculated as $Y_1 - Y_0 W^*$, or at the level of a single period t as

$$Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$$

That is the difference between the outcome of the treated element in the period t and the weighted outcomes by means of the "synthetic control" vector of the various untreated elements. At this point, however, it is necessary to understand whether this difference is statistically associated with the treatment or whether it depends on other factors (such as changes in other characteristics).

To do this, always referring to the pharmacological case, "placebo tests" are carried out which try to falsify the hypothesis of change due to the treatment. The approach is defined as placebo, precisely because it applies the same test seen previously to

elements or periods where the treatment did not take place; if the differences between the outcomes reached are similar or even greater than the case with treatment, this means that what was observed in the treated element is not attributable to the treatment itself but to other factors. If we consider a period in which the treatment has not occurred but the element under examination remains the same, the test is defined as “in-time placebo”; if the test is carried out over the same period but considering an element not subject to treatment, the approach is called "in-space placebo". Considering the latter, a simple method to conduct the test is to calculate the ratio between the root mean square prediction error (RMSPE) in respectively post and pre intervention time periods for the treated element and for the placebos. RMSPE in the pre-treatment case can be defined as

$$RMSPE = \left(\frac{1}{T_0} \sum_{t=1}^{T_0} \left(Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \right)^2 \right)^{1/2}$$

that is the root of the mean of the quadratic difference between the outcome of the element under examination and the outcome of the synthetic control over all pre-treatment periods. Similarly, it is possible to calculate the same value considering the post-treatment periods. The lower the likelihood of finding a ratio of RMSPE in placebo greater than the ratio in the treated item, the greater the likelihood that the difference in results is due to the treatment.

The method lends itself well to modeling situations in which it is not possible to directly compare the treated element with a single untreated element; this is the case of entire nations or regions, where there is only a small panel of “untreated” elements. The approach can lead to enormously biased results if you don't pay attention to how to deal with the various elements. As previously mentioned, it is important that the control group has characteristics sufficiently similar to those of the treated element. Furthermore, it is necessary to have enough pre-intervention periods in order to obtain a vector of weights that closely approximates the treated element. Similarly, it will also be necessary to have a good number of post-intervention periods, should the effects manifest gradually over time. In conclusion, it can be said that such an ex-post estimate is certainly applicable to the case where it is necessary to evaluate the potential price change after a merger in a specific country. In this case, the elements that are to be considered are the different nations: the nation "treated" will be the one where the merge took place, and the control group will be a collection of other similar countries where the merge did not happen. The outcome to be evaluated is the average price of the product or service

offered by the company and the characteristics on which it is based to calculate the vector W may include for example GDP or other indicators specific to the sector that is being analyzed.

4.2 **Case studies**

In this section, some of the most important merger cases in Europe will be analyzed, explaining the reasons behind the regulator's choices and pointing out where the antitrust should have done more.

4.2.1 ***T-Mobile / tele.ring (Austria)***

In August 2005, Austria's second largest MNO in terms of market share, T-mobile, announced the imminent merger with rival tele.ring. The merger will take place almost a year later, in April 2006, as it was subject to review by the antitrust. At that time, there were 5 market players in the telecommunications sector in Austria and they had highly asymmetrical market shares, as can be seen in table 1.

Table 1: Market share of Austrian MNOs before merger

	Mobilkom	T-Mobile	Orange	tele.ring	H3G
Year of market entry	1993	1997	1998	2000	2003
Market share before merger (Q1/2006)	39.5%	24.4%	20.7%	12.0%	3.3%

All companies at the time had their network infrastructure, therefore they were considered MNO. The case was analyzed starting from September 2005 both by the regulator in Austria and by the European Commission. The latter, after a first summary investigation, decided to continue with a more in-depth review of the case in November 2005. From the study it emerged that the merger could have led to anticompetitive effects: there would not have been an actual increase in prices in the short term. the term, but the downward trend observed in past years would have been curbed. The reason for this effect was mainly in the switching rates between tele.ring and T-mobile. In fact, in the previous three years, there was an increase in the market share of tele.ring which was stealing clients from T-mobile

and Mobilkom; consequently, the two market leaders suffered from a decrease in their market shares. This was due to the strong competitive pressure imposed by tele.ring, which offered much more advantageous prices on almost all rates. Finally, the commission found that neither Orange nor H3G could have replaced tele.ring with the resources and assets at their disposal. The former had comparable prices if not higher than the market leaders, while H3G had a rather limited infrastructure and relied heavily on national roaming, this would not have allowed it to compete adequately. To convince the commission to approve the merger, T-mobile proposed a series of remedies. The new colossus that came to be formed would have undertaken to transfer part of the infrastructure and spectrum to Orange and H3G. The commission concluded that this would be sufficient to avoid competitive damage, because by selling spectrum and supplying the infrastructure to H3G, the latter could establish itself on the market, increasing the competitive pressure. It is therefore emphasized that the ex-post analysis was carried out also considering the commitments, as it would have been impossible to separate the effect and analyze what would have happened if the merge had occurred without remedies.

4.2.1.1 Market share

In figure 11, it is possible to see the trend of the market shares in the period 2004-2009 of the main MNOs. The market leader Mobilkom, after the slight loss of customers described above, thanks to the introduction of a low-cost sub-brand, managed to regain market share even exceeding the pool of customers served in 2004. Orange saw a slight decrease after the merger, while H3G was the operator with the greatest growth in terms of market share. The expansion was mainly due to two reasons: H3G was the “late entrant” in the market, and it took years before it could build a reputation; furthermore, in the beginning, its infrastructure was rather limited and over the years (also thanks to the post-merger commitments) it was able to expand it, thus attracting more customers. There are no MVNOs in the graph, as at that time their importance was rather limited, with an overall market share of less than 2%.

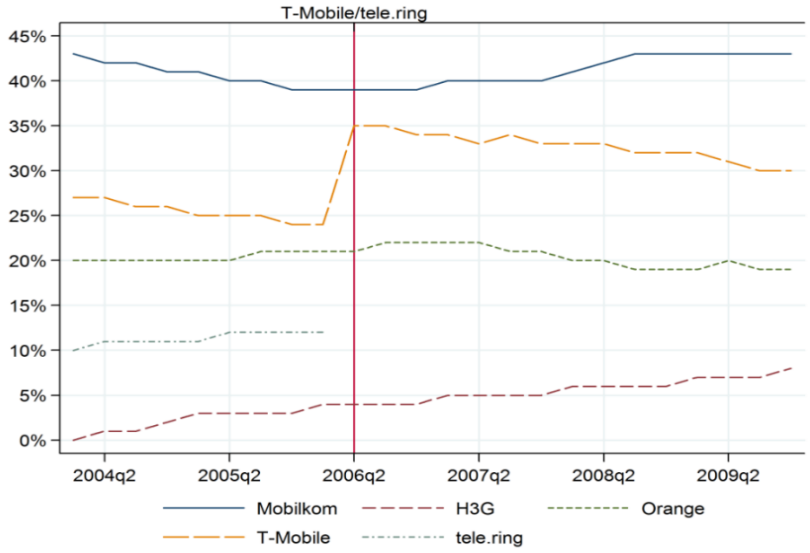

Figure 11: Market share trend from 2004 to 2009 in the Austrian market

4.2.1.2 Prices

Given the complexity and strong differentiation of offers from operators, it was decided to estimate a price indicator that aims to represent the average monthly rate of a typical bundle of services (voice, SMS, data). Consumers were separated into 3 main baskets (low, mid, and high) based on the consumption of these services. For simplicity, the mid segment is considered in the price trend analysis.

Figure 12 describes the price trend for the main operators and their sub-brands. We note how Mobilkom, with its A1 brand, has on average the highest prices on the market and the gap with the prices of other operators has tended to increase after the merge. However, it should be considered that in the second half of 2007 Mobilkom introduced its low-cost bob brand, which maintained lower prices than all the other players, thus clearly differentiating its customers and managing to raise its market share. As for the two merged companies, tele.ring in the years before the merger has always undercut its competitors, except for H3G (this, once again, underlines the strong competitive pressure).T-Mobile has always maintained the price between that of Orange and tele.ring; following the merger, it kept tele.ring as a separate brand and this allowed the company to adopt a different strategy, undercutting Orange and H3G with the new branch and keeping prices slightly higher with T-mobile. The reason why the market share has shrunk could therefore be attributable to non-price effects, such as the difficulty in integrating the two companies.

Orange, before the merger, maintained relatively high prices, but was the first to introduce its low-cost brand, called “Yesss!”. After the merger, the company tried to change its strategy by undercutting its competitors, but as seen above this did not have much effect on the market share. As for H3G, before the merge, it had always offered fares at the lowest price, except for the low-cost brand “Yesss!”. After the merge, also thanks to the commitments carried out by T-Mobile, the late entrant strategy changed radically: having more spectrum and infrastructure with greater coverage available, it was able to request slightly higher prices from customers but with fares that included a large number of SMS / min / MB and higher connection quality.

Consequently, it is possible to conclude that it is quite complex to trace back the trend of market shares to that of prices because during that period other elements of influence also came into play.

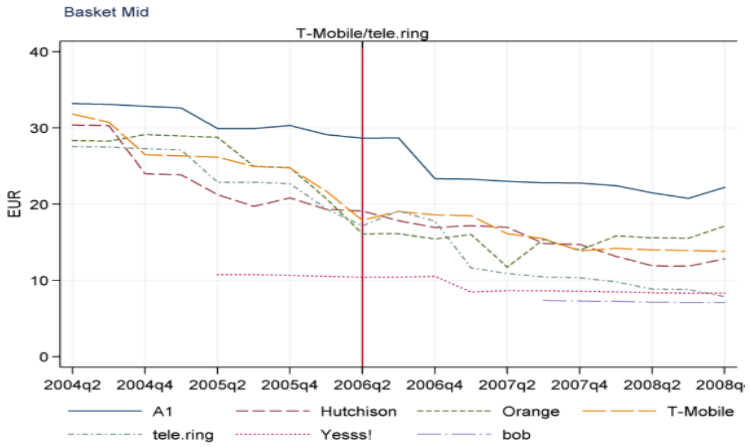

Figure 12: Trend of prices offered by the principal operator for the mid-usage basket

The decrease in the average price is evident from the analyzes set out above; however, in the telecommunications sector is a rather common pattern, for this reason, a comparison was made with a "control group" made up of 11 similar countries in which the merge did not take place.

As mentioned above, it was decided to analyze the price trend in three different segments.

In the low basket, as can be seen from the figure 13, the average price of the four cheapest tariffs in Austria fell from about € 22 to € 10 in the period Q2 2004-Q2 2008. The same average prices of the control countries also underwent a reduction from € 18 to € 12, but with a different trend. It is possible to note that only after the

merger, did the average price in Austria fall below the average of the other countries.

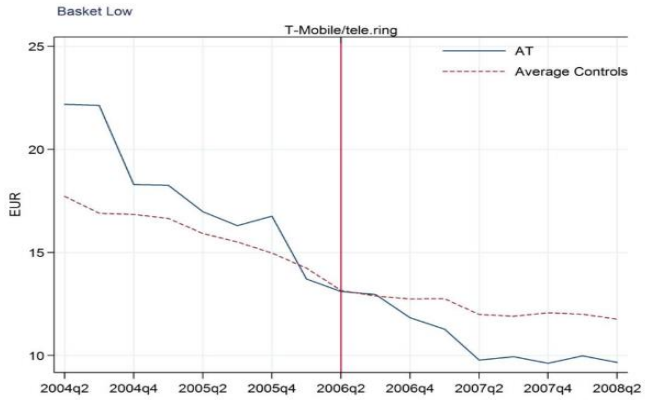

Figure 13: Average price trend for the low-usage basket

The case of mid basket appears to be slightly different as the average price decrease trend remained more or less the same until before the merger for Austria and the control countries; the gap between prices then widened after the merger when they reached respectively a value of around € 15 in Austria and around € 18 in the control countries (figure 14).

