

COMPETITION IN INTERNATIONAL MOBILE ROAMING

Master Thesis

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Foreword

This master thesis on the subject of Competition in International Mobile Roaming represents the concluding part of my studies at the faculty of Technology, Policy and Management of the Technical University of Delft (TUD), The Netherlands.

A large part of this research was conducted in cooperation with De Onafhankelijke Post en Telecommunicatie Autoriteit (OPTA) which is The Dutch Postal and Telecommunications National Regulatory Authority.

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I would like to thank the whole exam committee for facilitating and conducting interesting as well as challenging discussions that helped to shape this report.

Delft and The Hague,
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Roderik Hylkema

Executive Summary

Introduction to the Research

Using a mobile telephone abroad has rapidly become a generally appreciated convenience of modern technology; this feature of using the mobile handset abroad is known as International Mobile Roaming (IMR). In most cases users can nowadays roam abroad within Europe and other large parts of the world without having to dial difficult sequences and without changing their handset or mobile number. This all relies on the Global Systems Mobile (GSM) network that has grown into the most widely used standard for mobile communications.

When roaming services were just starting to appear, prices for these international services were high. This can possibly be justified by technical difficulties in making the networks work together or by the novelty of the services to the customers. At this moment (July 2003) however, even though IMR has become very common and prices of other mobile services have decreased, roaming prices are still very high and have not decreased at least over the past two years.

This raised concerns about the competitiveness of the markets for IMR with the European Commission (EC) and National Regulatory Authorities (NRAs) of the telecommunications sector. The EC started an investigation into the IMR sector in 1999 but this investigation still has not led to definite conclusions. An important preliminary conclusion of the EC research was that the IMR markets are indeed uncompetitive and that roaming constitutes a very important part of revenues for operators. Any attempt of the EC or NRAs to increase competitiveness of the IMR markets will strongly affect operators. This research is conducted in the context described above and is done in cooperation with OPTA, the Dutch NRA.

Motives for the Research

The two main motives to start this research are the perceived rigidity in prices as an indicator for competitive problems and the interest OPTA has in a better understanding of the IMR markets. The goal of this research is to make an independent, multidisciplinary analysis of barriers to competition that might exist in the field of International Mobile Roaming. If these impediments exist, the second goal is to analyze if and which regulatory instruments are needed to relieve these barriers resulting in improved competition.

To give a general feeling of the high tariffs involved for retail IMR services, a number of comparisons were made. The type of call that is made most often when roaming is an outgoing call to the home country and is generally priced around €0,90 excl. VAT per minute. For comparison, a fixed-to-fixed international call costs around €0,05. Contrary to all other types of calls, receiving a call whilst roaming is also billed; generally around €0,50. For a more detailed description of these tariffs, the reader is referred to chapter 1.

Technicalities of Roaming

Because IMR services heavily rely on the technical possibilities of the network and handsets, understanding how roaming works on a technical level is needed. The first important conclusion is that roaming is not that different from another mobile call in terms of call routing and the second important conclusion is the fact that a roaming handset is likely to roam on many foreign networks. It is possible to manually select a foreign (cheaper) network, however only few roamers actually make use of this possibility. The operators could automatically direct all roaming users to a specific (cheaper) foreign network, however this used to be technically difficult for operators.

Conduct on the Markets & Impediments to Competition

After these introductions, the analysis of the market structure and conduct leads to insights into how the roaming markets work and which impediments to competition are present. The most important actors are the users, the mobile network operators (MNOs) and the GSM Association (GSMA) which is the industry association that is responsible for the standards concerning IMR; actors such as roaming brokers/clearing houses, service providers and MVNOs are not mentioned in this summary but are described in the report itself.

All operators have to be a member of the GSMA if they want to offer IMR services, furthermore suppliers of wholesale IMR services have to be full MNOs and have to adhere to the rules as set out in the STIRA (Standard International Roaming Agreement).

Wholesaling operators conclude roaming agreements based on the STIRA. Without a roaming contract between MNO A and B, customers of operator A will not be able to roam on network B and visa versa. In these contracts, operators agree on the wholesale tariffs which they charge among themselves; so called Inter Operator Tariffs (IOTs). In short, the wholesaling operator makes a profit on the IOT and the retailing operator adds an additional retail margin of generally 25%. The research estimates the margin for a call to the home country made whilst roaming at approximately 75%; the margin for receiving a call whilst roaming is estimated around 49%. Except for insight into the margins, this also leads to the conclusion that operators make the highest profit (and are therefore dependant) on foreign roamers that they receive on their network.

Since the roaming market has the features of an oligopoly, that model is used to analyze which effects it might have on IMR competition. It is concluded that the oligopoly contributes to little competition because of price rigidity and possible tacit collusion. The tables below list the most important barriers to competition on the wholesale and retail market. A more detailed discussion on the commercial conduct and all these impediments can be found in chapter 3.

Wholesale	Impediments & explanation
	<p>Few wholesale substitutes: There are no wholesale services that can substitute wholesale IMR services. If more substitutes were available, foreign MNOs could use these to bypass the expensive wholesale IMR services.</p>
	<p>High wholesale transparency: The roaming framework (STIRA) set-up by the GSMA determines that all IOTs should be published on a website open to other foreign operators, an IOT is valid for 6 months and changes to IOTs should be announced 60 days in advance, IOTs and discounts should be valid in a non-discriminatory way to other MNOs and roaming agreements are not allowed between other parties than two full MNOs. This leads to the insight that the wholesale market is very transparent; IOTs can be monitored too easily to become competitive.</p>
	<p>Wholesale price rigidity and tacit collusion: Because of the STIRA outlined above, wholesale prices become very rigid. This inflexibility is stimulated by the existence of a wholesale oligopoly in which all parties depend on each other for routing outgoing traffic as well as for receiving inbound traffic. In general, in an oligopoly where monitoring is this easy, firms have a strong incentive to coordinate their behaviour (e.g. on prices); this is called tacit collusion and is likely to be present for IMR.</p>
	<p>Barriers to entry in the wholesale market: The most obvious reason for a barrier to entry is the fact that spectrum is limited and will not be extended in the nearest future. The second barrier lies in the STIRA; other firms than full MNOs cannot offer wholesale IMR services.</p> <p>No incentives to fight wholesale prices: Operators have no incentive to compete on wholesale prices because a high IOT is beneficial to revenues and the burden of a high IOT is carried by the foreign end-users. Because of an externality that traffic direction is not easily possible, there is no incentive to lower IOTs because this does not necessarily result in more traffic.</p>

Retail	Impediments & explanation
	<p>Low elasticity of demand: End-users generally do not find the level of roaming prices important when considering a new mobile subscription or when switching from operator. This low elasticity of demand is a disincentive for MNOs to start competing on retail roaming.</p>
	<p>Few Retail substitutes: There are no real retail substitutes for IMR services.</p>
	<p>Low retail transparency of tariffs: Retail tariffs for IMR services are not transparent to the users. Some networks bill for every 30 seconds, others per 60 seconds. SMS messages are different in price per network etc. This limits the end-users in their understanding of the height of the tariffs and limits the possibilities.</p>
	<p>Retail bundles: Competition on retail roaming tariffs is hampered due to the existence of retail bundles (subscriptions) that include roaming services. No separate selection based on roaming tariffs is possible for end-users.</p> <p>Relationship between national wholesale and foreign retail market: Operators are often part of large groups/alliances. Because of this fact it often happens that operators compete on a national retail level whereas they need a foreign subsidiary of the same operator for wholesale IMR services. This can be seen as an impediment to competition in the retail market.</p>

Market Trends solving impediments?

Looking at the objectives of the research the first question of whether or not competition is being hampered and because of which mechanisms, has been answered. In order to answer the second part of the research objectives it is required to investigate whether market trends are likely to solve these issues and thus will bring the IMR markets into a more competitive state; if not, regulatory intervention becomes possible. A number of market trends were identified: a trend toward more data services, more consolidation and direction of traffic.

Operators are starting to introduce more data services because the Average Revenue Per User (ARPU) is higher. New services such as GPRS and MMS also represent a big chance to be used abroad; however, the current framework for GSM roaming is also carried over into the newer markets for e.g. GPRS roaming. Obviously the market itself will not change the anti-competitive framework for IMR services.

The second trend is a shift towards consolidation and internationalisation in the sector. This trend could lead to improved financial strength of many operators and to economies of scale. Three large European operator groups Telefónica, T-Mobile and TIM recently created an alliance to be able to compete more strongly in cross-border markets. No real effects of this alliance have become clear yet and the expectation is that the alliance will bring more pan-European services instead of starting price competition for IMR services.

Finally there is a trend towards direction of roaming traffic onto specific foreign networks. This is done with Over The Air Programming (OTA) which makes it possible to send commands to the mobile station in the form of an 'invisible' SMS message; the mobile phone or the SIM-card will execute these commands. In this way it is possible to keep a mobile phone registered with almost always the same network. Since directing traffic is beneficial for the operators themselves (keeping revenues within the group) it is not necessarily said that MNOs will use OTA to start competing more strongly.

Concluding, there is no market trend in the markets for IMR that will increase competition in the nearest future. Supported by this conclusion, it is now justified to look into regulatory solutions for bringing the IMR sector to a more competitive level.

Legal Regulatory Framework

NRAs cannot simply apply any instrument to a certain market that appears to be uncompetitive. A legal framework exists for these purposes. A New Regulatory Framework (NRF) package has been designed within the EC to adapt sector specific regulation more to general competition law. This NRF establishes a framework for electronic communications infrastructure and associated services with the aim of creating effective competition for electronic communications throughout the EU. The New Framework has to be implemented by the Member States by 25 July 2003 and determines that NRAs in all Member States must conduct a review and analysis of markets as well as effective competition in the electronic communications markets.

The EC has included a list with already specified markets that need to be investigated on the level of competition; the national wholesale market for international mobile roaming services is one of these markets.

Because the NRF is more in line with general competition law, the notion of dominance is important. Dominance is "a position of economic strength affording it [the firm] the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers". A firm can be dominant by itself (single dominant) or together with other firms (joint dominant). Under the NRF, an NRA is almost incapable of regulating if there is no dominant position on the markets for IMR. Chapter 5 looks more detailed into the question of dominance and comes to the conclusion that it

seems very likely that a joint position is present on the wholesale IMR markets and that regulation of these markets is therefore feasible. In respect to the retail markets it seems more likely that joint dominance is present instead of single dominance.

The question is which type of instruments NRAs can apply to markets. Instruments that are most important are price/cost regulation, access regulation, instruments that prevent unfair pricing, that increase transparency or prevent discrimination in firms' offers.

Wholesale Remedies

This section gives a short overview of the remedies that have a chance to increase competition for IMR. Since it would carry too far to go into details in this summary, the reader is referred to sections 6.2 to 6.7 for wholesale solutions and to sections 7.1 to 7.5 for retail remedies.

- As the lack of wholesale substitutes can be seen as an impediment to competition, it would seem obvious to try to stimulate new substitutes on the market; however, actively stimulating wholesale substitutes is not an option for an NRA.
- The framework for roaming (STIRA) is an important impediment to competition; it leads to high wholesale transparency and price rigidity. The obligation of non-discrimination, the 60 days notice and the transparent publishing of IOTs to all foreign operators have detrimental effects. Removal of these three aspects would strongly increase incentives for competition; however, review of the STIRA can only be done under general competition law and not by an NRA.
- The existence of a wholesale oligopoly contributes to price rigidity and possibly to tacit collusion. An NRA has no instruments to remove the negative effects of the oligopoly since these originate from the GSMA framework which can only be reviewed under general competition law.
- Removal of the entry barriers should be done by NRAs and should be aimed at the framework within which roaming is conducted at present. Under the NRF, an NRA can impose a measure on a dominant operator to supply access (wholesale roaming) to any other entity (e.g. MVNO). Although removing this impediment will create a market that is more susceptible to competitive impulses, it is not likely that many new entrants will appear and that they will be able to put enough competitive pressure on the established firms.

A remedy that is likely not to fit the regulatory framework either is to design a new wholesale market place. In this new marketplace a wholesaling operator should be able to offer e.g. 100.000 roaming minutes of access for foreign users onto its network. This 'airtime' offer should be linked to a certain price that the operator wants to receive per minute. Another wholesaling operator, from the same country, would be able to offer only 50.000 minutes of airtime but for a lower price. Retailing operators in search of a good deal could then choose to buy the capacity from the cheapest or could choose to buy the larger amount leading to e.g. less risk. The new market place would be far more dynamic.

The remedy that is fully within the capabilities of NRAs is to regulate wholesale prices. As operators currently have incentives to keep wholesale prices high, it is not likely that in the near future price competition will start on the wholesale markets. Price regulation is a very strong remedy leading to lower wholesale prices in any case.

If wholesale prices are regulated, retailing operators could in theory significantly increase their retail margins. This would call for retail price regulation as well. However, retail price regulation requires the retail market to be defined as a relevant market. This requires EC approval. Introducing retail price regulation as a means to make the wholesale market more competitive is not the first option under the NRF; retail should be regulated only if wholesale does not work. This should be investigated in greater detail.

Another complicating factor is that wholesale price regulation could only be applied to those operators that are (jointly) dominant. In practice this means that only the (two) largest operators will have to lower its/their IOTs. However, this will be enough to introduce more competition since foreign operators are now able to procure significantly cheaper wholesale roaming. Other operators will also lower their IOTs to a competitive level.

Wholesale price regulation has a number of disadvantages the main of which is the fact that it can remove market dynamics and as a result not really increase competition. Wholesale price regulation is the only remedy that fits the NRF and that would resolve the current anti-competitive outcome of the market

Wholesale Remedies

1. The remedy with a predefined outcome is to regulate wholesale prices, if legally possible together with a limitation in retail mark-ups.
2. Parallel to remedy 1, the current framework for roaming should be reviewed under general competition law and should lead to less transparency and more dynamics; this is reached by limiting the publication of IOTs, reducing/removing the notice period of price changes and by removing the barriers to entry.
3. The most advanced remedy is to design a new wholesale market keeping in mind all current impediments.

Retail Remedies

Except for remedies on the wholesale level, an NRA has instruments at its disposal that can support the implemented wholesale solutions. One very strong remedy could be to regulate retail prices, however in general this can only be used after defining the retail market as a relevant market, after having this approved by the EC and only after wholesale regulation has proved to be ineffective. When retail regulation would be used to limit the retail mark-ups (see wholesale remedies above), it could be a very effective instrument.

Furthermore the retail market is well suitable for instruments that increase transparency. An example could be to prohibit the bundling of roaming together with other services or to oblige unbundled offers, to create a new framework for retail roaming tariffs; e.g. a Code of Conduct that states that all roaming tariffs should be transparently calculated per second.

Applying these instruments when instruments on the wholesale market are not being used seems to be rather useless because operators have little incentive to change their tariffs/pricing structure even when consumers are more aware or value their roaming tariffs more. This results in the following conclusion for the retail market:

Retail Remedies

A more pro-active role of NRAs is required on the retail markets to support measures taken on the wholesale level. This does not necessarily encompass retail price regulation but may also prohibit the current unclear ways of pricing/bundling and making the retail market more transparent by publishing information.

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Used Abbreviations

3GPP	3rd Generation Partnership Project
ARPU	Average Revenue Per User
BSC	Base Station Controller
CLI	Calling Line Identification
CPP	Calling Party Pays
EC	European Commission
ERG	European Regulators Group
ETSI	European Telecommunications Standard Institute
EU	European Union
GPRS	General Packet Radio System
GSM	Global System Mobile
GSMA	GSM Association
HN	Home Network
IMR	International Mobile Roaming
IMSI	International Mobile Subscriber Identity
IOT	Inter Operator Tariff
INTUG	International Telecommunications Users Group
IRP	International Roaming Platform
IRG	Independent Regulators Group
ISDN	Integrated Digital Services Network
LAI	Location Area Identifier
LBS	Location Based Services
MMS	Multimedia Messaging Service
MNC	Mobile Network Code
MNO	Mobile Network Operator
MO	Mobile Originated
MS	Mobile Station
MSC	Mobile Switching Centre
MT	Mobile Terminated
MVNO	Mobile Virtual Network Operator
NCA	National Competition Authority
NRA	National Regulatory Authority
NRF	The New Regulatory Framework
OPTA	Onafhankelijke Post en Telecommunicatie Autoriteit
OTA	Over The Air
PLMN	Public Land Mobile Network
RAN	Radio Access Network
RPP	Receiving Party Pays
SAT	SIM Application Toolkit
SIM	Subscriber Identity Module
SMP	Significant Market Power
SMS	Short Message Service
STIRA	Standard International Roaming Agreement
TAP	Transferred Account Procedure
UMTS	Universal Mobile Telecommunications System
VN	Visited Network
VAS	Value Added Services
WLAN	Wireless Local Area Network

INTRODUCTION TO ROAMING AND THE RESEARCH

In the last several years mobile communications have become a part of every day life for many people. Even though mobile communications is about more than only a mobile phone, this device is generally accepted to have introduced the concept on a large scale. By now, the number of mobile telephone connections in The Netherlands is even larger than the amount of fixed telephone connections.

In Europe and well beyond, the most widely used standard for mobile telephony is the Global Systems for Mobile communications (GSM) network. When designed in the 1980's, a very important requirement to the system was the possibility of using the phone outside of the coverage of the own network, for instance when travelling abroad.

In 2003 this has become one of the most respected features of the GSM network and is believed to have contributed considerably to the growth and success of the GSM network. Being able to seamlessly use the mobile telephone in a network different from the own domestic home network is known under the term "roaming". This seems to be an appropriate name since it means: "travelling purposefully unhindered through a wide area" [BRI02].

Roaming is sometimes used in a national setting to allow costumers of one network to use the resources of another network within the same country. This is done in order to provide a better coverage or quality. In this research national roaming agreements are left out of consideration. International mobile roaming (IMR) refers to making use of a network in another country, and exactly this type of mobile roaming is analyzed.

1.1 Motives for the Research

With the GSM network, users were finally able to keep using the same mobile number and telephone handset in a rapidly growing number of (European) countries. I believe that, among other factors (e.g. novelty of the service), the benefit the service brought to users justified paying a high tariff for roaming services.

Later, in 1999, the European Commission (EC) opened a sector inquiry into the IMR sector, the atmosphere in the sector changed. The investigations were started because of the fact that Mobile Network Operators (MNOs) were indeed able to lower the tariffs for national mobile calls but were very reluctant to lower tariffs for international roaming. The investigation of the EC was based on the presumption that there was a lack of competition in the sector resulting in price rigidity.

Following this investigation in 1999, a number of National Regulatory Authorities (NRAs) conducted benchmarking studies of the roaming tariffs, the International Telecommunications Users Group (INTUG) has actively been advertising that the IMR markets are not competitive enough and the Independent Regulators Group (IRG) had formed a workgroup on this subject. In 2002 however, the interest of the involved non-market parties seems to have declined, probably due to the complex nature of the problem, the trans-border character or because priority was given to more pressing concerns. The sector has not demonstrated much change since the investigation of the EC. Roaming charges have remained stable and new services have not really been introduced. The following three figures give an overview of retail tariffs that were collected for this research.

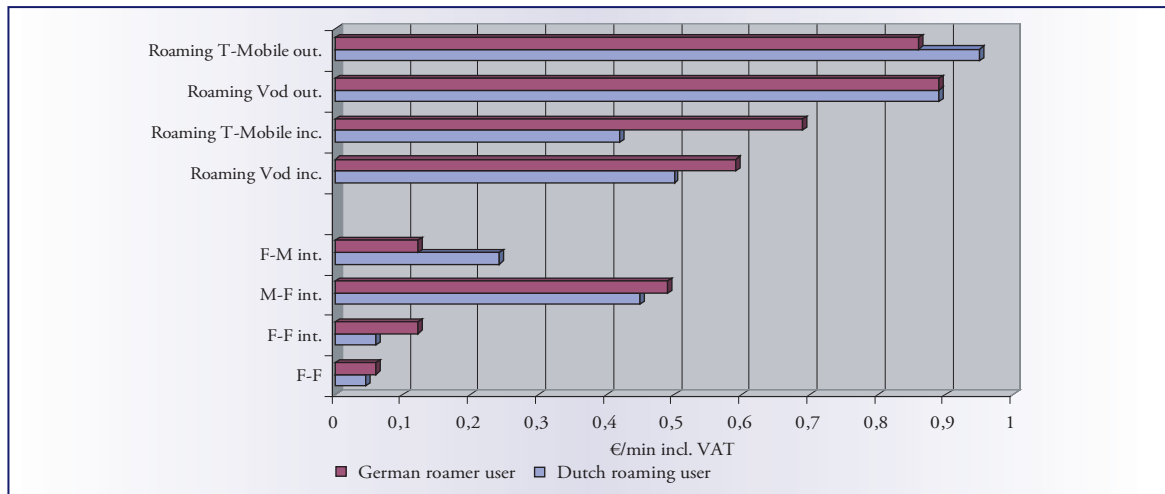


Figure 1. Retail roaming tariffs (to home) compared to other retail tariffs.

