



# **The Norwegian and the German mobile telecommunication sectors – what explains the higher German end prices the last five years?**

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## *Abstract*

The per-unit end prices in the German mobile telecommunication sector are now at Norwegian level, after being about twice as high as the Norwegian per-unit end prices in 2010. By analysing the mobile telecommunication sectors in the two countries, two probable causes of the end price differences the last five years are found. One is the demand side differences between the two countries, causing slower development towards higher revenue per user and lower per-unit end prices in Germany. The other is the static competition in the German market during the period of on-net/off-net price discrimination, caused by Deutsche Telekom and Vodafone's joint market share and the possible tacit collusion between them.

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# 1. Introduction

## 1.1 Research motivation

Reports like the OECD Communications Outlook consist of data on the telecommunications industry, where market characteristics, technology use, investments in infrastructure, regulatory trends, consumption trends and end prices in the OECD countries are presented. However, literature explaining the counter-intuitive end price differences between Norway and Germany has so far not been found by the author of this paper.

The reason for the choice of the compared countries is cultural ties of the author and first-hand economic experiences related to them.

## 1.2 Research introduction

Mobile telecommunication prices have been falling sharply in the OECD area after the privatisation processes started in most of the member states in the early 1990s (OECD, 2011). Germany and Norway are two of the countries that have experienced these falling prices, but the Norwegian consumers have benefited from lower prices than the German consumers the previous decade (OECD, 2001-2011). However, the German per-unit end prices have dipped the last two years, being today at around Norwegian level. The paper will present the development of the industry in the two countries from 2008 until today, June 2013. With the starting point of the thesis being the difference in end prices of the traditional mobile telecom services, voice call and SMS, these will be of main focus, but the mobile data service will also be considered. The paper considers both business subscriptions and personal subscriptions, although some of the data, e.g. the underlying traffic for the end price examples, match personal consumption better than business consumption. The paper is written with the intention of it being read also by readers with only little business and economy knowledge.

## 1.3 Research question

The Norwegian and the German mobile telecommunication sectors – what explains the higher German end prices the last five years?

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## **2. Data and theory**

### **2.1 Data and theory part introduction**

The paper is a multiple-case study, exploring two cases, being the Norwegian and the German mobile telecommunication sectors, and presenting the differences relevant for the research question. The data used is secondary data from multiple, publically available sources.

The data and theory part includes data on voice and data traffic, end prices, market shares, accounting data, frequency allocation and frequency cost, infrastructure cost, consumer behaviour, regulatory differences between the two countries, and theory connected to the regulation of the sector.

### **2.2 Voice and data traffic**

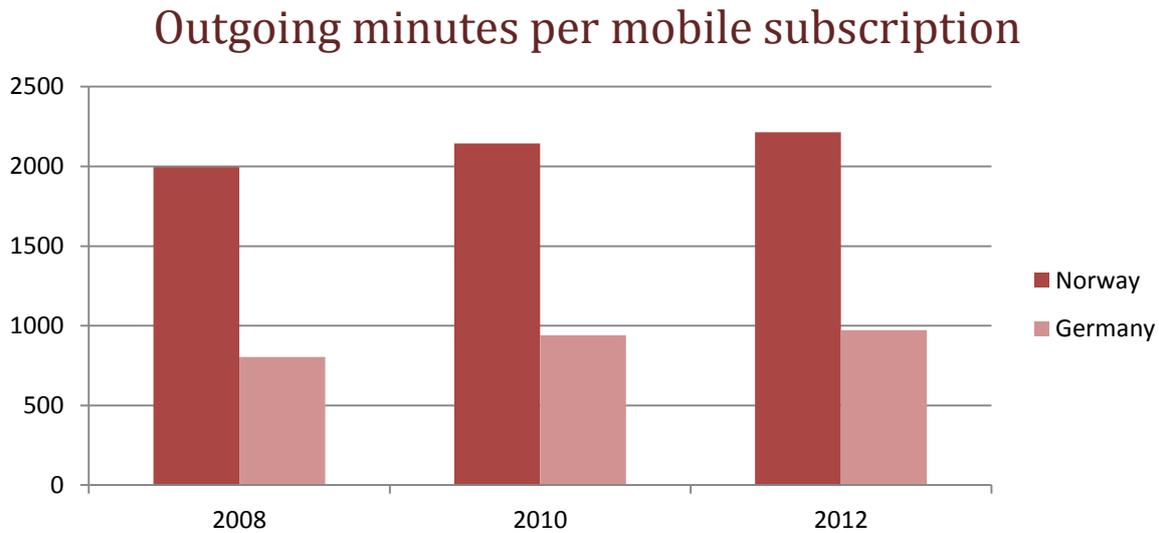
#### **2.2.1 Voice traffic**

There are distinct differences in the use of fixed and mobile telephony between Norway and Germany. In 2010, the fixed-line (originated) voice traffic in Norway amounted to 6.4 billion minutes, while the mobile (originated) voice traffic amounted to 12 billion minutes (NPT, 2012c). The same year, the fixed-line (originated) voice traffic in Germany amounted to 195 billion minutes, while the mobile (originated) voice traffic amounted to 102 billion minutes (Bundesnetzagentur, 2011). Converted to percentages, mobile voice traffic constituted 65 per cent of total traffic in Norway, while it constituted only 34 per cent of the German total traffic. The average mobile voice traffic share in the European Economic Area (EEA) was 57 per cent in 2010 (GSMA & A.T. Kearney, 2011).

In 2012, the share of voice traffic originated in the mobile network was 73 per cent in Norway and 38 per cent in Germany (NPT, 2013b) (Bundesnetzagentur, 2013a) (Bitkom, 2013a).

In figure 1 below voice traffic originated in the mobile networks in Norway and Germany is shown, per subscription.

Figure 1



Sources: (Bundesnetzagentur, 2013a) (Bundesnetzagentur, 2012a) (NPT, 2013b) (Bitkom, 2012a) (Bitkom, 2013a)

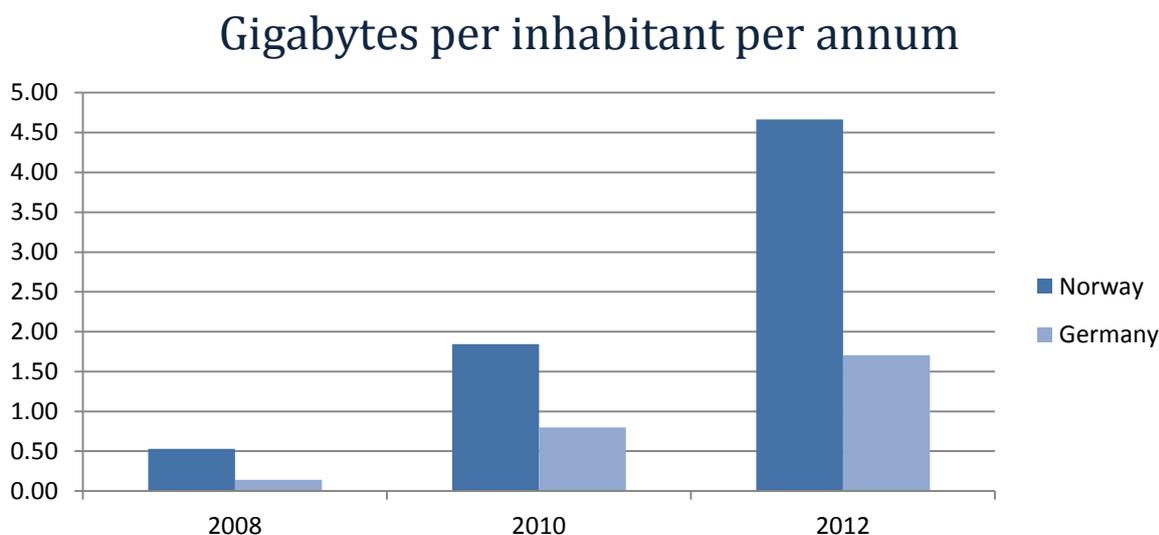
The figure shows the significant difference in traffic per subscription between the countries, with the Norwegian traffic being about twofold the German traffic. Number of minutes originated per mobile subscription in 2012 was 2214 in Norway and 972 in Germany.

The 2013 German market penetration rate, being the number of subscriptions per inhabitant, is 1.38, while the Norwegian rate is 1.14. This means that the mobile voice traffic differences between Germany and Norway are smaller per inhabitant than the per subscription differences shown in the figure above, with outgoing minutes per inhabitant in 2012 being 2530 in Norway and 1340 in Germany. The market penetration rates are based on subscription numbers of 113 million for Germany and 5.8 million for Norway, and on population numbers of 82 million for Germany and 5.1 million for Norway (NPT, 2013b) (Bundesnetzagentur, 2013a) (Statistics Norway, 2013) (Statistisches Bundesamt, 2013).

## 2.2.2 Mobile data traffic

While voice call revenue is decreasing in both Norway and Germany, and the level of voice traffic has matured, data traffic and data revenues are sharply increasing in both countries. Below is figure 2, showing the sharp increase from 2008 to 2012 in mobile data traffic per inhabitant in Norway and Germany.

Figure 2



Sources: (Bundesnetzagentur, 2013a) (NPT, 2013b) (NPT, 2012c) (Bundesnetzagentur, 2011)

The difference in the levels of data traffic between the two countries is even bigger than the difference in the levels of voice traffic. In 2010, the average German inhabitant transmitted 0.8 gigabytes of data, while the average Norwegian transmitted 1.84 gigabytes. The difference increased from 2010 to 2012, with the ratio Norwegian to German data traffic level being 2.3 to one in 2010 and 2.75 to one in 2012.

The data traffic numbers here, both for Norway and Germany, include both the traffic from ordinary mobile telecom plans and from dedicated subscriptions for mobile data. The share of data from ordinary mobile telecom plans is increasing, but still low, at 38 per cent in Norway in 2012 (NPT, 2013b).

## 2.3 End prices

The OECD Communications Outlook is published every 2 years. It provides an overview of the price levels in the different OECD countries. The OECD uses a method where they build standard baskets of consumption, and then compare the resulting prices for these baskets in the different OECD countries. The prices presented for each country are the prices of the least-cost plan in each country, given the demand profile of the different baskets (OECD, 2011).

The average duration of the standard calls in the following tables is around 2 minutes and the calls are of all types (mobile-to-mobile, mobile-to-fixed, on-net, off-net, and voicemail) and calls made at different times of the day and the week.

The numbers are in euros per basket per month. They include value-added taxes, which are 25 per cent in Norway and 19 per cent in Germany (DBJ, 2013) (NTA, 2013). Without the value-added taxes, the Norwegian numbers would consequently be even lower, relatively.

The numbers are not PPP (purchasing power parity) adjusted. OECD operates with PPP adjusted numbers as the rule, but I find the absolute numbers to be the more appropriate. Adjusting for PPP would also make the Norwegian numbers even lower, relatively.

## 2008

The OECD mobile baskets of 2008 were the low-use basket (30 calls, 33 SMS' and one MMS per month), the medium-use basket (65 calls, 50 SMS' and one MMS per month) and the high-use basket (140 calls, 55 SMS' and one MMS per month). The resulting prices in euros per month are shown in the following table:

*Table 1*

<b>2008</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
<b>Germany</b>	<b>8</b>	<b>31</b>	<b>47</b>
<b>Norway</b>	<b>9</b>	<b>17</b>	<b>31</b>

Sources: (OECD, 2009), numbers in euros per month, not PPP adjusted, 2008 EUR/USD 1.47

## 2010

The 2010 baskets were one low-use basket (30 calls and 100 SMS' per month), two medium-use baskets (100 calls plus 140 SMS' and 300 calls plus 225 SMS' per month) and the high-use basket (900 calls and 350 SMS' per month) (OECD, 2011). The resulting monthly bills in Germany and Norway were as presented in the following table:

*Table 2*

<b>2010</b>	<b>Low</b>	<b>Medium</b>	<b>Medium</b>	<b>High</b>
<b>Germany</b>	<b>16</b>	<b>34</b>	<b>79</b>	<b>109</b>
<b>Norway</b>	<b>6</b>	<b>17</b>	<b>41</b>	<b>58</b>

Sources: (OECD, 2011), numbers in euros per month, not PPP adjusted, 2010 EUR/USD 1.33

The Norwegian end prices were far below the German in 2008 and 2010, and the difference was at its largest in 2010 with Norwegian prices around half of the German.

As mentioned in the previous section on mobile use, the 2009 average was 177 minutes per month per subscriber in Norway and 70 minutes per subscriber per month in Germany (OECD, 2011). This means that the average German subscriber received monthly bills around the OECD low-use basket and the average Norwegian subscriber bills around the lower medium-use basket size. This matter of operator revenue per subscriber is presented further in the section 2.4 on average revenue per user (ARPU).

**2013**

The last year, the German end prices have been falling significantly, while the Norwegian prices have flattened out. The cheapest German mobile telecom plans are now below the cheapest Norwegian plans. The cheapest plans, based on the two medium-use baskets and the high-use basket of 2010, are two-part tariffs plans and flat-rate plans (without on-net/off-net price discrimination). The two-part tariff plans consist of a certain fixed monthly fee and a certain amount of included use, while the flat-rate plans consist of a certain fixed monthly fee and unlimited use (of voice calls and/or SMS', not mobile data). The following tables show the prices in June 2013, retrieved from one German and one Norwegian mobile plan data base (Handytarife.de and Telepriser.no) with tariff calculators. The numbers in the following table are resulting from the two medium-use and the high-use baskets of the OECD 2011 baskets:

*Table 3*

<b>2013</b>	<b>Medium</b>	<b>Medium</b>	<b>High</b>
<b>Germany</b>	15	20	20
<b>Norway</b>	15	26	26

Sources: (Telepriser.no, 2013) (Handytarife.de, 2013), numbers in euros per month, 2013 EUR/NOK 7.6

The cheapest plans in the latter of the two medium-use baskets and in the high-use basket are, in both countries, standard two-part tariff or flat-rate plans, offered by most of the operators. The type of plan, two-part tariff or flat-rate, depends on which operator is offering the plans, as not all operators offer flat-rate plans at those prices. The German least-cost flat-rate plans in the latter of the medium-use baskets and the high-use basket in the 2013 table are plans offered by both Telefónica and E-Plus, while the Norwegian least-cost plans in these baskets are offered by different operators, including Telenor and TeliaSonera (Handytarife.de, 2013) (Telepriser.no, 2013) (E-Plus, 2013) (TeliaSonera, 2013). Both the German and the Norwegian providers have been offering these inclusive-plans (without on-net/off-net price discrimination) for a number of years, introduced in Norway in 2005 and in

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Germany in 2006, but they became more popular and cheaper in Norway earlier than in Germany (Bundeskartellamt, 2010) (OECD, 2007). As shown in the last table, today's prices are identical in the two countries for the first of the medium-use baskets, and lower in Germany for the latter of the two baskets. Like the 2008 and 2010 numbers, the 2013 prices are including value-added taxes and are not PPP adjusted.

Since the end prices in the table are based on the OECD baskets of 2010, data traffic is not affecting the prices in the table. In the cheapest Norwegian mobile plans offered on the basis of the latter of the medium-use and the high-use baskets, one GB of data transmission is included. In the cheapest German mobile plans in these baskets, only 500 MB are included. Upgrading the German plans to include the same volume of traffic as the Norwegian, one GB, costs 5 euros per month for the least-cost plans, meaning that the cheapest German plans cost 25 euros and the Norwegian 26 euros per month with similar included data traffic (E-Plus, 2013) (Handytarife.de, 2013).

In German mobile inclusive-plans, with a certain amount of mobile data included, the standard is that when the limit is reached, the subscriber is not charged per MB excessive use, but experiences that the mobile data transmission is choked (down to GPRS speed) (Bundesnetzagentur, 2013a).

## 2.4 ARPU (Average Revenue Per User)

### 2.4.1 Mobile service revenues

The mobile data revenues become more and more important for the operators. Revenues from mobile telecom excluding mobile data have been falling the last five years, but thanks to the increasing mobile data revenues, total mobile service revenues have been increasing slightly in both Norway and Germany (NPT, 2013b) (Bitkom, 2012b) (Bundesnetzagentur, 2013a). When including dedicated subscriptions for mobile broadband, the mobile data revenues (non-SMS) constituted 19 per cent of total mobile service revenues in Norway in 2012 (NPT, 2013b).

In Germany, the mobile data revenues (non-SMS, but including dedicated mobile broadband subscriptions) constituted between 25 and 32 per cent of total mobile service revenues for the four mobile network operators in 2012, being higher than the Norwegian average for all

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German MNOs (Vodafone Group Plc, 2013) (Telefónica Deutschland Holding AG, 2013) (Deutsche Telekom AG, 2013) (KPN, 2013). The sales revenues from voice traffic have been declining by about 5 per cent per year the last couple of years (Bitkom, 2012b).

### *Share of fixed fees of mobile service revenues*

In Norway, where the development away from linear pricing plans has come further than in Germany, the share of revenues from the fixed fee related to the two-part tariff subscriptions increased much since 2010. In 2012, 41 per cent of the revenues from ordinary mobile subscriptions were from the fixed fee and signing fee (NPT, 2013b). This is up from 21 per cent in 2010.

## **2.4.2 ARPU**

The average revenue per user (per subscription, not per subscriber), the ARPU, is a popular measure within telecommunications. With total revenues flattened out in the mobile communication sectors in both Norway and Germany, and subscription numbers increasing by small figures since 2009 (falling in Germany since end of 2011), the ARPUs have been decreasing since 2009 in both Norway and Germany (Bundesnetzagentur, 2013a) (NPT, 2013b). Since the average Norwegian mobile subscriber is using mobile services much more than the average German, the total ARPU per month and year has been higher in Norway than in Germany the last five years. The change to mobile telecom plans of fixed monthly fees and included use have led to much lower per-unit end prices, but only a flattening out of the operators' revenues and the connected ARPU, primarily due to increased data traffic (Bundesnetzagentur, 2013a) (NPT, 2013b).