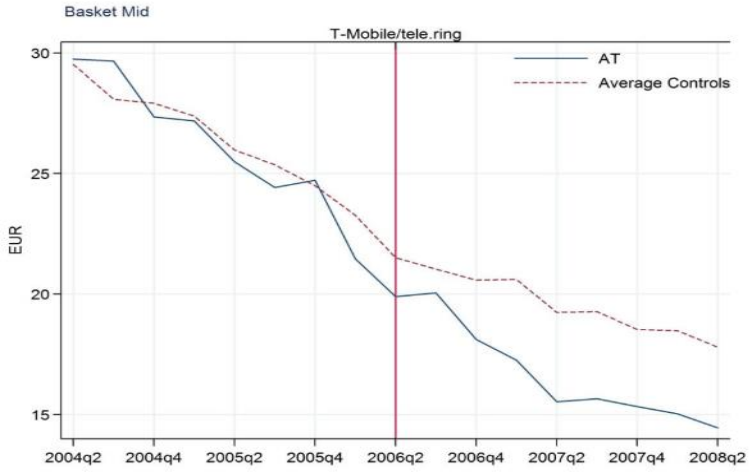

Figure 14: Average price trend for the mid-usage basket

Finally, in the high segment, the pattern between Austria and the control countries seems to be more or less the same; however, even in this case, a greater decrease in prices in Austria was noted once the merger took place. In this case, the price

level in Austria already started from a lower value than in the control countries (43 € VS 50 €) and then reached values of 22 € and 30 € respectively in the second quarter of 2008 (as shown in figure 15).

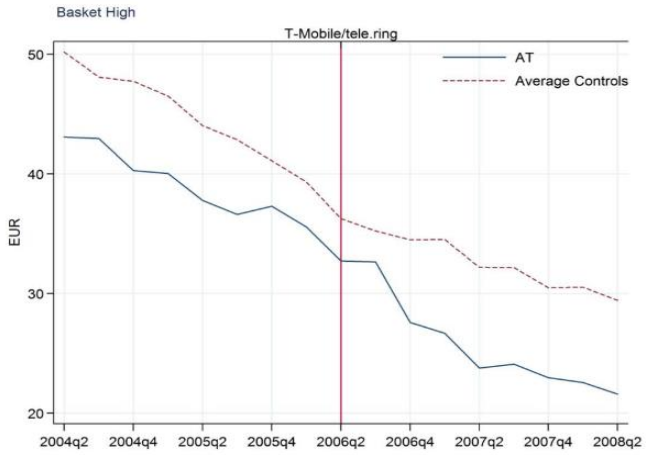

Figure 15: Average price trend for the high-usage basket

At first glance, it could therefore be said that the merger has had a positive impact on competition, reducing prices on average more than what has been observed in countries where the merger did not take place. However, it should be emphasized that in this first preliminary analysis, factors that could in some way influence the price country by country have not been taken into consideration. In the next section, the econometric analysis carried out tries to include these elements.

4.2.1.3 Econometric analysis

For the following econometric analyzes, the two approaches previously described in section X were used, calming them in the specific case considered.

4.2.1.3.1 DiD

Using the "difference in differences" approach, an attempt was made to estimate the difference in prices in Austria relative to the control countries. Taking into consideration the basic model expressed by equation (15) which derives from (13) where the independent variable MTR has been inserted and the merger effect was

split into two different variables, one concerning the short-term effect and the other referring to the long-term; we have reached the results shown in table 2: for all three segments, there was a reduction in prices after the merger; this is evidenced by the fact that the short and midterm effect coefficients are always negative.

$$ln(p_{i,t}) = A_i + B_t + \beta_{1t}S_{i,t} + \beta_{2t}L_{i,t} + \delta_1 GDPgrowth_{i,t} + \delta_2\, log(\,MTR_{i,t}) + \,\varepsilon_{i,t} \quad (15)$$

In the case of the first two segments (low and mid) the difference is also statistically significant as can be seen from the p-value, while in the high case the coefficients are not statistically significant. MTR and GDP growth are instead variables used as proxies for network costs and quantities required by the market respectively: both coefficients are positive, proving that the price increases as these two elements increase. Considering therefore to assume that the decreasing trend in the control countries is almost the same as in Austria, it is possible to state that, on average, the merger in Austria has led to a greater decrease in price compared to the 11 countries where this did not happen.

Table 2: Difference in differences econometric results

	(1)	(2)	(3)
Dep. Variable	log Price	log Price	log Price
Basket	Low	Mid	High
Short-term effect	-0.231***	-0.134***	-0.074
	(0.000)	(0.008)	(0.131)
Medium-term effect	-0.340***	-0.180**	-0.128
	(0.000)	(0.028)	(0.111)
GDP growth	1.562	0.906	1.114
	(0.254)	(0.558)	(0.468)
log MTR	0.007	0.098	0.130
	(0.958)	(0.570)	(0.463)
Constant	3.263***	3.847***	4.327***
	(0.000)	(0.000)	(0.000)
Observations	1,727	1,727	1,727
R-squared	0.737	0.815	0.832
Country-spec. trend	NO	NO	NO
Common trend test	Failed	Passed	Passed

Cluster-robust pval below coefficients (s.e. clustered at country level)[82]
Time fixed effects and country-provider fixed-effects
Excluded quarter (merger) Q2/2006; pre-period 8 quarters; post-period 8 quarters; cheapest 4 tariffs
Common trend test if: "Failed" we reject the null hypothesis of common trend at 10% level
*Significance level: *** 1%, ** 5%, * 10%*

4.2.1.3.2 Synthetic control group

For the creation of the synthetic control, the 11 OECD countries already used in the DiD analysis were taken into consideration. We analyzed 8 pre-merge periods (Q2 2004-Q1 2006) and 8 post-merge periods (Q3 2006 - Q2 2008) excluding the second quarter of 2006, the period in which the merge took place, as it cannot be considered as purely pre or purely post-merger. As described in section 3.1.2, the pre-merge periods were used to estimate the weights to be associated with each country by defining the "synthetic control" vector in the three different segments examined. The results of the econometric estimate are shown in table 3.

Table 3: Synthetic control group and placebo tests results

Basket	Period	Effect	Rank	Selected controls
Low	short	-0.191	4/12	CH; SE; FR;
Low	medium	-0.404	1/12	
Mid	short	-0.085	4/12	ALL- UK, CH, SE, highest weight
Mid	medium	-0.148	5/12	
High	short	-0.005	5/12	DE; FI; HU; FR, CZ
High	medium	-0.036	8/12	

Excluded quarter (merger) Q2/2006; pre-period 8 quarters; post-period 8 quarters; cheapest 4 tariffs

The first two columns represent the segment and the period taken into consideration; the “Effect” column approximates the percentage change in price, as the logarithm was used in the estimate. Finally, the “Rank” column expresses the results of the placebo tests to verify the significance of the results. As one can easily see, the effect is always negative, with different magnitudes depending on the period and segment of reference. This would lead to the conclusion that, compared to the control countries, the merger in Austria has led on average to a reduction in the average price. Looking more closely at the column relating to the rank, it is noted that the significance of the estimates is not reliable: except for the medium term in the low segment, in all other cases, the rank is greater than or equal to four. This means that for at least 4 of the placebo tested, the effects on price reduction were greater than in the Austrian case. This evidence suggests that, most likely, the synthetic control group approach does not lead to consistent results; the reason could simply be the lack of pre-merge periods which led to a vector of biased weights. Despite this, the method still excludes a possible post-merger price increase.

4.2.1.4 Conclusions

In almost all the analyses described above, the results show that, in Austria, after the merger, there was a price reduction when compared with other similar countries. However, it should be emphasized that the estimates are not reliable from the point of view of the extent of this reduction: the estimated values of the coefficients are very variable and have too wide ranges between them to be able to define a precise number. Furthermore, the second type of approach used led to insignificant results. For this reason, it is not possible to say that there is a strong causal link between the merger and the price reduction. There are 4 different reasons why the Austrian market remained competitive once the merger took place:

- The commitments offered by T-mobile ensure that the two smaller operators (Orange and H3G) could increase the competitive pressure. In particular, it was seen how H3G was able to become more independent by increasing its national coverage thanks to the sites provided by T-mobile.
- Post-merge, the market structure remained highly asymmetrical and with 4 operators, this was able to limit the loss of competition
- Efficiencies were generated in the newly merged entity, which were partly passed on to the customer through a price reduction. This is mainly due to the economies of scale resulting from the increase in volumes.
- Several low-cost sub-brands were introduced by the main MNOs, which met the demand of the lowest-paying customers and brought competitive pressure to the market.

4.2.2 ***Case T-Mobile / Orange (Netherlands)***

The following analysis takes into consideration the merger that took place between T-Mobile and Orange, two Dutch MNOs, in August 2007. Also in the Netherlands, only two years earlier, two other MNOs merged; the following study, however, does not analyze this instance in detail. However, it should be emphasized that the results described below are certainly influenced by the previous merger. The merger process went through the scrutiny of the European Commission, which decided to approve the acquisition by T-Mobile without remedy. Antitrust mainly focused on the uncoordinated effects of competition that could have emerged both in the retail market and in the wholesale market. It was not necessary to study any possible coordinated effects as low price transparency was found, in addition to strong post-

merge asymmetry and high excess capacity in the industry. The regulator concluded that the merger would not harm competition in the two markets for several reasons. Orange and Mobile were not considered “close competitors” as the switching ratios between the two MNOs were found to be rather limited; secondly, the commission stated that the strong presence of MVNOs and service providers on the market would still have kept the competitive pressure high. On the other hand, analyzing the wholesale market, the high excess capacity and a fair amount of unused spectrum have led the regulator to avoid possible competitive damage. The regulator concluded that the merger would not harm competition in the two markets for several reasons. Orange and Mobile were not considered “close competitors” as the switching ratios between the two MNOs were rather limited; secondly, the commission stated that the strong presence of MVNOs and Service Providers on the market would still have kept the competitive pressure high. On the other hand, analyzing the wholesale market, the high excess capacity and a fair amount of unused radio spectrum have led the regulator to exclude possible competitive damage.

4.2.2.1 Market share

The trend in market shares is shown in figure 16, but it should be emphasized that there are no MVNOs, as they will be dealt with later.

