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**Conference Paper**

## A Study on the Optimal Number of Mobile Carriers: Discussion of Discussion of Magic Number – three or four

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## **A Study on the Optimal Number of Mobile Carriers: Discussion of Discussion of Magic Number – three or four.**

**Masashi Ueda**

### **Introductions**

In recent years, mergers between communications companies have been progressing especially in mobile carriers' market. Regulatory authorities are worried about increasing consolidations and less competition, and have decided to impose conditions on the mergers or even disapprove them. In many cases, just before the generation change, the competitively inferior operators sell their business and exit the market because of the cost of acquiring spectrum.

The concern of the regulators is cases such as Ireland and Austria, where ARPU rose because the competitive environment became milder due to mergers between MNOs.

On the other hand, in Germany, where measures to promote competition after the merger (reallocating part of the new company's spectrum to other companies, leasing out 20% to 30% of its capacity, etc.) were effective, ARPU did not increase.

On the other hand, when a window for new spectrum acquisition opens, new entrants may join the market.

In the fifth generation (5G), Dish in the US, 1&1 Drillisch in Germany, and Rakuten in Japan took advantage of the opportunity to enter the market. In the case of Drillisch and Rakuten, they acquired spectrum and/or licenses in 2019 with the expectation of migrating existing customers from MVNOs to MNOs.

Dish, on the other hand, is one of the major satellite operators, and it was looking for opportunities to enter the market by acquiring a certain amount of new spectrum at each frequency auction. In addition, when T-Mobile US acquired Sprint, Dish took over the MVNO and prepaid customers of the former Sprint in order to promote competition after the merger. In addition, when Telefónica (O2) acquired E Plus in 2014, Drillisch also leased 30% of O2's spectrum capacity for MVNO services as a post-merger competition incentive.

Going back even further, when France's free (Iliad Group) entered the French cell phone market in 2012 after gaining 5 MHz from a new frequency allocation in 2009, the three incumbents launched their sub-brands before free launched its services and implemented substantial price cuts. As a result, free's entry resulted in lower cell phone prices regardless of the carriers. However, because of the proximity between the offered prices of independent MVNOs and that of free, consumers found little price

advantage in MVNOs. As a result, many MVNOs withdrew from the market by 2014, and their existing customers were absorbed by MNO sub-brands.

When Rakuten launched its MNO services (4G and 5G) in 2020, it offered them at the same price as its MVNO services. As a result, many MVNO operators faced a difficult situation. On the other hand, in 2021, under pressure from the regulator, the Ministry of Internal Affairs and Communications (MIC), rather than as a result of competition, the big three existing companies began to offer new sub-brands at roughly the same price as Rakuten.

While there has been no change in the number of MNO operators, there have been mergers between broadband and mobile operators. In Germany, there was a vertical merger between major MVNO Drillisch and fixed-line broadband major United Internet in 2017, while in the UK there were vertical mergers such as BT's acquisition of EE in 2016 and the merger between Telefonica (O2) and Virgin Media in 2021.

As you can see, the entry and exit situations in each country are diverse, and the regulatory environment is also different. In this paper, we would like to analyse the economic impact that changes in regulatory policy, changes in the number of companies such as frequency allocation, mergers, new entrants, and other events that have affected the market since 2000 have had on the market competition situation in each country, and examine how the results have affected the ARPU and the competitive environment in the country as a whole. Then, we will examine whether there is an optimal number of companies in the market, especially for cell phone companies; whether the magic number is three or four. In this topic as Tyagi (2018) addressed the recent four-to-three telecoms' mergers in the EU, and criticised the circular loop that the Commission is trapped in – with regard to design of remedies in telecommunications mergers – and underscores the need for a more innovative approach to remedial design.

However, since the results are not necessarily only statistically significant, this report will be tentative.

### **Discussion of the benefits of competition and social surplus**

According to GSMA report, there are three domestic mobile operators in 17 European countries (Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Latvia, Lithuania, Luxembourg, Malta, Norway, Slovenia, Sweden, Switzerland) and four operators in five countries (Poland, Portugal, Romania, Spain, and UK) in the 4G mobile market and that the former performance is better than the latter in especially the average standards of speed, latency, coverage area, and investment (CAPEX). The implications of this analysis are as follows. If four companies compete

in the market, excessive competition will result and social welfare will be lost, but three companies are not worried because each operator can make capital investment with peace of mind.

Though this is theoretically correct, regulators, on the other hand, believe that a merger with horizontal integration would not be easy to admit because it would weaken competition and reduce consumer surplus.

Since the countries selected by GSMA are considered to be a little biased, the following table shows the results of the GSMA's analysis, in this study, we add other well-developed countries', like France, Germany, Japan, Korea, China, and the United States of America etc., data in addition to GSMA analysis. We evaluate whether competition conditions have changed due to changes in the number of companies or other factors.