### *2012 – based on accounting data of the MNOs*

Based on the yearly financial reports for 2012, simply dividing the revenues from the mobile services by the number of subscriptions, give weighted averages (weighted by the market shares) of the ARPUs of 13.6 euros per month in Germany and 39.5 euros per month in Norway (Deutsche Telekom AG, 2013) (Vodafone Group Plc, 2013) (KPN, 2013) (Telefónica Deutschland Holding AG, 2013) (Telenor ASA, 2013) (TeliaSonera AB, 2013) (Tele2 AB, 2013). These numbers are adjusted for the differences in the market penetration rates between the two countries. For Norway, only the ARPUs for the three mobile network operators Telenor, TeliaSonera and Tele2 are included, and the Norwegian average ARPU would have been slightly lower if the mobile virtual network operators' ARPUs were

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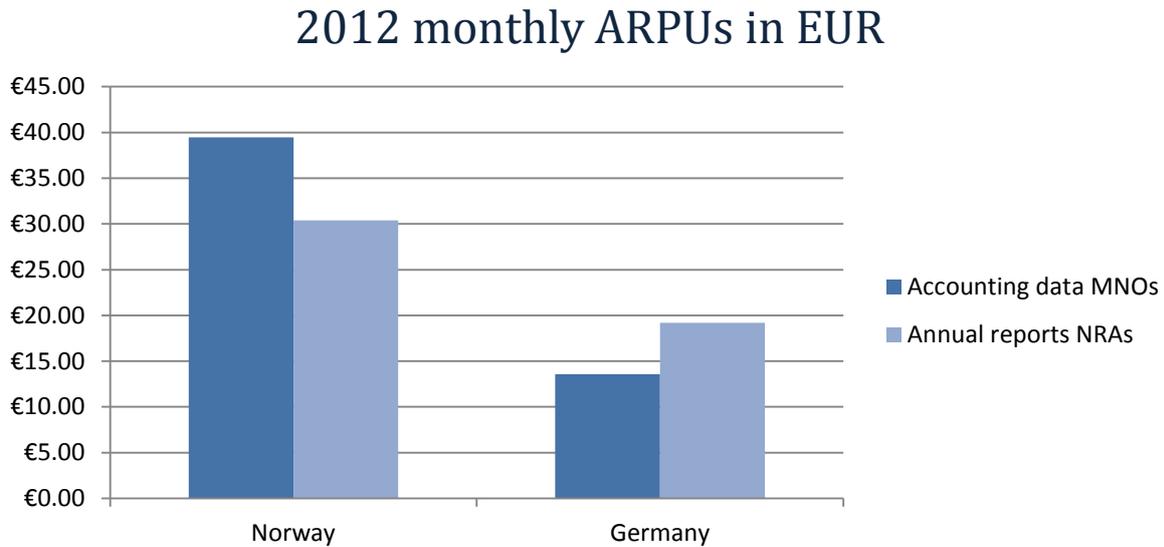
included (assuming the mobile virtual network operators have lower ARPUs than the mobile network operators). A mobile virtual network operator (MVNO) is a mobile operator that buys capacity in the network from the mobile network operator (MNO), who owns the physical network. For Germany, the subscription numbers are including the MVNOs' subscriptions in the networks, but the revenues are not including the MVNOs' revenues, meaning that the German average ARPU should be somewhat higher.

### *2012 – based on the annual reports of the NRAs*

The ARPUs reported in the annual reports of the national regulatory authorities (NRAs) for 2012 are somewhat different from the ones calculated above, and are balancing the difference between Norway and Germany. The Norwegian Post and Telecommunications Authority (NPT) reported the monthly ARPU to be 30.4 euros in 2012 (NPT, 2013b). This is below the ARPU from the accounting data of the three MNOs. This is probably due to the exclusion of the independent MVNOs, but may also be due to the inclusion of fewer revenue accounts in the NPT calculation than in my calculation. I have included interconnection revenues in the ARPUs calculated from the MNOs' accounting data, the reason being to adapt all numbers to the least detailed German company reports.

Dividing the total revenues from mobile telecom stated in the 2012 annual report of the German NRAs, the Bundesnetzagentur (BNA), by total number of German subscriptions in 2012 gives the higher ARPU that was demanded from the accounting figures. The German ARPU per month from this calculation is 19.2 euros ((€26 billion/113 million subscriptions)/12 months) (Bundesnetzagentur, 2013a).

Figure 3



Sources: (Deutsche Telekom AG, 2013) (Vodafone Group Plc, 2013) (KPN, 2013) (Telefónica Deutschland Holding AG, 2013) (Telenor ASA, 2013) (TeliaSonera AB, 2013) (Tele2 AB, 2013) (DNB, 2013) (NPT, 2013b) (Bundesnetzagentur, 2013a)

## 2009

The OECD reported in their Communications Outlook 2011 the 2009 monthly national ARPUs to be 29.2 euros in Norway and 16.7 euros in Germany (OECD, 2011) (DNB, 2009). Here there are also calculation differences from my calculation, in addition to a 14 % weaker Norwegian krone against the euro in 2009 than in 2012 (EUR/NOK 7.48 in 2012, EUR/NOK 8.74 in 2009), causing the lower Norwegian 2009 ARPU in the OECD report than the 2012 ARPUs from the financial reports of the operators and from the annual report of the NPT (DNB, 2013). Both the Norwegian and the German ARPUs were slightly higher in 2009 relative to 2012, however (Bundesnetzagentur, 2013a) (NPT, 2013b).

## 2.5 Market concentration

### 2.5.1 Market shares

#### 2012

There are two mobile networks covering the whole of Norway, one network covering 70 per cent of the population, and 19 mobile virtual operators (NPT, 2012b). The two complete networks are owned by Telenor ASA and TeliaSonera Norway AS. The third network, being built by Tele2 Norway and covering 70 per cent of the country's population in April 2013, is

to be expanded until it covers 75 per cent of the population, in accordance with Tele2's contract with the NPT (DN, 2013b).

Figure 4 – Market shares in the Norwegian end market

Norway



Source: (NPT, 2013b)

In 2012, Telenor had half the Norwegian market, 49.7 per cent, measured by the number of subscriptions. Second biggest operator is TeliaSonera, which includes both operators NetCom and Chess, with 24.4 per cent. Tele2 (including Network Norway) has 18.7 per cent. The remaining MVNOs have 7.1 per cent of the market, Ventelo being the biggest with 2.3 per cent (NPT, 2013b). Numbers for the subsidiaries or different brands of the MNOs are hidden in the respective MNO's numbers.

In Germany there are four mobile networks covering the whole population, and about 168 MVNOs (Bundesnetzagentur, 2013c) (Teltarif.de, 2013). The MNOs are Telekom Deutschland GmbH (Deutsche Telekom), Vodafone GmbH, Telefónica Germany GmbH und Co. OHG and E-Plus Gruppe GmbH & Co. KG (Bundesnetzagentur, 2013c).

Figure 5 – Market shares in the German end market

Germany



Source: (Bundesnetzagentur, 2013c)

At the end of 2012, 16 per cent of the German subscriptions were connected to MVNOs independent from the four MNOs (Bundesnetzagentur, 2013a). When including this share of 16 per cent independent MVNOs and spreading it across the four network operators, the

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shares are like the ones in the figure above. This is not fully accurate, as more MVNOs are connected to the physical networks of Vodafone and Deutsche Telekom than the networks of E-Plus and Telefónica. Including the MVNOs, Deutsche Telekom had 27.2 per cent of the German market, Vodafone had 25.2 per cent, E-Plus, owned by the Dutch KPN, had 17.4 per cent and Telefónica, branded O<sub>2</sub> in Germany, had 14.3 per cent (Bundesnetzagentur, 2013c).

When excluding the MVNO subscribers, the market shares are 32.3 per cent (Deutsche Telekom), 30 per cent (Vodafone), 20.7 per cent (E-Plus) and 17.1 per cent (Telefónica) (Bundesnetzagentur, 2013c).

## **2009**

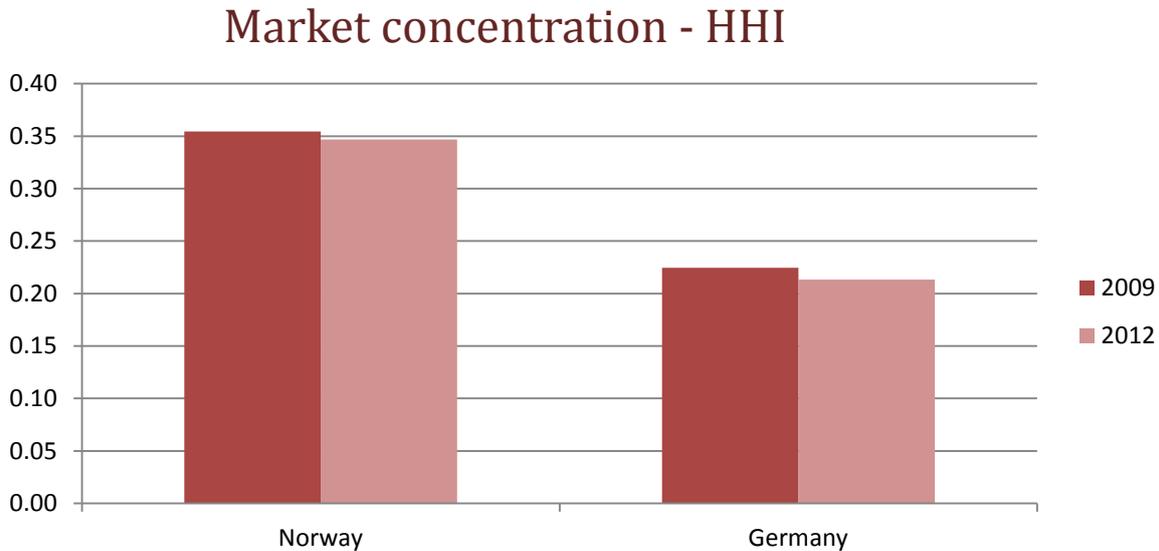
In Norway in 2009, Telenor had 51 per cent, TeliaSonera 28 per cent, Tele2 8.7 per cent, Network Norway 7.4 per cent (Tele2 had not yet acquired Network Norway at the time) and other MVNOs 4.9 per cent of the subscription market in 2009 (NPT, 2009a) (Tele2 AB, 2010).

The independent MVNOs had a bigger share of the German subscription market in 2009 than in 2012, at 22 per cent (Teltarif.de, 2011). When including the MVNOs' share of 22 per cent, Deutsche Telekom had 28 per cent, Vodafone 26 per cent, E-Plus 13 per cent and Telefónica 11 per cent of all German subscriptions (Bundesnetzagentur, 2013c). If excluding the MVNOs, Deutsche Telekom had 36 per cent, Vodafone 33 per cent, E-Plus 17 per cent, and Telefónica 14 per cent of the subscription market (Bundesnetzagentur, 2013c).

### **2.5.2 Market concentration**

The Herfindahl-Hirschman Index (HHI) is a measure often used to measure the market concentration of a specific market (Haucap, Heimeshoff, & Stühmeier, 2010). The way it is calculated is by raising the market share of each player in the market to the second power and summing them up. This leads to a higher index number for markets where the biggest players have large market shares. The HHI is a convenient measure for exhibiting the relative sizes of the operators in the sector, as a complement to the study of each operator's market share.

Figure 6



Sources: the 2009 and 2012 annual reports of the Norwegian and the German MNOs

## 2012

Applying HHI calculation method to the 2012 numbers for Norway and Germany gives the HHI figures of 0.35 for Norway and 0.21 for Germany. The German number includes the market share of independent MVNOs of 16 per cent. The difference would be even clearer if the shares of the independent MVNOs in Norway and Germany were divided into each single MVNO before raising it to the second power, since the MVNO share of the German market is bigger than in Norway. However, these HHI figures display the more concentrated Norwegian market compared to the German, and is mainly caused by the 50 per cent share of Telenor in the Norwegian market.

## 2009

In 2009, both the German and the Norwegian market concentrations, measured by the HH Index, were slightly higher than today.

The 2009 market shares give HHI figures of 0.35 for Norway (2009 figure of 0.355 vs. 2012 figure of 0.347) and 0.22 for Germany. The German number includes the market share of independent MVNOs of 22 per cent. In 2009, Tele2 had still not acquired Network Norway, and that is why the market concentration was more or less the same at that time despite the higher market shares of Telenor and TeliaSonera (Network Norway, 2013).

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## 2.6 Consumer mobility

A measure on consumer mobility is the churn rate. This is the average annual rate at which customers stop subscribing to their providers' services, as formulated by the Oxford Dictionary (Oxford University Press, 2013). This definition includes multiple provider changes done by the subscriber per annum, while other definitions count no more than one change per subscriber per annum (GSMA & A.T. Kearney, 2011).

Based on survey information, the German average churn rate was 19 per cent in 2011, up from 18 per cent in 2010 (Statista GmbH, 2011). The Norwegian average churn rate was 20 per cent in 2011, also based on survey information (NPT, 2011a). Both these numbers include a maximum of one change of provider per subscriber per year, meaning that multiple changes of one single subscriber are not counted. These churn rates were measured within the latest period of German end prices decreasing at higher speed than the Norwegian end prices. Churn rates for 2005 or 2006 would have been interesting, and would assumingly have been lower for the German market than for the Norwegian, but rates for those years have not been obtained.

## 2.7 EBITDA margins

The earnings before interest, taxes, depreciation and amortization (EBITDA) is a popular measure on the operations performance, and especially in industries with high capital expenditures. Depreciation and amortization are not cash expenses, and the EBITDA is therefore a good measure on what has been generated from operations (Berk & DeMarzo, 2011). The measure used in this section is the EBITDA margin, which is the EBITDA over total revenues. The OIBDA, operating income before depreciation and amortisation, used by Telefónica instead of the EBITDA, differs from the EBITDA in that it does not include sources of income and expenses connected to activities that are not part of the core operations of the company (Berk & DeMarzo, 2011).

### *2012*

In Norway, Telenor Norway achieved an EBITDA margin of 42.4 per cent in 2012, up from 39.6 per cent in 2011 (Telenor ASA, 2013). These numbers are for all telecom operations in Norway, including fixed-line telephony, internet and TV operations.

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TeliaSonera Norway's margin for mobile services was 31.8 per cent in 2012, down from 35 per cent in 2011 (TeliaSonera AB, 2013).

Tele2 Norway achieved a margin from their mobile services of 4.5 per cent in 2012, up from 0.7 per cent in 2011 (Tele2 AB, 2013).

In Germany, Deutsche Telekom achieved an EBITDA margin of 40.3 per cent in 2012, and a margin of 41.1 per cent in 2011 (Deutsche Telekom AG, 2013). These are numbers for all operations of Deutsche Telekom in Germany, including fixed telephony, fixed internet and TV services.

Vodafone Germany's margin was 34.8 per cent in 2012 (financial year until 31<sup>st</sup> of March 2013), down from 36 per cent in 2011 (Vodafone Group Plc, 2013). These numbers also include fixed-line revenues and costs. The fixed-line revenues account for 23.5 per cent of total revenues.

Telefónica Germany achieved an OIBDA margin of 24.5 per cent in 2012, up from a margin of 22.8 per cent in 2011 (Telefónica Deutschland Holding AG, 2013). These numbers are for all operations of Telefónica Germany, also including broadband and fixed-line operations, with the mobile services accounting for 74 per cent of the total revenues.

KPN Germany's EBITDA margin from their mobile services was 37.9 per cent in 2012, down from a margin of 41.8 per cent in 2011 (KPN, 2013). KPN is the Dutch owner of the brand E-Plus, which is the third largest MNO in Germany. E-Plus also operates the brands Base, Simyo, Vybemobile and Ay Yildiz. E-Plus only provides mobile services.

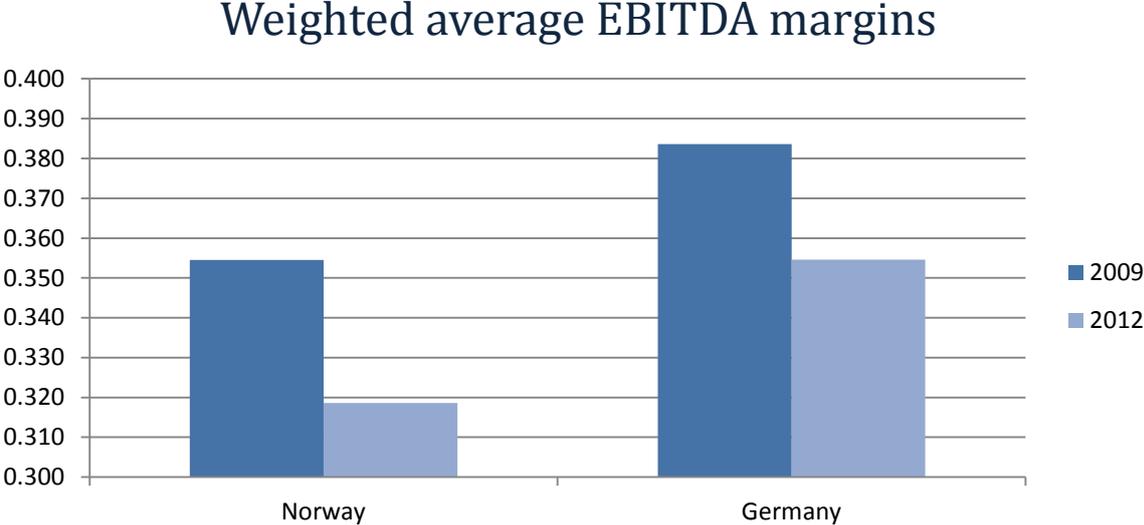
## **2009**

In Norway, the 2009 EBITDA margin for the mobile services of Telenor Norway was 40.4 per cent (Telenor ASA, 2010). The TeliaSonera Norway margin was 35.2 per cent for the mobile services (TeliaSonera, 2010). The 2009 margin for the mobile services of Tele2 Norway was 6.9 per cent (Tele2 AB, 2010). At this point, Tele2 did not yet own Network Norway, and had a market share of 8.7 per cent.

In Germany, the 2009 EBITDA margin for the mobile services of Deutsche Telekom was 41.6 per cent (Deutsche Telekom AG, 2010). The margin of Vodafone Germany was 39 per cent (for all services and for the financial year ending March 31<sup>st</sup> 2010) (Vodafone Group Plc., 2010). Telefónica achieved an OIBDA margin of 24.4 per cent from their mobile

services (Telefónica Germany, 2010), and E-Plus an EBITDA margin of 41.9 per cent from mobile services (KPN, 2010).

Figure 7



Sources: the 2009 and 2012 annual reports of the Norwegian and the German MNOs

The chart above shows the average national EBITDA margins, weighted by the market shares of the operators. It shows the higher average margins in Germany and the reduced margins in both Norway and Germany in the short period of three years. The 2009 and 2012 margins in Norway were 0.36 and 0.32, respectively, while the German margins were 0.38 and 0.36, respectively. The 2012 numbers are not as accurate for Germany as the 2009 numbers, as there is only E-Plus of the four MNOs that have separate mobile services accounts in their 2012 financial report (as of June 2013).

## 2.8 Infrastructure costs

The telecom infrastructure investments per capita and per subscriber are higher in Norway than in Germany. Between year 2000 and 2009, the Norwegian telecom investment per access path varied between 1.4 and 5.5 times the German investment (OECD, 2003-2011). The 2005 figures with Norwegian investment being 5.5 times the German were an exception, with the rule being ratios between 1.4 and 2.4. In 2009 the mobile telecommunications investments per capita were 34 euros in Norway, while the German investments per capita were 24 euros. The total German investments in mobile telecom were 1994 million euros and the Norwegian 172 million euros (assuming mobile investment share of total investment

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being the same in Norway as in Germany) (OECD, 2011) (2009 EUR/USD 1.39). These numbers are excluding frequency costs.