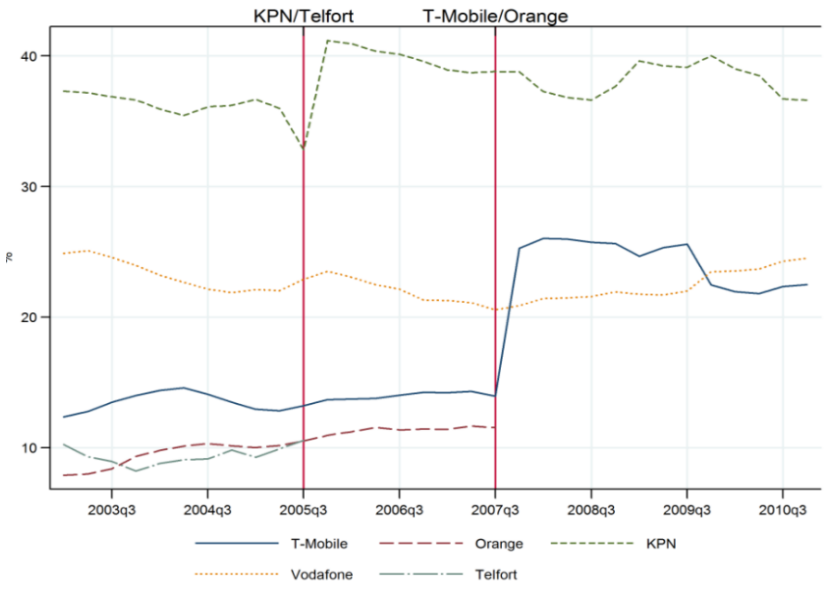

Figure 16: Market share trend from 2003 to 2010 in the Netherlands

It is noted how, thanks to the merger of 2005, KPN has increased its market share up to 40%, almost double compared to the second MNO of the country, Vodafone. The market leader, which was already experiencing a decrease in the number of subscribers before the acquisition, continued to lose customers throughout the period observed, except for Q3 2008, when KPN acquired Debitel, a leading MVNO. Vodafone's market share, up to the date of the merger between T-Mobile and Orange, was slightly decreasing; the trend then reversed, but overall, the share always remained between 20 and 25%. Orange and T-Mobile, at the time of the merge, had relatively lower market shares (10% and 15% respectively), which allowed the merged entity to become the second MNO by subscribers even if for a limited period. In fact, at the end of 2009, there was a strong decline probably due to the removal by T-Mobile of about 1 million inactive users; this event again led Vodafone to be the second MNO by market share.

Despite being a novelty in Europe, the Netherlands was characterized by a strong presence of MVNOs on the market. In addition to the overall market share of the virtual operators, figure 17 also shows the market share of the MVNOs aggregated by the host.

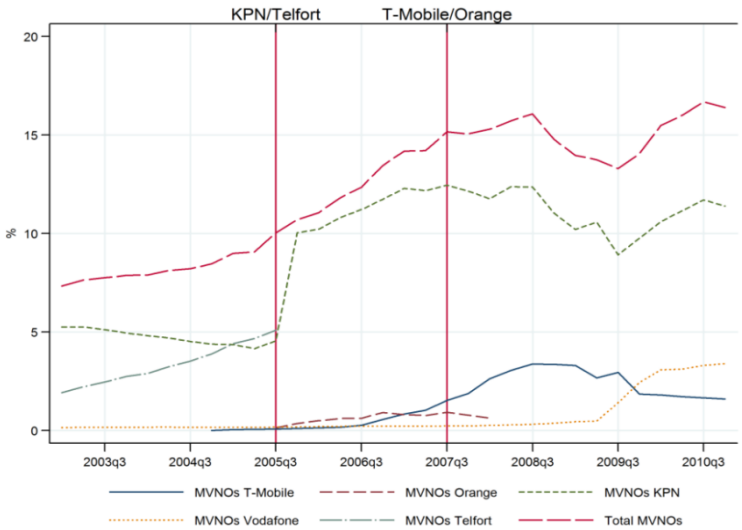

Figure 17: Trend of MVNOs market share aggregated by host

From an overall point of view, the growth of the latter over the entire period under examination is evident. The trend was limited only by the aforementioned acquisition of Debitel, but in aggregate the virtual operators went from having 7% of the market in 2003 to more than doubling their share in 2010. From table 4, it can be seen how during those years also the number of MVNOs has gradually increased,

given the scarcity of barriers to entry and the strong attractiveness. However, it should be emphasized that the 5 main MVNOs owned about 70% of customers, so the concentration was rather high.

Table 4: Number of MVNOs between 2005 and 2010

	2005	2006	2007	2008	2009	2010
Number of MVNOs	14	20	23	28	29	37
Newly launched independent MVNOs	5	5	3	4	3	6
Exit through acquisition by MNO or closing	2	0	1	2	3	0

As shown by the graph, the main hosts in the initial period were Telfort and KPN, which after the merger of 2005 managed to cover almost the complexity of the wholesale market. This is also because the other operators entered the market only later and without great results. After the merger of 2007, there were however slight changes mainly due to the choice to change host by some virtual operators, note for example the decrease of T-Mobile and the consequent growth of Vodafone.

4.2.2.2 Prices

Figure 18 shows the trend of the retail price in the Netherlands for the main operators, also considering sub-brands and the largest MVNO of the period, Tele2. For the sake of simplicity, although the study was carried out by dividing the consumer into the usual three segments based on usage, the mid basket is taken into consideration.

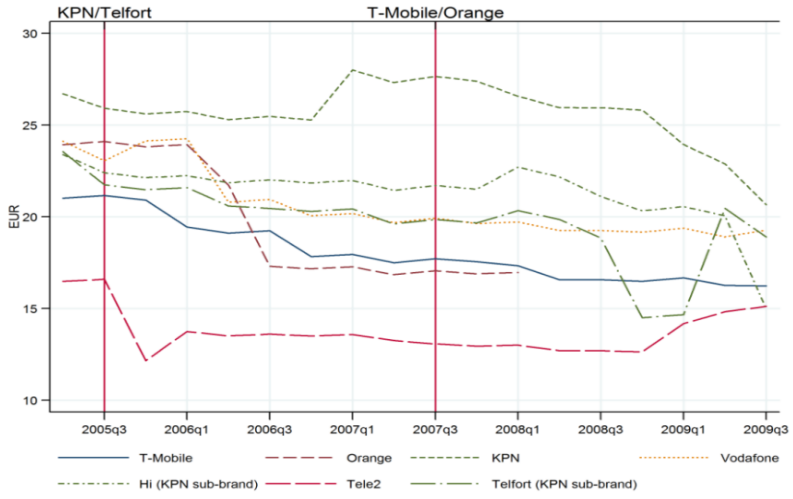

Figure 18: Trend of prices offered by the principal operator for the mid-usage basket

It can be seen how KPN uses a positioning strategy similar to that seen for Mobilkom in the Austrian case: the main brand has always maintained prices above the market average over time, while the Hi sub-brand has tried to capture the demand of the lowest sellers. T-Mobile has always remained below average, while Orange, initially positioned on higher rates, has begun to offer much more aggressive pricing which has led to it being the cheapest MNO before the Merge. Tele2, on the other hand, throughout the analysis period has always maintained the lowest price, however gradually reducing its gap with competitors. Overall, there was a slight decrease in prices, but from a graphical point of view, it does not seem that the trend was strongly influenced by the two mergers.

Also in this case, the trend in market shares does not seem to be perfectly explained by the trend in prices, proof of the fact that further elements of influence could have emerged during the years taken into consideration. For example, Vodafone, in the post-merger periods, has always maintained higher prices than the newly merged entity, but contrary to what one might expect, it has still managed to overtake T-Mobile in terms of customers.

However, to better understand the effect of the merger it is necessary to adopt the same methodology already seen in the previous case. Below, for the three reference segments, the comparison between average prices in the Netherlands and the control countries will be analyzed (similarly to the Austrian case but in this case, the countries considered are 12). For the average price, the 4 cheapest rates for each country were taken; figure 19 represents the low segment, figure 20 the mid segment and figure 21 the high segment.

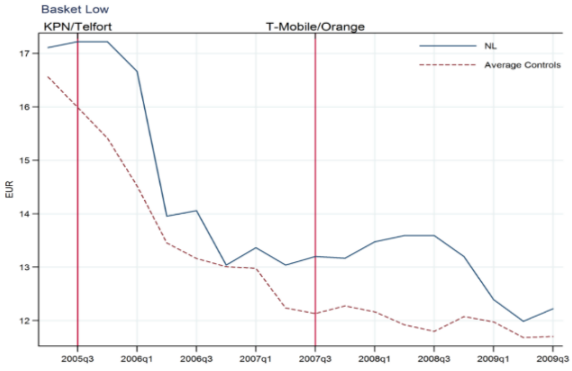

Figure 19: Average price trend for the low-usage basket (Netherlands)

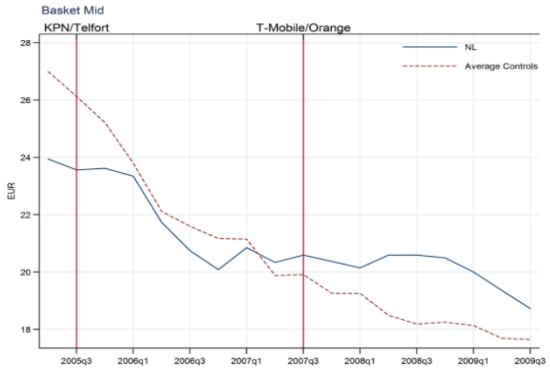

Figure 20: Average price trend for the mid-usage basket (Netherlands)

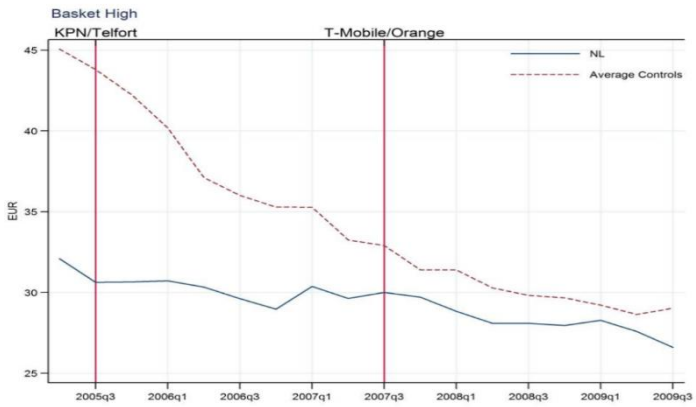

Figure 21: Average price trend for the high-usage basket (Netherlands)

For the first two baskets, the trend seems to be more or less the same up to the date of the second merge, the high segment deviates slightly where it can be seen a strong decrease in prices following the first merge in the Netherlands, which brings the average value closer to that of the control countries. If for the latter segment the post-merge trend turns out to be quite similar comparing the two trends, the same cannot be said for the low and medium basket. In this case, in the periods just following the merge, the trend differs markedly: in the Netherlands, even a slight growth is observed, while in the other European countries the trend remains negative.

4.2.2.3 Econometric analysis

Some premises are necessary before going into the detail of the econometric analysis described below. The merger was only approved in Q3 2007, but it should be emphasized that it was announced earlier and consequently some effects could have influenced prices in the previous quarter as well. As a result, Q2 and Q3 2007 were excluded from the analysis. Also, the 2005 merge between KPN and Telfort certainly influenced the pre-merge periods; in order to be conservative, only 4 periods before the 2007 merge were considered (Q2 2006-Q1 2007). Finally, although MVNOs played a key role in the market, they were excluded from the analysis mainly due to a lack of data.

4.2.2.3.1 DiD

The results of the econometric analysis are reported in table 5; similarly to the Austrian case, two variables representing the merge effect in the short and medium term were used, in addition to GDP and log (MTR) as control variables. If for the GDP also in this case the positive correlation with prices was found to be significant, the same is not true for the MTR where not only is not significant, but even the coefficients are negative.