First, we determine correlation coefficients of factors likely to be relevant to the market. And we chose the factors like competitive indicators (Herfindahl-Hirschman Index / HHI, Share Fluctuations Index / SFI, number of companies, etc.), management indicators (revenue, CAPEX, ARPU, etc.), contract status (number of subscribers of each service, etc.), and service status (speed, latency, service coverage, etc.), policy (Frequency allocation, roaming obligation, obligation to open communication equipment, network, etc.) in each country. And using the regression analysis, we'd like to find 'optimal situation or numbers' in the mobile market. At least, we want to find situations that can be inferred from the relationships between the variables.

## **Germany**

O2's acquisition of E-Plus in 2014 reduced the number of companies from four to three; even with three carriers, ARPU per subscriber has continued to decline. Even with three MNO, ARPU per subscriber continues to decline. The fact that prices have not risen despite the decrease in the number of companies may be due to potential competitive pressures resulting from post-merger pro-competitive measures.

MNOs invest in infrastructure in a relatively efficient manner. Additionally, from 2019 onwards, they are systematically improving their coverage areas and speeds in accordance with 5G license conditions. In addition, in unprofitable areas such as rural areas, the three MNO are sharing facilities and continuing to invest efficiently. In addition, as seen in the case of Vodafone and others, they have spun off their tower facilities and are sharing them with other companies to increase the utilization rate of their facilities, thereby further improving investment efficiency. In contrast to other major European countries, the three existing companies in Germany mainly invest in tower facilities by themselves and their own groups.

On the other hand, major MVNOs such as freenet and Drillisch keep their service quality at the same level as the major MNOs and only offer lower prices. Small and medium MVNOs have narrowed down their target customers and have adopted a niche strategy with unique features in terms of age group, price, and usage.

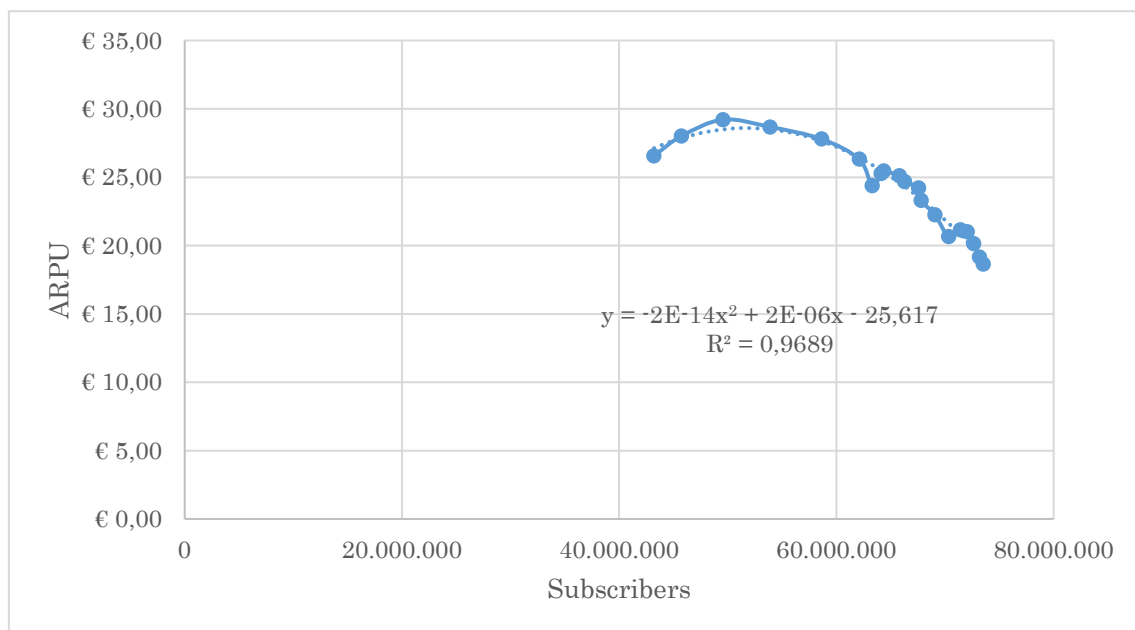
Almost half (47.9%) of the subscribers in the cell phone market in Germany are with MVNOs. In the past, as in other European countries, sub-branded MVNOs of MNOs held a high share of the market, but as a result of pro-competitive measures since the merger of O2 and E-Plus, the share of independent MVNOs has been gradually increasing.

The merger conditions approved by the European Commission for approval in July 2014 include the following<sup>1</sup>.