## 2.9 Regulation of the mobile telecommunication markets

### 2.9.1 Introduction

To make sure that the network operators allow competitors to use their network capacity, the wholesale markets in Norway and Germany are regulated by the NRAs. The work is divided into three, being to define and limit the markets, to analyse and reveal possible significant market power, and to intervene in the right manner in cases where providers have significant market power (NPT, 2012i). The European Commission has defined seven markets of the telecom sector, with a recommendation on these markets being regulated specifically. These markets are to be analysed and reported from by the NRAs to the Commission. The Norwegian authorities report to ESA (the EFTA Surveillance Authority). ESA and the EFTA countries also orientate to the recommendations of the Commission (NPT, 2012f). The seven markets are (1) access to the fixed telephone network, (2) call origination on the fixed telephone network, (3) call termination on individual fixed telephone networks, (4) wholesale access to the local loop, (5) wholesale broadband access, (6) wholesale terminating segments of leased lines, and (7) voice call termination on individual mobile networks (European Commission, 2007a). These seven markets of the 2007 update of the directives of the Commission are down from a number of 18 in the 2003 edition of the directives. Market 15 of the 2003 directives was the “access and call origination on public mobile telephone networks” (European Commission, 2007a). Call origination is the service a network operator offers when it lets a customer start and establish voice connection to another network (NPT, 2010b). This market is still under thorough observation and regulation by the Norwegian regulatory authorities, due to Telenor’s exceptional position in the Norwegian market, but is not part of Commission’s markets recommended for such specific regulation, and is not regulated in Germany. The Commission recommends that this market should be handled by competition authorities *ex post* like most markets. The former market 15 will be explained in section 2.9.4 on call origination.

A challenge for the NRAs is that not only do they have to make sure there are competitors entering and staying in the market, they also have to make sure that the network owners are

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compensated enough to preserve and expand their infrastructure over time. This trade-off is often referred to as the static/dynamic trade-off (Valletti, 2003) (Charles River Associates, 2012). What may be the optimal choice by the regulators in one static case, e.g. to set access price equal to the short-run marginal price ex post, is in turn hindering investors' willingness to invest, as they will not be compensated fully.

Call termination is the service a mobile network operator or a mobile virtual network operator offers when it lets a customer receive a call from another network. Normally, the provider charges the originating network operator, the network from which the call has its origin, a price for this service. With MVNOs in the market, interconnection may be established also within the same physical network, meaning that the call is originated in the MNOs network and terminated in the MVNOs virtual network, or vice versa (Bundesnetzagentur, 2011). The market for "voice call termination on individual mobile networks" is the telecommunication market 7 of the Commission (European Commission, 2007a).

The charging system in both fixed and mobile telephony in the EU and in the EFTA member states is based on the calling-party-pays principle. This means that the called network sets and charges the call termination rate and that the calling network pays what is charged (European Commission, 2009). This principle basically gives any operator significant market power in the call termination market.

Due to the calling-party-pays principle, the market for call termination is regulated in all EU and EFTA countries. The core part of call termination regulation is the maximum price allowed to be charged for this service. These prices are today symmetric in both Norway and Germany, meaning that they are identical for all the network operators. The norm since year 2000 has, however, been asymmetric prices (Bundesnetzagentur, 2007) (NPT, 2008). These asymmetric prices have been there to give entrants the incentives and the possibility to build infrastructure and to compete with the incumbent operator, or just to even out the market power in the market. Subsequently, as the markets have matured, the prices have converged, and are now identical for all operators in both Norway and Germany. These symmetric prices are newly fledged and came into action the 1<sup>st</sup> of December 2012 in Germany and the 1<sup>st</sup> of January 2013 in Norway (Bundesnetzagentur, 2012b) (Norwegian Ministry of T&C, 2012).

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The presence of first mover advantages in mobile telecommunications gives the incumbent operator and the first entrant exceptional advantages over the rest of the entrants (Much & Heimeshoff, 2012) (Bijwaard, Janssen, & Maasland, 2008) (Foros & Steen, 2008). These first mover advantages mean that asymmetric regulatory treatment of the operators may be necessary to reach the goal of fair and effective competition in parts of the telecom sector.

In Norway, Tele2 and Network Norway have earned much from the asymmetric construction of the termination rates the last years, an asymmetry constructed to give Tele2 and Network Norway the incentives and capital to build the third mobile network in Norway (NPT, 2012b).

The asymmetric termination prices in Germany up until 2010 were based on the relative market shares in number of subscriptions and sales, while the asymmetric prices in 2011 and 2012 were based on an efficiency measure that did not take into account the sales figures and market shares (E-Plus/KPN, 2010). The efficiency measure is part of a cost allocation method of the German Federal Network Agency termed electronic cost documentation (EKN, from German), which again is part of their costing method KeL, which will be explained in the next section on the costing methods.

The introduction of the new symmetric mobile call termination rates are in line with the Commission's goal of reaching effective competition and subsequently to reduce or simplify the sector-specific regulation (European Commission, 2007a).

## **2.9.2 Costing methods of the NRAs**

This section presents the costing methods used in the regulation of both the call origination and the call termination market.

The choice of costing method depends on how the regulator assesses the costs to be included in the measure, whether the measure should be based on the actual costs incurred by the network owner or if it should be based on hypothetical costs incurred by an entrant investing in the infrastructure needed today, and how the infrastructure should be depreciated financially (Charles River Associates, 2012).

The Commission published the new recommendations on the regulatory treatment of fixed and mobile call termination rates in the EEA in May 2009 (2009/396/EC) (European Commission, 2009). The purpose with the termination rate (TR) recommendation is to clear

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the path for harmonisation of the call termination rates within the economic area, and to set a new common standard for costing within the area. Harmonisation of mobile call termination rates (MTRs) is also to take place nationally, meaning that the MTRs are to be symmetric within each member state. Valid exceptions from this symmetry requirement need to be based on objective cost differences that are outside the control of the operators concerned, like uneven frequency allocation due to out-dated licence allocation (European Commission, 2009). The Commission does, however, recognise that market entrants have higher unit costs than the established operators until reaching a minimum efficient scale, and gives the national regulatory authorities (NRAs) the option of compensating such entrants temporarily (up to 4 years) (European Commission, 2009). The new method standard, the pure LRIC method, was to be implemented by the NRAs by the 1<sup>st</sup> of January 2013, but the Norwegian NRAs are one year behind this schedule and the German NRAs are applying for the continuation of their own method (Bundesnetzagentur, 2012b) (Analysys Mason, 2013).

### *The LRIC method*

The Norwegian NPT and the German BNA use the long-run incremental costs, LRIC, when regulating and supervising the telecom market 7 (mobile call termination), and in Norway also the former market 15 (mobile access and call origination) (Analysys Mason, 2013) (Bundesnetzagentur, 2012b). When using the LRIC method, the fixed long-term costs related to for instance infrastructure become variable and are included in the cost measure. The short-run marginal cost of producing one additional unit, e.g. one additional voice call, in a network with spare capacity is near zero, and basing the recovery costs on this would therefore not include the relevant costs for the network owner. Including operating expenses in a cost measure for mobile network operators is also not sufficient, as the capital expenses are the major expenses for the network operators. Even though both the NPT and the BNA use LRIC models for the determination of the maximum allowed termination charges, their models are unlike in which costs to include in the increment (Bundesnetzagentur, 2012b) (Analysys Mason, 2012) (Barth & Heimeshoff, 2012).

### *The Norwegian LRIC version*

Until the end of 2010, the Norwegian call termination prices were set using different versions of LRAIC<sup>+++</sup>, long-run average incremental costs plus mark-ups, before today's use of LRIC. The 2010 version of LRAIC<sup>+++</sup> included network common costs, location updates and administrative costs and was based on the mark-up costs of the operator with the

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highest costs (NPT, 2010c) (Analysys Mason, 2013). Since then, new versions of LRIC have led to inclusion of lower costs than before, as part of a gradual reduction down to a pure LRIC level in 2014. This gradual reduction of the rates is resulting from a gradual exclusion of common costs that are not traffic driven, and more emphasis on the costs of a hypothetical operator, instead of the traditional emphasis on the actual costs of Telenor and TeliaSonera (Analysys Mason, 2013).

### *Pure LRIC*

There are different practices on which common costs to include in the cost measure, and through this, different versions of LRIC. The new standard for call termination in the EEA is the bottom-up *pure* LRIC model, from the TR recommendation of the Commission of 2009.

The pure LRIC model does not include mark-ups for common costs. The reason given by the Commission for this is, among other reasons, that the call termination market is a two sided market, where both the originating part and the terminating part benefit from the call (European Commission, 2009) (NPT, 2010c). This challenges the logic of the calling-party-pays principle, and suggests that the costs of the termination service should be split between the call originator and the call terminator.

The pure LRIC model only considers the additional costs, also called avoidable costs, related to the call termination service, and the resulting measure is therefore relatively low when there is spare capacity in the networks (European Commission, 2009). To determine the pure LRIC costs, the bottom-up model is run two times, once with and once without the termination service being offered. The difference between the two resulting cost measures is the avoidable costs related to offering the termination service, i.e. the pure LRIC costs related to the service (European Commission, 2009) (NPT, 2010c). In other words, no output independent costs are included in the pure LRIC measure.

The term bottom-up means that one identifies the costs of building a network, built by a hypothetical cost-efficient operator. The opposite approach, a top-down approach means that one uses actual costs faced by an operator that already has deployed its infrastructure (Charles River Associates, 2012). The most obvious advantages and disadvantages of the two approaches are the work saved by the regulators when using the top-down approach, but on the other hand the neutral outcome of a bottom-up approach.

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The pure LRIC model is to be adopted by the Norwegian NPT in 2014, and the Norwegian version is currently under development (Analysys Mason, 2013). The Germans do not want to change to a pure LRIC model, as they find their current model to be better suited for the German market, and has applied to the Commission for the continued use of their LRIC version (Bundesnetzagentur, 2012b).

### *The German LRIC version (FS-LRIC/KeL)*

The German model for the determination of the maximum allowed call termination rates considers the common costs related to all activities in the network, in addition to the direct costs related to the termination service. The German model is called full service LRIC (FS-LRIC), or in German “Kosten der effizienten Leistungsbereitstellung” (KeL). In the German model there is a mark-up for output independent common costs, which includes a reasonable interest rate for capital employed and administrative costs (Barth & Heimeshoff, 2012). This mark-up will make sure that the compensation given through the termination rates covers the average costs of an efficient operator in a fictitious market with perfect competition. Since the continued use of KeL is not in line with the TR recommendation of the Commission, the German BNA has applied to the Commission for the continued use of the model (Bundesnetzagentur, 2012b).

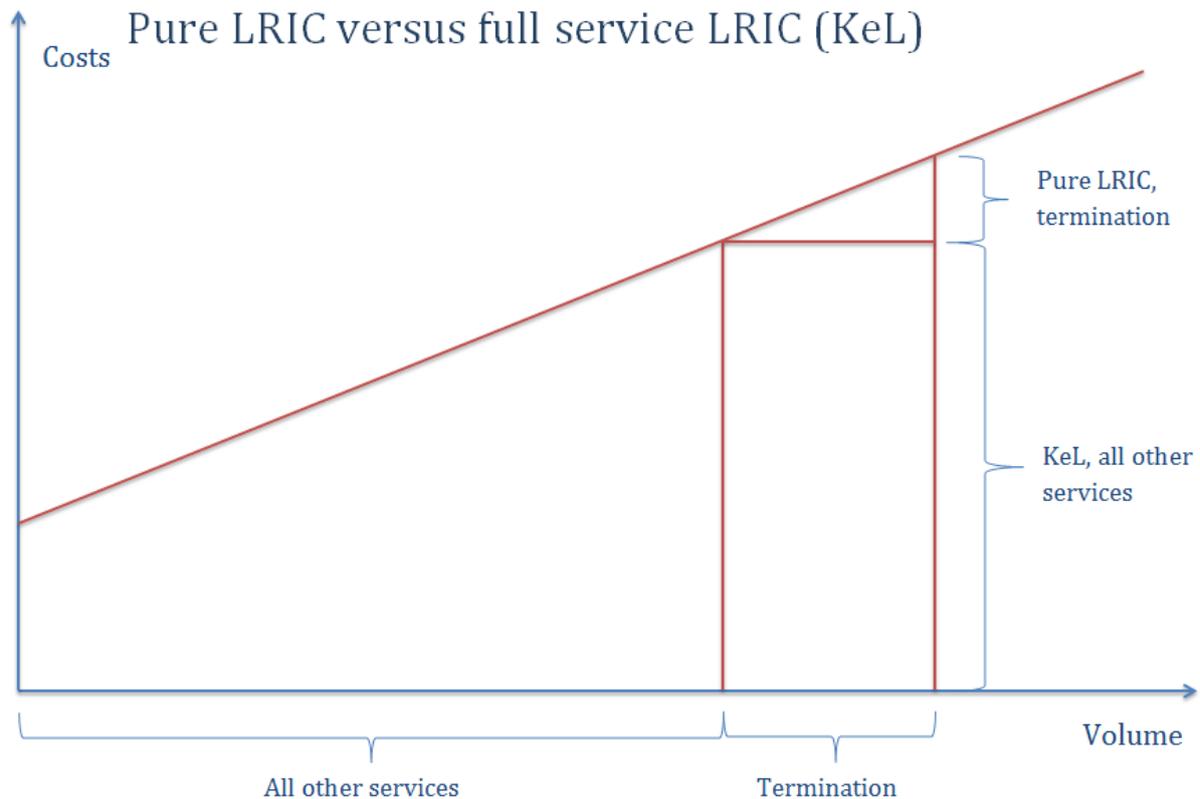
The new version of the KeL model, the resulting rates of which came into force the 1<sup>st</sup> of December 2012, is a bottom-up model based on a reference network operator being an efficient operator facing current costs (as opposed to historic) with 25 per cent market share, being 28.5 million SIM cards, each with a specified demand based on the average demand per subscriber in today’s networks, and a specified number of frequency blocks in the 900-, 1800-, and 2100 MHz bands (WIK-Consult, 2012b).

As will be presented in section 2.9.3 on the call termination rates, the latest reduction of the MTRs in Germany is mainly a result of a higher data traffic share of total data and voice traffic, meaning that a smaller share of the common costs are to be covered by the call termination service (Bundesnetzagentur, 2012b).

### *Pure LRIC vs. LRIC with mark-ups*

The difference between pure LRIC and full service LRIC in cases of low network capacity utilisation is shown graphically by the following (rough) figure:

Figure 8

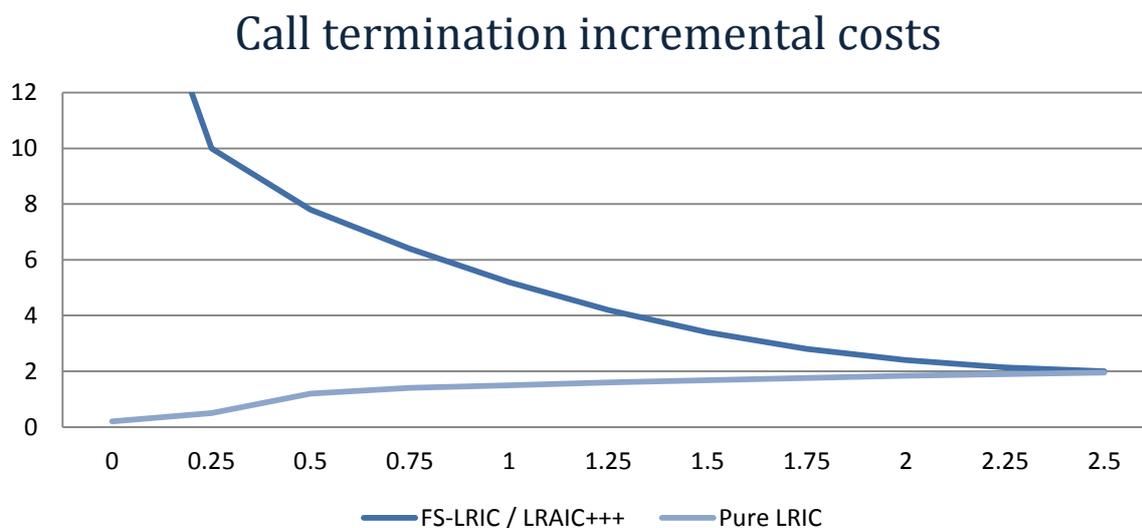


Source: (WIK-Consult, 2012a)

Total network costs are primarily resulting from the need for geographic coverage, meaning that there will be a minimum of installed capacity independent of demand. Due to this, the pure LRIC measure will increase as traffic volume increases and capacity utilisation is increasing, due to the increasing marginal impact of the termination service on the network capacity. This is the opposite traffic-cost relationship to the one of LRIC measures with mark-ups for common costs. With mark-ups for common costs, the common costs are divided by traffic volume and the measure will thereby decrease as volume increases. In certain cases of stretched capacity, the pure LRIC measure may also exceed the FS-LRIC measure (Analysys Mason, 2010).

Shown graphically, the termination cost measures resulting from the two different approaches, as traffic volume in the network increases, would look something like the following, with traffic ratio compared to today's traffic volume on the x-axis, and the cost measure (e.g. eurocents) on the y-axis:

Figure 9



Source: (Analysys Mason, 2010)

### *Cost appraisal and asset depreciation*

When making use of the LRIC costing method, the NRAs have to decide on how to appraise the costs and how to depreciate the assets. The cost recovery may be based on either historic costs or on the current costs related to the investments. A historic cost approach means that one considers the actual investment costs as the costs that are to be recovered, meaning that they will not be reappraised, but recovered fully. A current cost approach, on the other hand, will normally lead to under-recovery for the investor, as the investment value is reappraised each period to reflect the costs related to deployment at date (Charles River Associates, 2012). Under the new regulatory regime of the Commission, with the use of the pure LRIC method, the efficient costs are to be found based on the current cost approach (European Commission, 2009).

The NRAs have different choices when it comes to depreciation method of the assets, which will affect the LRIC measure. The EC recommends economic depreciation to be used by the NRAs, wherever feasible (European Commission, 2009).

The straight-line depreciation approach means that the asset is depreciated with the same amount each period, based on either the historic, actual investment value, or the calculated costs of a future or hypothetically built network. This straight-line depreciation leads to a front-loaded payment profile (sum of depreciation and return on capital employed declining each period), as opposed to the case of annuity depreciation, where the sum of depreciation

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and return on capital employed is the same each year of the economic life time of the asset (Ofcom, 2013). Annuity depreciation is the method used by the BNA in the latest determination of call termination costs (WIK-Consult, 2012a).

Economic depreciation, which is the recommended approach in the TR recommendation and used by the NPT, means that one tries to mimic a competitive market and depreciates the asset according to how much market value there is left in the asset, which means that the depreciation is the change in economic value during the period (Ofcom, 2013). Another way of putting it is that the economic depreciation follows the demand profile of the asset (Charles River Associates, 2012).

### **2.9.3 Call termination rates**

#### *Call termination rates and end prices*

The Commission is concerned that call termination rates above cost are used for cross-subsidisation between operators, meaning that two or more operators (with significant market power) use the high termination prices as an excuse for higher end prices and weakened competition (European Commission, 2009). To address this concern over the medium term, termination rates should be cost oriented, paragraph seven of the TR recommendation goes (European Commission, 2009).