Table 5: Difference in differences econometric results

	(1)	(2)	(3)
Dep. Variable	log Price	log Price	log Price
Basket	Low	Mid	High
Short-term effect	0.062	0.093**	0.133***
	(0.232)	(0.021)	(0.000)
Medium-term effect	0.009	0.099**	0.167***
	(0.864)	(0.038)	(0.001)
GDP growth	2.598**	1.964**	1.825**
	(0.013)	(0.025)	(0.015)
log MTR	0.015	-0.032	-0.083
	(0.906)	(0.723)	(0.226)
Constant	2.591***	3.066***	3.527***
	(0.000)	(0.000)	(0.000)
Observations	1318	1318	1318
R-squared	0.707	0.727	0.785
Country-spec. trend	NO	NO	NO
Common trend test	Failed	Passed	Failed

Cluster-robust pval below coefficients (s.e. clustered at country level)
Time fixed effects and country-provider fixed-effects
Excluded quarters (merger) Q2-Q3/2007; pre-period 4 quarters; post-period 8 quarters; cheapest 4 tariffs
Common trend test "Failed" we reject the null hypothesis of common trend at 10% level
*Significance level: *** 1%, ** 5%, * 10%*

The table shows how on average the merger has had an impact in terms of price increase. In particular, as the use of the service increases, this effect tends to be stronger. In fact, if the coefficients in the case of low basket are quite low, the same is not true for mid and high where the percentage increase in prices is between 10 and 16%, with all significant terms. Furthermore, the effect appears to be more evident in the medium term than in the short term. Recalling the various premises necessary for the interpretation of these data, it is however possible to state that, in general, the merge has led to an increase in prices as also highlighted by the various robustness tests carried out during the study.

4.2.2.3.2 Synthetic control group

By applying the method described in section 3.1.2 and using the 12 OECD countries already seen above for the DiD approach, we obtain the vector of weights associated with each country, to find the synthetic control. The results are reported in table 6 and divided between short and medium-term; in this case, they express a positive effect of the merger on prices. However, the placebo tests, as can be seen from the rank column, lead to not significant results; in particular, the value that would come closest to the threshold of significance relates to the high basket in the short period, but also in this case as many as 4 countries where the merge did not take place had an RMSPE ratio higher than the Dutch one. It cannot, therefore, be excluded that the estimated effect is also due to further unobservable factors.

Table 6: Synthetic control group and placebo tests results

Basket	Period	Effect	Rank	Selected Control
Low	short	0.138	10/13	BE; FR; IT
Low	medium	0.080	9/13	
Mid	short	0.105	6/13	BE; FI; SE
Mid	medium	0.156	6/13	
High	short	0.107	5/13	BE; FI; UK
High	medium	0.147	6/13	

Excluded quarters (merger) Q2-Q3/2007; pre-period 4 quarters; post-period 8 quarters; cheapest 4 tariffs

Also in this case, the reliability of the estimates is severely limited both by the small sample of countries and by the low number of periods available in the years prior to the merge.

4.2.2.4 Conclusions

From the results reported in the previous sections, the fundamental element that emerges is the following: after the merger between T-Mobile and Orange there was an actual increase in prices, which most affected the segment of high users of services. It should be emphasized that, as in the Austrian case, the estimates are not entirely reliable given the scarcity of data available and the possibility of specific trends for countries where the merger did not take place. Surely, it is possible to conclude that the two mergers that took place in the Netherlands have decreased the competition, but it is not possible to attribute this fact with certainty to one, to the other, or both. It should also be considered that the study did not analyze in

detail the role that the various virtual operators had in limiting this effect, however, it would appear that the competitive pressure brought to the market by the latter was not sufficient.

*4.2.3 **Telefonica / E-Plus (Germany)***

In this section it will be taken over the German case analyzed in section 2.5 but, this time, it will be studied from the post-merge perspective.

4.2.3.1 Introduction

Following the authorization of the transaction, the market was found to be more symmetrical and the respective shares are shown below (table 7):

Table 7: Market share before and after merger of Germans MNOs

	Telekom Deutschland	Vodafone	Telefónica	E-Plus
Market share before merger (Q3/2014)	33.8 %	27.0 %	22.4 %	16.7 %
Market share after merger (Q4/2014)	34.6 %	28.0 %	37.40 %	

The merger could only be implemented following the signing of an agreement between Telefonica and the commission, in which the conditions and requirements necessary to maintain fair competition were highlighted. Three main remedies were introduced. Telefonica would have to divest part of its radio spectrum and its assets, in order to facilitate the entry of a new MNO or MVNO on the market. Added to this, the company should have expanded its wholesale agreements with MVNO and service providers, offering 4G services to any interested player in the future. Finally, Telefonica was to sell up to 30% of its network capacity to one or more MVNOs before the acquisition was completed.

These allowed, in July 2015, the expansion of Drillisch on the market, a company (MVNO) which was given the right to buy 20% of the network capacity of Telefonica

(with an option for an additional 10%). This event had a significant relevance, because, in the following years, this company has been able to increase the number of its subscribers, from 2.07 million at the end of 2014 to 3.43 million at the end of 2016 (an increase of 65%).

The fairness and high level of competition in Germany was also guaranteed by the fact that this nation was characterized by a huge number of MVNO and minor service providers, which altogether accounted for about 15% of the market in 2012. Following the concessions given to Drillisch, this value increased, slightly eroding the remaining market share of the three national operators as highlighted below (table 8).

Table 8: MNOs and MVNOs trends of revenues share

	2012	2013	2014	2015	2016	2017e
MNO share of the total external revenues	84.9%	83.5%	84.0%	82.0%	81.0%	80.8%
MVNO/SP share of the total external revenues	15.1%	16.5%	16.0%	18.0%	19.0%	19.2%

4.2.3.2 Prices

Subsequently, the price evolution for each category of customers (low, medium and high usage profiles) was analyzed at national level, comparing it with a group of ten control countries (respectively at figure 22, 23 and 24).
In all three cases, the countries in the control group were correctly and accurately approximating the treated country. Although the first have an increasingly higher price value than the one observed in Germany, the variations and the time trend are similar until the date of the merger. Things, on the other hand, change by precisely observing the period after the merger. For all three categories of customers (although with different intensity, higher for the low category and lower for the other two), prices for telephone rates have started to grow, going even beyond the values of control states over a 12-18 months period.

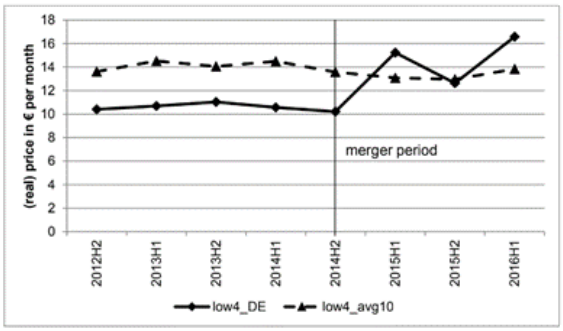

Figure 23: Average price trend for the low-usage basket (Germany)

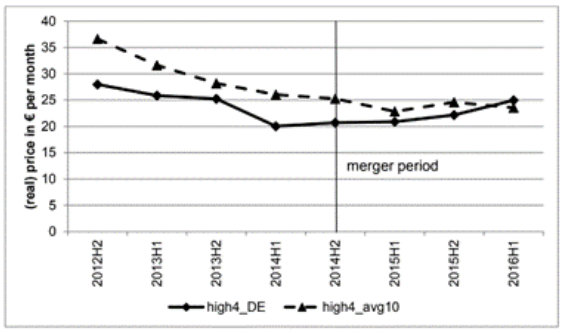

Figure 24: Average price trend for the mid-usage basket (Germany)

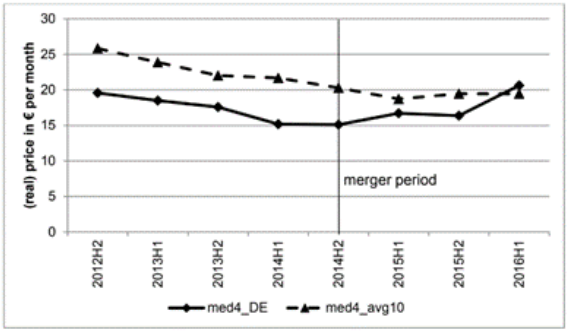

Figure 22: Average price trend for the high-usage basket (Germany)

4.2.3.3 Econometric analysis

In order to analyze these results, trying to identify a hypothetical correlation between prices and the fusion itself and its level of significance, difference in differences approach and synthetic control group were used. Since, as shown above, the control countries correctly approximate the price trend and the unobservable effects characterizing the country in question, the use of the base DiD is sufficient, thus neglecting the version having the country specific trends. Also in this case, like in the one analyzed before, related to the exposed and commented version at the section x, the model previews the insertion of the variable MTR like proxy for the network costs.

Through the base DID, the results obtained have evidenced the positive correlation, for each of the temporal periods post-merger taken in examination and for each of the three analyzed profiles of customers, between the realization of the merge and the recorded increase of the prices. In particular, the largest difference in terms of price changes between the country analyzed and the control group was recorded for the 'low' segment, where the estimated coefficients for the three post-merge

semesters were between 0.25 and 0.45. The values for the other two client categories were between 0.14 and 0.35 for the 'medium' and between 0.13 and 0.25 for the 'high'. However, even if these values indicate that a positive correlation between the merger and the increase in the prices has been recorded, the confirmation of their significance is verifiable only through the analysis of the p-values. In this case, all these values are relevant, those relating to the category 'low' have a greater degree of significance (p-value < 0.01), but also the others are significant (p-value < 0.1).

Turning to the analysis of the case through the synthetic control group, again, the results obtained (shown at table 9) by observing the coefficients generated are positive, thus indicating an increase in prices compared to those of the control group considered. Also in this case it is necessary to test the significance of the values, calculating the p-value for each category of customers, in each period. This indicator was approximated with the number of countries with a higher RMSPE than the treated country, divided by the number of placebo tests performed. However, since the control group is made up of ten countries and considering significative only those values associated with a p-value <0.1, for the case under consideration this means taking into account only those cases in which the RMSPE of the nation in question turns out to be greater than all those of the control countries. For this reason, as it is possible to see in the table, only the data relating to the category 'low' in the third half after the merger is significant.

Table 9: Econometric results

	Low (4 tariffs)			Medium (4 tariffs)			High (4 tariffs)		
	DiD basic	DiD trend	Synth	DiD basic	DiD trend	Synth	DiD basic	DiD trend	Synth
2015 H1	0.434***	0.458***	0.461	0.202***	0.270*	0.088	0.136**	0.180	0.154
	(0.000)	(0.000)	0.100	(0.004)	(0.083)	0.200	(0.039)	(0.304)	0.400
2015 H2	0.248***	0.277**	0.212	0.139*	0.219	0.043	0.131*	0.181	0.181
	(0.000)	(0.034)	0.300	(0.050)	(0.249)	0.200	(0.071)	(0.402)	0.100
2016 H1	0.454***	0.506***	0.431†	0.348***	0.470**	0.126	0.250***	0.327	0.124
	(0.000)	(0.002)	0.000	(0.000)	(0.048)	0.200	(0.001)	(0.219)	0.400
GDP growth	1.017	-0.000		2.484*	0.480		2.762**	1.362	
	(0.483)	(1.000)		(0.097)	(0.800)		(0.047)	(0.461)	
MTRs	-0.094	-0.002		-0.064	-0.022		0.041	0.062	
	(0.274)	(0.975)		(0.472)	(0.820)		(0.662)	(0.576)	
constant	2.375***	4.555***		2.647***	6.071*		3.022***	4.686*	
	(0.000)	(0.006)		(0.000)	(0.086)		(0.000)	(0.055)	
Obs.	77	77		77	77		77	77	
R^2	0.863	0.922		0.877	0.913		0.899	0.919	
Trend test passed?	Yes			Yes			Yes		

Further tests of the robustness of the results were also carried out subsequently, modifying the number of tariffs considered for each category of customers, the year used to observe the average consumption and other factors. The results of these tests, according to the specifications considered, showed different results both in terms of magnitude and trend and, in one case, they also showed a negative effect of the merger on prices for customers 'medium' and 'high'.

4.2.3.4 Ex-post evaluation of synergies

In addition to the use of these classic ex-post analysis tools, Telefonica's economic results were observed in the years following the merger. The latter are not attributable to the new merged entity formed but are the result of a pro forma analysis concerning Telefonica alone.