Figure 1 demonstrates the difference in the price-level between a call that is made whilst roaming and other types of calls. From top to bottom it shows respectively: an outgoing roamed call from a German/Dutch user roaming in The Netherlands/Germany, an incoming roamed call in The Netherlands/Germany. For the sake of a tariff comparison, other types of international calls were added. These are a fixed-to-mobile call, a mobile-to-fixed call, a fixed-to-fixed call all from Germany to The Netherlands and visa versa. The last two tariffs are a domestic fixed-to-fixed call. When looking at these rates it becomes obvious that (outgoing) IMR rates are much higher than other (mobile) types of international calls. Thus, the motive for this research is justified.

The second figure shows the trend of roaming tariffs for a Dutch corporate subscriber roaming in Germany and making a call home to either a mobile or fixed telephone. The diagram also demonstrates the differences between the most expensive and the cheapest networks. It is clear that during the first half of 2003 the tariffs for international mobile roaming in Germany have not changed at all. This insight forms an addition to the motive of conducting a research into IMR.

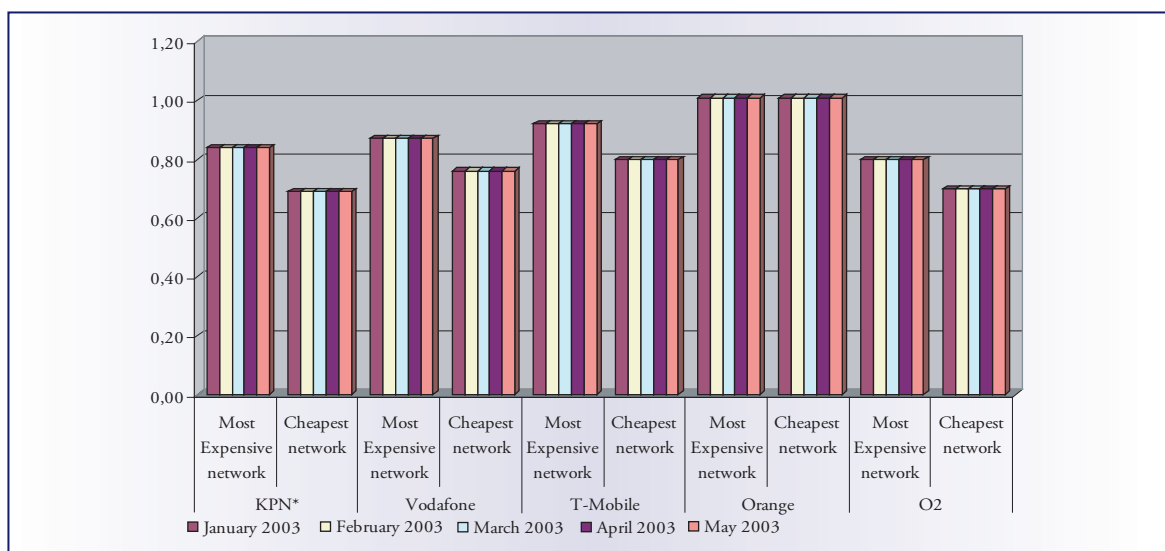


Figure 2. Retail roaming tariffs, roaming in Germany and calling to The Netherlands. Standard Corporate subscription, excl. VAT.

The third diagram gives an overview of long term price trends for IMR services. Again, the example of a Dutch user roaming in Germany has been used. This time a standard consumer subscription was investigated when making the same type of call as in Figure 2. Data for the five Dutch MNOs was collected for the periods of January 2001, 2002 and 2003. Looking at the results it becomes clear that tariffs can vary slightly but that in most cases roaming tariffs in 2003 are on exactly the same level as they were in 2001. Almost no change in prices in two full years is a very strong argument to investigate competitiveness of the sector!

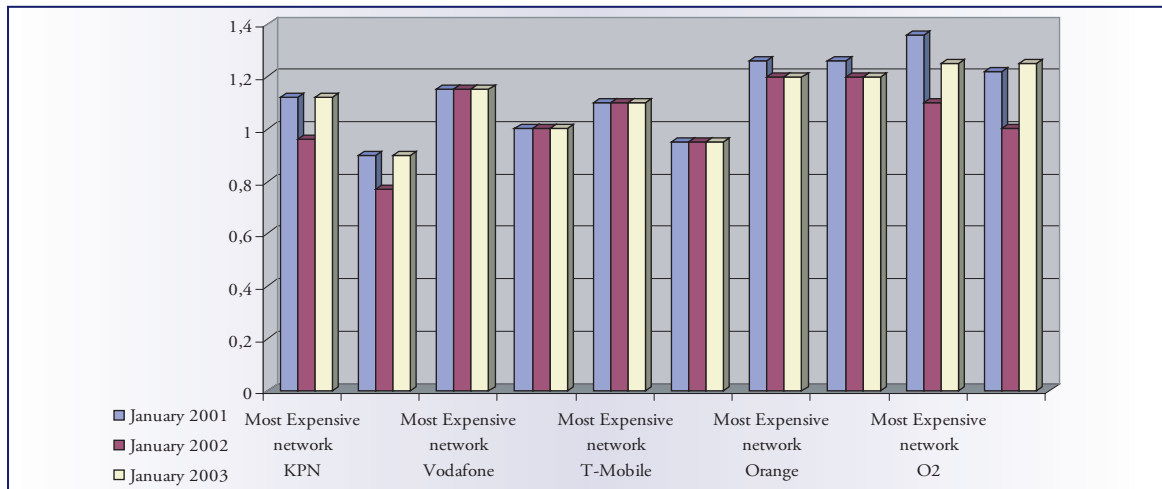


Figure 3. Retail roaming tariffs, calling from Germany to The Netherlands. Standard consumer subscription, excl. VAT.

This paragraph relates to only one motive for this research into the competitiveness of IMR markets, namely the rigidity of prices. The next section looks at the context of the research and will introduce the second motive.

1.2 Context of the Research

The second motive for this research lies in the fact that the IMR markets are of an interest to the Dutch National Regulatory Authority OPTA. The European Commission has designed a new framework within which regulation of the telecommunications sector should be conducted. This new framework includes the obligation for NRAs to investigate the competitiveness of the markets for IMR. If competitions proves to be sufficient, no actions are required.

It is evident that OPTA has an interest in the analysis of the IMR markets. Since this research is done in cooperation with OPTA, this perspective justifies looking independently into the IMR markets and making an analysis of their competitiveness.

The task of OPTA and NRAs in general is to regulate certain telecommunications markets in such a way that effective competition on the market is stimulated. This aim to structure a competitive telecommunications sector can apply to the market of e.g. fixed telephony, broadband services or mobile telephony and is most likely to result in efficient production and pricing. Therefore it will ultimately result in the highest benefits for both producers as well as for consumers [DGTP00].

In many cases however, the market itself does not converge to this state. In a liberalized telecommunications market, the most obvious reason for this is usually the position of the former national monopolist, often called incumbent. The incumbent or other dominant firms could misuse their market power and could show anti-competitive behaviour [inDev00].

In other words, market failure can arise due to the way in which the market is organized or due to the way in which the market parties behave. This gives the distinction between the structure of the market and the market conduct. From an uncompetitive state, the market will not become competitive by itself. This can have very negative side effects for companies wanting to enter the market or for smaller companies already active. Apart from that it could be that consumers are harmed by the market structure because prices are too high or because new technological developments are not introduced as a result of a lack of rivalry. Because of these reasons regulators such as OPTA were established to try to steer markets into a more competitive shape.

The scope of this paper will be limited to the European Union (EU) since OPTA's policy field is legally limited to The Netherlands in the first place and secondly to the EU.

1.3 Goal of the Research

As mentioned before, some research has already been done on the subject of this report. However, it will be for the first time that an integrating approach as in this report will be chosen. The goal of the research is to analyze the structure and conduct of the IMR markets, to assess whether or not barriers to competition are present in those markets and if so, because of which reasons. For if barriers to competition exist (which seems likely already at this point), the next step is to determine whether the market will solve these barriers by itself in the near future. If not, this research will investigate which (legal) remedies that NRAs have at their disposal would prove to be effective in increasing competition. Additional recommendations will be given where applicable.

The goal of this research is to make an independent, multidisciplinary analysis of barriers to competition that might exist in the field of International Mobile Roaming and to then analyze which regulatory instruments are likely to relieve these barriers resulting in improved competition.

This goal can be divided into two distinct research questions that contribute to reaching the goal of this research:

1. Does the structure and conduct of the market(s) for international mobile roaming hinder effective competition? If yes, which impediments to competition exist?
2. Will these barriers to competition be alleviated by market developments? If not, by which regulatory instruments can these impediments be removed?

Box 1. Goal of the Research.

Because technological developments are quite unpredictable and because innovations can take place at a rather high pace, this report will confine itself to a period of 1 to 2 years in which competition should increase.

1.4 Structure of the Report

This report that is structured as follows. This introduction has just given the general motive for looking into the competitiveness of the IMR markets, namely high retail prices and the interest that OPTA has in the IMR markets.

Chapter two will then give the technical foundation that is needed in order to understand how roaming works. For instance, chapter two will explain how mobility is managed in order to make roaming possible.

Chapter three forms the core of the analysis made in this report. It starts off with an introduction to the actors that play a part in offering IMR services, it then introduces the distinction between the wholesale and retail roaming markets that will be used throughout this report. Chapter three results in a list of impediments (barriers) to competition on both the wholesale and retail IMR markets.

Having seen which impediments to competition exist, chapter 4 looks at market trends in IMR services and discusses that there are no trends leading to a more competitive outcome for IMR services. This makes looking into regulatory solutions a justified approach.

Chapter five describes the legal framework within which all instruments should fall that are applied by an NRA. This framework consists of an analytical process defining markets and assessing competition. Chapter 5 also lists the types of instruments an NRA can apply and additionally it links the legal framework to market structure/conduct by means of the notions of oligopoly and dominance.

Chapters six and seven give remedies that will improve competition on respectively the wholesale and retail IMR markets. These chapters are structured in line with the impediments. Some remedies are described that fit the legal framework whereas others are not legally allowed.

The final chapter gives a concluding overview of the research structure and the remedies on wholesale as well as on retail level.

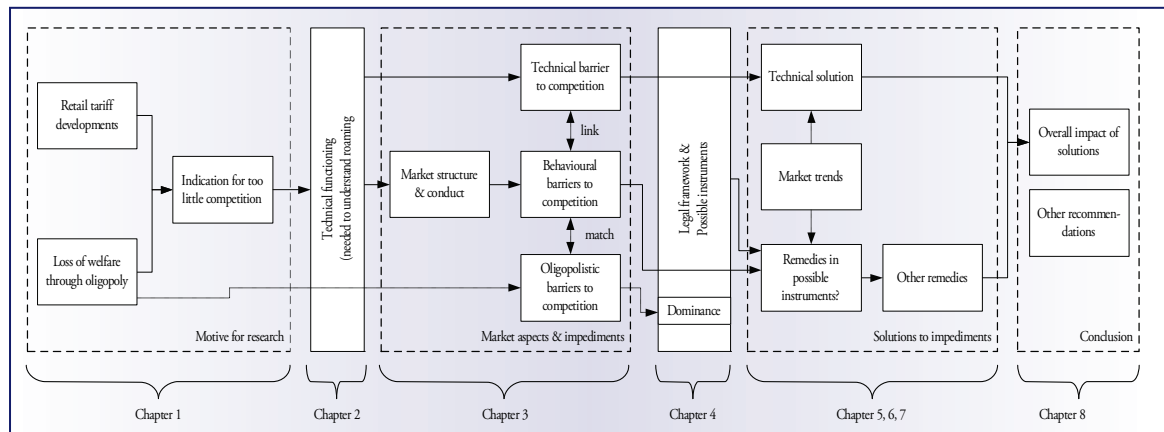


Figure 4. Line of Argumentation.

2. THE TECHNICAL ASPECTS OF ROAMING

This chapter will serve as the technical foundation of this report. Before it is possible to look into the way in which the market is structured and the way in which the parties on the market behave, it is needed to describe how International Mobile Roaming (IMR) works technically. Except for an insight into the technical mechanisms that lay behind the commercial behaviour of the market parties, this technical chapter will later function as a framework of thought for finding possible impediments to competition on the market for IMR. It is possible to identify impediments only with an understanding the technology behind mobile roaming and when the structure and conduct on the market is clear.

2.1 Introduction GSM and the Cellular Principle

The GSM Public Land Mobile Network (PLMN) is a very complex system the design of which started at the end of 1982. The result can be found in thousands of pages of technical specifications at the 3rd Generation Partnership Project (3GPP) [3GPP03] and the European Telecommunications Standard Institute (ETSI) [ETSI03].

The GSM system can be described on a number of different levels such as the mobile radio channel (radio propagation) and the interface specifications of the system. However interesting these subjects might be, this detail seems irrelevant to this report. It would carry too far to cover all the aspects related to GSM in this report. That is why this technical chapter will focus on IMR and describe those functions needed to understand how roaming works.

Because of the nature of radio waves and the limited spectrum available, frequencies have to be spatially reused. This is done by creating so called 'cells' (radio zones) to which a specific subset of frequencies is assigned. These cells are usually modelled by a hexagon because this shape can cover a certain surface without overlapping. Two adjacent cells must never have the same frequency because this can cause radio interference. The next time that the same frequency can be used is at a distance of D (the frequency reuse distance). By using the principal of frequency reuse, the layout of the cellular network will automatically form clusters of cells. By planning the layout of the cells in a smart way, the total frequency available to an MNO can be used without causing too much interference to the neighbouring cells while at the same maximizing the capacity of the system.

To understand how the GSM system works and to be able to look at the competition on IMR markets, the underlying principles of cellular technologies and radio wave propagation do not need to be explained in greater detail. The next section will look at the GSM system architecture

2.2 The GSM System Architecture

The GSM network consists of a large number of modules and network nodes. Each of these nodes serves a different goal and is used in the event of e.g. logging onto the network, making/receiving a call, or more important for this report: roaming abroad.

2.2.1 The Mobile Station (MS)

From a user's perspective the most important part of the network is the mobile phone. In the GSM standards this is called the Mobile Equipment (ME) and together with the Subscriber Identity Module (SIM) this forms the Mobile Station (MS). The SIM is basically a smart card with memory and a small microprocessor and forms the personal identification of the user on the network. Because the SIM can be used with all mobile handsets, it allows the user to keep the same SIM-card while changing handsets. As will be shown later on in this chapter, the SIM does not only store information important to the network but it can also store user-information such as telephone numbers, SMS-messages and far more information.

In respect to roaming the SIM is a very important entity with many functions that cannot be done without in order to provide a good roaming service. How the SIM is used for roaming is treated later on in this chapter.

2.2.2 GSM Sub-systems

The GSM network itself is divided in three functionally different sub-systems defined in the GSM standards:

- The Radio Network Sub-System (RNS)
- The Network and Switching Sub-System (NSS)
- The Operation and Maintenance Sub-System (OMSS)

The figure below provides an overview of the components of a standard GSM network. All three subsystems will be described and the functionalities of the nodes in each subsystem will be given. These functions are not yet applied to IMR.

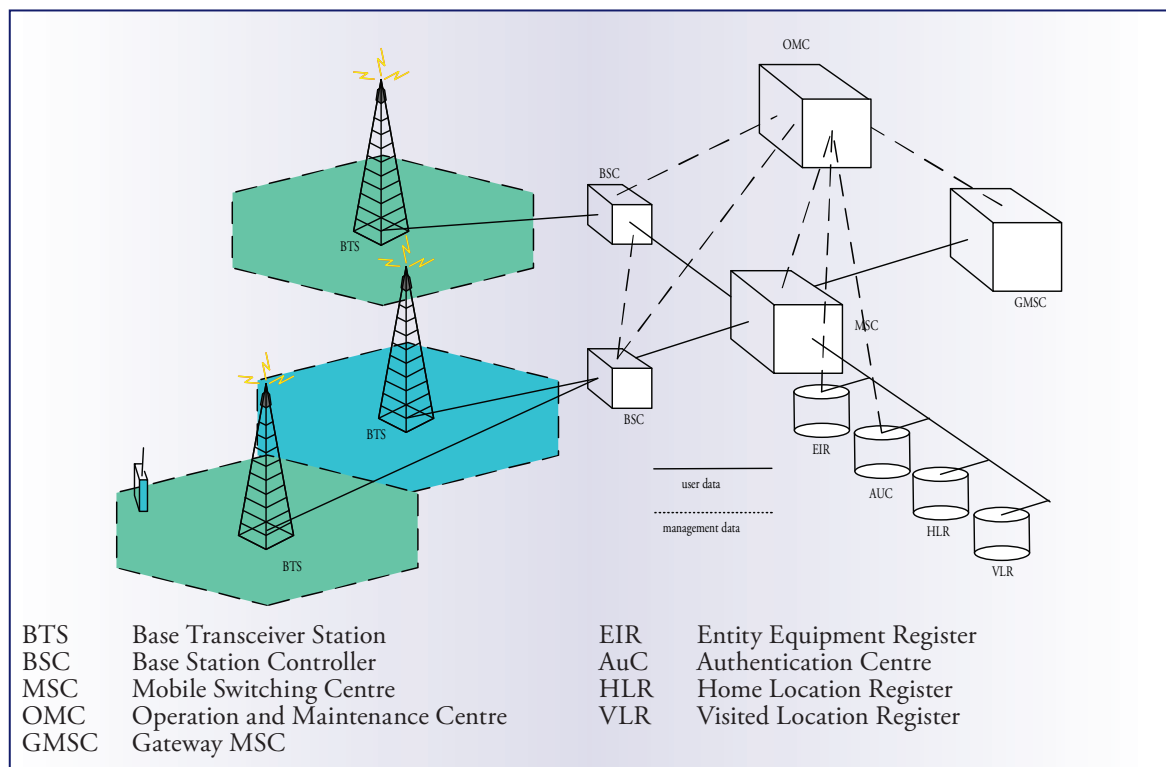


Figure 5. GSM Network Overview. Based on: GSM Switching, Services and Protocols.

The Radio Network Sub-system (RNS)

The Radio Network Sub-system is called Base Station Sub-system (BSS) in the GSM standard. As was explained above, GSM uses a cellular structure. The Base Station Transceiver (BTS) is the entity in the network that is responsible for providing the signal to the MS. The Base Station Controller (BSC) controls one or more BTSs. The intelligence of routing in the Base Station Subsystem resides with the BSC. As is shown in Figure 5, the BSC is connected to a BTS but on the other side it is connected to the Mobile Switching Centre (MSC) (for routing calls) and to the Operation and Maintenance Centre (OMC) for monitoring and maintenance tasks.

Every BTS controls one cell and since a MSC manages more than one BTS, the MSC also manages many cells. A number of cells can be grouped in Location Areas (LAs) that are used for locating a subscriber.

The Network & Switching Sub-system (NSS)

The second GSM subsystem is the Network and Switching Sub-system (NSS). This sub-system is responsible for the main switching functions of GSM and it contains all important databases that are used for subscriber data. The most important node in the NSS is the Mobile Switching Centre (MSC), which is the main switch in the network responsible for routing calls; e.g. routing an incoming call to the correct MS. As can be seen in Figure 5, the MSC has one or more BSCs under its control. The MSC is not a regular fixed network switch since it has to take into account that the users are moving around and can therefore change their location. Furthermore the MSC has to manage the allocation of radio resources.

A mobile network has to interconnect with other types of networks and that is why the MSC is connected to a Gateway Mobile Switching Centre (GMSC). This node in the network connects to the fixed networks in the country, e.g. the Integrated Digital Services Network (ISDN). For cost reasons, the GMSC is very often implemented in the same machines as the MSC [MOU92: p.103]. Through the GMSC the GSM PLMN is able to connect to other networks, e.g. for incoming calls.

Furthermore, GSM relies heavily on a number of databases. The most important databases are the Home Location Register (HLR) and the Visited Location Register (VLR). The HLR stores all information of users that “belongs” to a certain home network. The HLR stores information on subscription and permissions of the users as well a link to the current location of the user [EBE01] (used for roaming).

The VLR stores the location of an MS that is currently visiting in a foreign network. Since mobiles are able to roam between the foreign networks with which the home operator has a roaming agreement, the roaming mobile needs to be registered in the foreign network. In short, this is done by using the VLR which stores the location information of a visiting mobile. Roaming will be discussed in greater detail later on.