- To sell off up to 30% (20% and 10% option) of the combined network capacity (data "throughput" and "volume", and "voice and SMS capacity" lending) to one or more (up to three) MVNOs at a fixed price.
- The sale of spectrum and certain assets to new MNOs or MVNOs that use the network capacity.

The first condition led to the later Drillisch breakthrough and the increase in MVNO market share, while the second condition led to the reallocation of spectrum that was returned in the 2015 auction.

Figure 1. Relationship between price and number of subscriptions



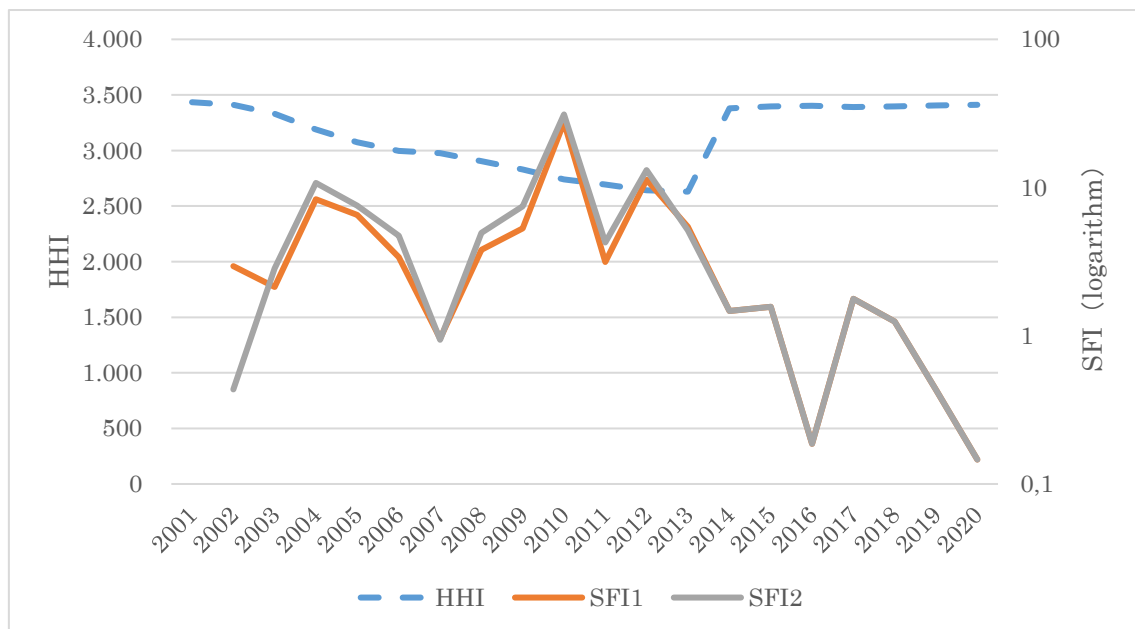
<sup>1</sup> Telefónica Deutschland/E-Plus (Case M.7018) [2015] OJ C086/7

In Germany, ARPU has been dropping almost every year during this period, regardless of the decrease in the number of MNO. Also, when ARPU goes down, subscribers tend to decrease. There is no clear relationship between changes in the number of companies and prices in Germany.

If there is no decline in the level of service, consumer welfare is improving because the number of subscribers is increasing due to lower prices.

Note that the data used does not include services dedicated to IoT and M2M.

Figure 2. Concentration level



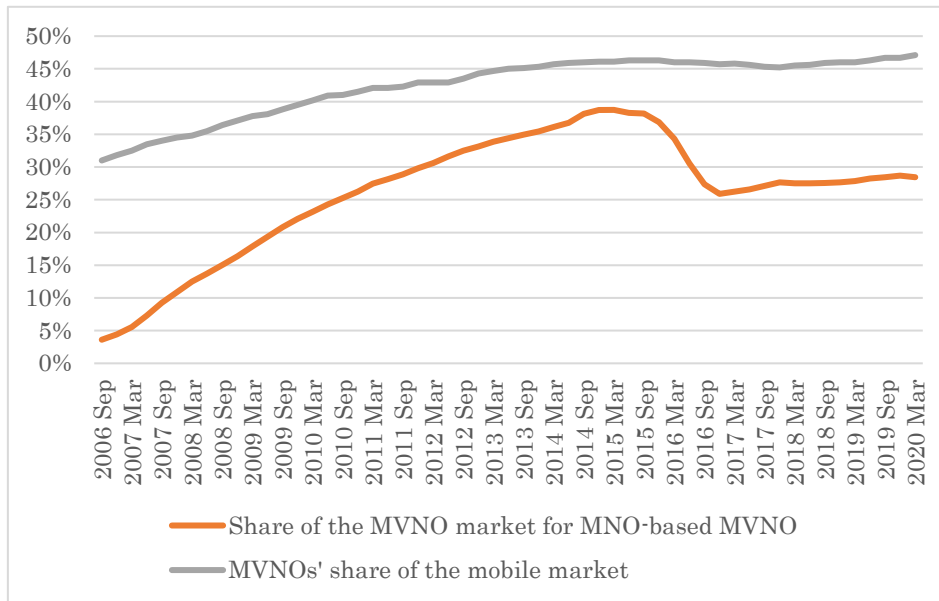
HHI: Herfindahl-Hirschman Index (representing the degree of exclusivity)