Initial estimates predicted that it would have been possible to achieve around €5-5.5 billion of combined effect distributed at 70%-30% between opex and capex, arriving, over five years (in 2019), to record annual run-rate synergies of €800 million. The realization of these synergies (highlighted in figure 25) started in a promising way in the first two years, registering a value of €280 million in 2015 and €430 million in 2016. On the basis of these latest annual results, the initial target was revised, raising the annual value to €900 million at the end of the period under consideration.

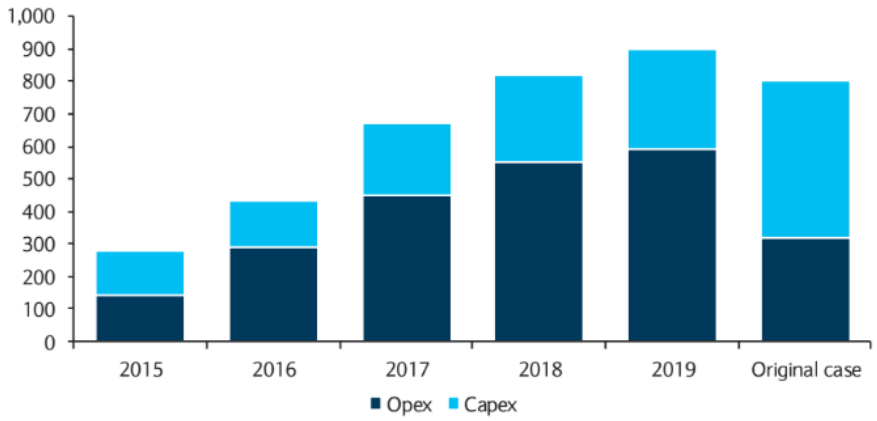

Figure 25: Synergy realization over the years (EURm)

However, at the end of the fifth period, the results did not meet initial expectations and forecasts. In fact, the cumulative value (between opex and capex) of synergies generated in 2019 amounted to €640 million (table 10), which led to a minimum increase in EBITDA, up to €1.9 billion with a CAGR rate of 0.3%.

Table 10: Comparison of pro-forma results for Telefonica O2 (EUR m)

Actual Result	2013 PF	2014 PF	2015	2016	2017	2018	2019
Revenues	8,082	7,950	7,888	7,503	7,296	7,320	7,458
Opex	5,876	6,076	6,073	5,643	5,421	5,436	5,555
EBITDA	2,206	1,875	1,816	1,860	1,875	1,884	1,903
Capex	1,300	1,163	1,032	1,102	932	958	1,044
OpFCF	906	712	784	758	943	926	859
Delta vs Pre-Deal							
Revenues			(62)	(447)	(654)	(630)	(492)
Opex			(3)	(432)	(655)	(640)	(521)
EBITDA			(59)	(15)	1	10	29
Capex			(131)	(61)	(231)	(205)	(119)
OpFCF			72	46	232	215	147

These results highlight how Telefonica, post-merger, has been subject to high pressures that have negatively impacted revenues, almost nullifying the cost synergies obtained. This outcome could be, firstly, attributable to the strong impact of the remedies introduced. In fact, Drillisch has increased the competition on the market, obtaining a consistent share in a short time. Secondly, there have been further difficulties in integrating the two networks, which, according to numerous surveys submitted to customers, has significantly reduced the quality of the service, worsening the user experience.

4.2.3.5 Conclusions

In conclusion, the results obtained with the two support instruments showed an increase in prices in the country considered compared to the control group countries. However, while what has been achieved through the DiD was found to be significant throughout the time frame considered, the same cannot be said about the results obtained by the synthetic control group. In addition, due to the results of the robustness tests carried out, it must be underlined that this analysis may not be totally accurate. Due to the availability of data for only 18 months after the

merger, the study is attributed to this period and the results should be interpreted as a short-medium term effect following the merger. Finally, since only MNOs were considered for the analysis, not taking into account the related sub-brands and MVNOs (which together represent about 20% of the market), it is not said that the results and considerations can be extended to the entire market. Anyway, to conclude, this merger did not simply lead to an average increase in the prices charged to customers for the subscription of tariffs but did not lead to the economic benefits expected and hoped by the companies involved.

4.2.4 Hutchison (3)/ Telefonica (O2)

4.2.4.1 Introduction

The agreement between Hutchison and Telefonica took place on the 22nd of June 2013 and provided for the transfer of O2 and 48 customers to Hutchison, operator which, in this way, would go from the last to the second place in terms of market share (shown at table 11).

Table 11: Irish Market share

	Vodafone	Meteor	O2 (incl. 48)	Hutchison (3)
Market share before merger (3rd quarter 2014)	39.2 %	20.2 %	23.3 %	8.9 %
Market share after merger (4th quarter 2014)	38.8 %	20.5 %	32.0 %	

The operation was made official by the commission on the 28th of May 2014, event only possible thanks to the introduction of two remedies imposed on Hutchison. The first foresees the necessity of the extension of the agreement relative to the sharing of the network with Meteor also to the period after the fusion. Talking about the second one, it provides the obligation to sell part of its network capacity to MVNOs, before the actual acquisition of Telefonica. Specifically, these virtual operators could have required up to 15% of the capacity of each of the two parties involved. In addition, should the Monitoring Trustee consider the growth plan of a virtual operator aiming to become an MNO to be likely, the latter would have a ten-year period to require the divestment of part of the frequency spectrum at Hutchison.

The implementation of these remedies began on the 20th of August 2015, when iD, an MVNO, decided to enter the market using the network capacity of Hutchison. However, despite his intention to attract 6% of the market within five years, after

little less than three decided to abandon it because of the very unpromising results reached (only 0.7% of the market had been obtained in the first two years). In addition to iD, also a second virtual operator decided to enter the market: Virgin Mobile. On the 5th of October 2015, this division of Virgin Media Corporation began its inclusion. This event, however, did not generate the acquisition of a large market share, but compared to the other MVNO, its dimension seemed to be growing (slowly) over time.

4.2.4.2 Prices

Again, the analysis was carried out by considering three customer segments, namely low, medium and high usage profiles. This is a comparison between what is happening in Ireland and what is happening in a group of ten control countries.

In all three profiles, as in the German case, the approximation of price trends observed in the countries covered by the control group countries appears to be correct. This is true until until the moment when the merger occurred, with the price in Ireland always being higher or at least equal to the one of the control countries but characterized by the same trend. Then, in the first period observed after the merger (first half of 2015), we can see a divergent trend between the two curves for each category of customers, caused by an increase in prices in the treated country (figures 26, 27 and 28, respectively show these trends for the low, mid and high customer category).

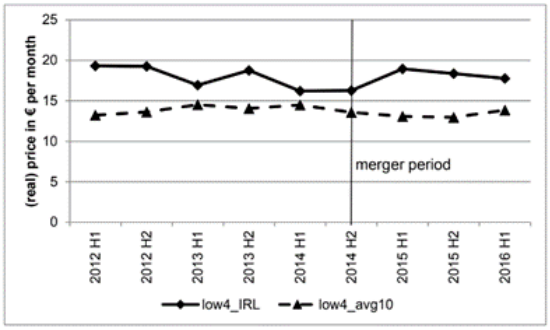

Figure 26: Average price trend for the low-usage basket (Ireland)

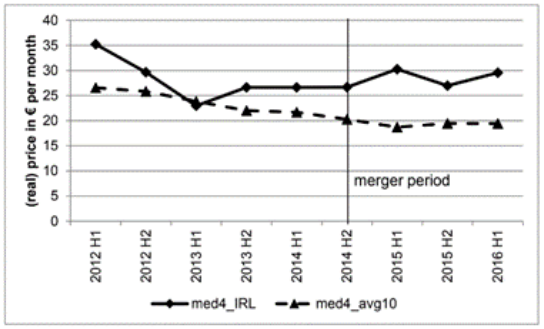

Figure 27: Average price trend for the mid-usage basket (Ireland)

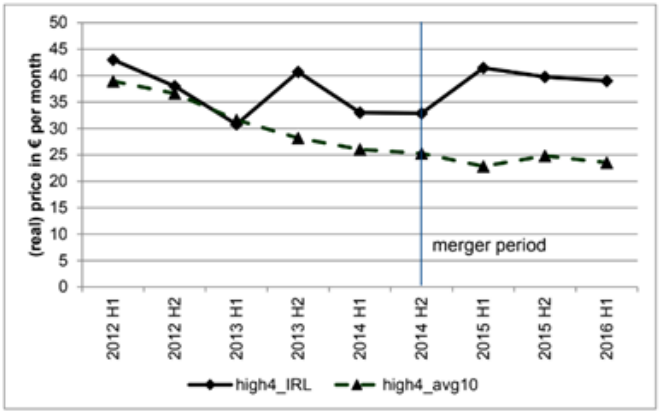

Figure 28: Average price trend for the high-usage basket (Ireland)

4.2.4.3 Econometric analysis

Like in the previous cases, the objective is to evaluate the presence of an hypothetical correlation between prices and the fusion itself, evaluating its level of significance. To this end, the support and analysis tools used were the difference in differences approach and the synthetic control group. It is not necessary to observe what has been achieved through the DiD with country-specific trends because, as shown in the previous paragraph, the ten countries chosen to approximate price developments in Ireland succeed in replicating variations and unobservable effects correctly over time. Also in this case, like in the one analyzed before, related to the exposed and commented version at the section x, the introduction of the variable MTR like proxy for the network costs is necessary to better explain the effects of the event.

Through the base DID, the results show a general price increase in the period of time taken into account following the merger. However, the magnitude of this effect and the significance associated with the degree of correlation between the realization of the merge and the recorded increase of the prices varies depending on the category of customers and on the time instant considered. Specifically, the highest values were observed in relation to the 'high' category, which are, moreover, the most significant in each of the three semesters following the merger. The results for the other two categories show a significance of the effect in the first semester of the post-merge period. After these initial data, significance is absent in the following period and returns to characterize the values of the 'medium' segment in the final semester.

Turning to the analysis of the case through the synthetic control group, again, it's possible to observe an increase in prices compared to those of the control group considered (table 12). This outcome is due to the coefficients generated, which are always greater than zero, thus positive. However, by calculating p-value as described above, none of these values are significant. This outcome could be attributed to the level of accuracy of the input data, in fact, despite the control group seems to well replicate the treated country, the accuracy of this approximation is lower than the one characterizing the previous case.

Table 12: Econometric results

	Low (4 tariffs)			Medium (4 tariffs)			High (4 tariffs)		
	DiD basic	DiD trend	**Synth**	**DiD basic**	DiD trend	**Synth**	**DiD basic**	DiD trend	**Synth**
2015 H1	0.163** (0.042)	0.351*** (0.000)	0.244 (0.400)	0.398*** (0.000)	0.402** (0.011)	0.444 (0.300)	0.436*** (0.000)	0.279* (0.063)	0.829 (0.300)
2015 H2	0.121 (0.167)	0.414*** (0.002)	0.229 (0.400)	0.156 (0.136)	0.235 (0.312)	0.239 (0.400)	0.360*** (0.002)	0.154 (0.439)	0.682 (0.500)
2016 H1	0.052 (0.664)	0.329*** (0.009)	0.197 (0.400)	0.370*** (0.004)	0.346 (0.107)	0.167 (0.900)	0.305** (0.027)	0.063 (0.774)	0.644 (0.500)
GDP growth	0.256 (0.798)	-0.358 (0.731)		1.078 (0.312)	0.198 (0.866)		-0.420 (0.752)	-0.353 (0.766)	
MTRs	-0.118 (0.131)	-0.063 (0.440)		-0.058 (0.484)	-0.065 (0.440)		0.041 (0.623)	0.005 (0.956)	
constant	2.394*** (0.000)	6.723*** (0.000)		2.675*** (0.000)	9.131*** (0.002)		3.036*** (0.000)	6.112*** (0.000)	
Obs.	88	88		88	88		88	88	
R^2	0.873	0.926		0.877	0.915		0.903	0.931	
Trend test passed?	Yes			Yes			Yes		

4.2.4.4 Conclusions

In conclusion, the results obtained with the two support instruments showed an increase in prices in the nation considered compared to the control group countries. In this case, however, it is not possible to extrapolate specific information through the synthetic control group, since the results obtained have always proved to be not significant. The outcome of the analysis is reliable thanks to the coefficients

returned by the DiD, which were significant in most cases. Also in this case, several subsequent checks were made to analyze and test the robustness of the results obtained. They confirmed what is expressed above, since for each category of customers, in at least one post-merge semester, they showed a significant correlation between the price increase and the merger. In addition, none of these tests showed a negative coefficient, indicating that the upward pressure caused by the merger could be confirmed. It should be stressed again that, since the analysis regards only the first three semesters following the merger, its conclusions should be taken into account only referring to the short-medium term.