The Operation & Maintenance Sub-system (OMSS)

The final subsystem of a general GSM network is the Operation and Maintenance Sub-System (OMSS) sometimes also called the Operation Sub-System (OSS). This subsystem is responsible for the controlling and monitoring of network operation and is done by the Operation and Maintenance Centre (OMC). It is thus responsible for: “administration and commercial operation (subscribers, end terminals, charging/billing and collecting statistics), for security management and for maintenance tasks”[EBE01].

Two additional databases are a part of this subsystem; they possess functions that are both related to network security. The Authentication Centre (AuC) is responsible for authentication of users. The AuC

can be implemented as some additional modules in the HLR. The Equipment Identity Register (EIR) registers information about all MEs by means of the unique number every ME has (the International Mobile Equipment Identity, IMEI). For instance when a mobile phone has been stolen it can be refused service from a network by blocking its IMEI number.

2.2.3 Signalling

When a call has been set-up in a GSM network, the voice-data generated by the users has to be transmitted between the various network nodes in the system as well as between networks. This means that connections between the nodes in the network need to be in place. This is done by means of fixed (leased) lines and proves that the mobile GSM PLMN relies heavily on fixed connections that are connected to the GSMC.

Except for this voice-data, another type of connection is vital to a telephony service such as GSM. Whenever a call is made, a so-called circuit is set-up between the originator of the call and the receiving party to transfer the user-data. However, in order to set-up and maintain this connection, signalling between switches in the network is needed. The communication between the nodes of the network is done by international standards Signalling System Number 7 (SS7) and X.25 [MEH97]. In the signalling network, every MSC and database (HLR,VLR) is known as a Signalling Point (SP) and has its own Signalling Point Code (SPC) in the SS7 network. As will be shown later, there is a lot of communication between the various databases and switches; not only for mobile calls within one network, but also for mobile calls made whilst roaming.

All this communication is conducted over the SS7 network and results in the fact that PLMNs in different countries need to be connected via a SS7 network. The diagram below shows how the various switches/databases (registers) are interlinked through the SS7 network.

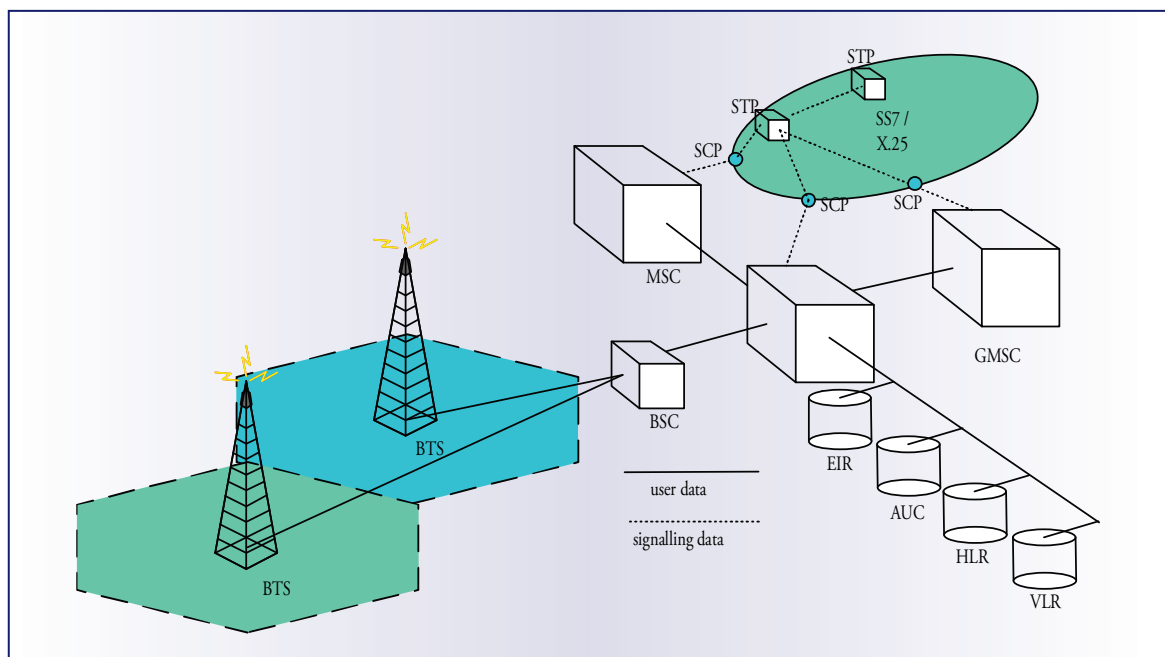


Figure 6. Signalling in a GSM network. Based on: *GSM Switching, Services and Protocols*.

In case of international calls, e.g. for roaming, two foreign networks have to be connected through an international SS7 network because these networks have to exchange database information on e.g. the current location of the user. There is far more information available on the subject of signalling in GSM networks. Yet, for the purpose of this report a more detailed description is not required.

2.2.4 Mobile Identification Numbers

Since the GSM network was designed for mobility of users, the network needs references as to the identity of users, their equipment and locations. A number of descriptors are being used for this. In order to show how calls are routed in the network, which entities in the network are being used and how international roaming works, first the most important mobile identification numbers will be explained [EBE01].

International Mobile Station Equipment Identity

The International Mobile Station Equipment Identity (IMEI) is the unique number that serves to identify the mobile handset. In cooperation with the EIR, it is possible to construct a white list (authorized), a grey list (malfunctioning) and a black list (unauthorized, e.g. stolen) of handsets in the network. The IMEI gives the possibility to identify the manufacturer as well as the date of production of the handset.

International Mobile Subscriber Identity

A second type of identifier is the International Mobile Subscriber Identity (IMSI). It is a unique number assigned to each user of a GSM network. The IMSI number is stored on the SIM and consists of several other identifiers:

- The Mobile Country Code (MCC). The internationally standardized number to identify the country in which a specific GSM network operates.
- The Mobile Network Code (MNC) used to identify a specific MNO within a country.
- The Mobile Subscriber Identification Number (MSIN). The MSIN identifies the user within the GSM PLMN.

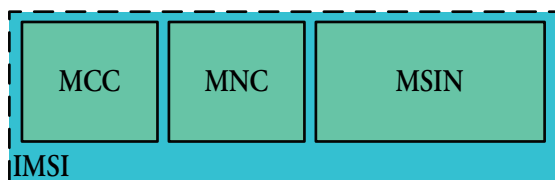


Figure 7. The IMSI number. Source: [MOU92: p.469]

Mobile Subscriber ISDN Number

The Mobile Subscriber ISDN Number (MSISDN) is the telephone number of a mobile station that can be dialled from a different telephone. The MSISDN follows the international ISDN numbering plan [GSM02.87]. The MSISDN consist of a Country Code (CC), a National Destination Code (NDC) and a Subscriber Number (SN) all of the home network of the user.

In the case of a Dutch mobile subscriber, the CC is 31, the NDC could be for instance 6 20 or 6 51 and the subscriber number can be any other combinations of 7 (for The Netherlands maximally 15) digits.

Mobile Station Roaming Number

The Mobile Station Roaming Number (MSRN) is an important number for users that roam onto a different network. The MSRN is a number that is temporarily assigned to a subscriber by the VLR of the area in which the user is roaming. The MSRN has exactly the same structure as the MSISDN that was described above; only in this case the numbers are not of the home network but of the visited network in which the subscriber currently roams.

The MSRN is assigned by the VLR in the visited network whenever a user enters a (new) Location Area. When the VLR assigns a MSRN, this MSRN is also sent to the HLR of the roaming subscriber. In this way the home network knows exactly where to find the roaming user. The MSRN is stored in the non-permanent memory of the SIM.

Temporary Mobile Subscriber Identity

The Temporary Mobile Subscriber Identity (TMSI) is the last important mobile identification number. It is a number that is assigned by the VLR to the MS that stores it on the SIM. The TMSI is not forwarded to the HLR of a roaming user. The TMSI is used to contact the MS instead of the IMSI to contact a MS. A new TMSI is assigned whenever a user moves to a new location area that belongs to a different VLR. The TMSI is also stored in the non-permanent memory of the SIM.

Location Area Identifier

As was said above, a number of cells can be grouped in Location Areas (LAs) that are used for locating a subscriber. Every LA has its own identifier, the LAI. By means of this LAI, the mobile station can always find out where it is located and reversely the network is able to find where to reach the mobile station.

2.3 Mobility in GSM

GSM is so widely used in The Netherlands, Europe and large parts of the world that by now it is taken for granted that a user is able to roam around his own and a foreign country while still being able to get service. When the GSM system was introduced, this was one of its main benefits or features. This section discusses how the GSM system is able to deliver these IMR services.

There are several technical levels on which the functionality and backgrounds of mobility in GSM can be described. The goal of the outline of the mobility functions that will be given below is not to give full insight into all related subjects such as the protocols that are used, the radio management issues et cetera since this is not considered a goal of this report.

The goal of this section is to show how the network keeps track of users while moving around in the network or between networks (roaming). At this technical level the main goal of the description is to show how the communication between the various databases in the system works in order to provide routing for calls.

2.3.1 Location Registration and Location Updating

Within a GSM network, users are able to move from one cell to another or from one network to the other. Before a user is able to use services on the network, e.g. be called, the mobile station first has to register with the network. When a phone is switched off, it usually takes a number of seconds before the name of the MNO appears in the display of the phone. This is called the Location Registration Procedure.

A mobile station is also able to change locations within a PLMN, move from cell to cell when the user walks or drives a car. This means that the mobile station and the network have to know approximately in which cell, (or in GSM terms) in which Location Area (LA), the mobile station is located; this procedure is called the Location Update Procedure.

These two procedures will be described for the case when the user is in the home network, and later on differences will be given in case the user is roaming abroad. It can already be stated now that the difference for these procedures between being in the home network and being in a foreign network is very small.

Location Registration Procedure

For a user to be able to register with a PLMN, the handset of the user selects the network to which to register. When the user is within the borders of his own country, the location registration procedure will try to register with the home MNO.

As was made clear above, every mobile station has its own equipment number, the IMSI. Furthermore, the mobile station is located in a certain location area indicated by means of the LAI. When the mobile station wants to register with the network, it reports to the network by transmitting its IMSI number and its LAI. These numbers go to the MSC. The MSC requests the VLR that is responsible for the LAI to register the mobile station with its current LA.

Before the mobile station is allowed to be registered with the network, the identity of the user first has to be checked/authenticated. This authentication procedure is started by the VLR and uses the HLR and the AUC of the network¹. If assumed that the authentication has been successfully completed, this is reported to the VLR and the VLR is able to assign a new MSRN as well as a new TMSI to the user. The MSRN is stored in the HLR together with the LAI. The TMSI is then received by the mobile station and the user is registered with the network². The TMSI is stored in the SIM. All communication between the various databases and the BSC/MSC is conducted over the X.25 / signalling network of the operator.

Location Update Procedure

The location update procedure is fundamentally the same as the location registration procedure. However, a location update is only done when the mobile senses that it has entered a new LA³. The mobile station requests a location update by transmitting its TMSI and LAI to the VLR. This can be the same VLR responsible for many LAs, or it can be another VLR. The VLR stores the new LAI for the user. The VLR sends a new MSRN to the HLR and it sends a new TMSI to the MS.

It can also occur that the corresponding VLR will change when a location update is needed. In this case the location update procedure is nearly the same only the new VLR will have to acquire identification (IMSI) and security information about the subscriber from the old VLR. After the new VLR has supplied the user with a new TMSI and has supplied the HLR with correct location information, it notifies the old VLR to remove its data about the subscriber.

As was shown above, the HLR knows where the user is located at any point in time by looking at the MSRN. With every location update this number would have to be changed. It is however also possible to send just the current number of the responsible MSC or VLR to the HLR. This would require less updates to the HLR since the MSC or VLR change less often when a user moves.

¹ The authentication procedure is outside the scope of this description because an in-depth understanding of this procedure does not contribute to understanding roaming.

² The TMSI is sent in encrypted form to the user, this is not a vital subject to understanding roaming.

³ BTS broadcasts the current LAI and the MS is able to read its current location from this LAI.

Registration & Location Updating for Roaming

It has now become clear how the network keeps track of the location of its users. All important location information is stored in the VLR and the HLR and this information can be used for routing calls to the subscriber. When the user is not in its home network but when roaming, networks have to be able to “know” where the user is located in order to route an incoming call to this user. The differences are very small.

It is not difficult to imagine that instead of the above mentioned VLR and HLR in the same home network, the HLR could be located in the home network of the user whereas the VLR is located in the visited network. This is demonstrated by Figure 8. Number (1) in the figure shows the request of the MS, (2) shows the insertion of the IMSI and LAI into the VLR, (3) shows the answer of the VLR in the form of a LAI and MSRN which is inserted into the HLR at (4). Number (5) shows the sending of the new TMSI to the MS.

A location update procedure which takes place whilst roaming can be understood in the same manner as below.

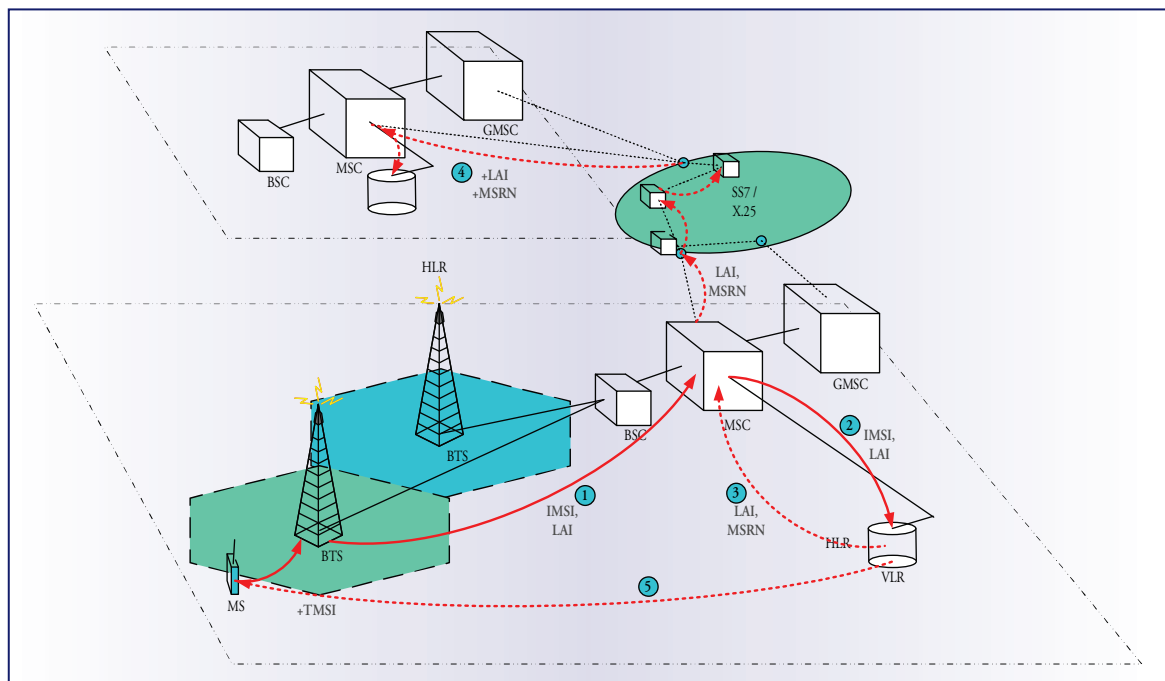


Figure 8. Location registration procedure whilst roaming.

2.3.2 Cell and PLMN Selection

The above description refers to the case when a mobile station moves and at the same time selects the cell that is best fit to supply service. The mobile station will select the best cell based on the quality of the radio channel. The signal should be at least of a minimum quality. When the mobile station finds a cell that could provide a better signal quality, it will switch to this cell. It might be possible that this cell is in a different location area and thus the mobile station will have to initiate a location update procedure. The following section is based on [MOU92: p.447-458].

When the user has been registered with a network, it will search only for cells of this network. Any other networks that are active in the same area are not inspected. This is quite logical because as long as the network with which the user has been registered provides a signal of good quality, the phone does not need to switch networks.

When the user finds himself in a foreign country with more than one PLMN, he/she is in most cases able to select service of more than one of these PLMNs. This depends on the existence of roaming agreements of the home operator with one or more foreign operators; roaming agreements will be discussed in chapter 3. If more than one network is available, a change of the network can occur only because of two reasons: either the user himself manually selects another network, or the current network is not able to supply a good quality level with the result that the handset will start the search for a new PLMN.

Different from the cell selection procedure that is fully automatically executed, the PLMN selection procedure uses the SIM and in case of a manual selection needs the input of the user. The SIM contains two lists (files) that are used for PLMN selection; the preferred and the forbidden PLMN list.

The preferred list contains a number of preferred networks with which a mobile station will first try to register in a certain country. The forbidden list is a list that is built dynamically and contains the networks which will not be tried for registration. If the user fails to register with a certain network, the PLMN identity will be put on this list on the SIM so that handset will not try to register with this same network anymore. The list is lost when the phone is switched off. Since the forbidden PLMN list has a limited capacity (in the GSM specifications this is standard 4, but can be extended), a new entry to the list replaces the oldest entry.

Now that the two most important files on the SIM in connection with roaming have been mentioned, two scenarios of PLMN selection will be discussed; the automatic and the manual PLMN selection.

Automatic PLMN selection

The most frequently occurring situation is when a user roams abroad and the mobile station automatically selects a foreign network on which the user is able to get service. This type of PLMN selection is fully automatic without any intervention of the user and that is why most people prefer this type of PLMN selection.

First of all, the network will try to register with the last known “good” network, this is called last network prevalence. If this network is unavailable, another procedure is started [MOU02: p.449]: “When a PLMN selection takes place in automatic mode, the PLMNs are tried starting with the first PLMN in the list of preferred networks which is in the list of found PLMNs and not in the forbidden PLMNs list”. In this way the mobile station registers with a certain PLMN. Again, the PLMN that the MS has selected will only be changed when the network coverage or quality becomes too poor or when the user actively switches the network.

Manual PLMN selection

Instead of the fully automatic PLMN selection process, the user is able to exert more control over the selection. After searching the frequency bands for networks, the mobile station is able to present a list of all found networks. These networks can be mentioned on the preferred PLMN list or on the forbidden PLMN list, this is of no influence.

The list is displayed using explicit, easy to understand names of the network providers. This list with names is embedded in the phone and can become outdated if names of networks change. In The Netherlands a roaming user with a modern telephone would, at this moment (April 2003), be presented with a list of the Dutch operators: KPN, Vodafone, Orange, T-Mobile, O2. If the phone is a bit older, e.g. Orange could be displayed as Dutchtone or T-Mobile as Ben.

After the MS has displayed all available networks, the user can manually select one of these networks. The difference with the automatic PLMN selection procedure is that when the user selects the network himself, this network does not necessarily have the strongest signal. It might provide other services, it might be cheaper in terms of tariffs et cetera.

2.3.3 Conclusion on Mobility in GSM

This section has demonstrated how the network keeps track of the location of all users. The combination of the HLR and VLR has proven to be very important in this respect. Furthermore, it was shown in which ways a mobile station searches for new cells within one PLMN, or how it searches for different PLMNs when the service level of the current network is not up to standards in a certain region. With this in mind it is now possible to look into how calls are routed to users.

2.4 Call Termination and Call Origination Routing

The emphasis in the previous section was laid on the way in which the network keeps track of the location of a user. Especially for roaming this is of particular importance since the user needs to be reachable at all time, even when located in a foreign network. The route that the call takes through the network when a call is setup whilst the user is roaming will be the subject of this section. For this purpose it is first needed to introduce two well-known principles for making calls after which these principles can be used to describe the call routing.

2.4.1 Calling principles

When the user is located in his home network as well as when the user is in a foreign network (the user is roaming) there are two straightforward principles for making a call:

- Either the user will initiate a call himself
(e.g. to the home network or to a local subscriber in the visited country)
- Or the user receives a call whilst roaming

The first type of call goes by the name of Mobile Originated calls (MO). This is logical since it is the roaming user who initiates the calls, the call originates at the mobile telephone and it ends (it is terminated) at a different node in the network (e.g. a fixed telephone in the visited country).

The second type of call is named a Mobile Terminated call (MT) since the call comes from another user and/or network (originates) but ends (terminates) at the mobile telephone of the roaming user.

2.4.2 Call termination routing

Mobile phones can be reached from any other type of phone, be it another mobile phone (in the same or in a different network) or a phone connected to a fixed network. All these networks are interconnected in order to be able to reach the largest number of other subscribers and as a result give the highest network benefits to users.

Imagine the case when a fixed subscriber dials the number of a mobile user that is roaming. This fixed network can be located anywhere. Three possibilities exist, but there is no difference in the call routing. The fixed network can be located:

- In the same country as where the mobile user is roaming
- In the home country of the mobile user
- In another country (3rd country)

The user dials the telephone number, the MSISDN. The fixed ISDN switch at which the call arrives detects that the destination of the call is a mobile number. This can be read from the NDC in the MSISDN. For example the NDC would be 6 20 where '6' stands for a Dutch mobile destination. The (international) PSTN/ISDN switch then routes the call to the appropriate Gateway MSC of the home PLMN. The home PLMN is chosen here because the fixed network does not have any information on the location of the user. The user could simply be in his home network or could be roaming abroad.