SCI: Share Fluctuation Index (a measure of the intensity of competition)

HHI and SFI were used to measure the degree of concentration over the analysis period. The former indicates absolute concentration, while the latter is an index used by the Fair Trade Commission of Japan to evaluate the state of concentration by looking at the rate of change in market share<sup>2</sup>.

<sup>2</sup> The SFI is expressed as the sum of the squares of the percentage changes in market share. [https://www.jftc.go.jp/cprc/reports/index\\_files/cr0304.pdf](https://www.jftc.go.jp/cprc/reports/index_files/cr0304.pdf)

Figure 3. MVNO market

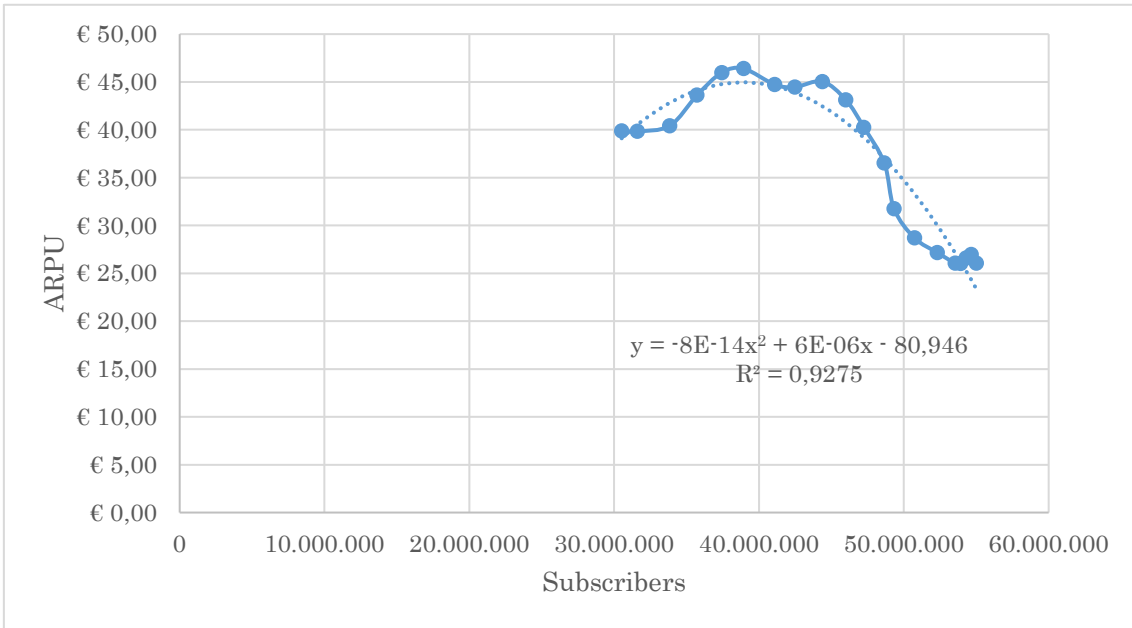


In Germany, the share of MVNOs in the cell phone market is increasing as a result of the MNO merger transition and pro-competitive measures. However, unlike in other major European countries, the share of MNO-affiliated MVNOs in the MNO market has declined.