5 Application of the ex-ante evaluation process: GUPPI analysis on the Thai case (2022)

In the following chapter, the author will carry out an ex-ante evaluation of the Thai Dtac /TrueMove H case, recently revised in a project carried out by NBTC, to which the two relators of the following thesis have worked directly.

5.1 Thai market overview

5.1.1 Introduction

In its early stages, the Thai telecommunications market consisted mainly of state-controlled companies. Nowadays, the main operators present are private companies that operate under the supervision of the NBTC (national broadcasting and telecommunication commission), the regulatory body in the country. The market has a value of around 640 million, second only to that of Indonesia in Southeast Asia. Despite the economic crisis resulting from the Covid-19 pandemic, the market has remained fairly stable in recent years, as can be seen from figure 29.

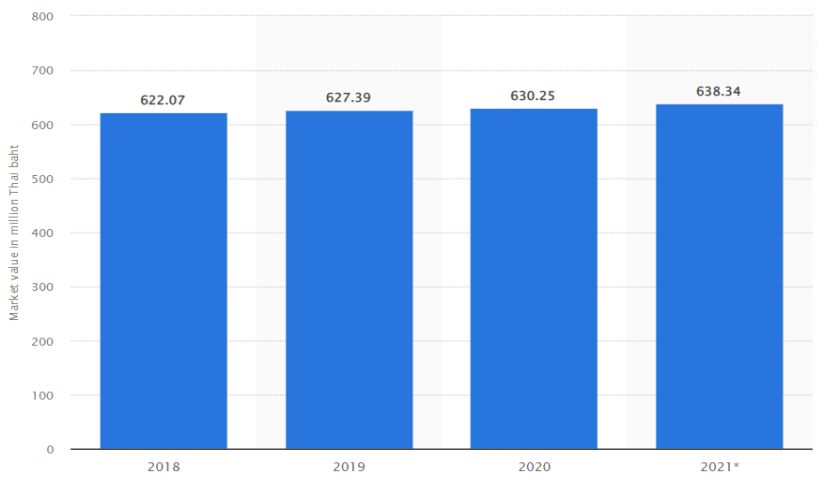

Figure 29: Thai telecom market value during the last four years

The sector can be divided into different categories: fixed line and fixed broadband communication, mobile communication, internet base communication. In recent

years there has been a strong development in the mobile communication market, with stable growth in the number of subscribers, as shown in figure 30.

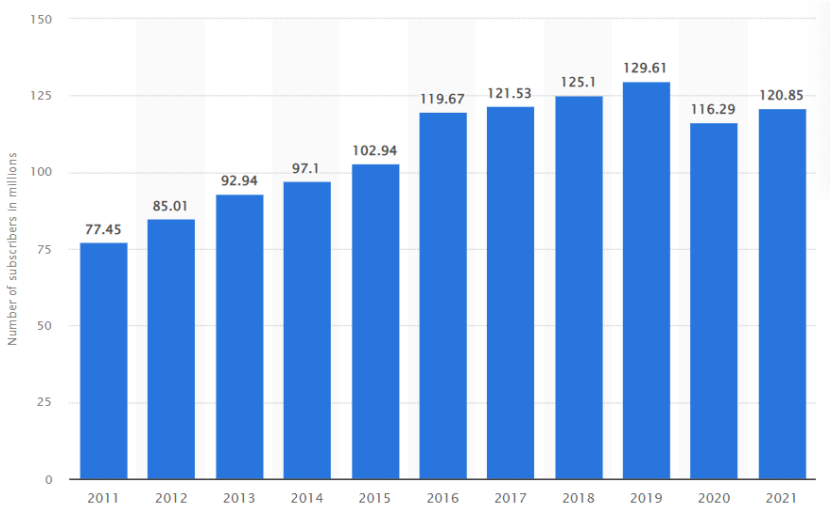

Figure 30: Number of Thai subscribers from 2011 to 2021

The State focuses heavily on the development of this sector in order to re-launch the economy after the collapse due to the pandemic and it is also for this reason that part of the frequency spectrum dedicated to digital TV has been reallocated to increase the network capacity of mobile operators. In order to achieve this goal, significant economic efforts will be required from companies operating to keep up with new technologies (5G, IoT, AI).

5.1.2 Operators

Currently, in the Thai telecommunications market there are three main rival companies named Dtac, TrueMove and Ais. It has therefore been decided to analyze them with a higher detail level, trying to generate a market profile for each of them. Specifically, the most significant variables such as "Total revenues", "ARPU blended", "Total cost of sales and services", "EBITDA", "EBIT", "Users" and "EBITDA Margin calculated" were identified, calculated and analyzed during the last three years and those data are reported in table 13, 14 and 15, respectively related to years 2020, 2021 and 2022. The value of revenues and total costs have been reported going back to the original data declared by the companies on their website, in the management, discussion and analysis section.

With aggregated data on service revenues, it has been possible to directly calculate the ARPU. The values we reported were obtained by calculating this indicator as total retail revenues divided by the number of users. It was noted that the values do not coincide perfectly with those declared in the MD&A and the main reason, according to our point of view, is the different interpretation of what can be defined as service revenue. We can't be sure of what was included by the companies because no description has been given about the calculation of the ARPU. We have decided to include in the total retail revenues both the core service revenues and the other service revenues, thus excluding all other items present. These include the sale of products (handset and starter kits), ignored as not considered revenue related to the service, IR revenues and Interconnection charges (which are instead that portion of revenues derived from subscribers of other MNOs who call MNO subscribers in consideration or use its network infrastructure), other operative income because it includes different sources of income and potentially represents revenue not directly attributable to the service. Network rental concerns the rental of the network infrastructure to any MVNO, for this reason it was also excluded from the revenue items related to retail and, finally, fixed broadband revenues were also excluded as they are not to be considered revenue related to the mobile phone service.

EBITDA was obtained by subtracting the opex from total revenues and subsequently adding depreciation and amortization. To this end, the cost items that it was decided to include in the opex were "total cost of sales and service", "selling, distribution and service expenses" and "administrative expenses", thus neglecting "gains/losses on exchange rates" and "management benefit expenses" since they were considered as non-operational expenses. This is an indicator of profitability of the company only based on operational management and, divided by the value of the total revenues, it allowed to derive also the last of the variables previously exposed. EBIT was obtained by removing the depreciation and amortization value from the previous total.

Finally, the number of users coincided with the value reported by the companies in the MD&A section in the closing quarter of each year.

Table 13: Year end data summary for the three companies (year 2020)

Year 2020	DTAC	TRUE	AIS
Total Revenues	฿78.817.999.37	฿106.226.000.00	฿172.890.265.29
ARPU Blended	฿3.06	฿2.67	฿2.98
Total cost of sales and services	฿55.973.275.05	฿92.557.244.00	฿110.848.322.79
EBITDA	฿29.386.519.57	฿27.490.557.00	฿76.929.057.29
EBIT	฿8.435.272.37	-฿3.628.980.00	฿37.711.057.29
Users	18.856.000.00	30.628.000.00	41.436.800.00
EBITDA Margin calculated	37.28%	25.88%	44.50%

Table 15:Year end data summary for the three companies (year 2021)

Year 2021	DTAC	TRUE	AIS
Total Revenues	฿81.320.003.25	฿111.086.000.00	฿181.332.889.76
ARPU Blended	฿2.92	฿2.51	฿2.82
Total cost of sales and services	฿60.786.942.57	฿94.933.741.00	฿121.453.193.23
EBITDA	฿29.266.799.10	฿31.978.268.00	฿91.553.273.49
EBIT	฿6.788.312.25	-฿1.818.523.00	฿38.179.247.76
Users	19.561.000.00	32.248.000.00	44.116.700.00
EBITDA Margin calculated	35.99%	28.79%	50.49%

Table 14:Year end data summary for the three companies (year 2022)

Year 2022	DTAC	TRUE	AIS
Total Revenues	฿80.600.057.00	฿102.966.000.00	฿185.484.688.00
ARPU Blended	฿2.68	฿2.36	฿2.69
Total cost of sales and services	฿60.680.888.00	฿88.568.768.00	฿126.171.786.00
EBITDA	฿29.280.991.00	฿32.887.568.00	฿89.877.395.00
EBIT	฿7.039.991.00	-฿4.955.832.00	฿36.960.395.00
Users	21.159.000.00	33.820.000.00	46.013.100.00
EBITDA Margin calculated	36.33%	31.94%	48.46%

5.1.3 Comparison between operators

As evidence of the fact that in this sector the competition is focused on price, it can be noted on figure 31 that the ARPU is in continuous and progressive decrease for all three operators, along the time interval considered. This index is what is typically considered and reputed a valid approximation of the price requested to customers. Typically, in the world of telecommunications, customers use sms, calls and internet data and each of these elements is associated respectively with a different unit cost. The ARPU is used in these cases to refer to a unique value, summarizing and approximating in a single data a typical bundle of the three key elements. In the case analyzed, the decrease of this proxy of the price from 2020 to 2021 for Ais and True has been greater (respectively 5.4% and 6.2%), compared to the one regarding Dtac (4.8%). This aspect is evidence of the fact that the first two companies are implementing a more aggressive strategy on prices, which has significant implications and is also confirmed by the trend of the total number of subscribers in recent years as shown in figure 32.

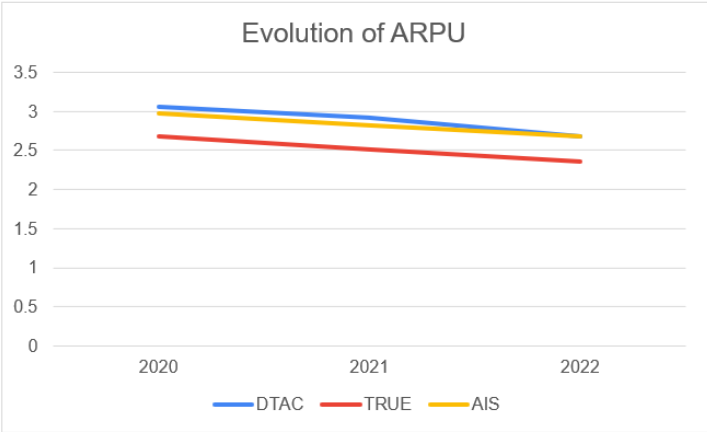

Figure 31: ARPU evolution for the three operators over the last three years.