The GSMC requests the current routing address, the MSRN from the HLR in the home PLMN. Based on the MSRN, the GSMC routes the call to the local MSC in the visited network. This MSC is not able to establish in which location area of the network the called user is located. That is why the MSC queries the VLR by sending the MSRN. The VLR responds with the current TMSI/LAI of the user and in this way the called user can be reached.

As far as used nodes in the network are concerned, there is no real difference between the roaming and non-roaming scenario. The only distinction lies in the physical location of the nodes. For example, when a user is roaming the HLR is located in the home network and the VLR is located in the visited network whereas the VLR would be located in the home network when the user is not roaming.

2.4.3 Call Originating Routing

Contrary to the case of call terminating routing described above, the routing of an originating call starts at the mobile station [MEH97: p.131-134]. After having requested service from the network⁴, the MS will send the MSISDN of the destination to the local MSC. This node in its turn sends the message on to the PSTN/ISDN switch. When the receiving party answers the call, the connection is made and the MS is informed.

For the pure setting up of the call, the HLR/VLR are used only to verify to whether the calling subscriber is allowed service. This shows that in this case the HLR/VLR is not used to the same extent as with a terminating call.

2.4.4 Conclusion on Call Routing

This section identified two calling principles namely mobile originated and mobile terminated calls. The first of which is a call that is started by the mobile user himself and the second of which is being received by the mobile user. Based on these calling principles it was possible to show in which way a call would be routed through the network; which nodes in the network were being used and which information they exchanged. This has given the technical foundation for understanding IMR. The next section will look into the important matter of billing and accounting in IMR.

⁴ Messages related to requesting service and authentication for call setup are not treated here.

2.5 Billing and Accounting in Roaming

Apart from the actual routing of a call, billing and accounting is another essential part of understanding how roaming works because it looks into how operators charge each other for services provided (e.g. access to the network). In general one of the most important aspects of any telecommunications service is the way in which it is billed to the customer. Without a proper billing system the MNO will not be able to keep track of the activities of its users and will therefore be unable to get revenue from its network. This section is dedicated to the technical aspects of billing and accounting to provide an overview of how billing works.

2.5.1 Exchange of Billing Information

When a user roams abroad, he/she uses the network and/or services of a foreign MNO. Since this foreign MNO has no direct relationship with the roaming user, it is impossible for the foreign MNO to bill the user that is in fact using its network. That is why both the domestic and the foreign MNO need to exchange roaming information in order to bill the customer correctly and to recoup costs from the home operator made by the visited MNO.

The foreign network stores information about the activities of the user. The details of calls made by the user are called toll tickets and are generated by the MSC controlling the user at that point in time [MOU92: p.572-577]. A toll ticket or call record contains all information that is necessary to calculate the charges of the call of a specific user⁵. For identifying the corresponding user, the toll ticket includes the IMSI of the user. Since it will not be the visited MNO that will bill the roaming user, the billing information has to be forwarded to the home MNO.

After the MSC has generated a toll ticket/call record, it is sent to the Billing System of the visited network. The billing system can be a part of the OMC (see also Figure 5). This is done to allow the visited network to be able price the call. For instance depending on the time of the day or the destination of the call. This billing system generates a bill on the call level and it produces a so called TAP file which stands for Transferred Account Procedure [GSM403/1]. Transferred account procedure relates to the fact that it is the domestic operator that is responsible for billing the customer – the account is transferred to the home MNO. But since the billing system makes bills for many users of many different home networks and because it is a specialist task to check the files for errors, this is often outsourced to a third party; a so called data and financial clearing house.

2.5.2 The Data and Financial Clearing House

The tasks of data and financial clearing are often performed by the same company. First data clearing services will be explained.

Data clearing services

The TAP files have to be sorted/grouped per user and sent to the billing system of the home operator. This is a task for a data clearing house. This type of company has a connection to the billing system of the visited MNO and receives the TAP files that the billing system produces. The data clearing house sorts and collates the call records that have been generated for a specific user [CIB03].

Furthermore the data clearing house validates the billing files. When billing files have been validated and sorted this information is sent to the billing system of the home MNO. The home MNO in its turns produces the bill for the customer.

Figure 9 shows how data clearing works. The visited network sends TAP files to the data clearing house. This company sorts, validates and checks the files and then send the files to the corresponding

⁵ See GSM Standard 12.05 [GSM12.05] for the contents of a toll ticket.

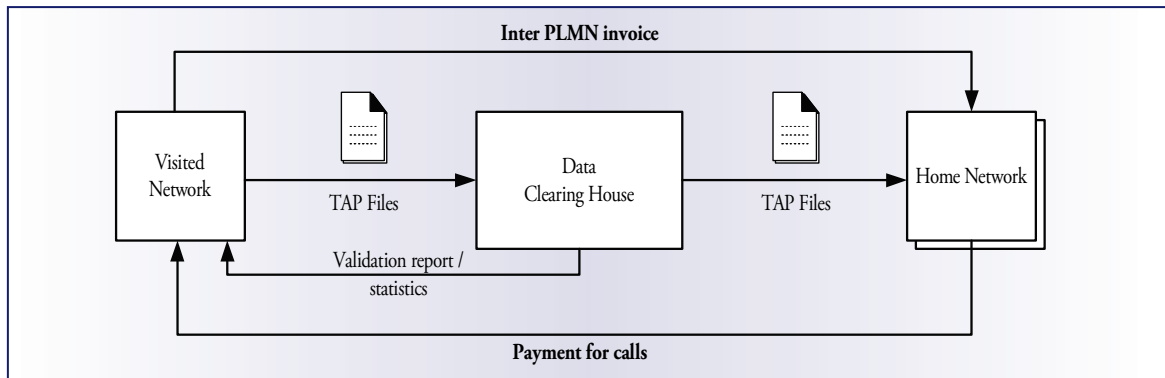


Figure 9. Data clearing house.

home network. The data clearing house sends a validation report to the visited network; the report contains the errors that were found. The figure also shows that the visited network prepares an inter PLMN invoice for the home network. This corresponds to the wholesale market for roaming services (see chapter 3).

The second function of a clearing house is very often to do financial clearing. This will be explained below.

Financial clearing

As was shown above, operators have to settle financial affairs among each other. Clients of MNOs roam onto each other's networks and make calls. The visited operator incurs costs because of this, and these costs are charged to the home operator. This generates a bill from the visited operator to the home operator. The calculation of these inter-operator bills, the settlement of these bills, sending the invoices et cetera, is done by the financial clearing house. The billing among operators will prove to be very important for IMR services. This will be considered in detail in chapter 3.

2.5.3 Conclusion

This section has looked at the technical aspects of billing and accounting for IMR. Billing itself is a very important aspect of roaming. Billing could be described on the level of "who pays what", but in this section the emphasis was on the technical aspects. It was shown that billing information needs to be exchanged between the visited and the home network and that this is done by means of TAP files. First a toll ticket is generated by the MSC responsible for the roaming user, this toll ticket is sent to the billing system of the visited network. This system produces a TAP that is generally sent to a clearing house that does further processing and sends it to the home network.

2.6 Conclusion on Technical Aspects of Roaming

This chapter forms the technical foundation to understanding the conduct on the market(s) for IMR services. The chapter gave an introduction into various technical aspects such as the GSM system architecture, signalling, mobility and routing and finally the billing aspects related to roaming. Understanding of these subjects will prove to be important to understanding the next chapter which deals with the market structure and conduct.

3. MARKET STRUCTURE AND CONDUCT

Now that the technical aspects of the functioning of roaming services have become clear, the market aspects have to be described. This analysis will not only include the various actors that are present on the market, the structure of the market but also the way in which the actors on the market behave in their activities; the market conduct. The Structure and Conduct model, based on Kay and Vickers (1990) [KAY90], will be used. This will be done respectively in paragraphs 3.3 to 3.6

The purpose of this analysis is to be able to draw conclusions on how competitive the market really is case competition is limited, to find out which mechanisms play a part in this.

Based on the technical analysis made in the previous chapter, it is now possible to derive a working definition for international roaming services. The definition that will be used in this report consists of a combination of descriptions given by the EC [EC00] and by OFTEL [OFT02/1].

International roaming allows a mobile subscriber to use his mobile phone on (any) a foreign network, for both incoming and outgoing calls and services. This facility is supported by commercial roaming agreements between operators and/or service providers.

Box 2. Definition of International Mobile Roaming.

3.1 The Actors active on the Roaming Market

This paragraph will give an overview of the most important market parties that are involved in supplying IMR services. This description will be limited to the actors that are really needed in order to make the service work. Producers of mobile phones are left out on purpose because this party has no influence on the pricing/competition in the IMR sector.

3.1.1 Actors

A small number of different actors is involved in the pure offering of IMR. First a description of each of these actors will be given in order to be able to understand the function of the various actors in the network.

Roaming users

Mobile users are the actors that create the demand for retail IMR services. Three types of different users can be distinguished: Consumers using a post-paid subscription, consumers using a pre-paid subscription and corporate users with special negotiated rates. Together these users build the total demand that exists to roaming services and they are the target market for selling retail roaming services.

Mobile Network Operators

This is generally understood as a licensed Mobile Network Operator (MNO). This type of company has acquired a license (either a 900 MHz. or 1800 MHz. frequency) that allows the MNO to build and commercially exploit a Radio Access Network (RAN) that utilizes this frequency. The MNO usually manages the complete infrastructure, billing, marketing et cetera. Some tasks such as collecting billing files from roaming partners are usually outsourced to roaming brokers or clearing houses.

At this moment (April 2003) there are five well-known mobile operators in The Netherlands: KPN Mobile, Vodafone, T-Mobile, O2 and Orange. The diagram below shows the market shares of these operators on the markets for mobile domestic telephony.

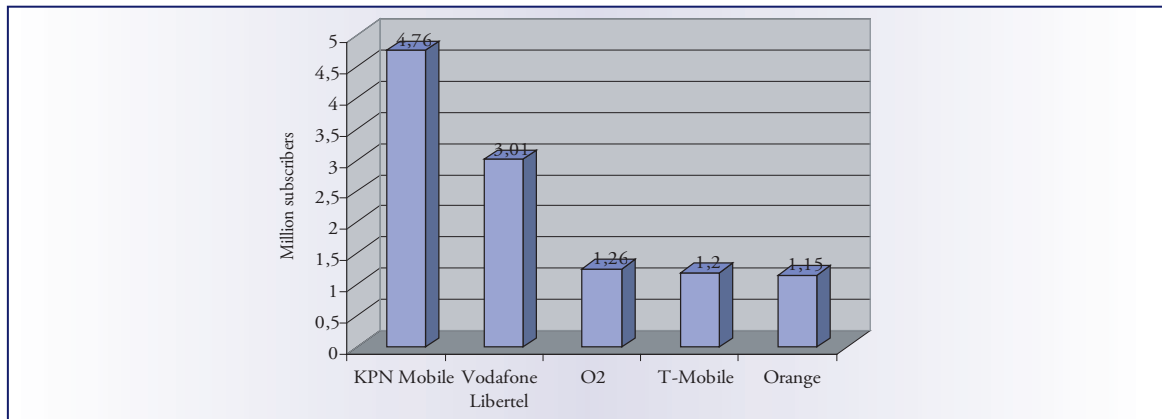


Figure 8. Location registration procedure whilst roaming.

The world of mobile telephony has undergone a rapid move to consolidation. Large international mergers have taken place with the result that none of the existing 5 operators active on the Dutch markets, operate only in The Netherlands. All operators (except O2/Telfort that left the mmO2 group [WEB03]) have become part of a larger conglomerate of operators. The European countries in which a group of operators is active can be seen in Table 1 below.

Operator Group	Countries of operations
Vodafone	Belgium, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, UK
Orange	Austria, Belgium, Denmark, France, Italy, Netherlands, Portugal, Switzerland, UK
T-Mobile	Austria, Germany, Netherlands, UK
O2	Germany, Ireland, UK
KPN	Belgium, Germany, Netherlands,
TeliaSonera	Denmark, Finland, Norway, Sweden

Table 1. Operator groups in Europe. Source: OVUM 2003 [OVU03].

Looking at mobile telephony on a European level, it is of an interest to consider the market shares of the respective groups of operators. Two large operators are not part of an operator group: the Italian MNO TIM (Telecom Italia Mobile) and the Spanish MNO Telefónica.

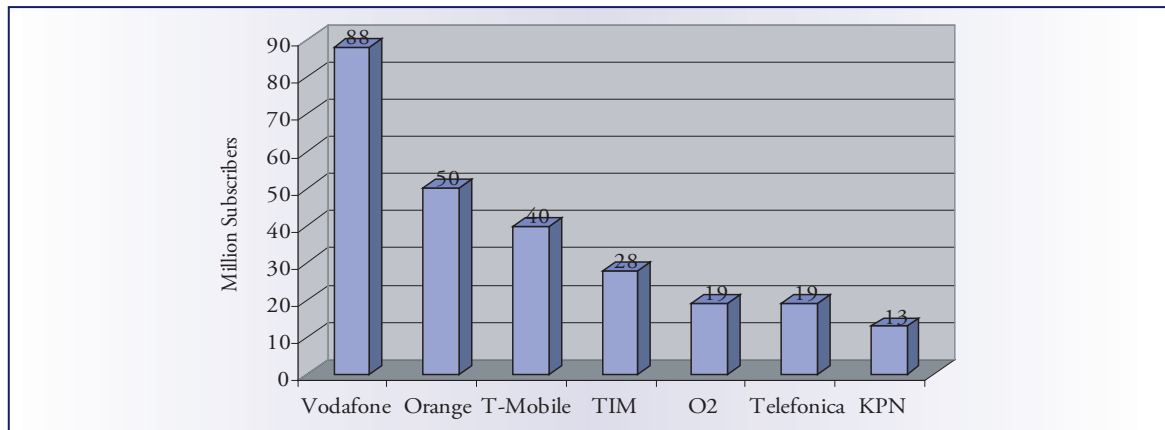


Figure 11. Subscribers of European operator groups. Source: OVUM 2003 [OVU03].

Licensed MNOs engage in roaming agreements with foreign MNOs in order to allow their customers to use mobile services when they are abroad. The roaming agreements will be discussed in greater detail in paragraph 3.4.3

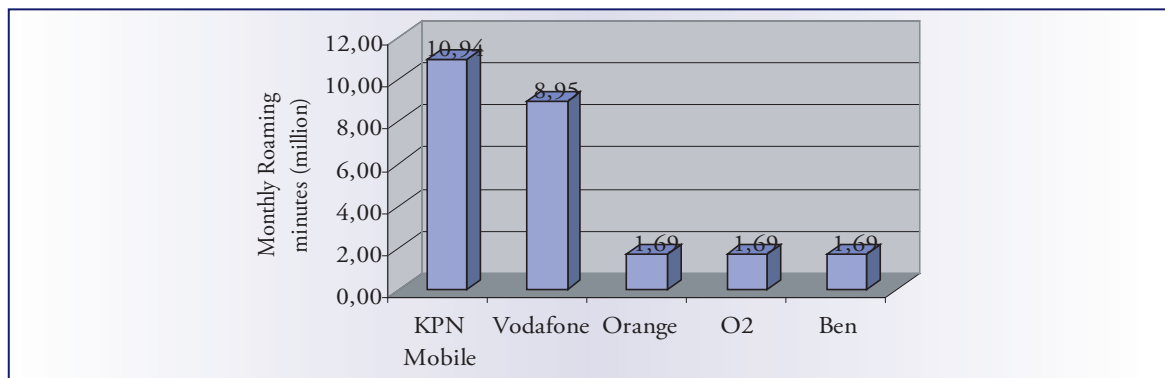


Figure 12. Approximated roaming retail minutes (million), 2002.⁶

Service Providers

Service providers are either completely independent from an MNO or are so-called “tied” service provider. A service provider sells services to its subscribers but it does not own a complete network infrastructure. It is reselling the services of the MNO, sometimes adding their own features such as a different way of billing. An independent service provider can buy services from various MNOs and resell these to its customers, whereas a tied service provider is always bound to one specific MNO. Debitel for instance, is the largest independent service provider in The Netherlands with approximately 1.4 million subscribers [DEB03]. Debitel is a daughter of the Debitel Group with branches in Germany, France, Denmark and Slovenia. It resells access to the networks of KPN Mobile, Vodafone and O2. Debitel provides its own SIM-card s and in addition has its own tariffs.

In the Dutch market for mobile service providers consolidation happened at the end of 2001 when Debitel acquired the other Dutch service provider active at that moment; Talkline [MCN03]. Another company that could be seen as a service provider is the Dutch supermarket chain Albert Heijn. Albert Heijn offers prepaid mobile telephony to its customers. For this it buys access to the network of KPN. Albert Heijn had approximately 50.000 subscribers [AH03] in March 2003. Albert Heijn provides its own SIM-card s but uses the retail tariffs of the KPN network.

In the field of retail roaming services, the service provider often simply resells the offers of the MNO in respect to tariffs and services.

⁶ Approximated based on roaming minutes in the UK per month: 95,3 million [OFT03/1]. Corrected for The Netherlands using number of callers (48 versus 12 million). The two largest Dutch retail operators have a roaming market share of 79% [EC02/1]. KPN is likely to still have the largest part of this (assumed 55% versus 45% for Vodafone).

Mobile Virtual Network Operator

The Mobile Virtual Network Operator (MVNO) is in theory a service provider only with the addition that the MVNO owns more parts of the mobile network. An MVNO has its own physical part of the network, usually a switching centre and its own Home Location Register (HLR). Furthermore it often issues its own SIM-cards with its own unique Mobile Network Code (MNC). The MVNO could own every part of the network except for the Radio Access part. In this way the MVNO is able to have more control over the user and is therefore able to offer more services than a service provider. It can route the calls of their subscribers in a different way than the MNO would.

An example of an MVNO in The Netherlands is Tele2. Tele2 partly uses the network of O2, but does issue its own SIM-cards. This allows them to interconnect with other operators and offer tariffs different than the ones of O2. Tele2 has approximately 200.00 customers in the Netherlands [TEL203].

Defining the difference between an MVNO and a service provider is difficult to give. The standard difference is that a service provider is seen as an extension to the MNO offering mainly the same services as the MNO using the MNO's total network. The MVNO is a mobile operator that does not own any spectrum bands, but who uses the Radio Access Network (RAN) of the MNO to offer its own services. These services can be completely different from the MNO's services, at different tariffs et cetera. The MVNO could for example offer a unified messaging service that the top-level MNO does not offer. To have control over its own users and to be able to offer Value Added Services (VAS)⁷ different from the MNO, the MVNO usually manages his own network databases and switching centres.

Roaming Brokers & Data Clearing Houses

Roaming brokers and clearing houses are companies that facilitate the interconnection of MNOs for roaming services and that handle financial aspects of roaming. There are a number of large roaming brokers or roaming clearing houses active in Europe:

- Comfone AG, based in Switzerland (Dutch clients are: KPN Mobile, Vodafone The Netherlands and O2 The Netherlands);
- EDS GmbH, based in Germany (Orange The Netherlands and T-Mobile The Netherlands);
- MACH, based in Luxembourg.

In general these companies supply services such as the interconnection with roaming partners, the management of roaming contracts, the reporting on the roaming services (e.g. statistics), data clearing services and financial services (e.g. invoicing to roaming partners).

Comfone AG has more than 100 operators connected to its roaming platform which makes up for more than 10.000 roaming connections. EDS provides the data clearing for roaming, with over 60 operators making use of the services, EDS handles 700 million roaming transactions per month which is 40% of the total worldwide roaming traffic. As of February 2003, Comfone and EDS have joined their forces by entering into a strategic partnership [COM03/1].

To illustrate the types of services that a roaming broker/clearing house offers, an exemplary scenario is given. Assume that a new MNO wants to offer retail roaming services in Europe. In order to quickly have roaming agreements with many European operators, the MNO could connect to an International Roaming Platform (IPR) of one of the roaming brokers, e.g. Comfone. Other (existing) MNOs have connections to the IPR already, and as a result the new MNO is able to offer roaming services on all these foreign networks connected to the IPR [COM03/2]. Only one signalling connection to the IPR is needed in order to offer roaming services on all foreign networks. Except for the connection part of roaming, the companies mentioned above all offer data and financial clearing services

⁷ A Value Added Service is for instance a voice-mail service, or unified messaging service.