The effect of a relatively high or a relatively low level of the termination rates on the end prices is, however, not clear with the two-part tariffs that are most common today (Andersson, Fors, & Hansen, 2012). Andersson, Fors and Hansen (2012) find that there is a positive, but insignificant correlation between a symmetric increase in mobile termination rates (MTRs) and the firms' profits. The correlation depends on the structure of the contracts in the mobile telephony market. The work by Andersson et al. is based on data of subscriptions with fixed monthly payments with included use and no on-net/off-net price differences for the consumers. However, the authors also refer to work that find a significant correlation between a symmetric MTR increase and firms' profits, but in that case, the work is based on linear pricing in the mobile plans (and no on-net/off-net consumer price differences), not inclusive-plans. Andersson et al. give one possible explanation to this correlation, being that the higher MTRs increase the marginal costs (but also increase marginal revenues) and thereby increase the end prices. This is also the reasoning the Commission adopted and expressed in the TR recommendation.

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The two way traffic of the mobile networks makes sure that a change in the level of the MTRs does not affect the operators' profits directly, as long as the MTRs are symmetric and the two way traffic is in balance.

Before the symmetric termination rates (at low levels) of today, the operators in both Germany and Norway were trying to influence the NRAs to make them set higher MTRs (Bundesnetzagentur, 2007) (NPT, 2007a). Even though the asymmetry changed from time to time, the average level of the MTRs has decreased continuously in both Germany and Norway since 2006 (see tables 4 and 5). However, in the years before 2006/2007, with the former tariff standard of on-net/off-net price discrimination and two-part tariffs, what would benefit the operators as a group were MTRs below marginal cost, in accordance with Gans and King's work (2001). The reason for this is that MTRs below marginal cost, with on-net/off-net price discrimination and two-part tariffs, make the need for expanding the network size (in terms of subscribers) less urgent. The reduction of the on-net prices to attract the additional subscribers is in turn not as important, and competition weakens. With weakened competition and higher no-net prices, profits increase, operators are better off, and consumers worse off. The MTR levels in both Norway and Germany were far above today's in 2006, and far above marginal cost, meaning that the MTR levels at the time were good for (strong) competition.

### *Call termination rates, two way traffic imbalances/asymmetries and end prices*

The two way traffic between the fixed and the mobile networks and between the mobile network operators is not necessarily in balance, and changing MTR levels may affect the operators' profits in cases of asymmetric traffic.

Before the implementation of the 2009 TR recommendation, the average European termination rates for fixed-to-mobile calls were nine times higher than the termination rates for voice call traffic going the opposite way (Barth & Heimeshoff, 2012). The Commission wants there to be no more preferential MTRs for mobile network operators, at the expense of the fixed network operators. The TR recommendation bases the new termination rates for both the fixed and the mobile network operators on the same costing method (pure LRIC), and thereby evens out the historic difference in these, making sure that the fixed network operators do not subsidise the mobile network operators in this manner anymore (European Commission, 2009).

The two network operators with bigger market shares are net recipients of calls in Germany, meaning that there are more incoming calls from than outgoing calls to the two smaller network operators (Barth & Heimeshoff, 2012). The asymmetric ingoing-outgoing traffic between the two smaller and two bigger network operators is in the proportion of 2 to 1, with the bigger operators being the net recipients. By lowering the termination rates, in an isolated case of asymmetric traffic flows, the smaller network operators become more competitive, as the net flow of termination charges from the smaller to the bigger operators is reduced.

### *The termination rate development the last years*

In the NPT's 2007 resolution on market 7 (wholesale market for call termination in the mobile network) in Norway, the second resolution on this market, it is stated that the price cap regulated rates are to be de-escalated from the 2007 level to a cost oriented level (NPT, 2007a). This means that the NPT has given the operators time to adapt to the new regulatory regime. The de-escalation is still in progress, as the following will display.

The 2010 termination rates in Norway were at 0.0625 euros for Telenor and Teliasonera and 0.1125 euros for Tele2 and Network Norway. Due to the gradual exclusion of mark-ups related to administrative costs, locational costs and network common costs in the LRIC model, the termination rates are much lower today than under the LRAIC+++ regime until the end of 2010 (Norwegian Ministry of T&C, 2011). From the 1<sup>st</sup> of January 2013, the rates are symmetric at 0.02 euros for all three networks. 0.02 euros is Analysys Mason's calculated reasonable MTR with today's LRIC model, but the rates will go further down when the pure LRIC model is becoming the standard in 2014 (Analysys Mason, 2013).

*Table 4 - Norwegian maximum MTRs*

<b>Norway</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b>Telenor</b>	€0.0850	€0.0813	€0.0732	€0.0690	€0.0625	€0.0385	€0.0267	€0.0203
<b>NetCom</b>	€0.1138	€0.1138	€0.0854	€0.0690	€0.0625	€0.0385	€0.0267	€0.0203
<b>Tele2</b>		€0.1444	€0.1409	€0.1149	€0.1125	€0.0385	€0.0334	€0.0203
<b>Netw. Nor.</b>			€0.1409	€0.1149	€0.1125	€0.1026	€0.0802	€0.0203

Sources: (NPT, 2008) (NPT, 2010c), (Norwegian Ministry of T&C, 2011), (Norwegian Ministry of T&C, 2012), EUR/NOK 8 for 2010, 7.8 in 2011, 7.48 in 2012 and 7.4 in 2013, based on exchange rates from DNB Markets.

The 2010 termination rates in Germany ranged from 0.0659 to 0.0714 euros and went down to a range from 0.0336 to 0.0339 from December 2010 to December 2012 for the four MNOs. From December 2012 to December 2013 they are symmetric at 0.0185 euros, before

they go further down to a symmetric level of 0.0179 euros (Bundesnetzagentur, 2012b). The sharp fall from 2010 and on to today is due to a sharp increase in the data traffic in the mobile networks the last 5 years, and thereby the smaller share of costs to be allocated to the termination service based on the German KeL costing model (Bundesnetzagentur, 2012b).

*Table 5 - German maximum MTRs*

Germany	2006	2007	2008	2009-2010	2011-2012	2013	2014
<b>Telekom</b>	€0.1100	€0.0880	€0.0792	€0.0659	€0.0338	€0.0185	€0.0179
<b>Vodafone</b>	€0.1100	€0.0880	€0.0792	€0.0659	€0.0336	€0.0185	€0.0179
<b>E-Plus</b>	€0.1240	€0.0990	€0.0880	€0.0714	€0.0336	€0.0185	€0.0179
<b>o2</b>	€0.1240	€0.0990	€0.0880	€0.0714	€0.0339	€0.0185	€0.0179

Source: (Bundesnetzagentur, 2012b) (Bundesnetzagentur, 2007)

Tele2 has received a total of 2 billion Norwegian kroner in subsidies from asymmetric call termination rates (subsidised by the other operators) in Norway. These subsidies were given to equip Tele2 with incentives to build a third Norwegian mobile network, and Tele2 is obligated to do so and to cover at least 75 per cent of the country's population (NPT, 2012d). As of April 2013, the network of Tele2 covers 70 per cent of the Norwegian population (DN, 2013b).

Termination of SMS' is not part of the seven telecom markets of the EC, but the EC acknowledges the need for ex ante regulation of other telecom markets if the NRAs find them not to pass the three-criteria test. Only three BEREC member countries (Body of European Regulators for Electronic Communications) are regulating their domestic markets for termination of SMS' today, being France, Poland and Denmark (Danish Business Authority, 2013).

## **2.9.4 Call origination**

In 2007, the EC updated their recommendations on telecom markets in which telecom-specific regulation should take place (European Commission, 2007a). The former market 15 of the Commission's 2003 recommendations is the market for "access and call origination on public mobile telephone networks" (European Commission, 2007a). In Germany, the BNA has implemented the 2007 recommendations from the EC and is not regulating the market 15 anymore (Bundesnetzagentur, 2013b). Earlier in 2007, before the new recommendations were announced, the BNA handed over a report of their analysis of the German market 15 to the EC (European Commission, 2007b). This report was part of the Commission's

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consultation with the NRAs prior to its new recommendations. In this report the BNA argued that there was effective supply competition between the four MNOs in this market, and the conclusion of the report is thereby in line with the subsequent recommendation of the Commission.

In Norway, the NPT is still analysing this market specifically, as part of their core responsibilities. The reason for this is that the market still fulfils the three-criterion test of the NPT, which is a standard test among the EU and EFTA member countries. The three criteria are (1) that the market is characterised by high barriers to entry, (2) that the market does not tend toward effective competition without regulation and (3) that general competition law is insufficient for the relevant market (NPT, 2010a).

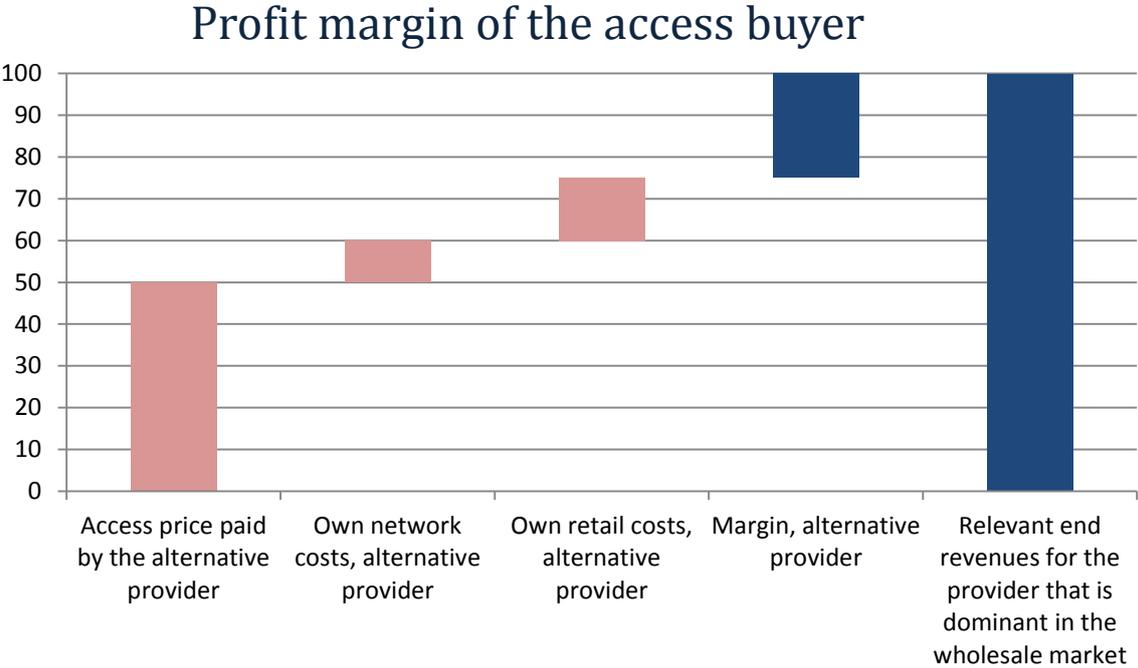
The way the NPT regulates the call origination market is by demanding and examining that Telenor, the operator with significant market power in this market, is offering access according to a non-discriminatory policy and that they, in relation to this, keep separate accounts for the different activities for the NPT to look over (part of the transparency requirement) (NPT, 2010b). The non-discriminatory requirement means that enquiries from two or more external businesses are to be considered objectively, as well as considering internal vs. external businesses objectively. Telenor is to comply with all reasonable enquiries on national roaming, MVNO access and colocation of equipment. They are also to prepare standard offers on these markets. The former direct price regulation of access is no longer valid (NPT, 2012g). The prices charged for this are, however, to be at cost oriented levels. These levels are to be in accordance with Principle 3 of the NPT's Document of Measures, and thereby cover common costs related to the infrastructure (NPT, 2009b). The separate accounts are to be reported each half-year, and there are to be separate accounts for voice, SMS and data traffic. The fixed network, mobile broadband telephony and international roaming are not covered by the separate accounts requirement.

As part of the follow-up on the non-discriminatory requirement, the NPT carries out a margin squeeze test (NPT, 2012h). The operator with significant market power, Telenor, is to allow a so-called reasonably efficient operator to cover its costs and make a fair profit through its revenues when buying access to the network of Telenor. The term reasonably efficient operator is defined through LRIC costing. The LRIC costing is preferably based on fully distributed historic costs related to end user business, and on current costs related to the infrastructure. The alternative to using LRIC and the term reasonably efficient operator

would be to base the margin squeeze test on the cost measure called equally efficient operator, which means as efficient as the incumbent operator. Normally, in common competition law, the equally efficient operator measure is used, but the NPT and the Norwegian Ministry of Transport and Communications find the reasonably efficient operator and LRIC to provide a better basis when following up Telenor and the non-discriminatory principle (NPT, 2012h).

Shown graphically, the marginal revenues, costs and profit margin of the access buyer:

Figure 10



Source: (NPT, 2012h)

If the difference between the end revenues and the access price charged by Telenor is not big enough to cover the access buyer’s costs and a fair profit, a margin squeeze situation exists. If the MNO (Telenor) combines charging prices above cost in the wholesale market with reducing its end prices below cost, so-called cross subsidisation is taking place (NPT, 2010b).

**2.9.5 EU roaming tariffs**

The international roaming charges in the EU and the EFTA countries are regulated by the Commission and have been reduced gradually each year since 2007. International roaming

tariffs are the prices charged by the national network operator for letting the subscriber use mobile telecom services in a foreign network (European Commission, 2013). The following table show the development in the EU roaming tariffs (regulated maximum) from 2009 to 2014:

*Table 6 - Maximum international roaming tariffs in the EU*

<b>Eurotariff max. roaming charge (per minute without VAT)</b>	<b>Making a call</b>	<b>Receiving a call</b>	<b>Sending an SMS</b>	<b>Receiving an SMS</b>	<b>Mobile internet (per MB)</b>
<b>Summer 2009</b>	€0.43	€0.19	€0.11	free	-
<b>Summer 2010</b>	€0.39	€0.15	€0.11	free	-
<b>Summer 2011</b>	€0.35	€0.11	€0.11	free	-
<b>Summer 2012</b>	€0.29	€0.08	€0.09	free	€0.70
<b>Summer 2013</b>	€0.24	€0.07	€0.08	free	€0.45
<b>Summer 2014</b>	€0.19	€0.05	€0.06	free	€0.20

Source: (European Commission, 2013)

The substantial decrease in all roaming charges reduces the operators' revenues related to international roaming, revenues which have contained profit margins far beyond the national roaming revenues (Digi.no, 2007).

## **2.9.6 Frequency auctions**

In both Germany and Norway the spectrum is regulated through auctioning of the most demanded frequencies, and a ceiling on how many blocks of frequencies each participant can acquire (Bundesnetzagentur, 2012c) (NPT, 2012a). Since these auctions are open for all interested parties, the prices of the blocks of frequencies will reflect the market's valuation of the frequencies. Furthermore, since the German market is much bigger than the Norwegian, but more or less the same frequencies are used for mobile telecom, the prices for the frequencies are higher in Germany. The frequencies used in both countries are the intervals around 900 MHz, 1800 MHz, 2100 MHz and the 2600 MHz (Bundesnetzagentur, 2010b) (NPT, 2013a).

The current distribution of the mobile frequencies in Norway is presented in the following table:

Table 7 – Norwegian frequency distribution

MHz Norway	800	900	1700	1800	1900	2100	2500	2600	Total MHz	Total blocks	Share
<b>Telenor</b>	15	15	20	20	20	50	40	40	220	44	47%
<b>TeliaSonera</b>	15	15	20	20	20	20	20	20	150	30	32%
<b>Tele2</b>	5	5	20	20	25	20	0	0	95	19	20%
<b>Total</b>									465	93	100%

Source: (NPT, 2013a)

The Norwegian distribution of the frequencies more or less reflects the market shares of the three network operators. On the matter of a possible upcoming auction of the vacant frequencies in the 800 MHz band, the challenger Tele2 and the incumbent Telenor argue what is the right way of distributing these licences. As these are relatively low frequencies and thereby travel further than higher frequencies, Telenor argues that since the authorities want the whole of the population to be covered by mobile broadband, one operator should be given the majority of these licences for there to be profits to be made. Tele2, on the other hand, assesses such a procedure to be a way of materialising the historic duopoly of Telenor and TeliaSonera/NetCom (DN, 2013a).

In Germany, the frequencies in the 800 MHz band were sold by auction in the auction rounds of early 2010, where most frequencies in the 0.8 GHz, 1.8 GHz, 2.0 GHz and 2.6 GHz bands were sold. The three operators Deutsche Telekom, Vodafone and Telefónica bought 20 MHz each in this band, and have been investing heavily in infrastructure since the auction, since the frequencies are to be used for mobile broadband (Bundesnetzagentur, 2012d).

The distribution of the German frequencies is quite even among the operators and the smallest operator (market share-wise, with 17 per cent), Telefónica, possesses more than one fourth of the licences.

Table 8 – German frequency distribution

MHz Germany	800	900	1700	1800	1900	2100	2500	2600	Total MHz	Total blocks	Share
<b>Telekom</b>	20	25	20	20	15	10	25	20	155	31	25%
<b>Vodafone</b>	20	25	5	5	20	15	45	20	155	31	25%
<b>E-plus</b>	0	10	27.5	27.5	25	20	20	10	140	28	23%
<b>Telefónica</b>	20	10	17.5	17.5	20	30	30	20	165	33	27%
<b>Total</b>									615	123	100%

Source: (Bundesnetzagentur, 2010b)

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As mentioned, the limited number of frequencies available for mobile telecom makes the German prices higher than the Norwegian. The outcomes of comparable previous auction rounds in the two countries show that the price difference between the countries is larger than what the population and ARPU differences alone would suggest. When comparing the prices paid for licences in the 2 GHz band in Norway in 2012 and in Germany in 2010, one finds that the most expensive frequencies in this band were 77 times more expensive in Germany than in Norway, and the least expensive frequencies 50 times more expensive (see appendix figure 7.2) (Bundesnetzagentur, 2010d) (NPT, 2012e). In addition, the Norwegian licenses in the mentioned auction are valid 20 years, while the German are valid 15 years, which makes the relative licence prices per year in Germany even higher.

Comparing frequency prices in less demanded bands give smaller price differences, however. The German 2010 auction licences in the 2.6 GHz band were less expensive than the ones in the 2 GHz band. Comparing them to prices for the licences in the 2.6 GHz band in Norway in 2007, gives quotients of 15 and 28 for the least and the most expensive frequencies, respectively (see appendix figure 7.2) (NPT, 2007c) (Bundesnetzagentur, 2010d).

### *Frequency prices relative to national market value*

The German-Norwegian population quotient is 16, based on a German population of 82 million and a Norwegian population of 5.1 million (Statistics Norway, 2013) (Statistisches Bundesamt, 2013). Due to the higher average ARPU in Norway than in Germany, the difference between the national mobile telecom market values of Germany and Norway is smaller than the population difference. Total mobile telecom revenue in Germany was 21.6 billion euros in 2009, while the Norwegian was 1.9 billion (OECD, 2011). This gives a quotient between the national market values of 11.5. German frequency prices of 50 times the Norwegian mean that the German operators pay far more in frequency fees per subscriber and per euro earned than the Norwegian operators.