### France

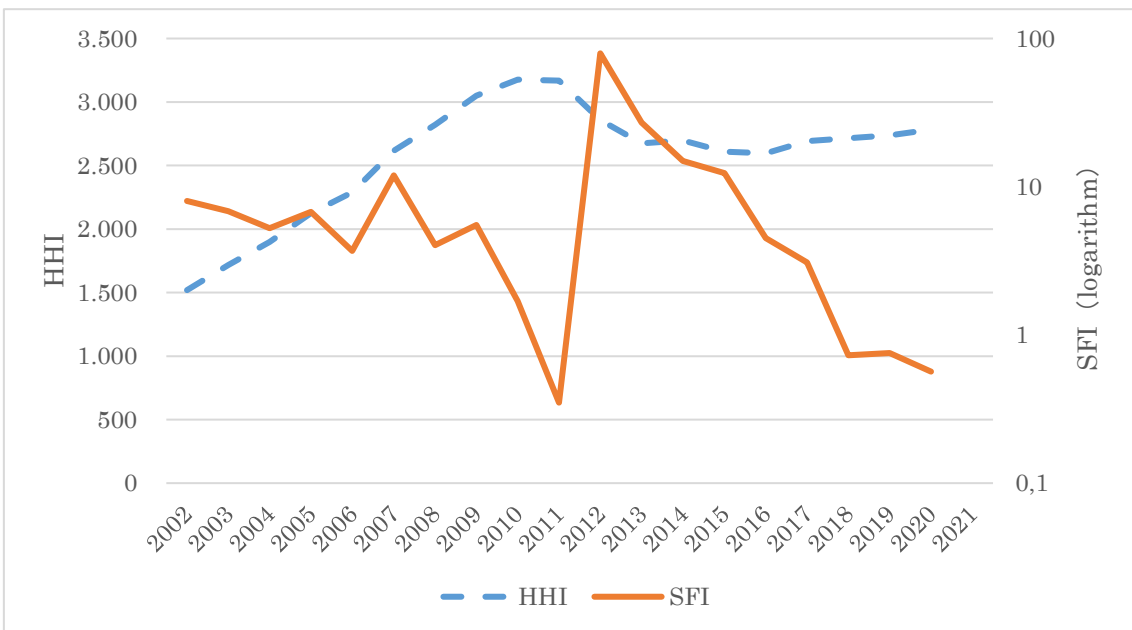
In France, in order to break the oligopoly of the big three, they decided to bring in a fourth MNO. Initially, it was planned to allocate 15MHz, but the winning bidder demanded payment in installments and the conditions could not be agreed upon, so the allocation was not made. Later, it was decided to allocate 5MHz to free (Iliad Group).

Figure 4. Relationship between price and number of subscriptions



Before free entered the market, the three major companies set up subsidiaries to provide low-cost MVNOs to prepare for the coming competition. As a result, there was a rapid decline in ARPU before and after free. Of course, ARPU dropped and subscribers increased.

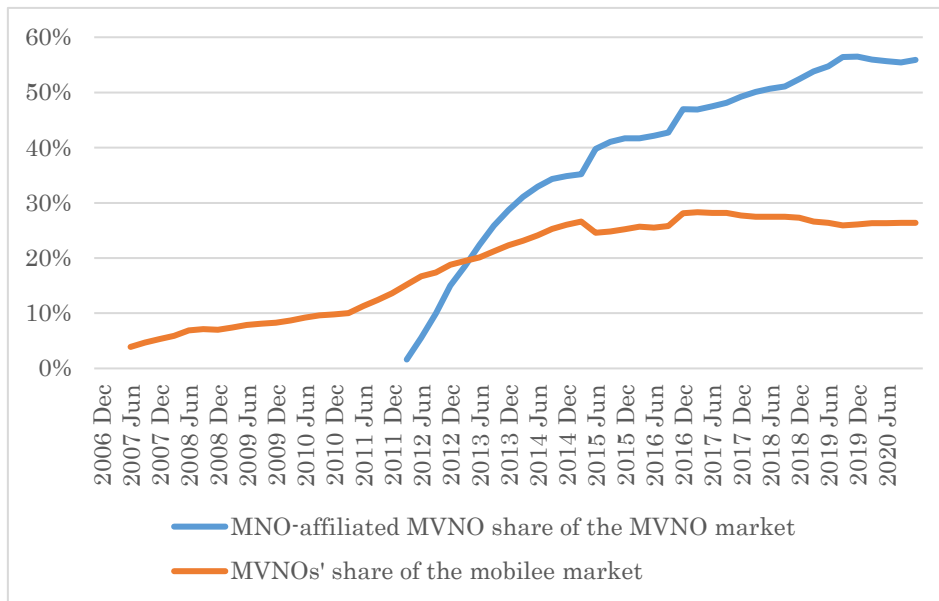
Figure 5. Concentration level





Prior to free entry, the HHI had been increasing year by year, as the authorities had feared, but with free entry, it went down for several years. However, after five years, the HHI has remained high. In SFI, there was a large change in market share in the year of free entry, but it has been declining since then, and in 2020, the level of competition is lower than before free entry.

