

measured, and even at product level rather than at firm level. The price concentration analysis can therefore look at the relationship between prices and concentration at the product market level. Second, studies assessing the relationship between concentration and profit margins and markups may be difficult to interpret: low markups may reflect intense competition but may also be observed when markets are populated with inefficient firms, perhaps due to a lack of competitive intensity. A more direct approach to assess the effects of competition, notably from the perspective of customers, is therefore to focus on the relationship between concentration and prices.

II.1.2 MOBILE TELEPHONY: CONCENTRATION, PRICES AND INVESTMENTS

Over the past 15 years, the mobile telecommunications industry has seen increasing consolidation. The industry has experienced several four-to-three mergers around Europe and beyond, thus increasing market concentration on a global scale²⁰². Within this general consolidation trend, the industry also experienced entries of Mobile Virtual Network Operators (MVNOs). These telecommunications service providers do not possess their own frequency spectrum and infrastructure, but instead lease Mobile Network Operators' (MNOs') network facilities.

This section presents the research findings of Lear et al. (2024) on the relationship between price and market structure in the mobile telecommunications sector using a novel dataset covering 29 countries (23 EU countries, as well as Canada, U.S., Japan, South Korea, Australia and New Zealand) over the period 2009-2019²⁰³ (the so-called 4G era)²⁰⁴. The long time period allows to exploit substantial variation in market structure induced by new MNO entry, MNO exit (through merger), changes in concentration as measured by the HHI, as well as changes in the number of MVNOs²⁰⁵.

In mobile communications, pricing is a complex issue, with fixed and usage-based price components, and the pricing schedules/profiles that change over time and country. Hence, choosing the 'right' measure of price in this industry is not an easy task. The approach used in the present analysis is to use ARPU, the average revenue per unit/user²⁰⁶. The main advantage of this metric is that it is a simple measure of how much consumers spend over

²⁰² Over the same period, some mergers have been blocked by competition authorities, including the European Commission. For example, case M.7612 - Hutchison 3G UK (owner of Three UK) / Telefonica UK (owner of O2).

²⁰³ The year 2019 is chosen as the concluding data point to avoid confounding demand and supply factors that may have been related to the Covid-19 pandemic.

²⁰⁴ Specifically, the analysis presented in this part draws on Lear et al. (2024), sections 2.2 and 2.3.

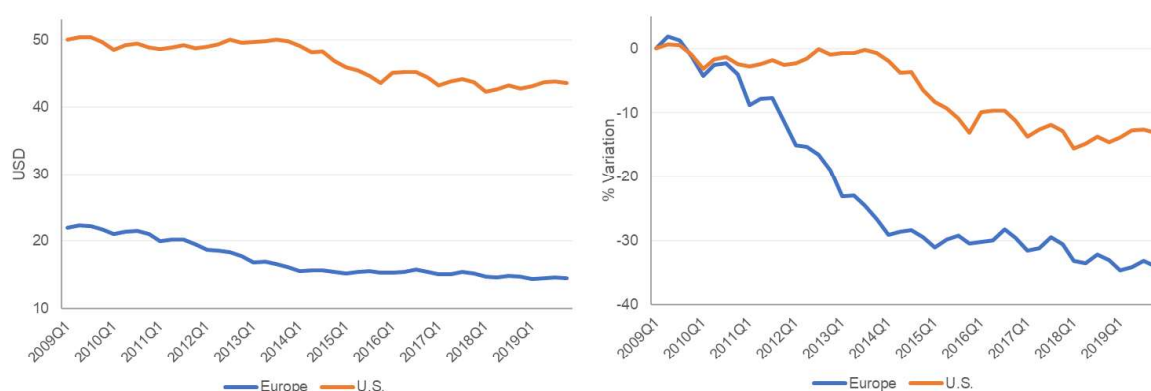
²⁰⁵ The mobile telecommunication industry provides a relatively 'ideal' setting for a cross-country panel study on the relationship between market structure and prices. In fact, differently from other industries, mobile telecommunications is not a free-entry industry. Instead, operators need to be awarded spectrum licences to operate in the market. Therefore, the regulated environment of different countries allows changes in the number of MNOs to be taken as largely exogenous events, helping to interpret the results as causal and unbiased. When using country HHI as the main variable to measure market structure, the research implements a so-called instrumental variable approach to address potential endogeneity issues. See Lear et al. (2024), section 2.2 for more details.

²⁰⁶ Data source: GSMA-I.

time on mobile telecoms and of the ‘effective price’ paid for this service. It therefore avoids several measurement issues that might occur when using the so-called basket approach²⁰⁷, which measures the price of a fixed bundle of mobile services for different usage profiles²⁰⁸.