### *Frequency cost relevance*

The result of the 2010 auction in Germany was total sales of 4.4 billion euros for 41 blocks of 5 MHz frequencies. Total number of 5 MHz blocks in the relevant bands for mobile telecom (the 800, 900, 1800, 2000 and 2600 MHz bands) is around 120, and using an average from the 2010 auction, the 120 blocks are worth around 214 million euros per German MNO per year (see appendix calculation 7.3). This corresponds to 28 per cent of the

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depreciation and amortisation accounts of E-Plus in 2012, and six per cent of the total operating expenses, depreciation and amortisation (KPN, 2013).

## **2.9.7 National regulatory procedures**

### *Asymmetric termination prices in Germany and Norway*

The asymmetry of the German mobile termination rates that came into effect late 2010 and lasted until 2012 was abnormal in a European telecom regulation context. The abnormality was the fact that the rate set for Deutsche Telekom, the market leader in number of subscriptions (32 per cent market share) and in revenues, was higher than the one set for E-Plus, the third largest operator with 19 per cent market share at the time of implementation. The BNA used their costing method, called electronic cost documentation (from the German “Elektronischer Kostennachweis”), where elements of the infrastructure are calculated bottom-up, but a top-down approach is used to set the different termination rates for the different operators, based on the voice and data traffic of the different MNOs (Bundesnetzagentur, 2010c).

Decisive for the high rate for Deutsche Telekom and the lower one for E-Plus was the average voice traffic volume per subscriber, which was about twice as high for E-Plus as for Deutsche Telekom. The higher average traffic volume per subscriber leads to a higher, so-called, minute efficiency, based on the German cost allocation method. This higher efficiency measure for E-Plus led to a lower MTR.

The MTR difference between E-Plus and Deutsche Telekom was also influenced by the more developed networks of Deutsche Telekom for pure mobile data transmission. Deutsche Telekom’s dedicated networks for mobile data released capacity in the network for mobile telephony and thereby increased their cost measure relative to E-Plus, due to the relation of network capacity utilisation and the cost measure shown by the graphs in fFigure 9 (FS-LRIC graph decreasing and pure LRIC graph increasing with increased network capacity utilisation) (E-Plus/KPN, 2010).

The E-Plus group argued that they found it strange that the BNA suddenly dropped their argumentation for higher MTRs for E-Plus than for Deutsche Telekom and Vodafone from the previous round of MTR determination. In that round, the BNA pointed out two reasons for higher MTRs for E-Plus and Telefónica compared to the market leaders Vodafone and Deutsche Telekom.

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One was that the smaller operators E-Plus and Telefónica have a smaller shares of intra network voice calls compared to the bigger operators Vodafone and Deutsche Telekom (E-Plus/KPN, 2010). This fact leads to higher termination charges paid by the two smaller operators than what the origination traffic implies. Continuance of this type of reasoning from the NRAs would be purely based on equalisation concerns. Instead of asymmetric rates, what is fair to the smaller operators is to avoid setting MTRs above actual cost, as this would lead to subsidies to the market leaders (from the smaller operators).

The other reason was the disadvantage in frequency allocation for the smaller operators compared to the two bigger. As the licences are normally valid for 15 years, the growing E-Plus and Telefónica have obtained fewer licences in previous auctions than would have been optimal. Such disadvantages are named as valid reasons for asymmetric termination rates in the EC Recommendation of 2009 (section 16), but only when resulting from non-marked-based mechanisms (European Commission, 2009). This means that the auction rounds are dealing with the problem alone, not needing subsequent equalisation measures. The frequencies in the 900 MHz band are the most relevant on the disadvantage matter, as these lucrative, long-reaching frequencies were on the hands of Vodafone and Deutsche Telekom alone, up until 2006. In 2006, Telefónica and E-Plus got hold of 10 MHz each in this band, but are still outnumbered by Vodafone and Deutsche Telekom, with 25 MHz each (Bundesnetzagentur, 2010b).

### *2007 German case on on-net/off-net price discrimination*

In July 2007, the Dutch owner of E-Plus, KPN, filed a complaint concerning alleged abuse of joint market power by Deutsche Telekom and Vodafone on the matter of on-net/off-net price discrimination. On-net/off-net price discrimination is the former normal procedure of charging different end prices for calls and SMS's terminated within the network and in another operator's network. In 2005, such tariffs were included in the subscriptions of 80 per cent of all German mobile users (Bundeskartellamt, 2010). The investigation by the German Competition Authorities subsequent to the complaint by KPN found that there was no substantial competition between Deutsche Telekom and Vodafone in the years around 2007, and that the competition in the market was driven by the smaller operators, that started offering two-part tariff plans without on-net/off-net price discrimination from 2006 and onward (Bundeskartellamt, 2010).

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When considering the competition in the four physical networks, Deutsche Telekom and Vodafone both had and have a joint market share far above of what is defined as a dominant power in the German Act against Restraints of Competition (paragraph 19, sentence 3), which is a joint market share of two or three undertakings in excess of 50 per cent (Bundeskartellamt, 2002). Deutsche Telekom and Vodafone have about 62 per cent of the wholesale market and 52 per cent market of the end market, based on the number of subscriptions (see section 2.4 on market concentration). The market shares of Deutsche Telekom and Vodafone have been close to symmetrical the last 10 years, even though their joint market share has dropped (Bundesnetzagentur, 2013c). This fact, in addition to similar EBITDA margins and financial strength is also pointed out by the German Competition Authorities in their summing up of the investigation of Deutsche Telekom and Vodafone. Dominant providers are able to create a lock-in and a suction effect in the end user market when using differentiated on-net/off-net prices in combination with a two-year minimum subscription period, the Competition Authorities write (Bundeskartellamt, 2010). The suction effect arises from on-net/off-net price discrimination, as customers in smaller networks see the advantages of being part of a larger network with low on-net prices.

Even though the German Competition Authorities list solid arguments for taking action against Deutsche Telekom and Vodafone, these proceedings were ended late 2009, before deciding if the market behaviour of the two dominant operators was abusive or not. The reason for this discontinuance was the development away from the on-net/off-net price discrimination (Bundeskartellamt, 2010).

### *Regulatory treatment of Telenor*

As explained in section 2.9.4 on call origination, the Norwegian NPT is still giving the call origination and access market in Norway special regulatory attention. The NPT states that this market does not tend toward effective competition without special regulation, and Telenor is the only operator being labelled as an operator with significant market power in this market (NPT, 2010b).

After the European Commission recommended the former market 15 on access and call origination to be taken out of the list of markets in need of sector-specific regulation in 2007, the Norwegian NPT had to come to a new decision on this market (European Commission, 2007a). This decision was announced in August 2010, being that the Norwegian market 15 would still be regulated, but without a specified access price as the ones that were set in the

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period before 2010 (NPT, 2010b). However, through the non-discriminatory requirement, the wholesale price charged by Telenor is still regulated.

Telenor filed a complaint against the decisions by the NPT of regulating the access and call origination market, both in 2006 and in 2010, as they did not, according to themselves, have significant market power in this market (NPT, 2010b) (Telenor, 2010). In 2010 they stated that since there was excess capacity in the network, there would be competition in the access market between NetCom (TeliaSonera) and Telenor without the NPT requirements (Telenor, 2010). Only technicalities in the 2010 complaint regarding deadlines for accounting reports were obeyed by the NPT. As a result, Telenor has to follow the access and non-discriminatory requirements of the NPT, and in addition offer transparency related to the operations.

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### 3. Method

#### *The purpose of the research*

This paper is based on the observation of the end price differences in the two national mobile telecom markets, and the purpose is finding the probable reason(s) for these differences. The research thereby needs to be exploratory (Saunders, Lewis, & Thornhill, 2009). The observed phenomenon as starting point for the research means that the research is inductive, trying to answer the research question (that is based on the observation), using collected secondary data and theory (Saunders, Lewis, & Thornhill, 2009).

#### *Collected data and data analysis*

The objective of the data and theory part is to present the parts of the mobile telecom sector in the two countries that are affecting the end prices. Choosing the valid parts of the mobile telecom sector to investigate is easy, as the sector is clear and easily understood when seen from the top. The work of investigating each part more thoroughly is harder, and with regard to maintaining a high level of data validity, it is in some cases important to use multiple sources of data and to demonstrate that the findings may actually affect the end prices (Yin, 2009).

Data on the development of the end prices and the underlying characteristics of the sectors over time are necessary for concluding on the parts of the sector causing the end price differences. In this paper, the data collected to analyse are both quantitative and qualitative secondary data.

Even though quantitative data is better suited for time-series presentations (in chart form) than qualitative data, the possibility of following qualitative development, of for instance regulatory treatment of former market 15, gives the case study strategy strength (Yin, 2009).

To display the development of the end price differences in the period, data from different points in time in the period have been collected. For the voice and data traffic and end prices, data have been collected for the years 2008, 2010 and 2012/2013. For the ARPUs, market shares and EBITDA margins, data from 2009 and 2012 have been collected. For the call termination rates, the development from 2006 until 2013/2014 is displayed. The reason for the collection of data from three points in time for the mobile traffic and end prices is the rapid development in these numbers in the period. The ARPUs follow naturally from the

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traffic and end price data. The weighted average EBITDAs and the market shares do not vary as much from year to year as the per-unit end prices resulting from each year's least-cost plans. Data from only two years for the three measures are therefore displayed. Call termination rates from as far back as 2006 are presented, since the termination rates during the last years of the on-net/off-net price discrimination are of interest.

The operators in both Norway and Germany are studying the competitors' prices when setting their own, resulting in standard offers offered by several operators, at the same fixed fee and the same amount of included use per month. The per-unit end prices resulting from the inclusive-plans are dependent on the utilisation of the included voice and data traffic volumes. The resulting least-cost plans in the latter of the medium-use baskets and the high use basket for the 2013 end markets are the same standard offers, and the resulting per-unit end prices based on the use in the high-use basket are thereby naturally lower than the resulting per-unit end prices in the medium-use basket. This means that multiple baskets are needed to give a fair comparison of the price levels between two countries, as the standard offers in one country may fit one OECD basket better than the standard offers in another country.

### *The relative sizes of the parts of the thesis*

The data and theory part in the paper is relatively large. Finding the relevant and right data and theory is the most important part of an exploratory work like this. As all the data and theory used is secondary, the job of analysing it is a job of extracting the decisive and the right data. The analysis will follow as naturally as possible from the data and theory part, making sure that the work is as reliable as possible, meaning that repeating work on the topic would conclude with similar findings (Yin, 2009). This makes the data and theory part relatively extensive.

The regulation of the MTRs has been given more space than its (absence of) effect on the end prices would suggest. The reason for this is the emphasis given by the operators and the NRAs to this part of the regulation.

### *Assessment of case study as a research strategy*

Robert K. Yin describes the case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009, p. 18). The clear

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advantage of the case study strategy, based on the research question in this paper, is the possibility to explore the cases of the Norwegian and the German mobile telecom sectors in the search for the cause(s) of the observed end price differences. Exploratory case studies have been criticised for being less scientific than other research strategies, but the research question in this paper calls for such a strategy (Yin, 2009).

### *Assessment of the collection of secondary data and the qualitative data analysis*

A shortcoming of the collection of secondary data and the subsequent qualitative data analysis is the strong influence of the researcher's biases. The researcher will be biased in both stages, and the work will bear the stamp of the researcher. Colin Robson (2002) introduces the observer bias and the observer error as threats to the reliability of the work. These are, as the terms imply, biases that I may have in my selection of data and possible errors in my data collection or in my data interpretation (Saunders, Lewis, & Thornhill, 2009). The reliability of the work refers to how reliable the data collection techniques and the analysis procedures of the researcher are (Saunders, Lewis, & Thornhill, 2009). The degree of reliability is high if one is sure that another researcher would reach similar findings when repeating the work on another occasion, based on the same research question.

I have tried ruling out the observer bias by looking at all the parts of the mobile telecom sector without prejudice. As the starting point for the paper was an actual wonder about the reasons for the difference in end prices, the prejudice has not been strong, and the data found in the research has surprised me. As all the data and theory used in the paper has been secondary, I have tried ruling out the observer error threat by using multiple sources of data on parts of the industry where multiple sources have been accessible.

### *The external validity*

The generalizability, named external validity by Yin, is the extent to which the findings in the research are generalizable to other settings, in this case to the comparison of mobile telecom sectors of other countries (Saunders, Lewis, & Thornhill, 2009) (Yin, 2009). As presented in the analysis part, the differences between the countries in the different parts of the sector affect the competitive environment and the end prices in both directions. All the different characteristics of the sector make the comparison of Norway and Germany unique and not generalizable, since the relative influential force of the different components of the sector will be different when comparing other countries. The purpose of the research is not to

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be able to generalise from the findings, but to find the reasons for the end price differences in this specific case.

However, the differences found can be generalised each by each, meaning that there will be no doubt that the difference in each single part of the sector will affect the competitive environment and the end prices in one direction only, if any. Statistical testing of the findings, based on data from all OECD countries, would be a natural follow-up on this research, though more challenging in terms of data collection.

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## 4. Analysis

The starting point of the thesis is the lower Norwegian end prices the last five years. This defies differences in the relative cost levels, topography, population size, population density, number of operators and market concentration, which all suggest a more competitive environment in Germany than in Norway. The analysis is an assessment of the components of the sectors in the two countries, allocating them to speak either in favour of or in disfavour of the observed end price differences. The components that are probable causes of the observed end price differences will subsequently be part of the conclusion.

### 4.1 Traffic

The Norwegians have adapted to a wireless world faster than the Germans, and the lower prices and higher volumes of traffic per Norwegian subscriber than per German subscriber the last five years are interconnected facts. The trend of substantially higher volumes of traffic per Norwegian mobile subscriber than per German mobile subscriber started already in 2000 (see appendix figure 7.1), and the consumption levels seem to be part of the culture, taking into account the higher ARPU in Norway. The flattening out of both Norwegian and German yearly voice traffic volumes, with the German level far below the Norwegian, support a statement of cultural differences playing a role, as the German end prices have fallen much since 2010 without voice traffic volume increasing much. Part of the differences in consumption levels between Norway and Germany is also the continued use of fixed telephony being higher in Germany than in Norway. The growth in mobile data traffic volumes is strong in both Norway and Germany, but has been stronger in Norway than in Germany since 2010. The higher volumes of voice and data traffic per subscriber in Norway support the observed per-unit end price differences the last five years, as the mobile telecom industry is an industry of high fixed and low marginal costs.

The market maturities and the differences in consumption levels will be discussed further.

### 4.2 End prices

From the peak in the end price difference between Germany and Norway in 2010, the prices are now at about the same level in the two countries (when including the same amount of

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data). The recent German price development has been rapid, as the 2010 German prices were about twice the Norwegian end prices. The resulting end prices from the two medium-use and the high-use OECD baskets show that the German prices have been cut in half for the medium-low OECD use basket, cut by two thirds for the medium-high OECD use basket, and by four fifths for the high-use basket from 2010 until today.

### *Tariff models*

In 2005 on-net/off-net price discrimination was included in the mobile plans of 80 per cent of all German mobile users (Bundeskartellamt, 2010). At last, the smaller operators in Germany started to offer two-part tariff plans with included use and without on-net/off-net price discrimination in 2006, as Deutsche Telekom and Vodafone benefited from the on-net/off-net price discrimination. These two-part tariff plans have been a success, and are today the norm in both Germany and Norway. However, the development toward the two-part tariffs being the norm has gone slower in Germany than in Norway. When the smaller German operators introduced the new tariff plans in 2006, there were already “price wars” between smaller MVNOs in the Norwegian market, and the consumers were getting used to the mobile telecom market being the buyer’s market (Nettavisen, 2006). Since then the market for two-part tariff plans in Norway has normalised, and the two-part tariff plans have included continuously more use up until today’s situation with TeliaSonera (starting May 2013) offering flat-rate voice calls (limited to 12 hours of call traffic per 24 hours), SMS’ and MMS’ in all their post-paid plans (Digi.no, 2013). The amount of included data traffic per month is now what separates the plans, and the rest of the operators will probably follow TeliaSonera on this standard shortly. In Germany, Telefónica and E-Plus also offer flat-rate voice calls, SMS’ and MMS’ in all their post-paid plans, but the data volumes included in their plans are lower (about half) than in the plans of TeliaSonera in Norway (for equal fixed fees) (Telefónica, 2013).

Head of NPT, Torstein Olsen, believes that the trend with flat-rate plans will continue and that the system with call units is out of date (Amobil, 2012). The competition from VoIP (Voice over IP) operators increases the need for such a development, says CEO of Telenor, Jon Fredrik Baksaas (Amobil, 2012). Deutsche Telekom Chairman René Obermann states a corresponding German situation in the 2012 annual report, saying that they feel the effects of free online voice and text messaging services (Deutsche Telekom AG, 2013). The VoIP and

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online messaging services are now substitutions for mobile phone calls and SMS' that were previously not too challenging for the mobile operators.

### 4.3 ARPU

The Norwegian ARPU has been much higher than the German the last five years, even though the Norwegian per-unit end prices have been lower. This is due to the (substantially) higher level of consumption per subscriber in Norway than in Germany. These different consumption levels may be due to cultural differences (either private or business related), but also partly to the greater purchasing power of the Norwegians. Today, the increase in voice traffic volumes is flattening out, and with falling per-unit end prices, the revenues from the traditional mobile services of voice call and SMS are decreasing. The ARPU has maintained its level, however, due to the increase in mobile data traffic volumes.

The Norwegian consumption of mobile services per subscriber has been far greater than the German consumption ever since the year 2000, and this may be the reason for the two-part tariff inclusive-plans becoming popular among operators as well as among consumers in Norway earlier than in Germany. As the marginal cost for the operators of providing one more unit of mobile services, e.g. one minute of voice call, is low, the ARPU is more important for the operator than the per-unit end prices. Two-part tariff and flat-rate plans also encourage the consumer to call even more or to transmit even more data, and the operator may thereby succeed in tempting the consumer into relatively high fixed fees, thereby securing a high ARPU level.

Today's difference in the ARPUs and the similar levels of per-unit end prices in the two countries suggest that the German market has the potential of both lower per-unit end prices and higher ARPU. The challenge for the German operators is to change the German consumer behaviour related to the use of mobile services, making them use more.

### 4.4 Market concentration and consumer mobility

The differences in market concentration support stronger German than Norwegian competition. Four German MNOs compared to barely three in Norway, and the more evenly matched German MNOs than the Norwegian, contradicts the higher end prices and EBITDA margins in the German market the last years.

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The German competition in the German market has strengthened much the last three years, however. With the stronger competition, the big operators are striving to hold on to their positions as market leaders, stated by Deutsche Telekom in their latest annual report. Chairman Obermann states that they feel the effects of the price pressures in the mobile subscriptions. Their cost-cutting measures do not fully compensate for the higher expenditures for improving or keeping their market position, he continues (Deutsche Telekom AG, 2013).