The GSM Association

In telecommunications standards are very important. The functioning of the network and roaming between networks would not have been possible without a good specification of the interfaces of the GSM network and well-defined standards. The GSM Association (GSMA) is the industry body that fosters and oversees the development of GSM standards required by the industry itself. The GSM Memorandum of Understanding (GSM MoU) was signed by a number of European public telecommunications operators in 1987. “It covered areas such as time-scales for procurement and the deployment of the system, compatibility of numbering and routing, the harmonisation of tariffs principles and accounting procedure” [MOU92]. The members had regular plenary meetings, more members joined and this grew out to become the GSM (MoU) Association.

Companies that can become a full member of the GSMA are MNOs of the second and third generation (GSM, GPRS, EDGE, 3GSM). Some other examples of members of the GSMA are: Billing Systems Suppliers, Data Clearing Houses, Financial Clearing Houses, GRX Carrier (GPRS Roaming eXchange), Infrastructure Suppliers, Mobile Terminal Suppliers, Roaming Brokers, SIM-card Suppliers and Signalling Providers.

All MNOs that conclude roaming agreements have to be a member of the GSMA. The GSMA is very active in the field of IMR. Since this subject is of great importance to their members, the GSMA has an International Roaming Expert Group (IREG). “IREG’s responsibilities include determining interconnection issues, numbering and addressing concerns and the tests needed between operators to ensure a first class service for customers” [GSMA03/2]. The working group IREG is responsible for the technical issues that members bring forward. The second working group, the Billing, Accounting and Roaming Group (BARG) “is concerned with the billing relationship between GSM operators. The principles established by BARG are incorporated into the roaming agreements that exist between operators” [GSMA03/3].

The GSMA acts in accordance to the wishes of its member. This means that the GSMA is on the lookout for new standards that could be beneficial to the commercial success of the GSM-standard. BARG, more specifically looks for billing principles that are beneficial to its members. “It should be stressed that neither group has anything to do with the manner in which operators charge their customers – that is the business of the companies concerned”. However, billing principles and standards that would be not beneficial to the sector are logically not introduced by the GSMA.

3.1.2 Conclusion

It has become clear that there are a number of actors important for IMR services. First of all the users themselves who increasingly use their phones abroad.

Secondly the MNOs who are the real providers of the service. For Dutch customers there is a wide choice of 5 MNOs for subscriptions that include roaming services. KPN Mobile and Vodafone have the largest client base in Holland and all operators except O2/Telfort are part of a larger conglomerate.

A third party, the roaming broker or financial/data clearing house usually takes part in offering the service. This company facilitates roaming by connecting the various operators via an IRP and by handling many of the billing aspects of IMR.

The fourth actor that is of importance for roaming is The GSM Association. The GSMA is trying to make an even bigger success of GSM and other mobile standards by organising conferences for its members. Furthermore it has created the institutional framework within which the parties function for international roaming. Companies wanting to offer these roaming services have to be a full member of the GSMA.

Having introduced the commercial actors that are active on the market, a start is made with the description of the structural layout and relations that exist in offering roaming services. This will be done by giving an overview of the relevant market(s) related to IMR services.

3.2 The Relevant Market

Before the structure of the roaming market(s) and the way in which the actors on these markets behave is described, it is first useful to state which markets exist in the field of IMR.

The European Commission (EC) notes that describing the product/service markets is not a goal in itself, but is needed to assess in a consistent way whether or not there is effective competition on a certain market. In order to do this, a consistent definition of the relevant market is needed. The purpose of this section is not to consider whether or not this definition is correct, but it will function as an introduction to the framework within which the EC looks at competition.

Tirole [TIR02] mentions that defining a relevant market is difficult and that “there is no simple recipe for defining a market, as is demonstrated by the many debates among economists and antitrust practitioners about the degree of monopoly power in specific industries”. The description below gives an overview of how the EC defines the relevant market related to IMR services. The first step in the process of a market analysis as is done by the EC consists of:

- A relevant product market on which the level of competition can be rated
- A relevant geographical market

Both the relevant products and geographical markets related to IMR have already been defined by the European Commission. The section that follows below is a quick overview of the considerations of the Commission to arrive at the relevant markets as currently defined. Considerations of the Commission are based on European case law as well [EC00/2].

In the electronic communications sector there are at least two main types of relevant markets to consider; that of services of facilities provided to end-users (retail markets) and that of access to facilities necessary to provide such services provided to operators (wholesale markets) [EC97].

The analysis as done by the EC has resulted in the following, generally accepted, relevant market for IMR:

- The national market for provision of wholesale international mobile roaming to foreign mobile network operators.

Box 3. Analysis of the Relevant Market.

The analysis as it was done by the European Commission [EC02/2] [OFT02/1] will be described below. The subjects of the retail and wholesale product market will be described and afterwards the geographic market will be mentioned.

3.2.1 The Wholesale Product Market

The wholesale market is the market on which MNOs buy access and capacity (airtime) to each other's network in order for their clients to be able to roam onto the foreign network.

To determine a relevant product market, the most important aspect is to look at substitutes that exist on the demand side and the supply side.

On the demand side (from the point of view of a foreign MNO buying roaming services in The Netherlands), each operator is a substitute for every other operator on the wholesale market. This implies that it is not appropriate to define the product market as operator specific, but that the market should be defined including all MNOs in a particular country.

From the demand side, wholesale international roaming cannot be substituted by any other form of access. For example domestic wholesale mobile services that are offered to service providers are not a substitute for wholesale international roaming because such service would not include recognising the foreign subscriber on the network. A foreign operator cannot enter into a wholesale airtime agreement with a domestic service provider because that would require the subscribers to use a new SIM-card and number. The same reasoning applies to access to fixed networks abroad. Access to these wholesale services is not able to deliver the mobility and the same accessibility (e.g. the same mobile number).

On the supply side, wholesale access (e.g. to a domestic fixed network) would not be an effective supply substitute because this service cannot provide features of accessibility and mobility. Furthermore, supply side substitutability is impossible in practice because all operators that supply domestic mobile call conveyance and access are already supplying roaming services. All possible supply side substitutes are not able to deliver the most important features of IMR such as mobility, coverage and the use of the same subscriber's number whilst being abroad.

Moreover, other companies such as service providers or MVNO are not able to switch into offering wholesale IMR services because MNO only supply wholesale roaming to other licensed MNOs.

These arguments result in the fact that the market is defined as the supply of wholesale IMR services. More detailed explanations of the wholesale market will follow later in this chapter.

3.2.2 The Retail Product Market

On the demand side there appears to be limited substitution for an end-user demanding roaming services; roaming calls are significantly different from other voice calls. If a hypothetical monopoly supplier of retail roaming services raised its price above the competitive level, subscribers would not consider other outgoing mobile services as suitable substitutes, and would therefore pay the higher price. Other means to receive and make calls, e.g. a foreign calling card or using more than one SIM-card, are not considered to be substitutes because of the loss of mobility or accessibility in terms of the same mobile number.

On the supply side it would be possible that a supplier of domestic mobile calls could switch to offering roaming services. However, since all domestic operators already offer roaming services, supply side substitutability is impossible in practice.

Furthermore it is needed to investigate if domestic mobile services are a substitute for roaming. This type of substitution can be effective. However it may require the unlocking of the mobile phone. Secondly, it gives the requirement of having to buy a new SIM-card when being abroad.

The EC then draws the conclusion that as a result of the arguments above, the retail market for IMR services forms part of the wider retail market of outgoing mobile services.

3.2.3 The Geographic Market

MNOs wanting to acquire wholesale roaming services to The Netherlands, cannot procure these roaming services from any other country because roaming in another country is not a substitute. As was already described above, there are no substitutes on the supply side. Therefore, it is certain that the geographic market for wholesale IMR services is national.

The geographic market for retail services is national at this moment; domestic MNOs are the main source of international roaming services. Users cannot buy roaming services from MNOs abroad, and MNOs abroad are not able to switch to offering roaming services abroad. In the future, this market might have a different character. As more pan-European services are offered, the market may change into a European market for retail services.

3.2.4 Conclusion

As a result of this analysis, the national market for provision of wholesale roaming to foreign mobile network operators has been defined as the relevant market. The retail market for roaming services is considered as part of a larger retail market for outgoing mobile calls. Now that the relevant market for international wholesale roaming services has been defined, it is possible to describe the conduct on this market as well as on the retail market. This will be done in the following paragraphs.

A side note should be made about the retail market as it is defined by the EC. It is questionable why roaming services would be only part of a larger market for outgoing mobile calls. An important feature of roaming is the possibility to receive calls when being abroad. Normally, in telecommunications services, outgoing calls are the only type of calls that is charged. Contrary when roaming abroad, incoming calls are charged as well. This gives rise to the possibility of defining a separate retail roaming market.

3.3 Introduction to Wholesale and Retail Roaming

As was already mentioned above, there are two levels on which the functioning of the roaming market can be described. The distinction between these two levels will prove to be very important throughout this report: the wholesale roaming market and the retail roaming market. This paragraph will serve as a general introduction to the description of the wholesale and retail conduct on these two markets in respectively paragraph 3.4 and 3.5.

3.3.1 Wholesale roaming

The most obvious part of the roaming services is the relationship between an MNO and a customer (corporate or consumer). However, the relationship between an MNO and another foreign MNO forms a very important part of IMR services. This type of service could be called the business-to-business or wholesale market. The construction of companies selling products to each other is very common and can be seen in almost any sector, be it in the trade sector or in the services industry.

In order for a customer of a specific MNO in The Netherlands to be able to roam onto a specific network in Germany, the Dutch MNO needs to have a roaming agreement with the German operator. Most of the time these agreements are mutual; the agreements work reciprocally. The MNOs buy wholesale roaming services from each other which means that it will also be possible for the German customers to use the Dutch mobile network.

Since MNOs want to offer a roaming service which is as good as possible, they conclude roaming agreements with many foreign MNOs. In theory this could be limited to only one MNO in every country but in order to guarantee coverage and service whilst roaming, MNOs tend to enter into roaming agreements with on average 3 foreign operators per country [GSMA03/4].

In these roaming contracts, the operators agree on which type of services will be offered and at which price. Services offered can be only voice services but also additional services such as fax or Short Message Services (SMS). Other, more intelligent VAS such as Calling Line Identification (CLI) or Short codes for voicemail (e.g. 333 for voicemail) whilst roaming are also offered on a regular basis. New roamed data services are becoming more important, this will be treated later on in chapter 4.

The members of the GSM Association have all adopted a framework for IMR. This framework logically consists of the GSM Memorandum of Understanding (GSM MoU), the Standard International Roaming Agreement (STIRA)⁸ and billing principles. This framework limits wholesale roaming agreements to be only concluded between operators who are licensed and who are a member of the GSM Association.

The STIRA is a standard type of contract between operators, a contract based on which individual operators will have to act when concluding roaming (mutual) agreements. This type of contract has strong consequences for the way in which roaming services are being priced. This will be considered in detail in the paragraph on the STIRA.

Instead of needing to have a separate roaming agreement with every other MNO with which roaming is required, it is also possible to obtain an indirect roaming agreement through a roaming broker. Except for reselling roaming services (access), the roaming broker also supplies signalling connections and access to billing services. By buying this type of services from a roaming broker, an MNO can obtain roaming services from many different foreign MNOs without the need to conclude and manage these contracts himself. The MNOs make use of the services of a roaming broker to take advantage of economies of scale.

⁸ The GSM Association notified the STIRA in 1996.

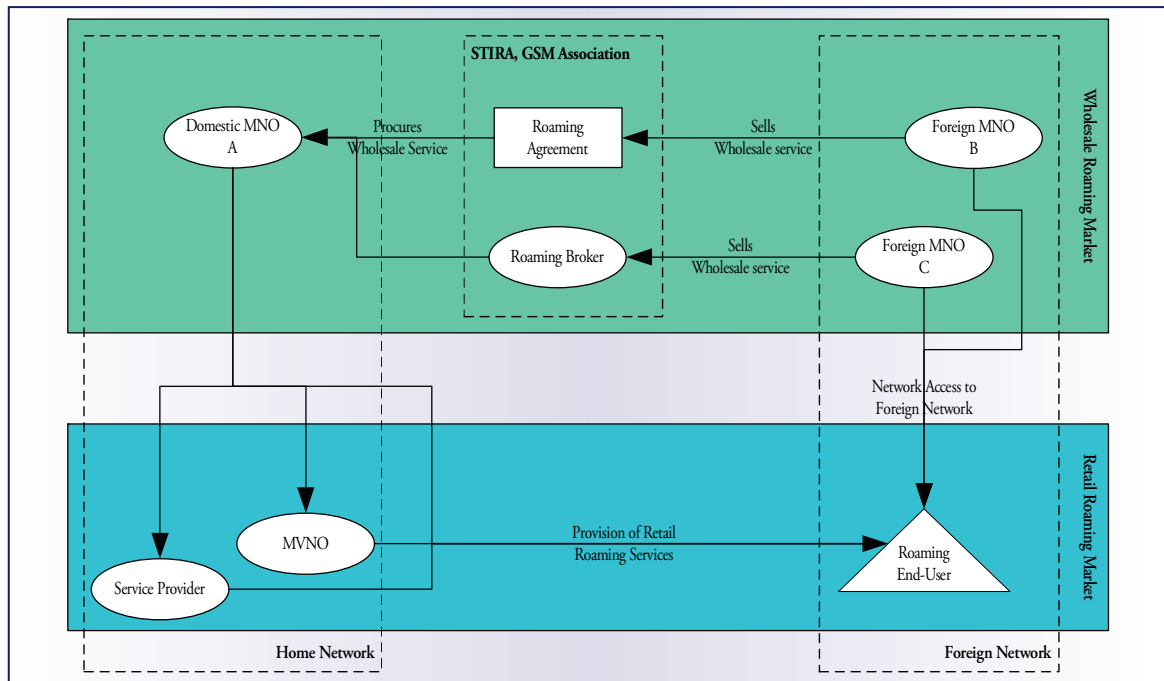


Figure 13. Wholesale and retail roaming markets.

The diagram above shows in which way IMR services are offered to the end-user that is located in a foreign network. Two MNOs, the domestic and the foreign MNO, have agreed on providing wholesale roaming services. As was discussed earlier, this is usually agreed on reciprocally; the reason for this is that a roaming agreement generates inbound/incoming revenues of foreign customers making calls whilst roaming. A demonstration of the commercial aspects is given further in this chapter.

A typical roaming agreement could have been realised based on individual negotiations between the two MNOs, or through the services offered by a roaming broker. All roaming agreements are concluded within the standard framework offered for roaming offered by the GSMA. This means that roaming brokers are also bound by this framework, the roaming brokers are all a member of the GSMA. Furthermore, the fact that roaming brokers and clearing houses act in accordance to the GSMA framework simplifies matters such as exchanging billing information because all billing files are constructed according to the same rules (set by BARG, GSMA).

As is also shown in the diagram above, since MNO A has roaming agreements with two foreign MNOs, the end-user will be able to roam onto the networks of both the foreign networks. Furthermore, if the roaming user would be customer of the service provider or of the MVNO, he would also have access to these networks because the MVNO or service provider indirectly has a roaming agreement with the visited MNO. The diagram above demonstrates that the foreign national wholesale market forms the input to the national (domestic) retail roaming market.

3.3.2 Retail Roaming

In chapter one it was shown that the tariffs users have to pay for roaming services have not changed much in the past periods. The roaming services that an MNO offers to end-users are called retail roaming services. This is the type of services that users have to do with in every day life when roaming abroad, among these services are making and receiving calls abroad, short messages, voice mails et cetera. It is important to note that in the retail market, the end-users are the customers.

3.4 Conduct on the Wholesale Roaming Market

After the introduction to the difference between a wholesale and retail market, it is possible to look deeper into the conduct on these markets. This section goes into the various aspects of the wholesale roaming market. The goal is to make clear how the wholesale roaming market works and which impediments to effective competition can be deduced from this conduct.

3.4.1 Commercial Conduct and Profit Margins

Figure 13 shows that the wholesale markets influence the retail markets when it comes to concluding agreements. If the foreign wholesale market is needed in order to make international roaming possible, it is logical that the prices on the foreign wholesale market also influence the national retail prices.

The difference in price between the wholesale and the retail market makes the retail profit margin of an individual operator. Again, this is comparable to any other sector. Profits are being made in other sectors of trade in exactly the same way. The entity that procures a good (wholesale), charges a profit margin to the end-customers and in this respect the roaming market shows similarities to normal trading.

In Figure 13 MNO A procures roaming services from MNO B. Because the user that belongs to network A, roams onto the network of B and because it therefore uses network resources of the foreign network, the foreign network (MNO B) charges the home network (MNO A) with a so called wholesale roaming charge. The GSM Association calls this type of charge an Inter Operator Tariff (IOT) and is formally defined as “a tariff between mobile operators, charged by the visited network operator to the home network operator for the use of the visited network” [STU02].

Naturally there are again two possible scenarios that might take place; a mobile originated call and a mobile terminated call. The way in which the IOTs are charged, as well as how prices are being set for both these cases, is discussed below.

Mobile Originated Roaming Calls

The case is considered where a customer of MNO A roams onto the network of MNO B and makes a call to a fixed user in his home country A. This type of call accounts for the majority of calls made whilst roaming [EE01]. The way in which the call will be routed is as follows:

The MNO B hands over the call to the domestic fixed network operator, e.g. fixed operator B1. This fixed operator in the visited country, routes the call to a fixed operator in the home country of the user, e.g. fixed operator A1. This fixed operator terminates the call onto the network of MNO A. The pure routing of the call however, does not set the retail price of the roamed mobile originated call. The way in which the operators charge each other is as follows: The fixed network operator B1 charges MNO B because it has to transit the call that originally belonged to MNO B. Because fixed network operator A1 charges fixed operator B1 for terminating the call onto its network, fixed operator B1 recovers this cost on MNO B. The call is now located in the fixed network in the home country. MNO A1 terminates this call on the network of MNO A.

The exchange of charges between the operators involved in handling the call from the roaming user is shown in Figure 14 below, for the case when services of a roaming broker are not being used (e.g. for financial clearing).

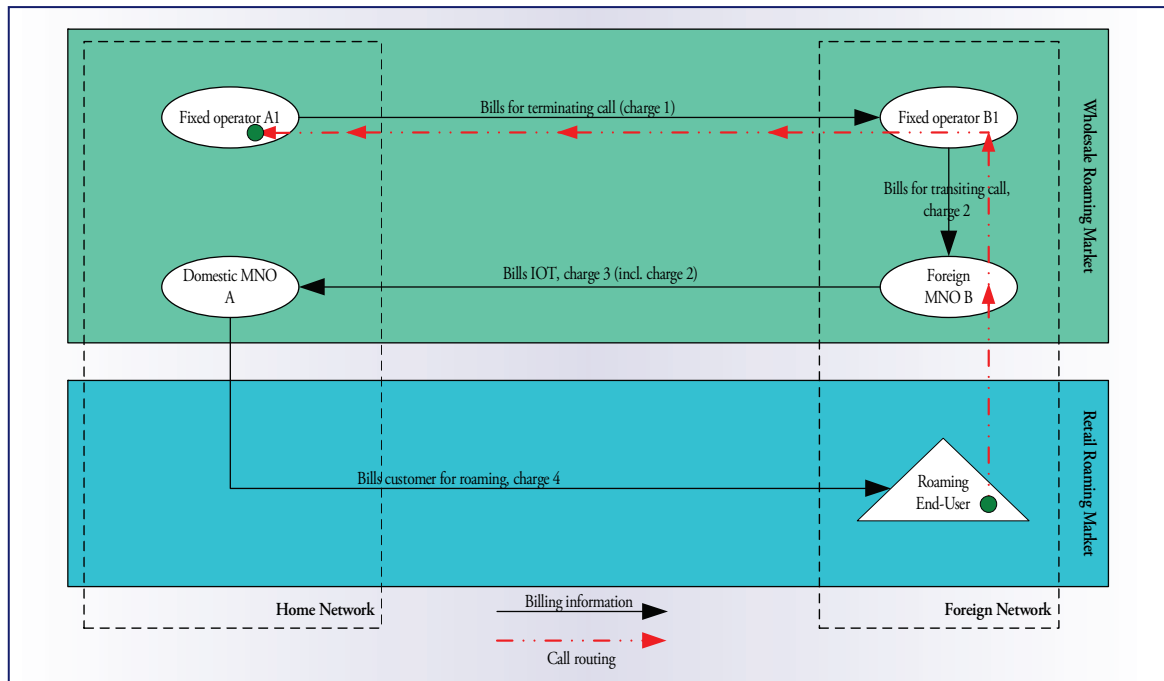


Figure 14. Inter Operator Charging for a mobile originated roamed call.

As can be seen in Figure 14, the roaming user is charged for all costs that are related to his call (charges 1,2,3 and 4). Exact details about the height and structuring of these costs are confidential to the operators. However, more insights into the matter are possible.