The dataset confirms some well-documented empirical regularities from the economic literature. First, from Figure 53 below, one can observe that throughout the period analysed (2009-2019) the average ARPU is considerably higher (almost the double, in fact) in the U.S. compared to the EU²⁰⁹. Although in both regions ARPU is decreasing over time, the relative trend appears also stronger in the EU (see right hand panel), thus suggesting an even larger differential compared to the U.S. over time.

Figure 53: Evolution of ARPU in EU countries and the U.S.: ARPU levels (left panel) and relative change in % (right panel)



Source: Lear et al. (2024)

Second, countries with fewer market players are characterized by a higher average ARPU. Figure 54 compares the trend in ARPU for EU countries with three and four MNOs throughout the time frame of analysis²¹⁰. One can observe that EU countries with three MNOs have consistently higher average ARPU compared to countries with four MNOs. Notably, the negative trend is very similar across the two groups of markets, suggesting that the difference in ARPU is likely to persist in the long run.

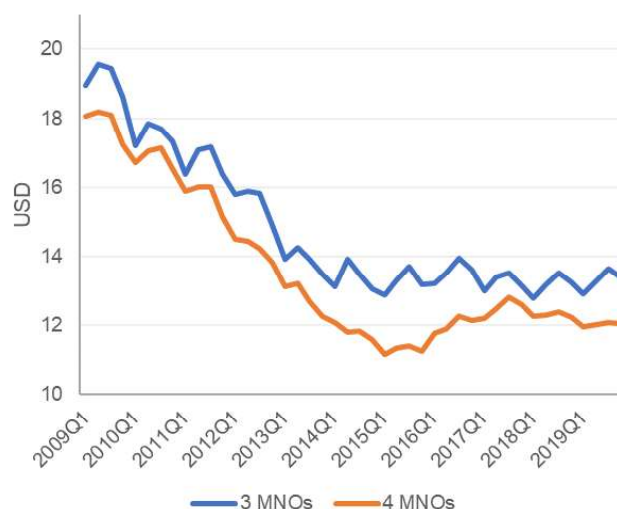
²⁰⁷ See Genakos et al. (2018).

²⁰⁸ The ARPU approach is, however, complemented with robustness checks using publicly available pricing data based on basket approach.

²⁰⁹ In line with Philippon (2019), Faccio and Zingales (2022). The latter estimate that the higher mobile service prices in the United States vis-à-vis Germany or Denmark represent a USD 44-65 billion a year transfer from consumers to shareholders, contributing to income and wealth inequality.

²¹⁰ In other words, the chart contains markets that are characterised by different market structures and that do not experience either new entry or merger activities within the panel. The group of countries with three MNOs include Belgium, Czech Republic, Estonia, Finland, Greece, Hungary, Latvia, Lithuania and Portugal. The group of countries with four MNOs: Denmark, Poland, Romania, Spain and Sweden.

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

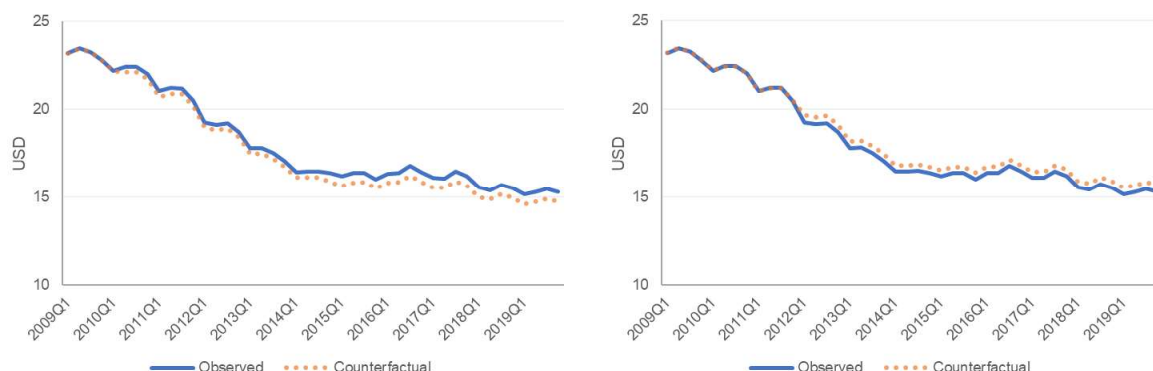


Source: Lear et al. (2024). Grouping based on countries with a constant number of MNOs over the period