The data on consumer mobility show similar rates of mobility in the two national markets in 2011, 19 and 20 per cent for Germany and Norway, respectively. 2011 was within the latest period of German end prices catching up on the Norwegian end prices, and similar churn rates at the time are thereby natural. Churn rates for 2005 or 2006 would have been interesting on this matter, but have not been obtained.

## 4.5 EBITDA margins

The lower Norwegian price level combined with the higher use level leads to a larger consumer surplus in the mobile telecom market in Norway compared to Germany. The higher average EBITDA margins in Germany show that the higher end prices in Germany are not due to higher operating expenses (alone). These EBITDA margins fell in both countries in the period from 2009 to 2012, but even more in Norway than in Germany. However, most operators have not reported the mobile specific EBITDAs for 2012, and the 2012 numbers are therefore not fully comparable and applicable.

The higher German EBITDA margins compared to the Norwegian the last years suggest that the German market has room for stronger competition. With strengthened competition, the focus on improved efficiency also becomes stronger, and this will probably enlarge the room for reduced end prices in relation to the Norwegian end prices further.

As the EBITDA margin of Telenor Norway has been relatively high (around 40 per cent) through the period, the lower average EBITDA margin in the Norwegian market is due to the lower EBITDA margins of the smaller operators. Tele2 has had EBITDA margins below 10 per cent during the whole period, and this illustrates the clear division of market power and competitive strength in the Norwegian market.

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## 4.6 Frequency costs and infrastructure costs

### *Frequency costs*

The German mobile telecom frequencies are more expensive (per subscriber) than the Norwegian frequencies. There are more or less as many MHz allocated to mobile telecom in the two countries, but the German market is much bigger and there are four MNOs in Germany and only three in Norway. The higher EBITDA margins in the German mobile telecom sector the last five years make the frequencies more lucrative for the operators and may also be a reason for the expensive German frequencies.

The higher frequency costs per subscriber increase the German marginal costs relative to the Norwegian marginal costs. The frequency cost difference between the two countries thereby supports the observed end price differences the last years. However, constituting only six per cent of the total operating expenses, depreciation and amortisation of E-Plus in 2012, the frequency cost relevance for the end price differences between Norway and Germany is limited.

### *Infrastructure costs*

Contrary to the situation in the frequency market, the German operators have cost advantages over the Norwegian operators in infrastructure deployment. The probable reason for this is that Germany is densely populated and relatively flat, as opposed to Norway.

Between year 2000 and 2009, the Norwegian telecom investment per access path varied between 1.4 and 5.5 times the German investment (OECD, 2003-2011). In 2009 the mobile telecommunications investments per capita were 34 euros in Norway, while the German investments per capita were 24 euros. The total German investments in mobile telecom were 1994 million euros and the Norwegian 172 million euros (assuming mobile investment share of total investment being the same in Norway as in Germany).

In Germany, the infrastructure costs per operator per year are twice as high as the frequency costs per year (499 million euros per operator versus 214 million euros per operator). This means that the German operators have a cost advantage over the Norwegian operators when considering the frequency and infrastructure costs together.

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## 4.7 Call termination rates

The expediency of MTRs as tool for equalisation regarding unrelated costs or differences in market power is debatable, and the new, symmetric MTRs in both Norway and Germany of today are therefore appropriate, as they aim to compensate for the termination service alone. The Commission states, in its recommendation on termination rates, that any deviation from the symmetric MTRs can only be justified by objective cost differences that are outside the control of the operators concerned, or higher costs for entrants below minimum efficient scale (European Commission, 2009, p. 71). This means that the former asymmetric rates in Norway, subsidising the entering operator Tele2, were in line with the new recommendation of the EC, while the asymmetric rates in Germany in 2011 and 2012, partly based on technicalities regarding the network technologies of the operators, were conflicting with the recommendation.

Even though German call termination prices and end prices for mobile services have decreased at high speed and seemingly in correlation since 2010, and though most operators have been supporting continued high levels of the call termination rates, the first does not lead to the other. Andersson, Foros and Hansen (2012) show that when the subscriptions are of the two-part tariff (with included use, without on-net/off-net price discrimination) structure, the level of the termination prices does not affect the operators' profits or the end prices significantly.

However, the new line of the EC and the NRAs, with the regulatory downward pressure on the MTRs and the introduction of symmetric MTRs may have led to a new mentality among the operators, with less focus on the MTRs. With symmetric MTRs and a clear MTR future, the former uncertainty about future asymmetric prices has been removed. Without this uncertainty, the operators' willingness to strengthen competition may have been influenced.

## 4.8 EU roaming tariffs

The continuously decreasing regulated (maximum) international roaming tariffs in the EU and EFTA countries reduce the operators' super profits related to the international roaming services. The effect of these reduced tariffs on national end price level is ambiguous. Such over-charging in one market could be used for cross subsidisation, giving the operator the economic leeway of reducing its margin in another market, e.g. the national mobile telecom

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market. However, effects of the high international roaming tariffs on national end price level the last five years are not known.

## 4.9 Regulatory procedures

Lighter regulatory treatment of the market leaders in Germany, and a clearer tendency in Norway to act in favour of the smaller and in disfavour of the bigger operators may have set the competition wheels in motion at an earlier time in Norway than in Germany. The relatively strict regulation of the Norwegian markets has given the smaller operators in Norway better and predictable terms, and thereby made the threat from smaller MVNOs present at all time. Weak competition in the German market and possible tacit collusion between Vodafone and Deutsche Telekom have until recently characterised the German market. The weak competition has now been replaced by substantial reductions in per-unit end prices, through relatively cheap two-part tariff inclusive-plans offered by all major operators.

### *Call origination regulation*

The EC's recommendation on which telecom markets to regulate specifically is a guide-line for the NRAs, but the exclusion of former market 15 in the newer recommendations does not mean that the market is effectively competitive in each EU and EFTA member state. ESA agreed to NPT's assessment and their argumentation for the continued need for ex ante regulation of the Norwegian market 15, based on NPT's application of the three-criteria test in the Norwegian market 15 (ESA, 2010). ESA and the NPT share the apprehension of the problems with Telenor's significant market power in the Norwegian market 15, in the same way the EC and the BNA share the apprehension of the German market 15 being effectively competitive (European Commission, 2007a) (European Commission, 2007b).

Telenor has to transmit all contracts made in this market to the NPT, in addition to reports twice a year stating the end prices and access prices charged by Telenor. Still, and in addition to this, Telenor is scrutinised from time to time when complaints are made. Such a complaint has recently (April 2013) been sent to the Norwegian Competition Authority and the NPT, where Tele2 is stating that the prices charged by Telenor for network access are too high and that the profit margin of Tele2 is being squeezed (DN, 2013c). Telenor is thereby checked even more thoroughly by the Norwegian authorities.

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Assuming the thorough supervision of Telenor keeps the company from discriminating in the wholesale market, entrants or competitors will buy capacity in their network as soon as the end price is right. The supervision secures a fair wholesale market in Norway which cannot as easily be taken for granted in the German former market 15.

### *The asymmetric MTRs of 2011 and 2012 in Germany*

Considering the line of the Norwegian NPT the years before today's symmetric prices, with symmetric MTRs for the two bigger operators, and considerably higher MTRs for Tele2, the asymmetric MTRs of 2011 and 2012 in Germany were conflicting with the Norwegian regime. Mostly due to E-Plus' higher volumes of traffic per subscriber and the higher so-called minute efficiency connected with this, their MTR was based on lower costs than the costs of Deutsche Telekom, and thereby set lower than the MTR of the market leader.

Even though the German asymmetric prices of 2011 and 2012 were resulting from a neutral cost allocation method rather than from a favourable treatment of Deutsche Telekom from the NRAs' side, the rates conflict with both the German BNA and Norwegian NPT's tradition of using MTRs as means for equalisation of market power. Asymmetric termination rates with lower rates for a smaller than a bigger MNO, have not been set by the NPT in Norway since 2006.

However, considering the sharp decrease in German end prices after 2010, it seems like the higher revenues from MTRs of Deutsche Telekom than of E-Plus have not eased the competition in end prices. However, as mentioned, high revenues from the operations in one market can be used to compensate for lower revenues in another, and the higher MTRs of Deutsche Telekom in 2011 and 2012 thereby increased their competitive strength in the end market slightly, relative to E-Plus.

### *Possible market power abuse by Vodafone and Deutsche Telekom*

Due to the specific supervision and regulation of Telenor, it is harder for Telenor than for the major German operators to exploit opportunities of earning super profits. The market share of Telenor (in subscriptions) in the Norwegian end user market was 50 per cent in 2012. The combined market share of Deutsche Telekom and Vodafone (in subscriptions) was 61 per cent in the German wholesale market and 52 per cent in the German end user market at the end of 2012. The rational choices for the consumers in the period of on-net/off-net price discrimination, and equal on-net prices offered, were Deutsche Telekom and Vodafone, as

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they had larger on-net groups than the smaller operators. Deutsche Telekom and Vodafone were accused, by E-Plus, of abusing their combined market power. The German Competition Authorities agreed that there were facts, like competitive standstill, that implied that further investigation of Deutsche Telekom and Vodafone in the case of on-net/off-net end price discrimination in 2007 was due. They did, however, not go through with the further investigation, as the case became out-dated in 2009 (Bundeskartellamt, 2010). The case was out-dated due to the move away from on-net/off-net price discrimination at the time. A pure discontinuance of the case against Deutsche Telekom and Vodafone may well be assessed as un-fair, as the alternative would have been to punish them in retrospect.

The concurrent developments from on-net/off-net price discrimination to two-part tariff plans without on-net/off-net price discrimination and from high end prices to low end prices suggest that the introduction of the new plans were the catalyst for the reduction of the end prices. The combined market power of Deutsche Telekom and Vodafone, and the absence of regulatory measures taken by the BNA may have been the reason for the late development towards lower end prices in Germany.

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## 5. Conclusion

The striking characteristics of the Norwegian and the German mobile telecom sectors suggest that the competition in Germany should be stronger than the competition in Norway. External factors like the topography, population size, population density and general price level, and the internal factors like number of mobile network operators and their relative sizes support a German sector characterised by lower costs, stronger competition and lower end prices than the Norwegian sector. However, the situation the last five years has been the opposite. The German mobile telecom sector has been characterised by higher EBITDA margins for the MNOs and higher per-unit end prices, but there has been a rapid development toward lower per-unit end prices the last three years.

Two characteristics of the mobile telecom sectors in the two countries may explain the former end price difference between the two national markets.

The first is the combination of the former on-net/off-net price discrimination and the relative market power of the German operators. In Germany, the four MNOs are more evenly matched in terms of subscription numbers than the Norwegian MNOs, but the two bigger operators, Deutsche Telekom and Vodafone, have still 62 per cent of the wholesale market. The two German market leaders are not regulated in the former market 15, and are generally not treated as strictly by the German BNA as Telenor by the Norwegian NPT. This is natural, but may have had unfavourable effects on the strength of the competition in Germany in the period of on-net/off-net price discrimination being the standard tariff model. Weak competition due to lack of competitive strength of the two smaller German MNOs was the case up to 2007, during the years of subscription standards with on-net/off-net price discrimination. Hints of tacit collusion between Deutsche Telekom and Vodafone were also given by the German Competition Authorities in their summary of their proceedings against Deutsche Telekom and Vodafone in the on-net/off-net price discrimination case. Regardless of tacit collusion between the two operators being the case or not, weak competition between the two operators and high end-prices characterised the German market up until 2008.

The Norwegian NPT is consistently treating Telenor stricter than the two other MNOs in the Norwegian markets and especially in former market 15 (access and call origination). This is due to the exceptional and continuing market power of Telenor in Norway. Even though the

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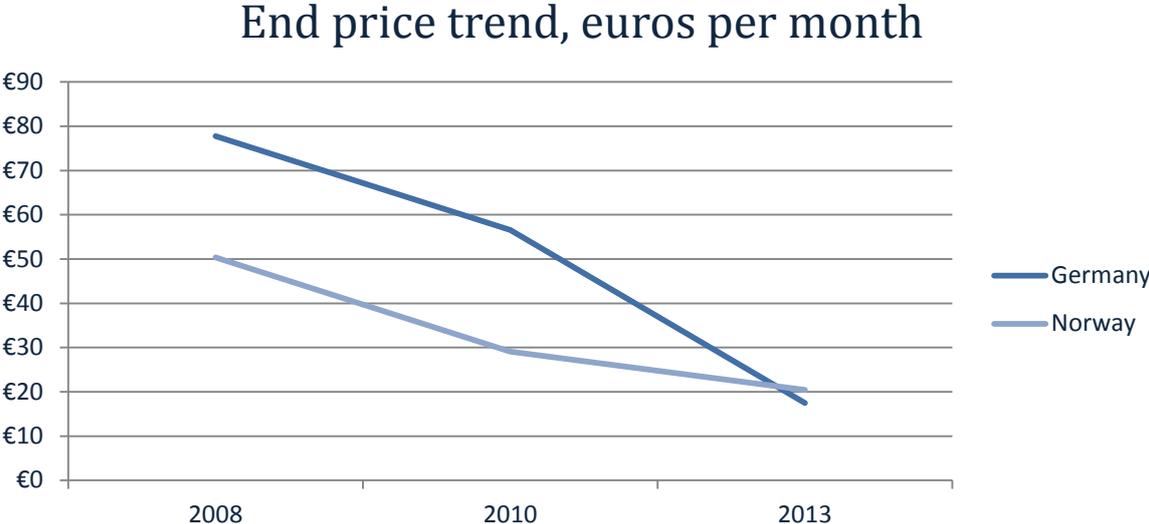
great market power of the market leader primarily is an advantage for Telenor, the resulting consistency and regulation of the market<sup>15</sup> give the competitors and potential entrants predictable terms of competition. The regulation has been a success, and has provided Tele2 with the incentives of building the third mobile network (through the asymmetric MTRs), has secured the entrance of MVNOs in the wholesale market, and has resulted in relatively low end prices in the Norwegian market.

The other characteristic of the sector that may explain the end price differences is the demand sides in Germany and Norway. In Germany, the level of fixed-line voice traffic is still higher than the level of mobile voice traffic, with 62 per cent of total voice calls. In Norway, the fixed-line share of total voice calls is 27 per cent. The Norwegians are using the mobile phone much more than the Germans also in absolute terms. This has been a fact since 1999, when the difference in mobile use between the two countries started to grow. In 2000, the average Norwegian mobile subscriber originated 922 minutes of voice traffic, being 1.78 times the average German subscriber (OECD, 2001). In 2012, the average Norwegian subscriber originated 2214 minutes of voice traffic, being 2.28 times the average German (see appendix figure 7.1). The high levels of Norwegian consumption and ARPU ever since 2000 made the Norwegian market well suited for an introduction of two-part tariff inclusive-plans. The lower consumption level in German market makes inclusive-plans less desirable for the consumers there than in Norway, and a following delay of the inclusive-plans becoming the standard plans in Germany is a possible reason for the lower relative fall in per-unit end prices from 2008 to 2010 in Germany than in Norway.

The EBITDA margins of the German MNOs show that there has been room for strengthened competition in the German sector, and the falling end prices of the last two years illustrate this. The increasing speed of the falling German end prices since 2010 suggest that the German sector in the years before was just waiting for something to force the end prices and margins down from their high levels. The on-net/off-net price discrimination that was baked into most mobile plans before 2006 made competition difficult for the smaller operators and the change away from that standard was needed. The inertia in the German sector was possibly what put the development on hold, but since 2010 the German sector has been surprisingly dynamic.

When scaling up the OECD high-use basket of 2008 to fit the consumption of the 2010 medium-use baskets, and using averages of the prices resulting from the two baskets in 2008, 2010 and 2013, we find the following end price trends for Norway and Germany:

Figure 11



Based on the consumption of the OECD medium-use baskets of 2010, in euros per month, see section 2.3.

We see the steeper trend line of the German end prices. The difference between the end price levels, which peaked in relative terms in 2010 (with German end prices being about twofold the Norwegian), has disappeared in only three years.

Assuming that the years of competitive standstill between Deutsche Telekom and Vodafone is over and that the full potential of the German mobile competition will be released, the German end prices will possibly continue downward further below the level of the Norwegian end prices, due to the economies of scale in the German sector. However, one of the reasons for the low per-unit end prices in Norway is the high level of mobile voice and data traffic. The low level of German mobile voice and data traffic relative to the Norwegian means that there is room for both lower per-unit end prices and higher ARPU in Germany, if the consumers are lured into or decide to adopt the Norwegian consumption level. With the German EBITDA margins already being high, and the relatively high level of included use in the standard German mobile plans, the German consumers can start using their mobile phones as much as the Norwegians without the ARPU level increasing at all.