If the retail price is taken as a starting point, the retail price is constructed in the following way. The visited MNO, in the case above MNO B, sets a certain IOT (charge B1) and charges this to the home operator. The home MNO A generally adds a retail mark-up in the range of 15% to 35% to this IOT [EC00]. This mark-up can be considered to be almost pure profit because there are few costs that could really be attributed to the home MNO for handling a roamed call except for receiving billing information from the foreign operator or a clearinghouse. Furthermore, the foreign MNO B charges the IOT which includes a very healthy profit margin. Of course, it could be possible that the foreign MNO sets this IOT at the level of the marginal cost, however this appears highly unlikely when looking at comparable international tariffs (see chapter 1).

Tirole [TIR02: p.66] mentions a more economic term for the relative mark-up, namely the Lerner index. The Lerner index is the “ratio between the profit margin and the price” and can be constructed based on the prices for non-roaming calls in the way as is explained in Appendix 3, Lerner Index for MO Roamed Calls. The conclusion of this analysis of Appendix 3 is stated in Box 4 below.

The visited (foreign) MNO makes an estimated wholesale profit margin of 75% on mobile originated calls to the home country of foreign users roaming on its network. A general retail price is around €0,80 excl. VAT, a more reasonable price would be between €0,20 and €0,30 excl. VAT.

Box 4. Wholesale Margin on MO roamed Calls.

Mobile Terminated Roaming Calls

The second scenario is the situation in which the user is being called whilst roaming. In this case the user pays as well; the Receiving Party Pays (RPP).

If a fixed user in the home country (connected to fixed network A1) calls the roaming user, the call is routed through fixed operator B1 in the visited country. Fixed operator B1 in its turn terminates the call onto the mobile network of MNO B. The stream of charges resulting from this call is as follows:

As always, the operator onto whose network the call is being terminated, charges a terminating fee to the operator that is terminating the call. In this case, MNO B charges fixed operator B1 for terminating (charge 1). Fixed operator B1 again bills the fixed home operator A1 for transiting the call onto its network (charge 2). Fixed operator A1 recovers this cost on MNO A (charge 3) and the domestic MNO bills the end-user (charge 4). This is shown in Figure 15.

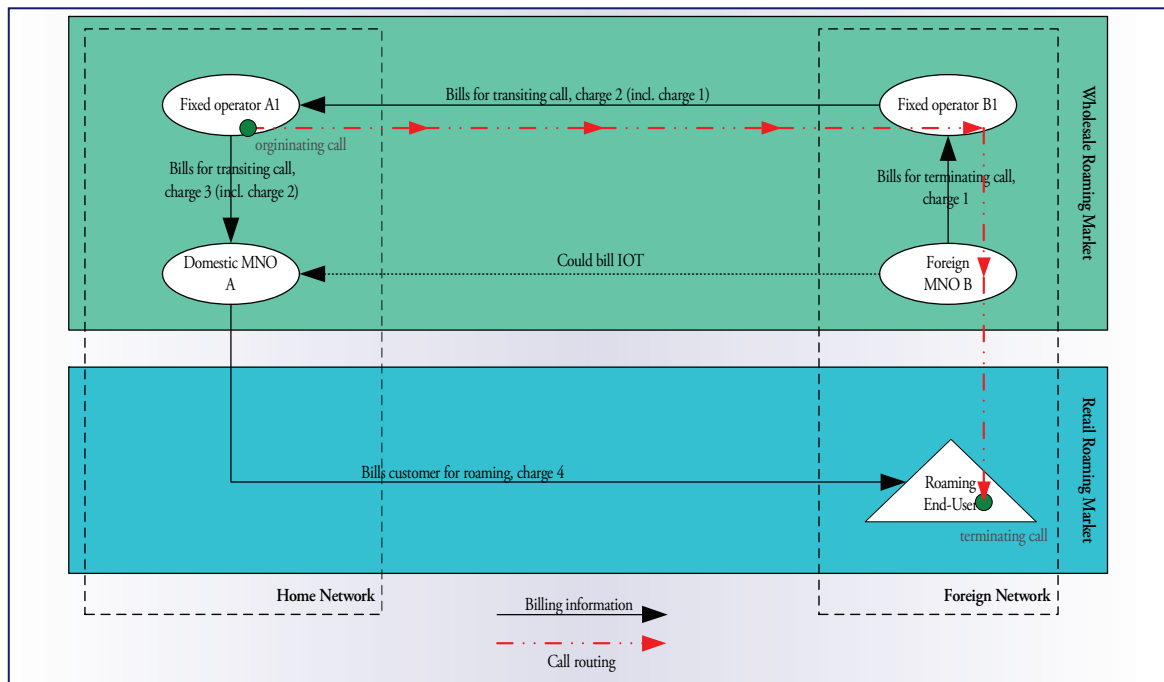


Figure 15. Inter Operator Charging for a mobile terminated roamed call.

The visited MNO B for the moment does not charge an IOT to home operator MNO A. This is mentioned in the research of Stumpf, [STU02]. The foreign MNO B however, is able to charge this IOT under the current framework of the GSMA. The billing with TAP3 (see chapter 2) makes this possible. As can be seen in Figure 15, charge 1 is exactly the same charge as a fixed-to-mobile terminating tariff (Mobile Terminating Access, MTA). These MTA tariffs have been under investigation by European NRAs and trying to be regulated by for instance OFTEL and OPTA. It seems to be logical that once MTA tariffs come down, tariffs for mobile terminated roamed calls (receiving a whilst roaming) will come down as well. Appendix 4 gives an estimate for the margin that the home MNO charges when billing the end-customer.

The home (domestic) MNO makes an estimated retail margin of 49% on calls terminating on a foreign network in which the home MNOs outgoing roamers are present.

Box 5. Margin on MT roamed Calls.

According to the Dutch branch of operator T-Mobile, T-Mobile has been using only one IOT and this IOT has been at the same price level for the last two years. This is in line with the arguments made above and would mean that an operator uses an IOT only in the case of a mobile originated call and not in the event of a mobile terminated call.

The home MNO makes the biggest profits on a mobile terminated call whilst roaming, and the visited MNO makes the biggest (wholesale) profits on mobile originated calls whilst roaming. This again makes clear why operators want to attract as much inbound roamers as possible on their networks, for example by putting up billboards at Schiphol Airport.

3.4.2 Wholesale Substitutes

The introduction to this chapter was the description of the relevant market: The national market for provision of wholesale IMR to foreign mobile network operators. In this definition of the relevant market, the various substitutes at both the demand and supply side were examined. This leads to the conclusion that there are few substitutes on the wholesale market.

From the demand side, wholesale international roaming cannot be substituted by any other form of access. For example domestic wholesale mobile services that are offered to service providers are not a substitute for wholesale international roaming because such service would not include recognising the foreign subscriber on the network. A foreign operator cannot enter into a wholesale airtime agreement with a domestic service provider because that would require the subscribers to use a new SIM-card and number.

The same reasoning applies to access to fixed networks abroad. Access to these wholesale services is not able to deliver the mobility and the same accessibility (e.g. the same mobile number).

On the supply side, wholesale access (e.g. to a domestic fixed network) would not be an effective supply substitute because this service cannot provide features of accessibility and mobility. Furthermore, supply side substitutability is impossible in practice because all operators that supply domestic mobile call conveyance and access are already supplying roaming services. All possible supply side substitutes are not able to deliver the most important features of IMR such as mobility, coverage and the use of the same subscriber's number whilst being abroad.

Over more, other companies such as service providers or MVNO are not able to switch into offering wholesale IMR services because MNO only supply wholesale roaming to other licensed MNOs (see the section "High barriers to Entry in the Wholesale Market" below).

A lack of substitutes can be seen as an impediment to competition in the wholesale market. If more wholesale substitutes would be available, foreign MNOs could use these to bypass the wholesale services offered by the MNOs.

Box 6. Lack of Wholesale Substitutes as Impediment.

3.4.3 Transparency of the Wholesale Market

This section looks into the level of the transparency of wholesale pricing. Insight into this subject can be gained by looking at the institutional framework within which IMR is realized.

The GSMA is the industry body that fosters and oversees the development of GSM standards required by the industry itself. The GSMA is very active in the field of IMR since roaming accounts for a large percentage of the revenues of its members. The GSMA has two working groups that are actively involved in aspects of international roaming such as billing and accounting principles and technical tests.

As was mentioned above, the GSMA has created a Standard International Roaming Agreement (STIRA) to standardise the roaming agreements between operators and to facilitate the process of concluding these agreements. This STIRA affects competition in mobile roaming. In order to be able to draw conclusions on the level of transparency of the wholesale market, the contents of the STIRA first have to be introduced.

Contents of the STIRA

The STIRA is being used by all operators and has been declared an internal standard. The STIRA is a classified document, however the following is known about it:

- Operators are in no way obliged to enter into a roaming agreement. These agreements are formed by means of free negotiations.
- Roaming agreements are usually made reciprocal in terms of access. Meaning that if customers of MNO A are allowed to roam onto the network of MNO B, customers of MNO B will be allowed to roam onto the network of MNO A as well. Prices discussed in the roaming agreement are however usually not applicable two-way.
- The STIRA arranges matters such as the access to special services (e.g. the use of short-codes for voicemail whilst roaming), liability issues and confidentiality.
- An IOT is valid for at least 6 months and changes should be announced to other operators 60 days in advance. This is done by means of the GSMA's Infocentre Website where all IOTs are published. Changes in IOTs can be monitored very easily.
- An IOT is priced in a so called Special Drawing Right (SDR) [VODC03]. This SDR is a basket of the four large currencies (Euro, Dollar, Yen and the Pound) [IMF03]. This SDR is converted into the local currency of the home operator when billing the customer.
- The same IOT is valid for all foreign operators wanting to conclude a roaming contract with the home operator.
- The STIRA does not speak about possible discounts on IOTs. This should be arranged separately by operators in an Annex to the contract.
- It does not allow for roaming agreements to be made between market parties other than the official GSM operators. Thus, a roaming agreement between an MVNO and a GSM operator is not allowed. The same applies to a roaming agreement between a service provider and a MVNO or GSM operator.

The wholesale market for roaming services seems to be very transparent. All operators are able to monitor very exactly the level of IOTs of foreign operators and charge the same IOT to all other operators (possibly except for discounts). Because changes to IOTs have to be announced 60 days in advance, the wholesale market becomes even more transparent.

The Standard International Roaming Agreement makes the wholesale market for roaming services very transparent. Monitoring of a possible change in IOT is very easy.

Box 7. Transparency due to STIRA as Wholesale Impediment.

3.4.4 Rigidity in the Wholesale Market

Because retail prices seem to have changed very little over time, it can be argued that the wholesale market (which is the input for the retail market) is not very dynamic either. This rigidity is stimulated by the institutional framework set out by the STIRA. Besides consequences for transparency in the wholesale market, the STIRA has further ramifications for rigidity and as a result for competition in the wholesale market.

As was shown above, an IOT is valid for 6 months at least and any change should be announced 60 days in advance. The probable reason why the GSMA incorporated this into its framework is that with hundreds of operators around the world, any change in IOT should be announced to all operators. Furthermore, all these operators should have time to change their retail roaming tariffs as a result of the change in IOT.

However, this does not lead to a dynamic market in which changes of IOTs are likely to be frequent. All operators have precise knowledge about IOTs of their competitors and over more each operator has about two months' time to think of the best strategy to change (or not change) its IOT. This takes away the incentive to do "spontaneous" actions in order to compete more strongly on IMR and therefore leads to a more undynamic market with less competition.

The Standard International Roaming Agreement makes the wholesale market for roaming services very rigid / undynamic because of the long timeframe within which changes to wholesale prices have to be announced.

Box 8. STIRA as Wholesale Impediment.

3.4.5 High barriers to Entry in the Wholesale Market

The wholesale market seems to feature high barriers to entry in the way that it is very difficult to enter the market as a wholesaler of IMR services. There are two options for entry into the market: either to be a full MNO with a complete own network, or to be an MVNO that rents parts of the network of a full MNO.

The first option seems not feasible because spectrum is limited and the chance of new assignment of spectrum in the near future is very low.

The second option might seem promising, except for the fact that an MVNO is not allowed to conclude its own direct roaming agreements with other MNOs or MVNOs (determined by the GSMA framework). An MVNO is only allowed to use the roaming agreements of the higher level MNO. This discards the second option as well.

The fact that roaming contracts can only be effectuated between two licensed operators, limits the number of possibilities considerably. Two types of actors that were discussed above, the service provider and the MVNO, are not allowed to engage directly in roaming agreements. A service provider will use the roaming agreement of the MNO of which it resells the services.

The framework offered by the GSMA forecloses the market for wholesale roaming services. By accepting the framework, no other companies than MNOs are allowed to offer wholesale roaming services. In other words, by using this framework the market has closed itself for any full-scale competitors entering the market. The conclusion is justified that there are high barriers to entry.

High barriers to entry exist due to the structure of the wholesale market and due to the limitations in the STIRA.

Box 9. High Barriers to Entry as Wholesale Impediment.

3.4.6 Discounts on the Wholesale Market

Since IOTs do not only form the price for a service on the wholesale level, but are also the main input costs a home MNO has for supplying roaming services abroad, one would expect to see high frequencies of discounting in this sphere.

It is very attractive for operators to arrange discounts on the IOTs because this would directly lead to higher profits or to lower retail tariffs (in case the discounts are passed on to the customers). However, it seems not likely that high discounts are being given at this moment and in the past, looking at the differences in retail price levels of IMR services between operators.

Discounts might be interesting, but on the other hand it is not the MNO that carries the burden of high wholesale costs. These costs are fully passed on to the end-user and as long as the end-user is willing to pay this amount, or as long as the end-user has no other choice the MNOs will not go through great troubles to arrange discounts on IOTs.

Non-discriminatory Discounting

It should be noticed that the discounts that are applied to the IOTs should be valid for all operators that are able to guarantee the same amount of traffic or number of users. If MNO A is able to deliver x minutes of traffic onto the network of MNO B and gets for example a 3% discount for this, then MNO A is obliged to give the same discount to MNO C if it is able to deliver the same amount of traffic. This non-discrimination principle is determined by the GSMA. This makes it very difficult for operators to give discounts based on individual negotiations.

Discounts on the wholesale market have to be given in a non-discriminatory way to all operators able to generate the same amount of traffic on the foreign network. This limits individual negotiations and deals.

Box 10. Non-discrimination as a Wholesale Impediment.

Technical Impediment to Discounting

Discounting can only be done if the home operator has some kind of bargaining power towards the visited MNO. The bargaining power could consist of a customer base that is large enough to be interesting to the foreign network or a customer base that would generate a high Average Revenue Per User (ARPU). For instance, an operator such as T-Mobile in The Netherlands has a relatively small customer base (1.4 million [OPT02: p.34]) and has a high percentage of consumer callers who in general do not make many and/or lengthy calls abroad. This of course decreases the power of MNOs such as T-Mobile to negotiate on discounts with the foreign network.

Instead of needing to have a large customer base in one country, the MNO could be part of a large conglomerate of MNOs. In theory this could increase the possibilities to arrange discounts. It seems most likely that at this moment all MNO arrange discounts themselves because roaming agreements are operator specific as well. No evidence has been found on the existence of one roaming contract for a group of MNOs. This is why even though a Dutch operator is part of a larger conglomerate of operators, the operator negotiates discounts on IOTs by itself.

On the other hand, MNOs that do possess a large client base with a considerable amount of business callers (e.g. KPN Mobile), should be able to negotiate some discounts. This due to the fact that all foreign operators want to receive customers that have a high expenditure and therefore generate large amounts of revenue for the visited MNO.

As was said above, discounting is done based on e.g. the amount of airtime that an MNO is able to guarantee on the foreign network. However, since a standard mobile station selects the foreign network from the preferred PLMN list or any network if this network has a better quality, it is not guaranteed that the roaming user will register with the network that gives the highest discount. With a standard mobile station (handset and SIM-card) the chance is high that a roaming user will register with more than one network in the visited country. This means that all foreign networks with which the home MNO has roaming agreements will get a share of the traffic that this user generates. Because of the technical limitations in directing traffic to a specific network, it is difficult to negotiate discounts. This rather strange externality limits competition on the wholesale IMR markets.

Because of the technical limitation in directing traffic to a specific network, it is difficult to negotiate discounts and as a result wholesale competition is being hampered.

Box 11. Technical Impediment to Wholesale Competition.

According to T-Mobile, the question of being able to arrange discounts with a foreign MNO is also a matter of 'chemistry' between the two parties. If the people working for the two MNOs are not able to work well together on a commercial level or on the technical level (testing the roaming), reaching a roaming agreement will take longer or a discount may be lower.

According to the replies to inquiries of Dutch operators, discounting on IOTs is being used in the sector. But to which extent it is being used, and what the level of discounting is, remains unclear. Appendix 2 explains why it is not possible to give an estimation of the level of discounts used in the sector.

Although it would seem beneficial to the operators to use discounting on the wholesale level, the amount in which this is being used is unclear.

Box 12. Use of Wholesale Discounting unclear.

3.4.7 Coverage of Mobile Networks

Coverage of mobile networks is not always perfect; more than one network is needed to keep coverage for roaming users. This in turn limits the possibility to make exclusive roaming deals with foreign networks in order to accomplish a lower wholesale price. The difference in coverage between two German networks is shown in Figure 16 and Figure 17 below. Because a roaming user might move out of coverage of one network, roaming agreements with more than one roaming partner are now almost always concluded. This limited coverage of foreign networks could be seen as an impediment to competition on the wholesale market because exclusive roaming deals are not agreed on.



Figure 16. Coverage of Vodafone D2 GmbH in Germany. Source: [GSMA03/5].



Figure 17. Coverage of O2 GmbH & Co. OHG in Germany. Source: [GSM03/6].

However, the impediment of incomplete coverage appears not to have a very big impact anymore. Operators with less coverage might have a cheaper IOT but because their coverage is not complete, roaming agreements with other operators are still required. In general, the coverage of mobile networks has become better and better over the last years [CON03/1]. Using The Netherlands as an example, there are now 5 MNOs whose networks have nearly full coverage. In countries where the landscape has more hills or mountains, networks are reaching a higher degree of coverage as well.

This trend leads to the fact that by now it is possible in Member States to conclude roaming agreements with at least one MNO that has full coverage. The barrier to competition originating from limited coverage will continue to be resolved by the market itself. This is due to the fact that it is vital to an MNO that coverage is large enough to reach a high percentage of the inhabitants of the country. In turn this means that an operator is likely to extend its coverage by means of installing more BTSs or by planning effectively⁹. In some cases operators could resolve this issue by concluding national roaming agreements; making use of the network coverage of another national MNO.

To conclude, limited coverage of mobile networks cannot be seen as a (technical) impediment to more wholesale competition. The remaining question would be why operators still conclude contracts with more than one partner. The answer is fairly straightforward: the more (bilateral) roaming contracts an operators has, the more lucrative inbound roamers it will receive from its foreign partners.

⁹ Note that not only the domestic subscribers profit from this, but also the roaming subscribers that roam onto this network.

3.5 Conduct on the Retail Roaming Market

The previous section described the conduct on the wholesale market and the impediments to competition in the field of IMR that can be derived from this conduct. The goal of this paragraph is to accomplish exactly the same, however on the retail market for roaming. The goal is to make clear how the retail roaming market works and which impediments to effective competition exist.

3.5.1 Retail Demand and Elasticity

It can be made plausible that also in The Netherlands the demand that these users generate is increasing over the last year(s). Users have a bigger wish to use the roaming services whilst abroad. OFTEL has made an overview of the mobile market in Great Britain and when comparing the number of minutes that were being called whilst roaming (demand for roaming services). Figure 18 shows the traffic volumes of retail roaming traffic of British subscribers roaming abroad. For the last quarter of 2002 this showed an increase of 23,5% compared to the same period of 2002 (221 million minutes) [OFT03/1]. These numbers are probably not representative for Holland because Holland has less inhabitants than Great Britain, however the trend of growth in the two countries is likely to be comparable.