Clearly, the above preliminary empirical assessment does not account for underlying cross-country differences that may explain the variation in price. Indeed, any cross-country comparison between ARPUs is not straightforward as customer habits, usage profiles, consumer purchasing power, regulations and tax rules may differ. Nonetheless, one can test if, following a change in market structure (e.g. merger or entry), it is possible to observe a change in prices compared to geographical markets that do not experience such a change (the control group), thus accounting for differences that are unobservable to the researcher (e.g. as they cannot be measured). This is the main reasoning behind the empirical strategy used by Lear et al. (2024), who have estimated a panel-based fixed effect model that controls for unobservable country-specific factors affecting market structure and prices. Overall, the results point to a strong and significant positive relationship between market concentration and prices. In particular, the estimates suggest that one additional MNO is associated with a reduction in average revenues per user (ARPU) by 7%. The impact is mostly driven by EU countries, in which one additional MNO is associated with a 9% reduction in ARPU.

The results from the above econometric analysis can also be used to obtain the estimated average price (ARPU) that would emerge in Europe without any merger or entry. Figure 55 below shows the evolution of the observed mean price in Europe (solid line) together with the price that would emerge absent mergers (left panel) or entry (right panel). Given the estimated negative relationship between the number of MNOs and price, absent the merger we would observe a lower average price (dotted orange line). On the other hand, without entry, average price would be higher than the observed one (idem).

Figure 55: Counterfactual estimates on ARPU without mergers (left panel) or entry (right panel) in Europe



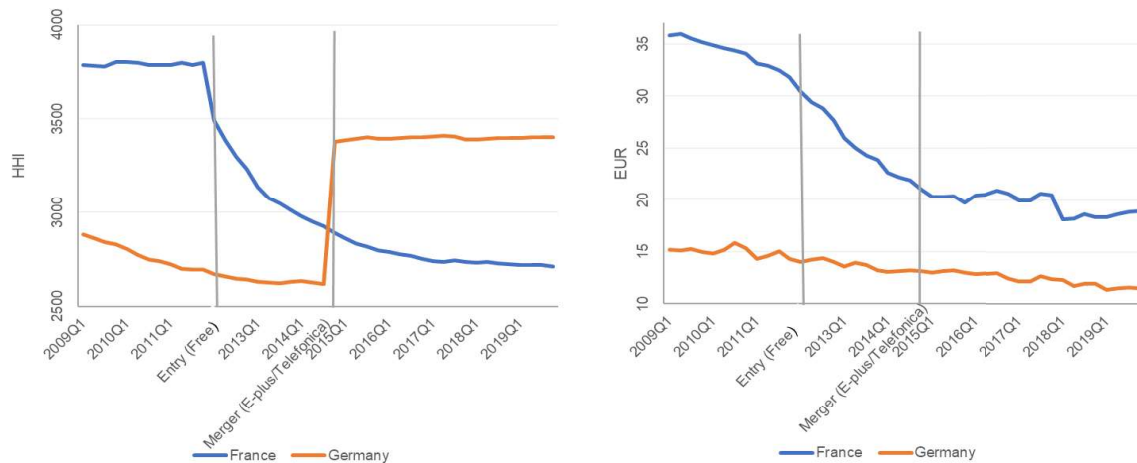
Source: Lear et al. (2024)

It is interesting to zoom in on how changes in the number of MNOs can affect prices by considering the specific example of market structure changes in France and Germany. Average ARPU decreased much more sharply following entry of a fourth player (Free Mobile) in France in 2012, compared to Germany where industry consolidation took place following the exit of a fourth player (E-Plus) in 2014, with some remedies imposed to counteract the effects of the merger²¹¹. Figure 56 below shows the evolution of the HHI in both countries (left panel) as well as the ARPU (right panel). As can be seen, both events affected market structure, thus changing the competitive landscape, while the gap in ARPU narrowed²¹².

²¹¹ See Case COMP/M.7018 - Telefonica Deutschland / E-Plus (2014).

²¹² According to Bourreau et al (2021), the sharp decline in ARPU in France may in substantial part be explained by the introduction of low-cost alternatives ('fighting brands') by the incumbents in response to the entry of Free Mobile. They find that the entry of Free Mobile increased consumer surplus by about €4.6 billion or about 7.7 percent of industry sales during the period 2012–2014. After deducting the loss in producer surplus (profits), the overall welfare gain would still be €2.2 billion and 3.7 percent of industry sales. By contrast, the change in ARPU after the exit of the 4th MNO in Germany may have been attenuated by (i) the remedy package put in place by the Commission (which was a 'capacity type' remedy, not just a regular access remedy, cf. https://ec.europa.eu/commission/presscorner/detail/en/IP_14_771), as well as (ii) some degree of customer inertia (gradualism in market adjustment) which may explain the more gradual change in ARPU observed.