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## 6. Bibliography

- Amobil. (2012, June 8). *Fastpris erstatter minuttpris: Amobil*. Retrieved April 19, 2013, from Amobil: <http://www.amobil.no/artikler/fastpris-erstatter-minuttpris/110046>
- Analysys Mason. (2010, June 25). *Mobile Termination Cost - understanding the move from LRAIC to pure LRIC: Analysys Mason*. Retrieved January 15, 2013, from Analysys Mason: <http://www.analysismason.com/About-Us/News/Newsletter/Mobile-termination-cost-understanding-the-move-from-LRAIC-to-pure-LRIC/>
- Analysys Mason. (2012, December 7). *2013 update of NPT's LRIC model: Analysys Mason*. Retrieved January 23, 2013, from Analysys Mason: [http://www.npt.no/marked/markedsregulering-smp/kostnadsmodeller/lric-mobilnett/\\_attachment/5274?\\_ts=13b89d83c48](http://www.npt.no/marked/markedsregulering-smp/kostnadsmodeller/lric-mobilnett/_attachment/5274?_ts=13b89d83c48)
- Analysys Mason. (2013, March 1). *March 2013 update of NPT's mobile LRIC model: Analysys Mason*. Retrieved May 13, 2013, from Analysys Mason: <http://www.npt.no/marked/markedsregulering-smp/kostnadsmodeller/lric-mobilnett>
- Andersson, K., Foros, Ø., & Hansen, B. (2012). *Empirical evidence on the relationship between mobile termination rates and firms' profit*. Bergen: SNF Working Paper No 27/12, NHH.
- Barth, A.-K., & Heimeshoff, U. (2012). *Der angemessene Kostenmaßstab für Terminierungsentgelte - "Pure LRIC" vs. "KeL"*. Düsseldorf: Heinrich-Heine-Universität Düsseldorf.
- Berk, J., & DeMarzo, P. (2011). *Corporate Finance, 2nd ed.* Boston: Prentice Hall.
- Bijwaard, G. E., Janssen, M. C., & Maasland, E. (2008, April-May). Early mover advantages: an empirical analysis of European mobile phone markets. *Telecommunications Policy, Volume 32, Issues 3-4*, pp. 246-261.
- Bitkom. (2012a, July 30). *Presseinformation: Bitkom*. Retrieved April 15, 2013, from Bitkom: [http://www.bitkom.org/files/documents/BITKOM\\_Presseinfo\\_Handyminuten\\_30\\_07\\_2012.pdf](http://www.bitkom.org/files/documents/BITKOM_Presseinfo_Handyminuten_30_07_2012.pdf)

- 
- Bitkom. (2012b, July 31). *5 Prozent mehr Handygespräche: Bitkom*. Retrieved May 16, 2013, from Bitkom: [https://www.bitkom.org/de/markt\\_statistik/64046\\_72960.aspx](https://www.bitkom.org/de/markt_statistik/64046_72960.aspx)
- Bitkom. (2013a, February 13). *Marktzahlen und Trends: Bitkom*. Retrieved April 15, 2013, from Bitkom: [http://www.bitkom.org/files/documents/BITKOM\\_Pressekonferenz\\_Mobile\\_Kommunikation\\_Praesentation\\_14\\_02\\_2013.pdf](http://www.bitkom.org/files/documents/BITKOM_Pressekonferenz_Mobile_Kommunikation_Praesentation_14_02_2013.pdf)
- Bitkom. (2013b, February 13). *Umsätze mit mobilen Datendiensten steigen stark an: Bitkom*. Retrieved May 30, 2013, from Bitkom: [http://www.bitkom.org/de/presse/8477\\_75060.aspx](http://www.bitkom.org/de/presse/8477_75060.aspx)
- Bundeskartellamt. (2002, December 24). *Act against Restraints of Competition: Bundeskartellamt*. Retrieved March 5, 2013, from Bundeskartellamt: [http://www.bundeskartellamt.de/wEnglisch/download/pdf/GWB/0911\\_GWB\\_7\\_Novelle\\_E.pdf](http://www.bundeskartellamt.de/wEnglisch/download/pdf/GWB/0911_GWB_7_Novelle_E.pdf)
- Bundeskartellamt. (2010, April 14). *Examination of possible abuse of a dominant position by T-Mobile and Vodafone: Bundeskartellamt*. Retrieved March 5, 2013, from Bundeskartellamt: <http://www.bundeskartellamt.de/wEnglisch/download/pdf/Fallberichte/B07-170-07-engl.pdf>
- Bundesnetzagentur. (2007, November 30). *Mobilfunk Terminierungsentgelte: Bundesnetzagentur*. Retrieved May 16, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/DE/2007/071130\\_Mobilfunkterm.html](http://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/DE/2007/071130_Mobilfunkterm.html)
- Bundesnetzagentur. (2010a, December 1). *Beschluss aufgrund des Antrages der E-Plus Mobilfunk: Bundesnetzagentur*. Retrieved March 4, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/DE/DieBundesnetzagentur/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2010/2010\\_101bis199/BK3-10-101\\_BKV/BK3-10-101\\_AnlageKonsultation.pdf?\\_\\_blob=publicationFile](http://www.bundesnetzagentur.de/DE/DieBundesnetzagentur/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2010/2010_101bis199/BK3-10-101_BKV/BK3-10-101_AnlageKonsultation.pdf?__blob=publicationFile)
- Bundesnetzagentur. (2010b, October 21). *Frequenzspektrum: Bundesnetzagentur*. Retrieved January 31, 2013, from Bundesnetzagentur: <http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Presse/Presse>

---

mitteilungen/2010/100830VerlosungGraphikFrequenzspektrum\_pdf.pdf?\_\_blob=publicationFile

Bundesnetzagentur. (2010c, December 1). *Beschluss aufgrund des Antrages der Telekom Deutschland: Bundesnetzagentur*. Retrieved March 4, 2013, from Bundesnetzagentur:  
[http://www.bundesnetzagentur.de/DE/DieBundesnetzagentur/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2010/2010\\_001bis100/BK3-10-098\\_BKV/BK3-10-098\\_AnlageKonsultation.pdf?\\_\\_blob=publicationFile](http://www.bundesnetzagentur.de/DE/DieBundesnetzagentur/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2010/2010_001bis100/BK3-10-098_BKV/BK3-10-098_AnlageKonsultation.pdf?__blob=publicationFile)

Bundesnetzagentur. (2010d, May 20). *Ende der Auktion: Deutsche Bundesnetzagentur*. Retrieved February 1, 2013, from Deutsche Bundesnetzagentur:  
[http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/Frequenzordnung/OeffentlicherMobilfunk/VergabeverfDrahtloserNetzzugang/Frequenzversteigerung2010/PraesentationEndeFrequVerstgrg.pdf?\\_\\_blob=publication](http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/Frequenzordnung/OeffentlicherMobilfunk/VergabeverfDrahtloserNetzzugang/Frequenzversteigerung2010/PraesentationEndeFrequVerstgrg.pdf?__blob=publication)

Bundesnetzagentur. (2011). *Tätigkeitsbericht Telekommunikation 2010/2011*. Bonn: Deutsche Bundesnetzagentur.

Bundesnetzagentur. (2012a). *Jahresbericht 2011*. Bonn: Deutsche Bundesnetzagentur.

Bundesnetzagentur. (2012b, November 16). *Bundesnetzagentur gibt neues Mobilfunkterminierungsentgelt bekannt: Bundesnetzagentur*. Retrieved November 22, 2012, from Bundesnetzagentur:  
[http://www.bundesnetzagentur.de/cln\\_1931/SharedDocs/Pressemitteilungen/DE/2012/121116\\_Mobilfunkterminierungsentgelt.html?nn=65116](http://www.bundesnetzagentur.de/cln_1931/SharedDocs/Pressemitteilungen/DE/2012/121116_Mobilfunkterminierungsentgelt.html?nn=65116)

Bundesnetzagentur. (2012c, May 30). *Vergabeverfahren Drahtloser Netzzugang: Bundesnetzagentur*. Retrieved November 22, 2012, from Bundesnetzagentur:  
[http://www.bundesnetzagentur.de/cln\\_1931/DE/Sachgebiete/Telekommunikation/RegulierungTelekommunikation/Frequenzordnung/OeffentlicherMobilfunk/VergabeVerfahrenDrahtlosNetzzugang/vergabeVerfahrenDrahtlosNetzzugang\\_node.html](http://www.bundesnetzagentur.de/cln_1931/DE/Sachgebiete/Telekommunikation/RegulierungTelekommunikation/Frequenzordnung/OeffentlicherMobilfunk/VergabeVerfahrenDrahtlosNetzzugang/vergabeVerfahrenDrahtlosNetzzugang_node.html)

Bundesnetzagentur. (2012d, December 21). *Aktuell, Ausgabe 4/2012: Bundesnetzagentur*. Retrieved April 16, 2013, from Bundesnetzagentur:

---

[http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Presse/Publicationen/aktuell/aktuell2012\\_04pdf.pdf?\\_\\_blob=publicationFile](http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Presse/Publicationen/aktuell/aktuell2012_04pdf.pdf?__blob=publicationFile)

Bundesnetzagentur. (2013a, May 6). *Jahresbericht 2012: Bundesnetzagentur*. Retrieved May 6, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Allgemeines/Bundesnetzagentur/Publicationen/Berichte/2013/Jahresbericht2012.pdf?\\_\\_blob=publicationFile&v=4](http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Allgemeines/Bundesnetzagentur/Publicationen/Berichte/2013/Jahresbericht2012.pdf?__blob=publicationFile&v=4)

Bundesnetzagentur. (2013b, January 31). *Zugangsregulierung: Bundesnetzagentur*. Retrieved May 27, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/cln\\_1931/DE/Service-Funktionen/Beschlusskammern/EinheitlicheInformationsstelleTK/4\\_Zugangsregulierung/3\\_Zugang-oeffentl-Telefonnetze-Mobilfunk/zugang-oeff--telefonnetzen--mobilfunk-\\_node.html](http://www.bundesnetzagentur.de/cln_1931/DE/Service-Funktionen/Beschlusskammern/EinheitlicheInformationsstelleTK/4_Zugangsregulierung/3_Zugang-oeffentl-Telefonnetze-Mobilfunk/zugang-oeff--telefonnetzen--mobilfunk-_node.html)

Bundesnetzagentur. (2013c, April 24). *Teilnehmerentwicklung im Mobilfunk: Bundesnetzagentur*. Retrieved April 24, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/cln\\_1912/DE/Sachgebiete/Telekommunikation/Unternehmen\\_Institutionen/Marktbeobachtung/Deutschland/Mobilfunkteilnehmer/Mobilfunkteilnehmer\\_node.html](http://www.bundesnetzagentur.de/cln_1912/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Marktbeobachtung/Deutschland/Mobilfunkteilnehmer/Mobilfunkteilnehmer_node.html)

Charles River Associates. (2012, July 1). *Costing methodologies and incentives to invest in fibre: Europa.eu*. Retrieved January 10, 2013, from Europa.eu: [http://ec.europa.eu/information\\_society/policy/ecomms/doc/library/ext\\_studies/20120705\\_finalreport\\_costing\\_cra.pdf](http://ec.europa.eu/information_society/policy/ecomms/doc/library/ext_studies/20120705_finalreport_costing_cra.pdf)

Council Directive (EC) 2002/21/EC of 24 April 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive). (n.d.).

Danish Business Authority. (2013, April 30). *Wholesale SMS termination on individual mobile networks: europa.eu*. Retrieved May 5, 2013, from europa.eu: [http://ec.europa.eu/information\\_society/newsroom/cf/dae/document.cfm?doc\\_id=2004](http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=2004)

- 
- DBJ. (2013, February 5). *Umsatzsteuergesetz: Bundesministerium der Justiz*. Retrieved February 5, 2013, from Bundesministerium der Justiz: [http://www.gesetze-im-internet.de/ustg\\_1980/](http://www.gesetze-im-internet.de/ustg_1980/)
- Deutsche Telekom AG. (2010, February 28). *The 2009 Financial Year: Deutsche Telekom AG*. Retrieved February 26, 2013, from Deutsche Telekom AG: <http://www.annualreport.telekom.com/site0409/en/index.php>
- Deutsche Telekom AG. (2013, February 28). *Q4 and Annual Report 2012: Deutsche Telekom AG*. Retrieved February 28, 2013, from Deutsche Telekom AG: <http://www.telekom.com/ar-2012>
- Digi.no. (2007, February 21). *Europas mobilkunder snytes for milliarder: Digi.no*. Retrieved May 9, 2013, from Digi.no: <http://www.digi.no/370275/europas-mobilkunder-snytes-for-milliarder>
- Digi.no. (2013, May 2). *Netcom «tar livet av ringeminutter»: Digi.no*. Retrieved May 16, 2013, from Digi.no: <http://www.digi.no/915941/netcom-tar-livet-av-ringeminutter>
- DN. (2013a, January 6). Slåss for mobilauksjon. *Dagens Næringsliv*, pp. 18-19.
- DN. (2013b, April 19). Bygger nytt mobilnett. *Dagens Næringsliv*, p. 22.
- DN. (2013c, April 10). Telekrangel om nettleie. *Dagens Næringsliv*, p. 22.
- DNB. (2009, December 31). *Gjennomsnittskurser 2009: DNB*. Retrieved February 11, 2013, from DNB: <https://www.dnb.no/bedrift/markets/valuta-renter/valutakurser-og-renter/historiske/hovedvalutaer/2009.html>
- DNB. (2011, January 30). *Gjennomsnittskurser 2010: DNB*. Retrieved November 28, 2012, from DNB: <https://www.dnb.no/bedrift/markets/valuta-renter/valutakurser-og-renter/historiske/hovedvalutaer/2010.html>
- DNB. (2013, May 23). *Gjennomsnittskurser 2012: DNB*. Retrieved May 23, 2013, from DNB: <https://www.dnb.no/bedrift/markets/valuta-renter/valutakurser-og-renter/historiske/hovedvalutaer/2012.html>

- 
- E-Plus. (2013, June 10). *Tarife: Simyo*. Retrieved June 10, 2013, from Simyo: <https://www.simyo.de/tarife.html>
- E-Plus/KPN. (2010, December 22). *Stellungnahme der E-Plus Mobilfunk GmbH & Co. KG: Deutsche Bundesnetzagentur*. Retrieved January 25, 2013, from Deutsche Bundesnetzagentur: [http://www.bundesnetzagentur.de/DE/DieBundesnetzagentur/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2010/2010\\_001bis100/BK3-10-098\\_BKV/Stellungnahme\\_E-Plus.pdf?\\_\\_blob=publicationFile](http://www.bundesnetzagentur.de/DE/DieBundesnetzagentur/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2010/2010_001bis100/BK3-10-098_BKV/Stellungnahme_E-Plus.pdf?__blob=publicationFile)
- ESA. (2010, July 30). *Comments pursuant to Article 7(3) of Directive 2002/21/EC: NPT*. Retrieved May 28, 2013, from NPT: [http://www.npt.no/marked/markedregulering-smp/marked/marked-15/\\_attachment/2645?\\_ts=139d8094785](http://www.npt.no/marked/markedregulering-smp/marked/marked-15/_attachment/2645?_ts=139d8094785)
- European Commission. (2007a, November 13). *Press Release IP/07/1678: Recommendation on Relevant Markets*. Retrieved January 08, 2013, from Europa.eu: [http://europa.eu/rapid/press-release\\_IP-07-1678\\_en.htm?locale=fr](http://europa.eu/rapid/press-release_IP-07-1678_en.htm?locale=fr)
- European Commission. (2007b, May 21). *Sache DE/2007/0627: CIRCA*. Retrieved May 27, 2013, from CIRCA: [http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/germany/registerednotifications/de20070627/de-2007-0627\\_enpdf/\\_DE\\_1.0\\_&a=d](http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/germany/registerednotifications/de20070627/de-2007-0627_enpdf/_DE_1.0_&a=d)
- European Commission. (2009, May 7). *Commission Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU: Europa.eu*. Retrieved January 10, 2013, from Europa.eu: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:124:0067:0074:EN:PDF>
- European Commission. (2012, June 18). *Telecommunication Market and Regulatory Developments 2011*. Brussels: Commission Services.
- European Commission. (2013, May 8). *Roaming tariffs: European Commission*. Retrieved May 9, 2013, from European Commission: <http://ec.europa.eu/digital-agenda/en/roaming-tariffs>
- Foros, Ø., & Steen, F. (2008). *Do first-mover advantages call for asymmetric regulation in the Norwegian mobile market?* Bergen.

- 
- Gans, J. S., & King, S. P. (2001). Using 'bill and keep' interconnect arrangements to soften network competition. *Economics Letters* 71, 413-420.
- Genakos, C., & Valletti, T. (2011). Testing the waterbed effect in mobile telecommunications. *Journal of the European Economic Association*, 9, pp. 1114-1142.
- GSMA & A.T. Kearney. (2011, November 30). *European Mobile Industry Observatory 2011: GSM Association*. Retrieved November 2, 2012, from GSMA: <http://www.gsma.com/publicpolicy/wp-content/uploads/2012/04/emofullwebfinal.pdf>
- Handytarife.de. (2013, February 18). *Handytarifrechner: Handytarife.de*. Retrieved February 18, 2013, from Handytarife.de: <http://www.handytarife.de/index.php?tarifrechner>
- Haucap, J., Heimeshoff, U., & Stühmeier, T. (2010). *Wettbewerb im deutschen Mobilfunkmarkt*. Düsseldorf: Düsseldorfer Institut für Wettbewerbsökonomie, Universität Düsseldorf.
- KPN. (2010, January 26). *Financial report Q4 2009: KPN*. Retrieved February 26, 2013, from KPN: <http://www.kpn.com/corporate/aboutkpn/Investor-Relations/publications/Financial-publications.htm>
- KPN. (2013, Februar 5). *Annual Results: KPN*. Retrieved February 26, 2013, from KPN: <http://www.kpn.com/corporate/aboutkpn/Investor-Relations/Publication-fourth-quarter-results-and-FY-2012-1.htm>
- Much, J., & Heimeshoff, U. (2012). *First Mover Advantages in Mobile Telecommunications: Evidence from OECD Countries*. Düsseldorf: Heinrich-Heine-Universität Düsseldorf.
- Nettavisen. (2006, November 24). *Ring for halv pris: Nettavisen*. Retrieved June 7, 2013, from Nettavisen: <http://www.nettavisen.no/it/article813788.ece>
- Network Norway. (2013, February 26). *Historien: Network Norway*. Retrieved February 26, 2013, from Network Norway: [http://www.networknorway.no/Toppmeny/Om\\_Network\\_Norway/Historien](http://www.networknorway.no/Toppmeny/Om_Network_Norway/Historien)

- 
- Norwegian Ministry of T&C. (2011, May 11). *Klage på PTs vedtak 2010: Norwegian Post and Telecommunications Authority*. Retrieved January 23, 2013, from Norwegian Post and Telecommunications Authority: [http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/\\_attachment/2385?\\_ts=139ba25b9cc](http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/_attachment/2385?_ts=139ba25b9cc)
- Norwegian Ministry of T&C. (2012, June 28). *Anmodning om utsatt iverksetting 2012: Norwegian Post and Telecommunications Authority*. Retrieved January 23, 2013, from Norwegian Post and Telecommunications Authority: [http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/\\_attachment/2357?\\_ts=139b9fa5473](http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/_attachment/2357?_ts=139b9fa5473)
- NPT. (2007a, May 8). *Vedtak om utpeking av tilbydere med sterk markedsstilling og pålegg om særskilte forpliktelser i markedene for terminering av tale i individuelle, offentlige mobilkommunikasjonsnett (marked 16): NPT*. Retrieved May 9, 2013, from NPT: [http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/\\_attachment/2563?\\_ts=139c4b680f6](http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/_attachment/2563?_ts=139c4b680f6)
- NPT. (2007b, May 8). *Vedlegg 3: NPT*. Retrieved May 9, 2013, from NPT: [http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/\\_attachment/2566?\\_ts=139c4b8126f](http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/_attachment/2566?_ts=139c4b8126f)
- NPT. (2007c, November 11). *Auksjon #8: Norwegian Post and Telecommunications Authority*. Retrieved February 1, 2013, from Norwegian Post and Telecommunications Authority: <http://www.npt.no/teknisk/frekvensauksjoner/avsluttede/avsluttede/auksjon-8-2500-2690-mhz-og-2010-2025-mhz>
- NPT. (2008, November 17). *Vedtak om utpeking ... (marked 16): NPT*. Retrieved May 16, 2013, from NPT: [http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/\\_attachment/2571?\\_ts=139c4bc8596](http://www.npt.no/marked/markedsregulering-smp/marked/marked-7/_attachment/2571?_ts=139c4bc8596)
- NPT. (2009a, May 19). *Det norske ekomarkedet 1. kvartal 2009: Norwegian Post and Telecommunications Authority*. Retrieved February 7, 2013, from Norwegian Post and Telecommunications Authority:

---

[http://www.nettvett.no/ikbViewer/Content/111000/Pressekonferanse\\_2008\\_v8\\_rev1.pdf](http://www.nettvett.no/ikbViewer/Content/111000/Pressekonferanse_2008_v8_rev1.pdf)