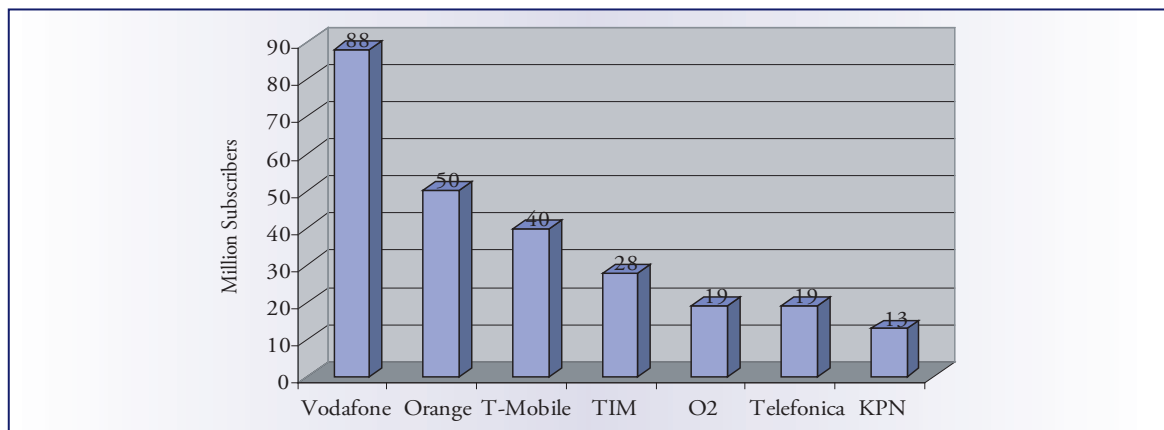


Figure 18. Retail roaming traffic volume (in million minutes) in Great Britain.
Source: OFTEL, Market Information, Mobile Update, 2002.

Because IMR is a service that people will use when travelling, it is likely that the more people travel, the more people will make use of roaming services. When looking at the number of intra-Europe travelling movements (e.g. by air passenger and road freight transport), this also shows quite a strong increase, especially when viewed over the last decade and for The Netherlands with one of the largest European hubs for air passengers and road transport. These developments are shown in Appendix 1. This shows that roaming services are becoming more and more important to users.

The demand for roaming services may be increasing but this does not mean that users have become more sensitive to the price of the services offered. Roaming services are offered in a package, a bundle of other services and cannot be bought separately. Since most end-users make domestic calls from their mobiles they have the highest interest in the price of their mobile handset, the price of a domestic call and the price of their subscription fee. The price level of international roaming services is not a driver for the demand of roaming customers. This means that demand can be considered to be very inelastic; an increase in the price does not beforehand mean a drop in the demand for roaming services. In other words, the user does not really find the level of roaming prices important when considering a new mobile subscription or when switching from operator. In its turn this low elasticity of demand is a disincentive for MNOs to start competing on retail roaming.

The fact that retail demand for IMR services can be considered to be very inelastic hinders an increase in competition considerably.

Box 13. Inelastic Retail Demand as Impediment.

3.5.2 Retail Substitutes

As was mentioned in the description of the relevant market, there are almost no real substitutes for retail roaming services. Domestic mobile services offered by the foreign MNO are not considered an effective substitute for both incoming and outgoing roaming services at this moment. It may require the unlocking of the mobile phone, it gives the requirement of having to buy a new SIM-card when being abroad and it results in having to use a different mobile number to receive calls.

The other substitute would be to use multiple SIM-cards at the same time. Because of the higher subscription costs, this type of substitution is only attractive to a limited target group such as frequent travellers. Over more, it is not possible to use the home mobile number abroad. This type of substitution can be effective, but probably in a limited fashion.

The final type of substitution could spring from fixed networks. A roaming user could use the foreign fixed network instead of roaming. However, this is not considered to be an effective substitution, because roaming has the added mobility over a fixed network.

This lack of substitutes can be seen as an impediment to competition in the retail market. If there were more substitutes, users could switch from using roaming services to using one of the substitutes. This would decrease the demand for roaming services and MNOs might start to compete more strongly on retail roaming services.

Box 14. Lack of Retail Substitutes as Impediment.

3.5.3 Retail Pricing and Transparency

The retail price is the amount of money the customer pays for a specific type of service. In theory, retail pricing is a very simple notion. It simply encompasses paying the price the operator asks for the service; just as in any other sector. However, the main problem that still exists is the vagueness of tariffs for IMR; one never knows exactly what a roamed telephone call costs.

In mobile telephony, the most obvious form of retail pricing are the tariffs for domestic mobile calls. In The Netherlands and throughout Europe this usually consists of paying a certain subscription fee every month and paying for the number of minutes that has been called. Pre-paid users buy a certain amount of minutes in advance and are able to call exactly this amount of minutes.

Retail Pricing

The difference between Mobile Originated calls (MO) and Mobile Terminated calls (MT) has already been brought up. This distinction between calls is important also for roaming services because the way in which the user is charged depends on it. In general there are two principles for charging users with the cost of their phone calls:

- Receiving Party Pays (RPP) and
- Calling Party Pays (CPP)

Most European networks use the CPP principle for tariffs since this feels most logical for most users; the one who calls pays the total charges for the complete call. When a user originates a call whilst roaming, the same principle of tariffs is applied. The roaming user pays for the complete charges of the call.

It is a different story when the user is being called whilst roaming. In this case the calling party has no way of knowing where the called party is located, either in the home country or abroad. Thus a combination is used between the CPP and RPP schemes. The calling party pays for the cost of handling the call till the national border and the called party (the user that is abroad), pays for receiving the call from the border of the home country to the visited country.

The distinction between these two makes the pricing very complex seen through the eyes of the roaming user¹⁰. Mobile originated calls (outgoing mobile calls) can generally be priced according to [EC00]:

1. Destination (domestic / international)
2. Time of day (peak / off-peak)
3. Time unit (per second / 10 seconds / 30 seconds / 1 minute etc.)
4. Type of network where the call is terminated (mobile or fixed)
5. A fixed set-up fee for each call (e.g. €0,06 for the first second)

Combinations of these pricing dimensions often lead to a large amount of combinations in roaming tariffs [VOD03/1]. The table below illustrates the difference between CPP / RPP and the way in which this influences the retail tariffs.

Operator	Mobile Originated (Calling) and thus Calling Party Pays (CPP)				Mobile Terminated (Being called) and thus Receiving Party Pays (RPP)	
	To fixed lines in Germany		To The Netherlands (fixed and mobile)		In Germany	
	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
E-Plus	1,05	0,90	1,05	0,90	0,59	0,59
O2	1,26	1,12	1,26	1,12	0,59	0,59
T-Mobile	1,26	1,12	1,26	1,12	0,59	0,59
Vodafone	1,26	1,12	1,26	1,12	0,59	0,59

Table 2. Retail tariffs of roaming into Germany with a KPN Mobile subscription. Prices in €/min and incl. VAT for a regular consumer's subscription. February 2003. Source: [KPN03/1]

If the tariffs that are shown above would be the only matter a user has to take into account, this could be considered to be more or less clear. However, every foreign network charges in a different way. For instance billing in blocks of 10 or 30 seconds, with different start-up tariffs, SMS messages might be charged differently et cetera. Appendix 8 gives an exemplary overview of the various additional terms that could apply to IMR tariffs.

The current state of retail prices is still not transparent or clear enough. The way in which roamed calls are being priced can be very different from domestic calls and the monthly phone bill can be quite a surprise after having been abroad.

¹⁰ A comparison can be made with domestic tariffs, where all operators want to appear as if they have the lowest tariffs. This was done by introducing price plans that include a number of 'free minutes' every month, free text messages etc. However, this type of tariff does not increase transparency to the user. The more complicated the tariffs are, the less the user will be able to make the best choice.

The current state of retail prices is still not transparent or clear enough. This lack of transparency hampers retail competition in a way that customers are unable to compare roaming tariffs of MNOs and do not know exactly what a call costs.

Box 15. Intransparent Retail Prices as Impediment.

The question is of course when tariffs can be considered to be transparent enough. In my point of view this level of price transparency is only reached when a customer that is interested is able to know beforehand exactly what a specific call will cost. At the same time an easy comparison between operators should be possible without too many efforts.

3.5.4 Averaged Retail Roaming Tariffs

Having these tariffs differ per country, per network and differ in many respects is difficult to understand for the users and might even be difficult to sell for operators. The in-transparency of these tariffs was noticed by consumer organisations already in 1999 (INTUG) and by publishing overviews of these tariffs they tried to stimulate the operators to change tariffs in place at that moment. Operators tried to increase transparency by setting up fax-back services which give the price list for roaming calls, by giving the latest tariffs to helpdesks that can be reached by phone and by publishing the pricing plans on websites. Of course this increased transparency but it still takes the initiative of the user as a starting-point. When a conclusion of the European Commission was also that roaming prices were still very intransparent, the operators introduced a so called “uniform” or “flat-rate” retail roaming tariff, meaning that in many countries in the EC, the same tariffs apply for most of the partner networks¹¹.

Operators show they are willing to make users more aware of the tariffs but on the other hand it might be reasoned that operators introduced these flat-rates because on a lower level, it makes the prices even more unclear and gives more freedom to the operators. The explanation for this is that it has now become totally unclear which network really is the cheapest. For the retail user the difference in price has become zero, but for the operators this difference still exists. They take less retail margin on calls made on/from certain networks and charge a higher margin on others; this averages out to exactly the same (or maybe an even higher) margin than before the introduction of flat-rates. Flat-rates such as the Vodafone Eurocall or Platinum pricing plan have of course resulted in an increase of the comprehensibility of the retail tariffs, but this does not mean that the prices for roaming have become more competitive.

As will be shown below, this increase in transparency due to averaged retail roaming offer has a very counter intuitive influence on the level of competitiveness of the (wholesale) sector. The averaged roaming retail price lowers the incentives that exist to manually choose the cheapest network.

The chance is very large that when a subscriber roams abroad, he/she will roam on a network that is not cheapest in terms of having the lowest IOT. As was shown above, the inability to direct traffic onto the network of a specific roaming partner is one of the barriers to competition. To the end-user the level of IOT does not matter, but as a result there will be fewer manual network selections to networks that are cheaper on a wholesale level. This leads to the vicious circle that more transparent tariffs would increase manual network selection (manual traffic direction) and would increase competition. But by making use of the averaged retail tariffs, this increased transparency is completely annulled.

The existence of averaged/uniform retail roaming tariffs hampers competition on the wholesale market by limiting manual network selection.

Box 16. Average Retail Tariffs as Impediment.

¹¹ All Dutch operators have introduced uniform international roaming rates. See operator's websites.

3.5.5 Retail (roaming) Proposition

As could already be seen in the conclusions drawn from the analysis of the relevant market, the retail market for roaming services is part of a larger retail market. This is an important notion because it influences the way in the operators compete with each other (see also paragraph 3.5.6). The roaming tariffs can be seen as a larger proposition to the customer. The customer buys a subscription from the MNO, the subscription is linked to a certain tariff for domestic (mobile) calls and this proposition also automatically includes tariffs for international roaming.

On the retail market for domestic mobile services, the Dutch MNOs compete very strongly on tariffs and services to attract customers. New (data) services are introduced at a high pace and tariff plans change quickly. Because the penetration level of mobile telephones in the Dutch market has reached a very high degree already (83% [EC02/4: p.45]), the MNOs compete for approximately the same base of customers. This is one of the reasons why a so called “churn-rate” was introduced. This rate indicates which percentage of customer base switches to another MNO.

Looking at the low elasticity that consumers have for roaming services, the MNOs compete generally by making good offers on mobile handsets, cheap domestic rates, new services and their brand names. The roaming tariffs can be seen as a part of this package offered to the customer but due to the low elasticity of demand for roaming services, the MNOs choose to compete more on the other factors because this will have the largest influence in attracting new customers. This however does not mean that the retail roaming market is not important for MNOs. The revenues that result from international roaming can account for as much as 37,5% of the revenues of an MNO (this is of course including the wholesale revenues). Seen in this light, the MNO would not like to have retail roaming tariffs that are significantly higher than those of other MNOs in the domestic market. Because whenever this would happen, consumers might look at the retail roaming tariffs as a weightier factor in deciding which MNO to select.

Another aspect that demonstrates the interest MNOs have in retail roaming services, is the fact that some advertising is being done to attract as many as possible foreigners on the network of an MNO. As already demonstrated, the highest profit comes from a foreign roaming user that makes a call whilst roaming. At “entry-points” such as Schiphol airport and the country’s borders with the surrounding countries, operators try to “catch” as many foreign users by laying out the network in a smart way and by putting up eye-catching billboards to attract as many users onto their network. Furthermore large operators advertise their international footprint as a clear advantage. The diagram below shows a simplified representation of the way in which the MNOs compete on the domestic retail markets.

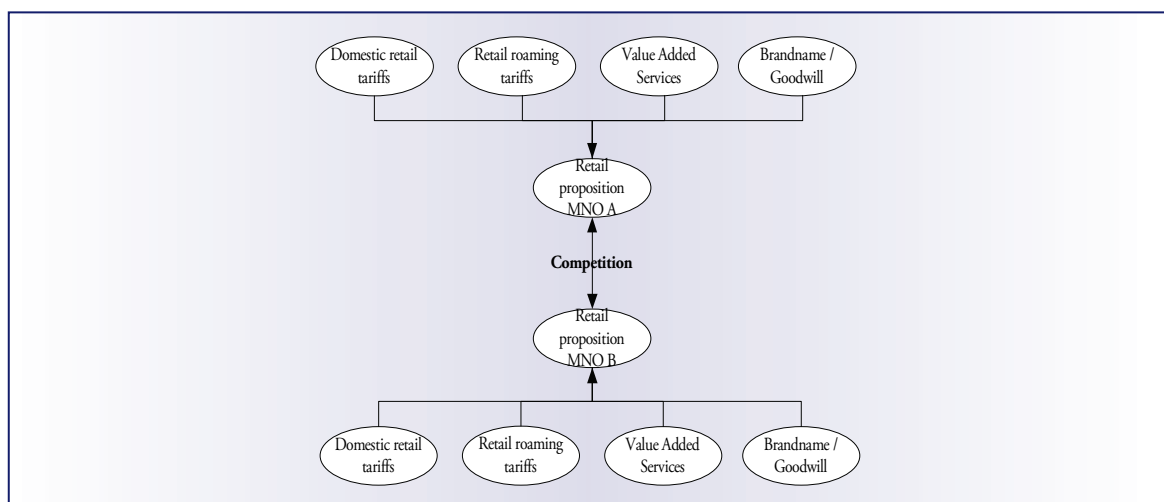


Figure 19. Roaming as a part of competition on the national retail market.

3.5.6 Retail Roaming Tariffs Part of a Bundle

Except for the existence of averaged retail roaming tariffs, the fact that roaming tariffs are part of a retail bundle complicates matters as well.

On the one hand, MNOs try to give transparent tariffs (see above) but on the other hand there is no MNO that offers a retail subscription that does not include roaming services. Imagine an end-user that knows he is not going to travel abroad and therefore does not want to use his phone abroad at all. Or imagine a subscriber who knows that he is going to travel very often and therefore he wants to get a lower tariff for roaming. I believe that the most occurring example is a user that would want cheap roaming rates for a very limited number of countries in which he/she roams often. Subscriptions without roaming support do not exist so far and subscriptions specifically aimed at the roaming user resulting in significant lower roaming tariffs, are not common either.

Small differences between subscriptions do exist, on this level a choice is available to the customer and does not form a problem. If a customer wants to get cheaper roaming tariffs, the user simply selects a subscription that includes the roaming tariffs of his choice (it is even possible to switch operators and keep the same original subscribers number). However, the roaming rates are linked very strongly to the tariffs for domestic mobile calls. This means that lower roaming tariffs abroad are directly linked to a higher subscription fee and more free domestic minutes. This link is not logical at all and it demonstrates how MNOs think about their roaming products: It is a part of a larger retail proposition and users who would like to have cheaper roaming tariffs are immediately forced to buy more domestic minutes as well.

By wrapping the roaming services in a larger package of retail services, a form of “bundling” takes place. Bundling can be understood in the sense that customers buy support for a service that they might not use, or that a user who makes few domestic calls but many roamed calls cannot select a subscription that fits his needs.¹²

This bundling of domestic tariffs and roaming tariffs gives the operator a chance to calculate different prices for the same product, to different users. The operator is able to apply price discrimination for IMR services. However, bundling does not necessarily have bad welfare implications. Bundling could be beneficial under some circumstances. CoRE research mentions in a report for the Australian NRA [CORE02]: “It might be cheaper to supply two products A and B together than to supply each product separately. Alternatively, demand-side factors come into play so that the consumers value the bundle more than they would value the individual products separately...Bundling is most likely to be socially efficient if it involves some cost savings relative to the sale of individual products.” It could be argued that these advantages of bundling also apply to IMR services.

Many MNOs bundle their roaming services with domestic services. An exception in this case is Vodafone. Vodafone not only has a flat-rate roaming tariff (doubtful whether this increases competition, see above) but also offers special services for frequent travellers. The so called Platinum pricing plan makes it possible to pay an additional monthly fee which results in roaming tariffs that are lower than for a standard subscription. This initiative shows that choice purely for roaming services is starting to become possible but that for the moment it is a novelty. It might also be a first indicator for more competition on IMR on the retail market.

¹² This point is mentioned very concisely by Europe Economics, *Cost Structures in Mobile Networks and their Relationship to Prices, Final report for the European Commission*, 28 November 2001.

I believe that offering a subscription that also contains IMR services might give benefits to consumers and general welfare. However, the lack of separate offers for IMR services is likely to limit competition.

Competition on retail roaming tariffs is hampered due to the existence of retail bundles (subscriptions) that include roaming services. No separate selection based on roaming tariffs is possible for end-users.

Box 17. Retail Bundling as impediment.

3.5.7 Retail – Wholesale Relationship

Having mentioned various impediments to competition, both stemming from the wholesale market and from the retail market, it is now possible to look at the consequences the interaction between the retail and wholesale market has for the relationship between MNOs.

The difference in the markets and the positions the MNOs have on these market, make the relationships between the firms multilateral. This two-way roaming agreement has a special influence on the relationships that exist between operators offering roaming services:

- On the wholesale roaming level, MNOs are each other's two-way customers and suppliers;
- On the national retail level, MNOs are each other's competitors (see Figure 19 above).

In theory, this would not be a strange situation since it concerns completely separate markets. However, the complicating factor is that many MNOs are part of a larger European or sometimes even global group of mobile operators. This results in the fact that, when seen on a European scale, the same operator can be a fierce competitor in a national retail market but at the same time can be supplying wholesale roaming services as a colleague/supplier to the foreign subsidiary of this same competitor.

There are two possible scenarios: Both firms can be part of the same holding conglomerate but with separated accounting or the firms can be competitors that need each other's services for roaming.

In both cases mentioned above, this could lead to the fact that operators will compete less strongly on the national retail roaming market, because the operators need each other on the 'higher' wholesale level. Retail competition is weakened because of this "retail – wholesale paradox".

It can be rather difficult for an operator to strongly compete on the national retail roaming market with an operator whose foreign subsidiary is a roaming partner on the wholesale level. This will dim a competitive impetus that an MNO might have.

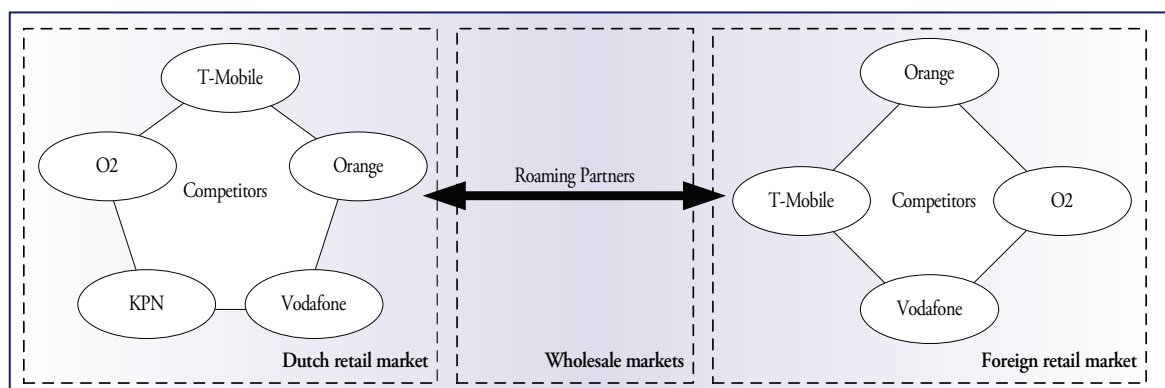


Figure 20. Wholesale and retail paradox.

On the level of individual business units, this paradox might not be so obvious. If the Dutch marketing department of MNO A could attract many more customers by lowering retail roaming tariffs, it would seem likely that it would carry out this price decrease. It is the marketing department that sets the retail prices for roaming and it is the wholesale department that concludes the roaming agreements.

However, since all operators have recognised the interdependence that exists between the competing firms, it also seems likely that the firms would rather choose to compete on a different market than roaming.

It can be rather difficult for an operator to strongly compete on the national retail roaming market with an operator whose foreign subsidiary is a roaming partner on the wholesale level. This can be seen as an impediment to competition in the retail market.

Box 18. Retail – Wholesale Relationship.

3.6 Oligopoly in the Roaming Wholesale Market

The question arises whether it is possible to describe the structure of the roaming markets by using one of the standard economic structural descriptions of a market. By looking at standard economic theory, it might be possible to explain the conduct of the actors on the market. This section aims to draw conclusions on the level of competition in the sector based on the market structure of oligopoly.