Figure 6. MVNO market



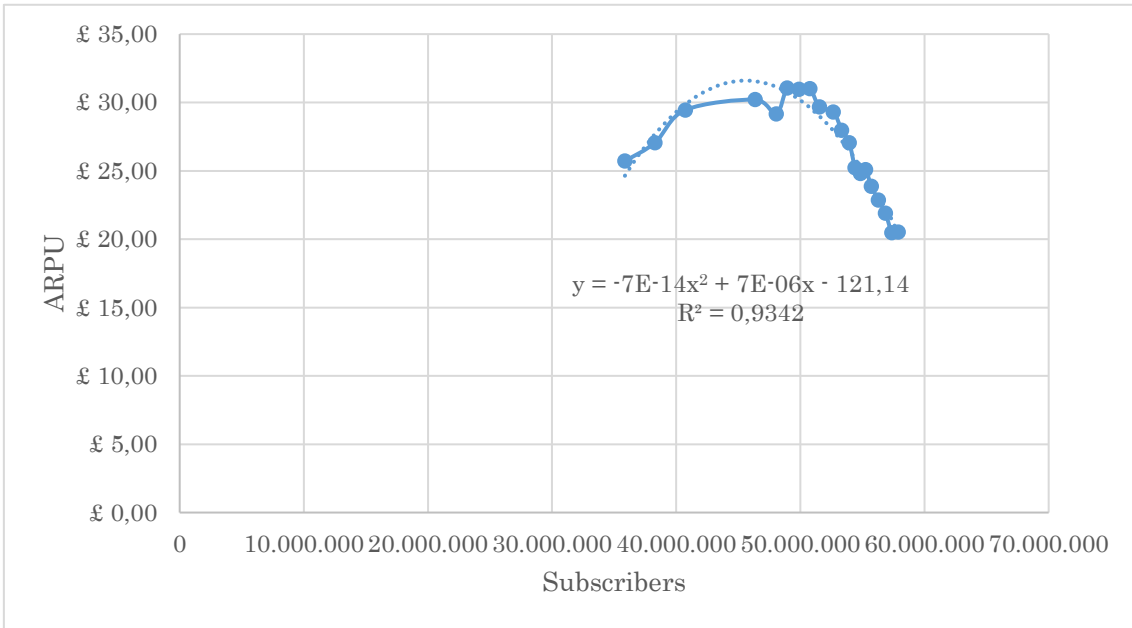
In the two years since their entry into the free market, MVNOs that had been competing in the lower price range began to withdraw from the business one after another. Many of these customers were taken over by MNO-affiliated MVNO.

### United Kingdom

Before T-Mobile and Orange merged to form EE, there were five MNOs in the UK. It was also the first market in the world to have MVNOs, so MVNOs play a significant role in the lower cost and voice communications markets.

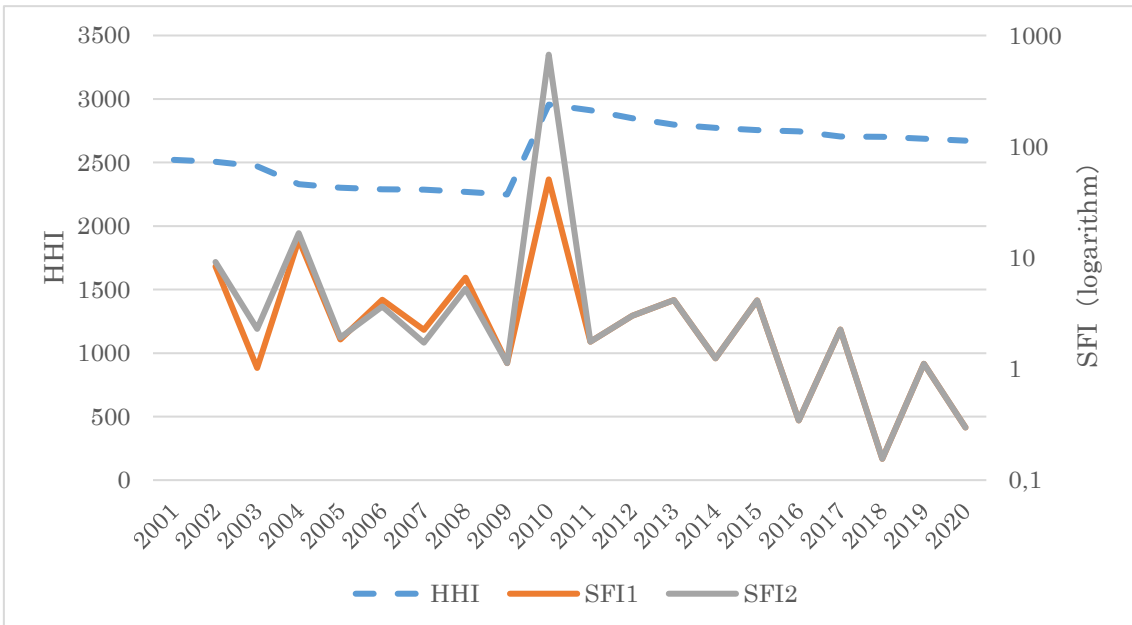
The UK is also characterized by examples of vertical mergers between major players, such as BT's acquisition of EE and the merger between O2 and Virgin Media.