In fact, by slightly widening the time interval considered and comparing the current data with those of the end of 2015, it is possible to see that there has been a sharp decrease in the number of customers for Dtac, as opposed to the growth achieved by the two rivals. The company went from 25.3 million subscribers to 20.3 over the past seven years, while Ais and True have recorded an increase from 38.5 to 45.5 million and from 19.1 to 33.3 million respectively. Although Dtac data for recent years seem to show a slow growth in the number of users, this is due to the overall increase in the telecommunications market size but is still lower in absolute terms than the one affecting the two rival firms, thus leading the company to gradually lose market share.

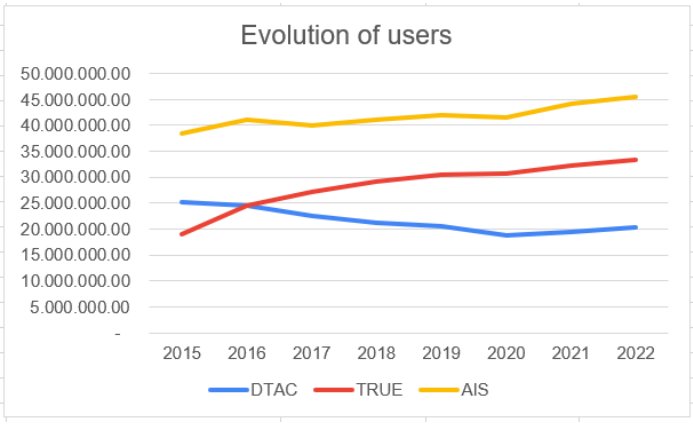

Figure 32: Users evolution for the three operators over the last seven years

Despite these rather discouraging remarks about Dtac, it should be noted that this company has so far proved to be profitable and able to detach dividends for its

shareholders. On the other hand, True has not proved to be as profitable in recent years; in fact as pictured in figures 33, 34, 35, despite the fact that the EBITDA index appears to be growing, the EBIT recorded is always negative. This could mean that, although the value of the first index increases (thus showing a good management of the operations area), the company is characterized by an inefficient management of its fixed assets and its infrastructure, resulting in negative values for the second one. On the other hand, Ais, strong of its leadership in terms of market share, did not show any particular decline in terms of its number of subscribers over the years (the value was found to be considerably growing over the considered time interval, although not constant from year to year), also showing the best results in terms of EBITDA and EBIT.

Regarding the source of the submitted data, it was decided to consider the values reported by the three companies on their site only in relation to the basic information, those which, otherwise, would not have been available (total revenues and costs and number of users). All the other variables have been independently calculated as expressed previously. In this way, after obtaining them, through a simple comparison with the data declared by the companies, it was possible to verify the correctness and the possible presence of out-of-scale values or forgetfulness. However, the outputs were consistent and in line with each other.

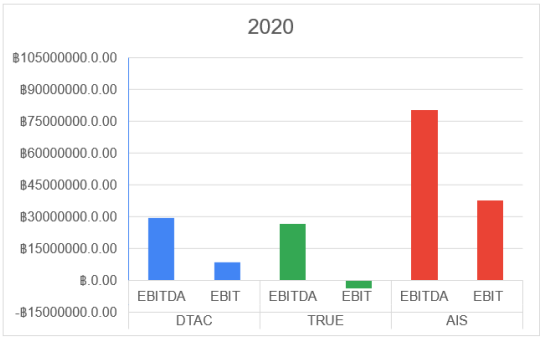

Figure 34: Profitability index for the three operators in 2020

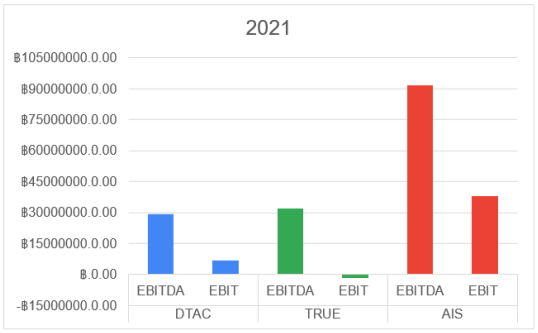

Figure 33: Profitability index for the three operators in 2021

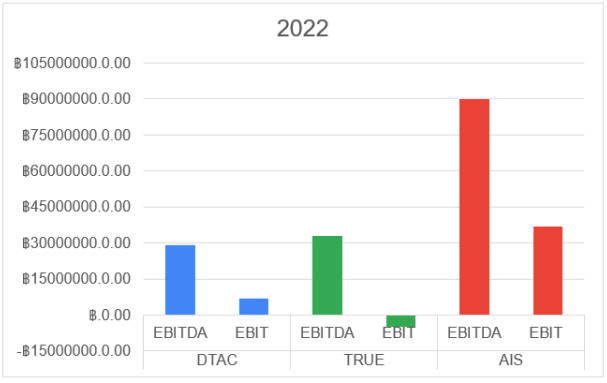

Figure 35 Profitability index for the three operators in 2022

5.2 Dtac /TrueMove H case

In this section the author tries to summarize the main events occurred from the beginning of the deal to the NBTC decision on the merger and analyzes quantitatively what could be the impact of this event.

5.2.1 Current events

The new challenges imposed, and the constant growth of the market meant that Total Access Communications (Dtac) and TrueMove H, respectively second and third player by market share, decided to join forces by announcing the merger. For True and Dtac the merge is quite natural as both have complementary elements and could trigger synergies. For example, Dtac is a very profitable company, which has always been able to pay dividends to its shareholders but which is having problems managing and maintaining its customers, with a reduction of about 10 million subscribers in the last 7 years. True, on the other hand, observed in the same period an increase in its customers of more than 11 million. However, it should be noted that the company is not financially sound, and its margins are gradually decreasing. This is also due to the large amount of money spent as infrastructure investments. The eventual merger would lead to the formation of the largest MNO in the country, overtaking the current market leader Advance Info Services (Ais). Also for this reason, Ais expressed a negative opinion regarding the possible merger, underlining how this could harm the final consumer. Reducing the number of operators in the market from 3 to 2 would limit the choice of the final customer and could also penalize other players in the industry such as suppliers and subcontractors, according to the administrators of Ais. The Thai market is already highly concentrated as shown in figure 36, as can be guessed from the Herfindal Index (HHI) which is around 3.5 and a move to just two large MNOs would raise the index to around 4.7, a rather worrying threshold. Furthermore, again according to what Ais disputes, the merge would violate the maximum spectrum value that can be used by a single operator, a rule imposed by the NBTC itself.

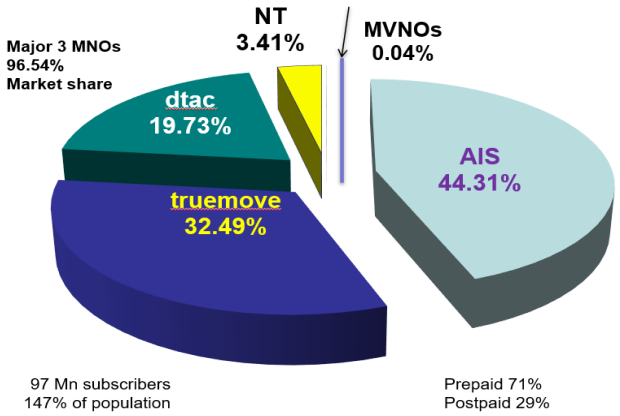

Figure 36: Market share in the second quarter of 2021

The response from Telenor, the Norwegian telecommunications giant which owns the majority of Dtac shares, was not long in coming. Current CEO, Steve Brekke, said that contrary to what Ais highlighted, the merger could increase competition in the market and therefore favor Thai subscribers. According to the Scandinavian administrator, the current competition on the market is fictitious as one player is extremely strong and the other two are too weak to counter it, for this reason the merge, creating an entity of the same level, would be able to intensify the war of price. Finally, the Telenor board underlined the intention to remain in the Thai market to make the new merged entity an extremely technological and avant-garde company, thus avoiding a possible exit. The NBTC has consequently started a delicate and complicated analysis of the case, evaluating it from different points of view. Four sub-committees specialized in different areas (law, consumer protection, technology, economics) have been organized to evaluate the merge. In July 2022, the law and consumer protection panel voted against the merge and the panel of economics experts said the merger could have a negative impact in several ways. Commission members estimated a possible increase in inflation, a reduction in GDP growth and a potential price increase in the range from 2.03% to 19.5%. For this reason, the regulator has prepared a series of conditions that the interested parties will have to sign and respect, in order to clarify the merger.

5.2.2 Quantitative analysis

5.2.2.1 Not technical summary

In the following section, the quantitative analysis carried out to analyze the possible effects on the price deriving from the elimination of the horizontal competition between TrueMove H and Dtac is described. The approach assumes that we are in a differentiated product segment, in which firms maximize their profits. The framework and the methods used are those widely described in section X, opting to calculate three different indicators: GUPPI, CMCR and IPR. For the following analysis, the three-year period 2019-2021 was considered, divided into quarters. From the financial data made public by the three operators, it was possible to break down the years into quarters, in order to have a more precise view of the changes that occurred period after period. For the company TrueMove H it was decided to discard the first quarter of 2019 as it was not possible to find the data for this particular period. TrueMove H is in fact part of the True Corp group which also includes True Visions and True online, two subsidiaries that offer different services than mobile telephony. True Visions is de facto the leading cable tv service provider, while True internet is the largest internet service provider in Thailand. For this reason, most of the financial and balance sheet data made public by the company are exclusively at an aggregate level and, for this reason, it was not possible to distinguish the punctual values for Q1 2019.

Although the individual tools are calculated differently, the required input data is common to all three. For simplicity, the potential reactions of the third market player, Ais, have not been taken into consideration. The entire analysis was conducted at an aggregate level, considering a single product for each company.

5.2.2.2 Data inputs

All the input data necessary for the calculation of the indicators were obtained from the financial statements and from the management, discussion and analyses (MD&A) published by the companies on their websites. Consequently, in the following section, all the results obtained are non-confidential and publishable.

5.2.2.2.1 Market share

The market shares are not included directly in the calculation of the indicators, because, as extensively described in the previous sections, in order to obtain GUPPI CMCR and IPR only the data on margins and diversion ratio are necessary. However, as will be pointed out in the next section, they have been useful for some approximations.

Not having the market shares updated quarter by quarter in the Thai market directly available, it was decided to consider only the three main MNOs, thus neglecting the customers of NT and the MVNOs present as they are below 4% overall. From the management and discussion analysis papers it was possible to obtain the number of subscribers for each company, moreover differentiated between the two prepaid and postpaid segments. To approximate the value of the market share, the number of total subscribers of the single company was therefore calculated in relation to the sum of the total subscribers of the three MNOs for each quarter.

5.2.2.2.2 Construction of diversion ratio

The key element in the calculation of the various indicators is certainly the diversion ratio. The elements necessary for an accurate estimation of the diversion ratio would require confidential data, not provided by the 3 MNOs, i.e. the number of port-outs as already seen previously for the cases analyzed by the European Commission. Consequently, to be able to publish concrete results, it was decided to use a less precise estimate exploiting market shares. In fact, by applying this type of approximation, there could be inaccuracies because customers do not make decisions in a perfectly homogeneous way as everyone is characterized by subjective preferences. Secondly, by operating in this way, a strong approximation is made regarding the reasons for the change of operator.

The equation given below expresses the simple estimation method used, where D is the forecasted diversion ratio and S represents the overall market share of the two firms.

$$D_{12} = S_2/(1 - S_1) \qquad D_{21} = S_1/(1 - S_2)$$

Below are the results obtained for the diversion ratio, as pictured in table 16 is deduced as Ais and True are closer competitors than the other MNO. The two merging companies have different values depending on the direction in which the

substitutability of the products is considered. In particular, the percentage of customers captured by Dtac in the case of True raises prices is lower than in the case of Dtac raising prices and TRUE capturing its customers.