Figure 56: The impact of entry and merger on HHI (left panel) and ARPU (right panel)



Source: Lear et al. (2024)

As regards MVNOs, the empirical research shows that these virtual operators have an impact on price which is very close to zero and not statistically significant, which suggests that they pose a negligible competitive constraint on MNO pricing. This may be explained by the fact that MVNOs are a source of product differentiation and segmentation for MNOs (allowing them to distinguish customer segments by price sensitivity) rather than a real competitive threat for the MNOs²¹³.

The dataset used in the analysis above can also be used to study the relationship between market structure and investment in mobile telecommunications. In this setting, the main variable of interest is mobile capital expenditure (CAPEX), both at the operator and country levels²¹⁴. Given available information on the number of connections (both at operator and country levels), it is possible to compute average capital expenditure per connection (or user), which is a more comparable (even if still imperfectly comparable) measure across operators and different countries. It should be noted that investment levels are not an objective in themselves (as capital efficiency is also important), rather they are interesting as a proxy for improvements in the quality and availability of communications services as experienced by users.

A descriptive analysis of the dataset provides first insights into the relationship between investment and market structure in mobile telecommunications. Figure 57 below shows the evolution of CAPEX per user in the two regions. First, a simple comparison between Europe and the U.S. (left panel) shows that the level of investment in the U.S. (a four-player MNO market in the period investigated, but with higher and more stable ARPU than in the EU) has been consistently larger than in the EU. CAPEX per operator increases at the same rate

²¹³ See Ennis (2006).

²¹⁴ Following the approach of Genakos et al. (2018).

on the two sides of the Atlantic. Second, when focusing on the EU, the relationship between pre-existing levels of concentration and investment is less clear-cut. The figure (right panel) compares the trend in CAPEX per user for EU countries with three and four MNOs throughout the time frame of analysis²¹⁵. Countries with four MNOs display a lower level of CAPEX per user compared to European countries with three MNOs.

Figure 57: Evolution of CAPEX per user in Europe and the U.S. (left panel) and in European countries, by number of MNOs (right panel)



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

At first sight, the above descriptive chart comparing 3-MNO countries with 4-MNO countries (right panel) might create the impression that investment per user is typically (slightly) higher in countries with three MNOs than in countries with four MNOs and that, as a result, further consolidation also *within* countries (from four to three players) could lead to higher investment levels at user level. However, one must be very cautious in drawing such conclusions. First, the selection of countries in the chart above is incomplete as it only portrays a limited set of countries, namely only those with a constant number of MNOs (3 or 4) over the entire period²¹⁶. Second, there may be systematic differences between the two groups which are not yet accounted for. In particular, the 4-MNO group contains several larger countries (Spain, Poland, Romania) where some economies of scale may drive down CAPEX per user as fixed network costs can be spread over more users²¹⁷. In other words, investment per user in 3-MNO countries may be higher, on average, because of these countries being small markets with few users, not because they have only three players in the market. As a result, any simple *cross-country* comparison (of 3-MNO vs. 4-

²¹⁵ That is, we focus on EU countries characterized by different market structures that do not experience either entry or exit during the period of analysis. The group of countries with three MNOs include Belgium, Czech Republic, Estonia, Finland, Greece, Hungary, Latvia, Lithuania and Portugal. The group of countries with four MNOs: Denmark, Poland, Romania, Spain and Sweden.

²¹⁶ Countries in the sample with three MNOs: Belgium, Czech Republic, Estonia, Finland, Greece, Hungary, Latvia, Lithuania and Portugal. Countries with four MNOs: Denmark, Poland, Romania, Spain and Sweden.

²¹⁷ Lear et al. (2024), p. 103. Given that costs of network deployment and operation are largely concentrated in local access networks, there are limits to the economies of scale available in bigger relative to smaller national markets.