Figure 7. Relationship between price and number of subscriptions



Despite the decline in the number of major market participants, ARPU in the UK has continued to decline since 2007, and there is no clear relationship between changes in the number of companies and prices in the UK.

Figure 8. Concentration level



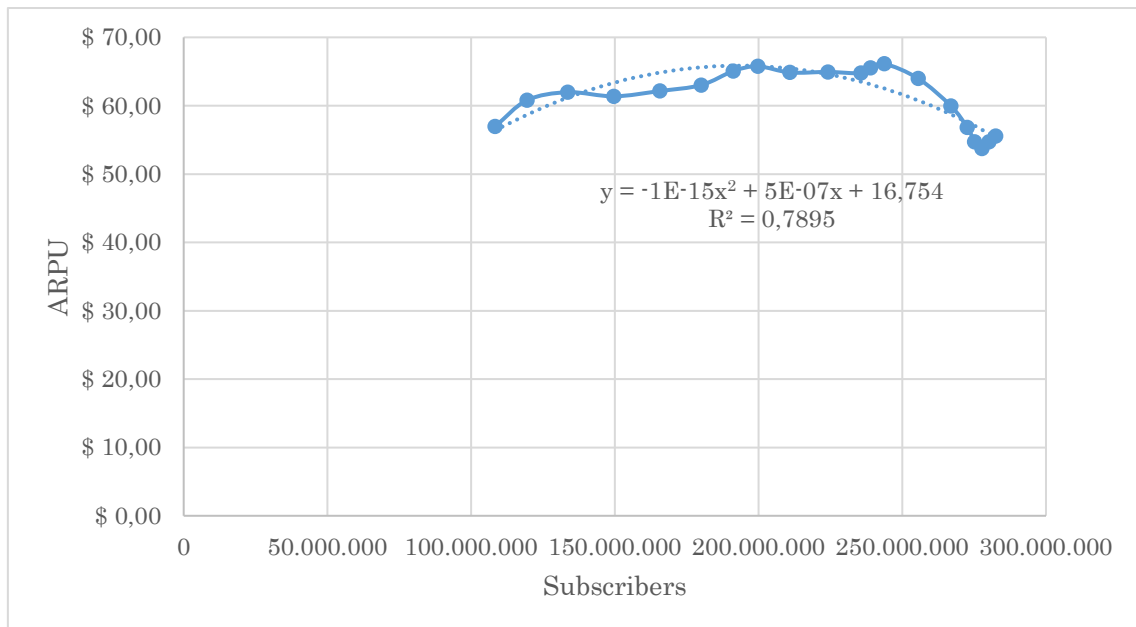
The HHI increased with the establishment of the EE, but the HHI has been gradually

decreasing since then. However, if we look at SFI, the change in market share is lessening, and competition in the MNO market is milder than it was during the era of the five-carrier system.

### United States

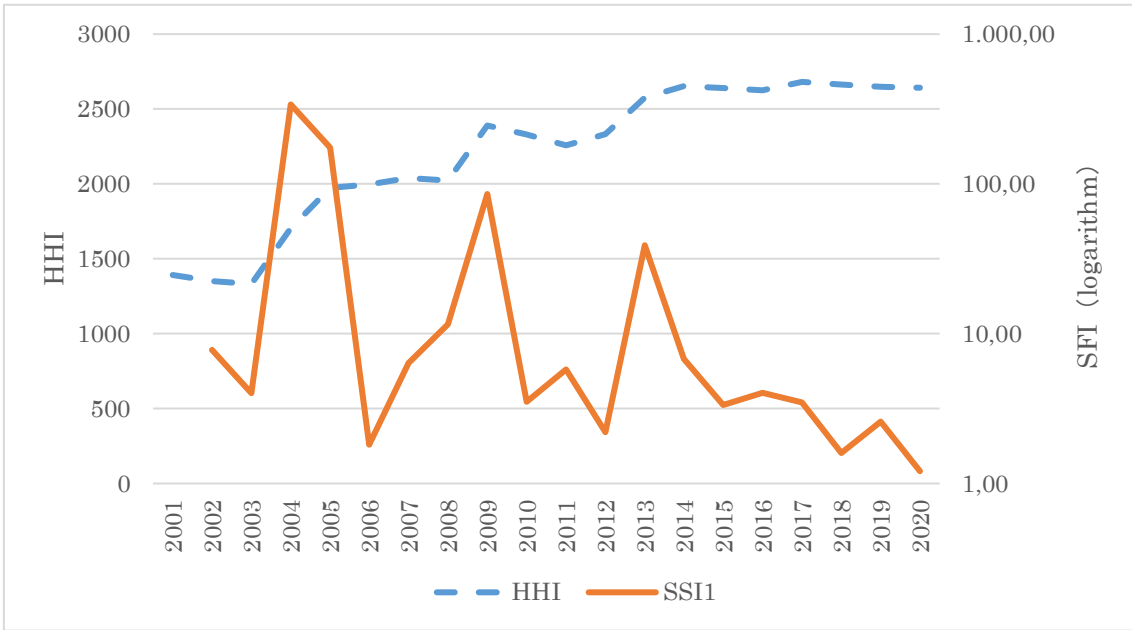
In the U.S., the merger between T-Mobile and Sprint was eventually approved, although there were competition concerns and a court case was filed to stop the merger. The entry of a fourth company was not clear until Dish, which acquires spectrum every time there is an auction, began full-scale capital investment in 2020.