Table 16: Diversion ratio matrix 2021

FROM/TO	DTAC tot	TRUE tot	AIS tot
DTAC tot	/	0,423	0,577
TRUE tot	0,308	/	0,692
AIS tot	0,378	0,622	/

5.2.2.2.3 Price

As reported in the previous sections, ARPU (Average Return Per User) is a good proxy for approximating the price of a typical mobile phone service bundle to a single value. A more accurate description of how this index was calculated could be found in section *5.1.2*.

5.2.2.2.4 Margins

For the calculation of the margin, it was decided to consider only the one deriving from the telephone service offered by the companies. For this reason, only the core service revenues were taken into consideration, i.e. the revenues deriving from the main activity of the MNOs. The costs of the service were subtracted from these, however excluding the so-called "Interconnection Charges" since the "Interconnection Revenues" were not considered in the revenues either. The reason for this exclusion lies in the fact that these revenue and cost items arise when subscribers of other MNOs call subscribers of the MNO in question or use national roaming among themselves on the network infrastructure of another MNO. Because of that, they are not directly attributable to the MNO customer base have been excluded.

5.2.2.3 Results

In the following section, in table 17, the results obtained for the for the 3 indicators described above, regarding the year 2021 are presented. For the sake of simplicity and clarity, it was decided to calculate the average annual index, although quarterly data were available. In any case, large deviations from the annual average in the individual quarters have not been found.

GUPPI index is the UPP, i.e an estimate of the value re-internalized in the new firm, divided by the price of the firm under analysis, thus obtaining a value (percentage margin) which quantifies the willingness of the company to increase prices.

CMCR % stands for percentage compensating marginal cost reduction and indicates the reduction (as a percentage of the price) of the marginal cost that would balance the push of the company to raise the prices once the fusion took place.

IPR stands for indicative price raise and is another index used to estimate the possible price increase after a merger. It requires the same variables necessary for the calculation of the other two indicators and allows to obtain a result even complex and asymmetric cases.

There are no fixed rules on the thresholds for these indicators to be considered acceptable and not possibly harmful to the consumer. However, often, the regulator sets a value of 5% or 10% (relative to GUPPI) the limit beyond which, in order for the merge to be approved, it is necessary to introduce some remedy that guarantees a high level of competition on the market. This is because it is estimated that, otherwise, the scenario could be considered as "merger to monopoly", absent an increase in supply or uncommitted entry.

In the following scenario, the calculated GUPPI value is 4.70% for Dtac and 4.71% for True, in line with the previous sections, since the CMCR % obtained values, which also consider the first round of feedback, are higher than the previous ones and equal to 7.38% for Dtac and 7.33% for True. Finally, the estimated price percentage increase is equal to 9.33% for Dtac and 9.22% for True. Very similar values have been obtained for the two companies, this underlines that there is no MNO that is able to capture more customers than the other following a price increase by the rival.

Table 17: Indicators results for the base scenario

	GUPPI [%]	CMCR [%]	IPR [%]
DTAC tot	4.70 %	7.38%	9.33%
TRUE tot	4,71%	7.33%	9.22%

5.2.2.4 Robustness Check

In the next section, the autors have conducted several robustness checks to prove the consistency of the results obtained. In particular, the first check was conducted using the more recent 2022 data, in the second the values of ARPU proposed by firms in the MD&A instead of the onces directly calculated from the financial statements has been used and in the third one we constructed a scenario where the two firms decreased their service-related total margin by 25% because of a loss of 20% of costumers.

5.2.2.4.1 Robustness check using 2022 data

Table 18 shows new estimates of diversion rates calculated using the latest 2022 data. It was decided not to use this data directly but only to prove the consistency of the results as the merge was officially announced in late 2021, when the 2022 values were not yet available. As one can easily see, the results are almost the same as the previous year, with Dtac and True that are not the closest competitors and with True that continues to be able to capture more customers than Dtac after a price increase from the competitor. These results, in line with those in section *5.2.2.3*, confirm the robustness of the estimates.

Table 18: Diversion ratio matrix using 2022 data

FROM/TO	DTAC tot	TRUE tot	AIS tot
DTAC tot	/	0,423	0,577
TRUE tot	0,311	/	0,689
AIS tot	0,381	0,619	/

As confirmed by the data in table 19, the GUPPI has a value between about 4% and 6%, the CMCR % stands between 7% and 9% and the indicative price raise is between about 10% and 11%. The values, although slightly higher than the previous year are however rather in line and consistent and confirm the potential upward push of prices of the new merged entity.

Table 19: Indicators results using 2022 data

	GUPPI	CMCR%	IPR
DTAC tot	6,08%	8,86%	11,20%
TRUE tot	4,31%	7,40%	9,78%

5.2.2.4.2 Robustness check with loss of clients

In this section it was not necessary to recalculate the values of the diversion ratio, since the reference year is 2021 again. It was decided to take into account the price increase foreseen by the base scenario (between 9 and 10%), assuming that, as a consequence of this, companies can go to lose 20% of their customers. Moreover, it has been estimated that this aspect can also lead to a more than proportional loss of operating margin of the players on the market and this value has been fixed to 25%. The cause of this effect lies in the reduction of efficiency resulting from the decrease in volumes and the presence of operating depreciation, which remains even in the case of loss of customers, among the cost items considered in the margin calculation. The data in table 20 show that the value of the GUPPI calculated in this section is equal to about 4-5%, the CMCR to 6-7% and, finally, the IPR to 8-9%. The above considerations regarding diversion ratios do not chance, since the year treated is still the same and the results are almost identical to the basic specification, only slightly lower (the difference is less than 1% anyway). Consequently, it is possible to confirm also through this check the robustness of the initial results, evidencing the possible future push for the merged enterprises to raise the prices.

Table 20: Indicators results with a potential loss of costumers scenario

	GUPPI	CMCR%	IPR
DTAC tot	4,4%	6,26%	8,61%
TRUE tot	4,42%	6,87%	8,51%

5.2.2.4.3 Robustness check with ARPU proposed

Also in this section the reference year is 2021, therefore the considerations expressed previously regarding diversion ratio are still valid. In this case it was decided to make a check of robustness using the ARPU provided directly by the

companies on their sites (instead of the calculated one) to obtain the value of the three indicators. Calculating again the value for the three indicators representative for the potential price increase, it has been obtained the result shown in table 21: a GUPPI of about 4-5%, a CMCR of 7-8% and an IPR of 9-10%. Also in this case there are no particular differences from the base scenario, indeed they are in the order of magnitude of cents of percentage points (basis points). This, obviously, goes in support of the robustness of the results obtained initially and testifies, also in this case, the possible push of the merged enterprise to raise the prices after the merge.

Table 21:Indicators results using ARPU proposed by MNOs

	GUPPI	CMCR%	IPR
DTAC tot	4.68%	7.36%	9.30%
TRUE tot	4.75%	7.39%	9.31%

5.2.3 Conclusions

In conclusion, because of the results obtained, it can be stated that the merger between Dtac and True is likely to push the new aggregate company to raise the price of its tariffs.

The merger was finally authorized on 21 October 2022, almost a year after the announcement by the two companies. The committee came to a decision after more than 10 hours of discussion, while several civic groups and trade unions immediately tried to assert their voice and express their negative opinion against this operation. Before the final vote, the board was basically split in half: two out of five members, including the chairman board were in favor: according to their vision, thanks to remedies, the merger would not have led to an effective duopoly and a consequent reduction in competition. Two other members, on the other hand, were in total disagreement and had strong concerns about the outcome of the operation. The last member of the committee had instead suspended his judgment, as according to his point of view there were still too many legal issues unresolved. As a result, as often happens in these circumstances, it was the chairman board that took the final decision thus bringing to three votes in favor of the merge. Several controversies arose following the decision with the main opposition groups who even accused the committee of corruption and lobbying. However, since the estimated values of the index calculated are close to the thresholds typically used to evaluate this type of operation, the approval was possible only after the introduction of further

restrictive conditions. For example, the mobile business units Tuc and Dtn, which are part of True and Dtac respectively, must remain separate for at least three years and approximately 20% of the network capacity must be sold to MVNOs. Furthermore, the new company has the obligation to show the tariffs for voice, data and messages separately; the value of the latter must be based on the average cost necessary to provide the service. According to the opposing groups, the remedies proposed by the committee would not be strong enough to maintain a good level of competition in the market. For example, the commission has imposed a 12% price reduction in tariffs within the first 90 days of the merger, which is extremely low compared to the possible increase due to the likelihood collusion between the two duopolists, which could be between 120% and 250%. Even having to keep the two brands separate for at least three years would not lead to any benefit for customers.

6 Takeways

In the previous sections we tried to summarize the main methods used to assess the impact of a merger several years after it took place, also describing some applications of different approaches to real case studies. Reducing what is seen theoretically to reality is a rather complicated challenge, especially in the telecommunications industry. First of all, it is necessary to build a price index, as the various offers and types of service on the market have different rates. This first step is quite delicate and requires creating an indicator that is representative of a typical bundle of services. Secondly, it is extremely complicated to separate the effect of the merger from all the undetectable impacts that can influence price developments. Moreover, from all the analyzed cases, it emerges the importance of the quality and the quantity of the available data; inaccuracy under this point of view can lead to completely biased estimates. However, it is not easy to collect a good number of data: for ex post analysis not only prices and market shares of the country where the merger took place are required, but also those related to all the control countries are always necessary. This requires a huge effort both in time and cost. Surely, even the roles that have had different remedies seen in cases strongly impact competition. It is not possible to exclude any damage to the overall well-being if the merger had occurred without the latter, since econometric analyses are not able to predict what would have happened in the hypothesis of merging without commitments. Despite the difficulties, the importance of these analyses remains, not only to understand the actual impact of the mergers that took place but also as a valuable tool for the regulator in assessing similar merge requests. Furthermore, the autors realized how complicated and time-spending is collecting a sufficient amount of data in terms of quantity and most importantly qualitative valuable, even if it was only a far less complicated analysis than the examples seen in the previous sections.

Having a structured and consistent method of analysis it's only the first step, then it's necessary to be able to extract data from different sources and compare them, to figure out if something is missing or if there is some outlier that could affect the calculations. After the first evaluation, it's always important to find out the meaning behind numbers and to give some interpretation otherwise it will be impossible to obtain reasonable outcomes. Eventually, to verify the accuracy of the results, it's always a good conduct to run several robustness checks where the analyst, changing some input data, tries to test the consistency of the conclusions obtained. The Thai case showed us that in the lasts years the approach of the regulator changed: the merge was approved by the authorities even if this will mean to practically have a duopoly on the market, something that would not have been

possible to bear by the regulator just 10 years ago. We are still not sure of what might be the outcome and the effect on the competition but what we know certainly is that somehow this case could become a precedent for the next merge proposal worldwide.

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8 Acknowledgements

First of all, I would like to thank my supervisor Carlo Cambini and my co-supervisor Erik Bohlin for giving me the opportunity to undertake this experience abroad and for their great availability and kindness during these months.

Then, I am grateful to my family, who has always been close to me, supporting every decision that I took and sharing with me even the most difficult moments of the everyday life, always reserving a word of encouragement.

A person I would like to say a special thank you is Alessia, who has always given me and my commitments the priority, managing to organize herself to be able to dedicate me even a few minutes where a simple smile was able to improve the whole day.

I would also like to express my gratitude for my grandfather, who, despite not being too familiar with the modern language and technologies, has always tried to understand what I was doing, giving me advice and always following me, both in the academic path and in my passions.

Finally, I would like to thank everyone who has contributed to make this journey special.