- NPT. (2009b, June 12). *Introduksjon til markedsregulering (SMP): Norwegian Post and Telecommunications Authority*. Retrieved January 18, 2013, from Norwegian Post and Telecommunications Authority: [http://www.npt.no/marked/markedregulering-smp/rammer/introduksjon-til-markedsregulering-smp/\\_attachment/479?\\_ts=137da56ab33](http://www.npt.no/marked/markedregulering-smp/rammer/introduksjon-til-markedsregulering-smp/_attachment/479?_ts=137da56ab33)
- NPT. (2010a, July 7). *EEA notification: Norwegian Post and Telecommunications Authority*. Retrieved January 18, 2013, from Norwegian Post and Telecommunications Authority: <http://www.npt.no/marked/markedregulering-smp/marked/marked-15/e%C3%B8s-notifikasjon>
- NPT. (2010b, August 5). *Marknad 15 - Vedtak: Norwegian Post and Telecommunications Authority*. Retrieved January 18, 2013, from Norwegian Post and Telecommunications Authority: [http://www.npt.no/marked/markedregulering-smp/marked/marked-15/\\_attachment/2676?\\_ts=139d83f0ad0](http://www.npt.no/marked/markedregulering-smp/marked/marked-15/_attachment/2676?_ts=139d83f0ad0)
- NPT. (2010c, April 29). *Varsel om vedtak om utpeking av tilbydere med sterk markedsstilling og pålegg om særskilte forpliktelser i marked 7: Norwegian Post and Telecommunications Authority*. Retrieved January 23, 2013, from Norwegian Post and Telecommunications Authority: [http://www.npt.no/marked/markedregulering-smp/marked/marked-7/\\_attachment/2399?\\_ts=139be6631d1](http://www.npt.no/marked/markedregulering-smp/marked/marked-7/_attachment/2399?_ts=139be6631d1)
- NPT. (2011a, October 31). *Befolkningens bruk av elektroniske kommunikasjonstjenester: NPT*. Retrieved February 11, 2013, from NPT: [http://www.npt.no/marked/ekomtjenester/statistikk/det-norske-ekomarkedet-rapporter/\\_attachment/4284?\\_ts=13abc4bc31c](http://www.npt.no/marked/ekomtjenester/statistikk/det-norske-ekomarkedet-rapporter/_attachment/4284?_ts=13abc4bc31c)
- NPT. (2011b, October 31). *Det norske ekomarkedet - rapporter: The Norwegian Post and Telecommunications Authority*. Retrieved January 4, 2013, from The Norwegian Post and Telecommunications Authority: <http://www.npt.no/marked/ekomtjenester/statistikk/det-norske-ekomarkedet-rapporter>

- 
- NPT. (2012a, July 2). *Auksjonar: The Norwegian Post and Telecommunications Authority*. Retrieved November 22, 2012, from The Norwegian Post and Telecommunications Authority: <http://www.npt.no/teknisk/frekvensauksjoner/auksjoner/auksjonar>
- NPT. (2012b, October 19). *Det norske ekomarkedet 1. halvår 2012*. Oslo: npt.no.
- NPT. (2012c). *Det norske markedet for elektroniske kommunikasjonstjenester 2011*. Oslo: The Norwegian Post and Telecommunications Authority.
- NPT. (2012d, June 29). *To milliarder i subsidier er nok: NPT*. Retrieved November 20, 2012, from The Norwegian Post and Telecommunications Authority: <http://www.npt.no/aktuelt/nyheter/to-milliarder-i-subsidier-er-nok>
- NPT. (2012e, October 10). *Auksjon #18: Norwegian Post and Telecommunications Authority*. Retrieved February 1, 2013, from Norwegian Post and Telecommunications Authority: <http://www.npt.no/teknisk/frekvensauksjoner/avsluttede/avsluttede/auksjon-2-2-ghz>
- NPT. (2012f, June 11). *Relevante markeder: The Norwegian Post and Telecommunications Authority*. Retrieved January 8, 2013, from The Norwegian Post and Telecommunications Authority: <http://www.npt.no/marked/markedsregulering-smp/rammer/relevante-markeder>
- NPT. (2012g, August 21). *Marknad 15 - særskilt regulering av Telenor: NPT*. Retrieved March 12, 2013, from NPT: <http://www.npt.no/marked/markedsregulering-smp/marked/marked-15>
- NPT. (2012h, May 31). *Prinsipper for bruk av marginskvistester: Norwegian Post and Telecommunications Authority*. Retrieved January 21, 2013, from Norwegian Post and Telecommunications Authority: <http://www.npt.no/marked/markedsregulering-smp/%C3%B8konomisk-regulering/marginiskvis>
- NPT. (2012i, October 1). *Introduksjon til markedsregulering (SMP): NPT*. Retrieved June 6, 2013, from NPT: <http://www.npt.no/marked/markedsregulering-smp/rammer/introduksjon-til-markedsregulering-smp>

- 
- NPT. (2013a, January 21). *Tildelte spektrumstillatelser: The Norwegian Post and Telecommunications Authority*. Retrieved January 31, 2013, from The Norwegian Post and Telecommunications Authority: [http://www.npt.no/teknisk/frekvens/tillatelser/tildelte-frekvenstillatelser/\\_attachment/2319?\\_ts=13c5d3ac6ed](http://www.npt.no/teknisk/frekvens/tillatelser/tildelte-frekvenstillatelser/_attachment/2319?_ts=13c5d3ac6ed)
- NPT. (2013b, May 15). *Det norske markedet for elektroniske kommunikasjons tjenester 2012: NPT*. Retrieved May 16, 2013, from NPT: [http://www.npt.no/aktuelt/nyheter/\\_attachment/8257?\\_ts=13ea833c18c](http://www.npt.no/aktuelt/nyheter/_attachment/8257?_ts=13ea833c18c)
- NTA. (2013, February 5). *Merverdiavgift: Norwegian Tax Administration*. Retrieved February 5, 2013, from Norwegian Tax Administration: <http://www.skatteetaten.no/no/bedrift-og-organisasjon/merverdiavgift/>
- OECD. (2001). *OECD Communications Outlook 2001*. OECD Publishing.
- OECD. (2007). *OECD Communications Outlook 2007*. OECD Publishing.
- OECD. (2009). *OECD Communications Outlook 2009*. OECD Publishing.
- OECD. (2011). *OECD Communications Outlook 2011*. OECD Publishing.
- Ofcom. (2013, January 22). *Economic depreciation: Ofcom*. Retrieved January 22, 2013, from Ofcom: <http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/depr0901.htm>
- Oxford University Press. (2013, May 30). *Churn Rate: Oxford Dictionaries*. Retrieved May 30, 2013, from Oxford Dictionaries: <http://oxforddictionaries.com/definition/english/churn-rate?q=churn+rate>
- Pindyck, R. S., & Rubinfeld, D. L. (2005). *Microeconomics*. New Jersey: Pearson Education Inc.
- Robson, C. (2002). *Real World Research, 2nd ed.* Oxford: Blackwell.
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Harlow: Pearson Education Ltd.

- 
- Statista GmbH. (2011, October 31). *Anteil der Mobilfunknutzer, die ihren Provider gewechselt haben: Statista GmbH*. Retrieved January 4, 2013, from Statista GmbH: <http://de.statista.com/statistik/daten/studie/199114/umfrage/anteil-der-mobilfunknutzer-die-ihren-provider-gewechselt-haben/>
- Statistics Norway. (2013, February 1). *Befolkning: Statistics Norway*. Retrieved February 1, 2013, from Statistics Norway: <http://www.ssb.no/befolkning/>
- Statistisches Bundesamt. (2013, February 1). *Bevölkerung: Statistisches Bundesamt*. Retrieved February 1, 2013, from Statistisches Bundesamt: <https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Bevoelkerung/Bevoelkerung.html;jsessionid=2F3D9F84A677F2589540BCDA68F28681.cae1>
- Tele2 AB. (2010, March 10). *Full Year Report 2009: Tele2 AB*. Retrieved February 26, 2013, from Tele2 AB: <http://www.tele2.com/341094.pdf>
- Tele2 AB. (2013, February 10). *Full Year and Q4 2012: Tele2 AB*. Retrieved February 27, 2013, from Tele2 AB: [http://www.tele2.com/TL2\\_Q4-12\\_FV\\_ENG\\_Final.pdf](http://www.tele2.com/TL2_Q4-12_FV_ENG_Final.pdf)
- Tele2 Norge AS. (2012, November 20). *Om Tele2: Tele2 Norge AS*. Retrieved November 20, 2012, from Tele2 Norge AS: <http://www.tele2.no/om-tele2.html>
- Telefónica. (2013, June 10). *Tarife: o2*. Retrieved June 10, 2013, from o2: <http://www.o2online.de/tarife/>
- Telefónica Deutschland Holding AG. (2013, February 27). *Full year results 2012: Telefónica Deutschland Holding AG*. Retrieved February 27, 2013, from Telefónica Deutschland Holding AG: <https://www.telefonica.de/page/18111/q4-geschaeftsjahr-2012.html>
- Telefónica Germany. (2010, February 26). *2009 Results: Telefónica Germany*. Retrieved February 26, 2013, from Telefónica Germany: <http://www.telefonica.de/news/2035/msg/0/2610/0/2009-q4-and-year.html>
- Telefónica Germany. (2012, November 6). *Investor Relations: Telefónica*. Retrieved November 14, 2012, from Telefónica Germany: <https://www.telefonica.de/page/17890/investor-relations.html>

- 
- Telenor. (2010, August 26). *Klage på vedtak om utpeking av tilbyder med sterk markedsstilling: NPT*. Retrieved March 13, 2013, from NPT: [http://www.npt.no/marked/markedsregulering-smp/marked/marked-15/\\_attachment/2666?\\_ts=139d83944e2](http://www.npt.no/marked/markedsregulering-smp/marked/marked-15/_attachment/2666?_ts=139d83944e2)
- Telenor ASA. (2010, Mars 23). *Årsrapport 2009: Telenor ASA*. Retrieved February 27, 2013, from Telenor ASA: [http://www.telenor.com/wp-content/uploads/2012/03/rapport\\_2009.pdf](http://www.telenor.com/wp-content/uploads/2012/03/rapport_2009.pdf)
- Telenor ASA. (2013, February 13). *Q4 Report: Telenor ASA*. Retrieved February 27, 2013, from Telenor ASA: <http://www.telenor.com/wp-content/uploads/2012/09/Telenor-Q4-2012-reportpdf>
- Telepriser.no. (2013, February 18). *Mobilkalkulator: Telepriser.no*. Retrieved February 18, 2013, from Telepriser.no: <http://www.telepriser.no/portal/page/portal/telepriser/forsiden>
- TeliaSonera. (2010, March 9). *Annual Report 2009: TeliaSonera*. Retrieved February 26, 2013, from TeliaSonera: <http://www.teliasonera.com/Documents/Reports/2009/AnnualReports/TeliaSonera-Annual-Report-2009-EN.pdf?epslanguage=en>
- TeliaSonera. (2013, June 10). *Abonnement: Chess*. Retrieved June 10, 2013, from Chess: <https://www.chess.no/abonnement/>
- TeliaSonera AB. (2013, January 31). *January-December 2012: TeliaSonera AB*. Retrieved February 27, 2013, from TeliaSonera AB: <http://feed.ne.cision.com/wpyfs/00/00/00/00/00/1D/5C/8F/wkr0006.pdf>
- Teltarif.de. (2011, December 22). *Discountmarken der Mobilfunke gewinnen immer mehr Kunden: Teltarif.de*. Retrieved May 21, 2013, from Teltarif.de: <http://www.teltarif.de/mobilfunk-markt-discounter-kunden-marktanteil/news/45054.html>
- Teltarif.de. (2013, April 26). *Telekommunikationsanbieter im Mobilfunk: Teltarif.de*. Retrieved April 26, 2013, from Teltarif.de: <http://www.teltarif.de/a/mobilfunk.html>

---

The EU Parliament and the EU Council. (2002, March 7). *DIRECTIVE 2002/21/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL*: *eur-lex.europa.eu*. Retrieved May 28, 2013, from *eur-lex.europa.eu*: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0033:0033:EN:PDF>

Valletti, T. (2003). The theory of access pricing and its linkage with investment incentives. *Telecommunications Policy*, 27, 659-675.

Vodafone Group Plc. (2013, May 21). *Vodafone announces results for the year ended 31 March 2013: Vodafone Group Plc*. Retrieved May 21, 2013, from Vodafone Group Plc: [http://www.vodafone.com/content/dam/vodafone/investors/financial\\_results\\_feeds/pr\\_eliminary\\_results\\_31march2013/dl\\_prelim2013.pdf](http://www.vodafone.com/content/dam/vodafone/investors/financial_results_feeds/pr_eliminary_results_31march2013/dl_prelim2013.pdf)

Vodafone Group Plc. (2010, May 18). *Year Ended 31 March 2010: Vodafone Group Plc*. Retrieved February 26, 2013, from Vodafone Group Plc.: [http://www.vodafone.com/content/dam/vodafone/investors/financial\\_results\\_feeds/pr\\_eliminary\\_results\\_31march2010/dl\\_prelim2010.pdf](http://www.vodafone.com/content/dam/vodafone/investors/financial_results_feeds/pr_eliminary_results_31march2010/dl_prelim2010.pdf)

Vodafone Group Plc. (2012, November 13). *Results for the 6 months ended 30 September 2012: Vodafone Group Plc*. Retrieved November 13, 2012, from Vodafone Group Plc.: [http://www.vodafone.com/content/index/investors/investor\\_information/financial\\_results.html](http://www.vodafone.com/content/index/investors/investor_information/financial_results.html)

WIK-Consult. (2012a, April 1). *Analytisches Kostenmodell: Bundesnetzagentur*. Retrieved January 29, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/Kostenmodelle/AnalytKM\\_Mobilfunk/Ueberarb\\_Referenzdokument\\_AKM\\_Mobilfunk.pdf?\\_\\_blob=publicationFile](http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/Kostenmodelle/AnalytKM_Mobilfunk/Ueberarb_Referenzdokument_AKM_Mobilfunk.pdf?__blob=publicationFile)

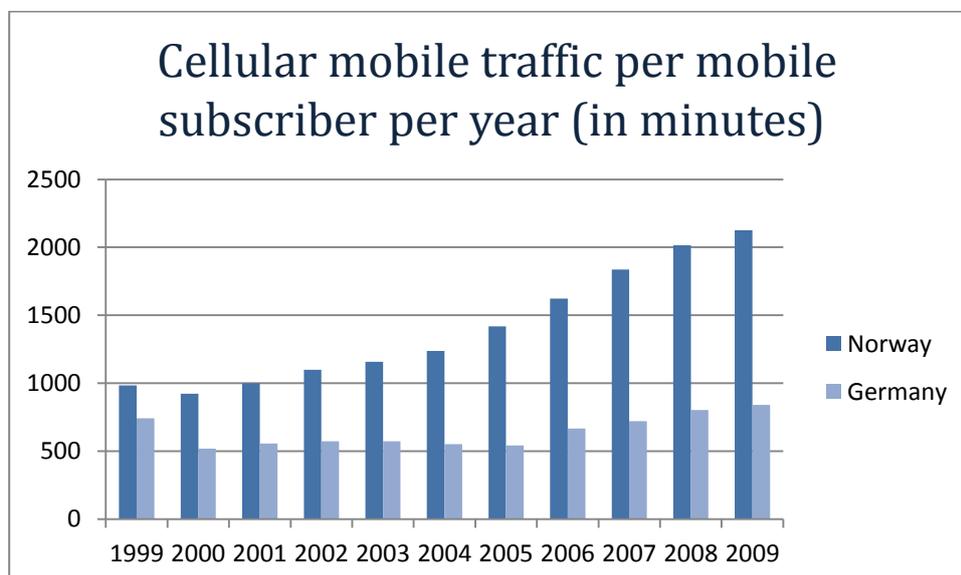
WIK-Consult. (2012b, April 24). *Mobilfunkkostenmodell: Bundesnetzagentur*. Retrieved January 29, 2013, from Bundesnetzagentur: [http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/Kostenmodelle/AnalytKM\\_Mobilfunk/PraesentationWIKConsult24042012.pdf?\\_\\_blob=publicationFile](http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Telekommunikation/Regulierung/Kostenmodelle/AnalytKM_Mobilfunk/PraesentationWIKConsult24042012.pdf?__blob=publicationFile)

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Yin, R. K. (2009). *Case Study Research: Design and Method, 4th ed.* London: Sage.

## 7. Appendix

### 7.1 Figure



Source: (OECD, 2011)

### 7.2 Table

<b>BNA auction 2010, numbers in thousand EUR</b>		<b>BNA auction 2010, numbers in thousand EUR</b>	
<b>Technology neutral, 2600 MHz</b>		<b>Technology neutral, 2000 MHz</b>	
Per	10 MHz, 15 years	Per	10 MHz, 15 years
High price	19100	High price	103000
Low price	17700	Low price	67100

Source: (Bundesnetzagentur, 2010d)

<b>NPT auction 2007, numbers in thousand EUR</b>		<b>NPT auction 2012, numbers in thousand EUR</b>	
<b>Technology neutral, 2500-2700 MHz</b>		<b>Technology neutral, 2000 MHz</b>	
Per	10 MHz, 15 years	Per	10 MHz, 20 years
High price	1250	High price	1333
Low price	625	Low price	1333

2007 EUR/NOK

8

2012 EUR/NOK

7.5

Sources: (NPT, 2012e) (NPT, 2007c)

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## 7.3 Calculation

### Outcome of the German 2010 auction for 41 blocks of mobile telecom frequencies

Vodafone D2 bought	12	blocks	for	1423	mill EUR
Telefónica O2 bought	11	blocks	for	1379	mill EUR
Telekom Deutschland bought	10	blocks	for	1300	mill EUR
E-Plus bought	8	blocks	for	284	mill EUR
<b>TOTAL</b>	<b>41</b>	<b>blocks</b>	<b>for</b>	<b>4386</b>	<b>mill EUR</b>

Total # of mob. telecom blocks	120	blocks
Ratio 120 blocks to 41 blocks	2.93	
Est. cost 120 blocks	12837	mill EUR
Years	15	
Estimated cost per year	856	mill EUR
Operators	4	
<b>Estimated cost per operator per year</b>	<b>214</b>	<b>mill EUR</b>

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## 8. List of abbreviations

MNO	Mobile Network Operator, owns the physical network
MVNO	Mobile Virtual Network Operator, buys capacity in the network from the MNO
NPT	Norwegian Post and Telecommunications Authority
BNA	Bundesnetzagentur (German Federal Network Agency)
MTR	Mobile Termination Rate
FTR	Fixed-line Termination Rate
TR	Termination Rate
Flat-rate	Tariff model with a certain fixed monthly fee and unlimited included use
Two-part tariff	Tariff model with a certain fixed monthly fee and a certain amount of included use
KPN	Koninklijke PTT Nederland, Dutch telecommunications company
The EC	The European Commission
The Commission	The European Commission
ESA	The EFTA Surveillance Authority
EFTA	The European Free Trade Association
Market 7	The market for voice call termination on individual mobile networks, defined by the European Commission
Market 15	The market for access and call origination on public mobile telephone networks, defined by the European Commission