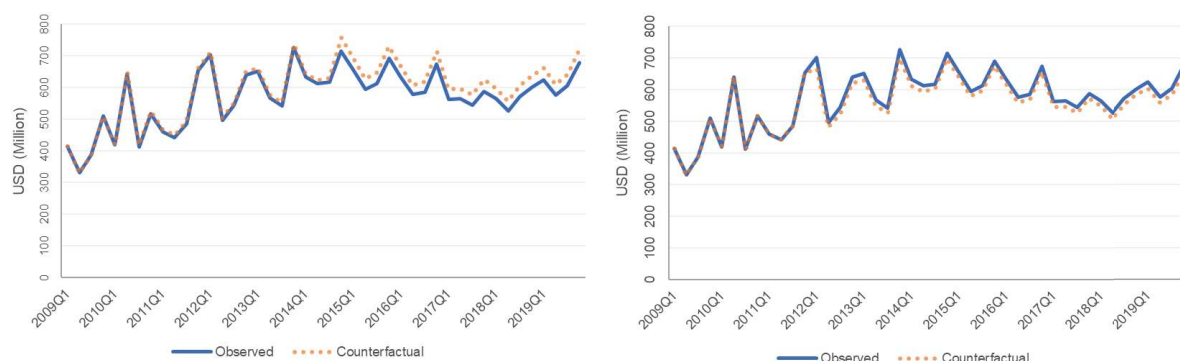
MNO countries) does not give us a complete answer to the question of what might happen if further consolidation would take place in any given country. To properly assess the *causal* effect of within-country consolidation it is necessary (as with the price concentration analysis before), to properly control for cross-country differences. One way to do so is to test, using the full sample of 29 countries²¹⁸, whether following mergers or entry, one observes a *variation* in investment levels compared to geographical markets that do not experience them (control group), thus accounting for shocks that are unobserved to the researcher.

The empirical results of this test point to a negative relationship between market concentration and investment. Regression results show that a rise in the number of MNOs is positively associated with country-level investment in mobile telecommunications (+10%). When using the HHI as the main variable of interest, the estimates are, on the other hand, statistically insignificant²¹⁹. The below figure visualises the obtained estimates using the number of MNOs. Given the estimated coefficient, without mergers (in the counterfactual) we would observe a higher average CAPEX, while without entry a lower one would emerge. All in all, the charts suggest a meaningful negative relationship between country-level CAPEX and concentration. It should be noted that a higher CAPEX level with an increase in MNOs may be attributable (at least in part) to the unavoidable costs of deploying an additional network, or elements thereof, and thus less relevant to user experience of network quality. Conversely, higher capacity utilisation rates may lower CAPEX needs per user for a given user-experience quality on a smaller number of networks, provided network capacity limits are not reached.

²¹⁸ The full set of countries goes beyond the selection of countries depicted in Figure 57 and comprises 23 EU countries (as well as Canada, U.S., Japan, South Korea, Australia and New Zealand). For further details, see Lear et al. (2024), Section 2.2.

²¹⁹ Interestingly, the regression analysis also shows a significant positive effect of MVNOs on aggregate investment (+0.3%), which appears consistent that MVNOs, by making mobile telecoms services more accessible to different consumer segments spurs demand and, hence, investment in mobile networks.

Figure 58: Counterfactual estimates on CAPEX without mergers (left panel) or entry (right panel) in Europe



Source: Lear et al. (2024)

Finally, when focusing on EU countries characterized by different levels of concentration at the starting period of the analysis, one can observe that 4G roll-out has been similar across market with different concentration levels²²⁰.

Summarising, the above research suggests that consolidation in mobile telecoms tends to lead to higher prices for users, while positive effects on investment in networks relevant to user experience or 4G roll-out could not be reliably discerned. An approximation by Lear et al. (2024) of the cost savings for European citizens deriving from higher competition (computed as the savings that would arise if all EU countries had four MNOs operating in the market) amounts to approx. EUR 800 million per year²²¹.

II.1.3 AIRLINES: CONCENTRATION AND PRICES

In the past 25 years, the airline industry, both in the EU and in the U.S., has seen quite some consolidation among established players, alongside new entry mostly by low-cost carriers (LCCs). The present section seeks to illustrate how, and to what extent, differences in the level of concentration impact upon price levels (fares per mile) in the sector²²². It does so on the basis of data from a period (2015-2019) preceding the Covid-19 crisis, i.e. it covers a relatively stable time period within which to study this relationship. At the same time, the pre-Covid focus of the analysis is also a limiting factor in that the significant changes in market structure that have occurred in the market due to the financial impact of the crisis and, where relevant, the support measures of the public authorities, are not comprised in the below presentation²²³. The same applies to other (recent) changes that

²²⁰ Lear et al. (2024), Figure 2.8.

²²¹ Lear et al. (2024), p. 98.

²²² The analysis draws on the research conducted by Lear et al. (2024), section 2.4.

²²³ For more detailed data on the impact of the Covid-19 crisis on the airline market in Europe, one can refer to European Commission (2023a).