Figure 9. Relationship between price and number of subscriptions



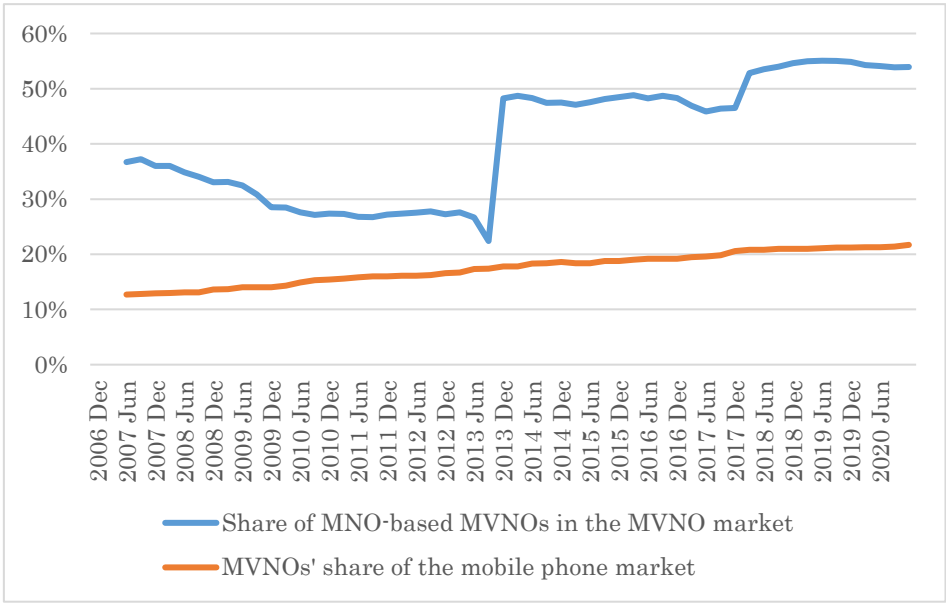
ARPU in the U.S. has not declined for a long time, except for a slight drop in the past few years. In the U.S., subsidized telecom rates are offered to low-income and tribal populations, and discounts from auction prices are offered to small operators acquiring spectrum to serve rural and tribal areas. Therefore, the ARPU of a typical MNO reflects the offered price after such subsidies, and the ARPU appears to be higher than in countries without similar systems.

Figure 10. Concentration level



HHI remains high, and competition is not as fierce as seen in SFI. In addition, the MVNO market is also concentrated, with the share of MNO-affiliated MVNO growing.

Figure 11. MVNO market



**Conclusion and Discussions**

We tried to find universal formula for our research question by using panel data and cross section data. But the market condition and regulation are so different among

them. So, we analysed the samples in some groups.

Of course, Western European samples are good for our research question. Due to the standardisation of regulations in European Union, differences in results due to variety among countries are limited. On the other hand, East Asian countries and the United States are generally different situations, but when we cut out some parts, certain similarity is found.

Summarizing the results of this analysis, the implications are as follows (tentative conclusion):

- 1) Number of companies in the market itself does not determine the competition. We cannot find any magic numbers. In other words, judging from the viewpoint of maximizing social welfare, all depends on the conditions, and it cannot be said that three companies are good, nor are four companies.
- 2) Looking at overall ARPU, a decline in service rates does not necessarily increase subscribers. Instead of considering the relation between service rates and subscribers, we should observe the number of users by technology (ex. 2G/3G/4G/5G/data/IoT). This is because the competitive environment differs in each market of technology.
- 3) The impact depends on the characteristics of new entrants, and this will increase competition, but in a few years such effect will diminish. During our survey period, we have observed in several markets that businesses which were very competitive at the time of new entry gradually became less competitive with the incumbent.
- 4) Although the markets are open and new entrants often come on board before a large generation change of network technology, it is rare that the number of companies is maintained until another generation starts.

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