3.6.1 Characteristics of an Oligopoly

The reason why the market structure of an oligopoly will be used is because the characteristics of an oligopoly at first sight come very close to the features of the roaming markets. However, an oligopoly in itself is not an objectionable market structure. As will be shown below, an oligopoly could lead to the same results as a market in perfect competition. A number of characteristics can be used to test whether the structure of the market is such that it can be called oligopolistic. These characteristics are given below:

1. In an oligopoly there are a small number of suppliers active on the market, whereas there are many buyers of the products (roaming minutes, wholesale or retail).
Compared to the market structures of monopoly (only one supplier), duopoly (exactly two suppliers) and perfect competition (many suppliers).
2. The second generally accepted characteristic of a market that functions as an oligopoly is the fact that considerable barriers to entry exist. Because of the structure of the market, it is very difficult for new entrants to enter the market.
3. Furthermore, all supplying actors recognise that they are strategically interdependent of each other. Firm 1 has a certain influence on the demand experienced by firm 2, for example through the price that firm 1 sets or by the amount of products firm 1 supplies. This interdependence is clear to both firms.

Except for the above mentioned characteristics, a distinction between two types of oligopolies can be made: an oligopoly that offers products that are homogeneous¹³ or that are differentiated¹⁴. The following section will apply these features of an oligopoly to the wholesale market for international roaming services.

3.6.2 The Oligopoly on the Wholesale Roaming Market

The first question that should be asked is whether an oligopoly exists on the wholesale market for international roaming services. In order to make this plausible, it is straightforward to show that the market meets all the requirements that an oligopoly brings forward:

Few Suppliers & buyers

There are five Dutch MNOs that all offer wholesale roaming services, whereas every foreign operator (many) wants to offer retail roaming services in The Netherlands and as a result, this foreign MNO is a demander of the product “wholesale roaming services”.

In the description of the relevant market in paragraph 3.2, it was mentioned that there are no substitutes for the wholesale product that the Dutch MNOs offer (roaming access for customers of foreign operators). This relates to the fact that there are few suppliers of wholesale roaming services in a specific country, since for instance a fixed operator is not able to offer these service (see also the relevant market, section 3.2). The first requirement is met; few suppliers and many buyers.

High Barriers to Entry

It is very difficult to enter the market as a wholesaler of IMR services. There are two options for entry into the market: either to be a full MNO with a complete own network, or to be an MVNO that rents parts of the network of a full MNO. It seems very unlikely that the first option is feasible because spectrum is limited and the chance of new assignment of spectrum in the near future is very low.

The second option might seem promising, except for the fact that an MVNO is not allowed to conclude its own direct roaming agreements with other MNOs or MVNOs (determined by the GSMA framework). An MVNO is only allowed to use the roaming agreements of the higher level MNO. This discards the second option as well. The conclusion is justified that there are high barriers to entry.

Interdependence of Actors

The third requirement is more difficult to demonstrate. Why do the MNOs depend on each other? An action by MNO 1 on the wholesale market, directly influences MNO 2's profits on the retail market and vice versa.

This can be partially demonstrated by looking at Figure 13, which shows that the retail markets are influenced very strongly by the wholesale prices charged by the foreign operators. Therefore if MNO 1 lowers its wholesale tariffs, this means that MNO 2 (when keeping the same retail mark-up) will experience lower profits in the retail market. This rule applies the other way around as well. This shows the interdependence of the operators on a wholesale level. This is shown by Figure 20 as well, on the retail markets the operators compete with each other but on the wholesale level the MNOs have to conclude roaming agreements. Besides this organizational need of having to agree on the roaming contract before roaming is possible, there is the commercial aspect that was proven above. Revenues from wholesale roaming are an important part of the total revenues of an MNO.

This leads to the conclusion that interdependence between the operators is present and that the operators are strongly aware of this mechanism.

¹³ Products that are considered to be perfect substitutes

¹⁴ Products that are not homogeneous. Differentiated products are usually different in form, place, time.

The discussion above showed that all the structural requirements of an oligopoly are met.

The second question is whether the products offered on the roaming wholesale market end in a homogeneous or a differentiated oligopoly. A quick inspection of the offered products leads to the result that the products can be considered to be homogeneous. This is because all operators offer wholesale minutes and because the nature of the services is very similar. A wholesaler offers network capacity to end-users of a foreign MNO, by means of roaming contracts (very often standard), with often the same type of services. Of course the networks of MNOs differ, but seen on the level of supplying wholesale roaming access these differences are too small to change the status of the product to heterogeneous. For example, the billing files that every operator produces can be in different formats due to different version of billing systems (TAP 3.x) but are processed by a clearing house in most of the times and therefore can be considered the same. Some operators are not able to supply specific value added services (VAS) such as a short-code for voicemail while roaming, but voicemail can still be reached by dialling a different number. The differences in VAS could be the only argument why wholesale roaming minutes are not homogeneous.

To conclude, it can be stated that the market for wholesale roaming services is a homogeneous oligopoly because there are few suppliers/buyers, because there are high barriers to entry and because the firms recognise their interdependence.

3.6.3 Bertrand Competition applied to Wholesale Roaming

The wholesale roaming market can be seen as a homogeneous oligopolistic market. In theory this is not bad. In fact, an oligopolistic market can yield the same results in terms of the price level as a market in perfect competition.

To show this, the Bertrand model [CAB00] of competition is introduced. The model consists of two firms supplying homogeneous products and setting their prices for this product at the same time. Assumptions are made that both firms have the same marginal cost¹⁵ that this marginal cost is constant and the demand is linear. For mobile telecommunications, the assumption that marginal costs are equal for the MNOs is conceivable because the structure of mobile networks is quite equal. A difficulty is that the cost for providing coverage for a 900 MHz MNO can be lower from the cost for an 1800 MHz MNO due to the size of cells and the needed number of Base Station Transceivers [EE01].

Taking Bertrand competition as an example, what would happen in this model if one of the firms would set a price higher than the marginal cost? This would lead to the fact that the other firm would be able to gain complete market share by setting a price a little bit below this price. Therefore it is logical that the only sustainable equilibrium price in the model would be on the level of marginal cost.

If the wholesale roaming market would function according to the just mentioned Bertrand competition model (even though it is in the context of an oligopoly), profits for the wholesalers would be very low; this is not a realistic situation and neither is it desirable¹⁶. There are three reasons that could explain why Bertrand competition does not come close to reality.

1. Product differentiation [CAB00: p.105]. Companies try to differentiate their products from the products offered by their competitors. On the wholesale level however, this is not a valid argument because the wholesale services offered by the MNOs are very similar.
2. The capacity of a firm is limited. "By undercutting the rival, a Bertrand duopolist receives all of the market demand". It might however be possible that the firm is not able to produce enough to cover the complete market demand; the capacity of the firms is constrained. The capacity in a

¹⁵ Marginal cost is the cost for supplying an additional unit.

¹⁶ As was mentioned before, all companies are allowed to make a healthy profit margin. It is however the lack of competition in the roaming markets that forms a problem.

mobile network is not unlimited and therefore this argument might be valid. Consider the example below:

A firm 1 would be able to undercut the price of a competing firm 2, resulting in the fact that firm 1 might acquire complete market share. Only this will not happen because firm 1 has a limited capacity, leading to the insight that in this case firm 2 will still get a piece of the market. This in turn results in the fact that the equilibrium price will be higher than in the Bertrand model (without capacity constraint) discussed above.

This could lead to the conclusion that the cause of wholesale roaming prices above marginal cost level is due to the fact that capacity is limited.

However, if the capacity of the industry in a certain market is large in relation to the total market demand, the conclusion mentioned above fails. This can be understood by thinking of an oligopoly with e.g. 3 firms that have a total capacity larger than the market demand. If firm 1 has reached its production limit, there will always be another firm that is able to supply for the same or lower price so that the capacity of this firm is also filled. This will ultimately result in prices set at the level of marginal cost.

3. The final reason why prices on the wholesale market are not set at marginal cost level could be found by looking at the fact that in the Bertrand model, a firm is unable to retaliate by lowering its wholesale price. This could lead to a price war, meaning that as soon as one firm sets its price, the competing firm will undercut this price. The reason for the inapplicability of the Bertrand competition model to the wholesale roaming market lies in the limitation of the Bertrand model: retaliation is not considered.

This section made clear that oligopoly in itself can lead to exactly the same results as a market in a state of perfect competition. The Bertrand competition model is a perfect example of this possibility. However, the Bertrand model applies only partially because it does not consider the fact that competition can take place in a more dynamic fashion; a constant undercutting of the price by oligopolists resulting in the fact that firms take each other's strategies into account when determining the price level.

3.6.4 Tacit collusion in Oligopoly

Instead of starting a price war with which none of the firms on the market is better off since in the end they will make no profit, it would be very beneficial for the firms if they could all set a price at the monopoly level. Even more because all the firms on the wholesale market recognise their interdependence. If the price would be set at the level of a monopoly, the first thing that would happen is that a competitor undercuts this price and, as with Bertrand competition, would acquire the total market's demand.

The conclusion why the Bertrand model did not fit the situation was that it is a 'static'¹⁷ model. In reality however it is much more likely that the firms will react to each other's decisions in more than one round; this would change the Bertrand model to a dynamic one. In this type of dynamic setting, a firm could set the monopoly wholesale price with the implicit threat of lowering its wholesale price to the marginal cost level if the competing firms do not price at the same collusive level [KRE90]. This threat will sustain the equilibrium because none of the firms would like the product to be priced at marginal cost. In practice however, it is likely that only the large conglomerates such as Vodafone, T-Mobile and Orange have the power to enforce this. The threat of a collective IOT price cut by one of these entities would prevent the smaller MNOs from lowering the IOTs too much.

¹⁷ Static is meant in the sense that the oligopolists make their decisions in only one period of time (e.g. they determine the price level.)

Two forms of collusion exist; collusion either by means of using explicit deals (this is illegal under competition law and is considered to be a cartel) or the so called tacit collusion¹⁸, all meant in order to find market equilibria such that all firms are better off. Tacit collusion refers to agreements established between firms using silent rules of for instance pricing or supplied quantity.

In this type of collusion, there is a big temptation for a firm to undermine the tacit collusion arrangement. By cheating on the collusive price, the firm is able to attract more demand. When this cheating is done in a smart way, the other firms will be unable to see why they loose market share.

As might be obvious, collusive arrangements in general are not easy to establish in the first place and secondly they are difficult to maintain. A number of notions relate to collusive agreements in general [KRE90]:

1. A (tacit) collusive arrangement works only if all parties have something to gain.
2. It is necessary in any collusive arrangement that each participant is able to monitor the actions of others.
3. Tacit collusion is more difficult the more firms there are in the industry.
4. Punishment for cheating must be imposed to prevent parties from (slightly) undercutting the price arrangement.

Gains for all Parties

The first notion above is applicable to the case of IMR. Most operators on the wholesale market have an interest in a high IOT. Because the operator that has to pay a high IOT can also charge a high IOT himself later on to a foreign MNO. Since all operators are active on the wholesale market as well as on the retail market, they have a double interest in a high IOT. This is because a high IOT leads to a higher retail profit.

Some net-paying operators might benefit from a lower IOT on the wholesale market. This type of operator has a client base that roams abroad a lot in comparison to other operators. The net-paying operators have to pay more IOTs than they can charge to foreign MNOs for inbound roamers. Because of this, the balance between incoming and outgoing IOT payments is negative. The net-paying operators would like to see IOTs go down because this would decrease the negative balance. However, these net-paying operators are also active in the retail market. Here the same argument applies, namely that for the retail market lower IOTs is not a positive trend. All operators have incentives to keep IOTs high.

Monitoring

The second notion says that collusive arrangements need to have some kind of monitoring function built in. This would mean that every MNO has to be able find out what the wholesale price of another foreign MNOs is. For the wholesale roaming market this is solved by the GSMA's Infocentre Website. All the IOTs and changes to IOTs of the foreign operators are published there. By using this website, a change in IOTs becomes clear to all other MNOs instantly. If a tacit collusive arrangement exists, it would be very easy to monitor any cheating or undercutting of the average price.

Many Parties, Collusion is difficult

The third notion is very straightforward. The more parties are active on the market, and the more parties join the collusive arrangement, the more difficult it is to monitor the actions of all these parties. In the case of wholesale international roaming, it would be very easy to monitor changes even though there are dozens of operators in Europe. This was proven in paragraph 3.4.3 on transparency on the wholesale market because of the STIRA.

¹⁸ Sometimes also called implicit collusion.

Punishment for cheating

The last notion demonstrates that some kind of punishment is needed in order to prevent firms from breaking away from the arrangements. This is only valid if an MNO would have a reason to break away. In the case of mobile roaming this is very uncertain. If an MNO sets its IOT lower, this means that it becomes cheaper to roam onto the network. However, if the retailing MNO lowers its retail tariffs this becomes apparent only in the average retail tariff for that country (average retail roaming tariffs). Therefore it might not be useful at all to lower an IOT because an inbound roaming user is not going to select this cheaper network. This is because the user experiences the average retail tariff. The decrease in IOT could be beneficial not only to the MNO that has lowered its IOT, but it can also become beneficial to the other MNOs in that country.

Additionally, it is technically difficult for the home MNO to direct traffic onto this network that has just become cheaper as a result of the lower IOTs. As has been already described above, the handset of the user selects the network on which it roams based on a number of criteria such as the preferred network list on the SIM. To “lock” the user on this cheaper network has always been very difficult. This is beginning to change and traffic direction is possible by using adapted phones, for example Nokia specifically made phones for KPN that check the preferred list more often, or by using special SIM-cards. More on technical developments can be found in the next chapter.

If a tacit collusive arrangement exists in the wholesale roaming market, it seems unlikely that any kind of punishing measure is in place. There is no leading firm that could enforce this measure. The GSMA acts as a representative of the MNOs but does not give any directions as to recommended price level of IOTs. It seems that the MNOs are free to lower the IOTs within the framework of the STIRA (e.g. no change within 6 months) if they would want that.

3.6.5 Tacit collusion in Wholesale Roaming?

So does it seem plausible that a tacit collusive arrangement exists between the MNOs? The fact that the firms have a lot to gain by such an arrangement speaks in favour of the existence. The fact that it has been made very easy to monitor the actions of ‘competitors’ on the (national) wholesale market also speaks strongly in favour of the existence. Furthermore firms are in frequent contact with each other in forums, organisations, associations on technical developments and standardisation. A more detailed analysis on the justification of the latter argument can be found in Appendix 3.

The argument that it is difficult to maintain the arrangement with so many firms on the market is true, however it only holds when the firms have an incentive to break away from the standard behaviour of setting high IOTs.

The need for an incentive also applies to the fourth argument that a retaliatory measure is needed. Operators are free to set lower IOTs, but if this gives no additional benefit why would a firm do this? The firm knows which revenues it will make when it acts in line with the current behaviour of the market; in order for the firm to change its conduct it would need to have a very strong incentive. The threat of an enforcement measure (a negative incentive) is not always needed; a positive incentive to join the current market conduct is enough. This leads to the insight that a punishment might not be needed to enforce any tacit collusive arrangement that exists in the wholesale roaming market. An indirect retaliatory mechanism that could be present is the thought that once an operator would consistently lower its IOTs in order to ‘rock the boat’, other operators might cancel their roaming agreements with this operators. This would harm the competitor in quite a strong way because the competing operator would miss the high revenues from inbound roaming users.

Because of these reasons it seems to me that it is likely that tacit collusion could very well be present on the market for wholesale international roaming services. Notice that this does not give any proof whatsoever that an explicit cartel arrangement exists in the sector. The firms are able to collude on their behaviour without needing to make explicit agreements.

3.6.6 Price Rigidity

A characteristic of a market in a state of oligopoly is the fact that there is a large chance that the market will show signs of price rigidity [DIE96: p.381]. As was demonstrated already, price rigidity is present in the retail roaming markets. Under the assumption that retail mark-ups do not change considerably, this means that prices on the wholesale market show rigidity as well.

The most famous theory that explains this price rigid behaviour of oligopolists is known as the kinked demand curve. The economic website Revision Guru mentions [REV03]: “This theory was developed in the late 1930s by the American Paul Sweezy. The theory aims to explain the price rigidity that is often found in oligopolistic markets. It assumes that if an oligopolist raises its price its rival will not follow suit, as keeping their prices constant will lead to an increase in market share. The firm that increased its price will find that revenue falls by a proportionately large amount, making this part of the demand curve relatively elastic (flatter).

Conversely if an oligopolist lowers its price, its rivals will be forced to follow suit to prevent a loss of market share. Lowering price will lead to a very small change in revenue, making this part of the demand curve relatively inelastic (steeper).” This leads to the following diagram that shows the kinked demand curve of an oligopolist offering wholesale roaming services.

The figure above shows the demand for wholesale roaming services that an MNO experiences (D_w).

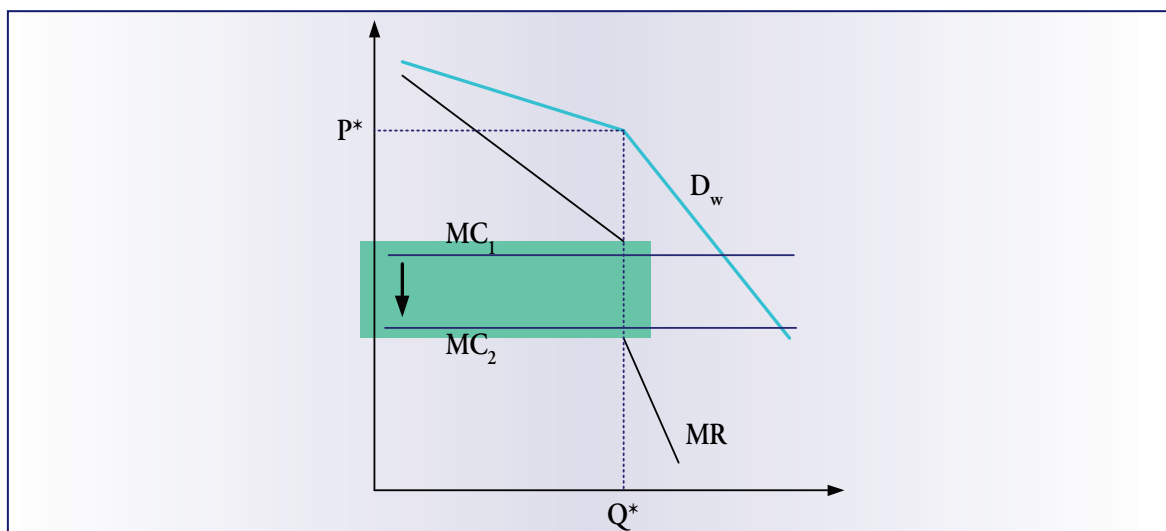


Figure 21. The kinked demand curve resulting in price rigidity in an oligopoly. Source: [ECO03].

The marginal revenue (MR) shows a vertical discontinuity at the same level of the kink in the demand curve. The equilibrium price forms there where the MC equals MR. This is at the level of P^* . However, when the marginal costs change from MC_1 to MC_2 , the price remains exactly the same. There is a certain bandwidth within the oligopolist MNO is ‘allowed’ to lower its price. As soon as a firm would set its wholesale roaming price outside of this bandwidth, the other firms on the market would respond.

If all firms use approximately the same retail mark-up, the theory of the kinked demand curve shows why the retail price for IMR services differ very little among MNOs. There are relatively small differ-

ences in retail price, but it might be so that these differences are 'allowed' and fall within the bandwidth of permitted prices.

However except for the above mentioned application of the kinked demand curve theory, the theory is not completely relevant for the wholesale roaming market but does give the mindset needed to think about this problem. Two scenarios come to the fore:

1. It is possible that in the case of an increase in the IOT of a competitor, a firm will indeed raise its prices as well because it is not certain that the firm with the lower price gets an equal amount of additional traffic on its network.
2. If a firm lowers its IOT, the competitor will probably not lower its own IOT because of the same reason mentioned above.

This mechanism is related to two notions:

- a) The fact that customers show a quite inelastic demand for retail roaming services. The customers do not select the cheapest network and that is why having a lower IOT is not necessarily proportionally beneficial to the amount of traffic from inbound roamers on the network.
- b) It is difficult for operators to direct traffic onto a specific type of network. That is why a lower IOT does not ensure more traffic for the wholesaling network.

The two scenarios and the two notions that relate to it, demonstrate that price rigidity is indeed present on the IMR markets; not only from a practical point of view (comparison of retail tariffs), but also from a theoretical approach (kinked demand curve).

3.6.7 Conclusion on Oligopoly

The wholesale roaming market can be seen as a homogenous oligopoly because it complies with the requirements: few suppliers and buyers, interdependence between firms and high barriers to entry while at the same time the products on the market can be seen as substitutes.

From a competition point of view, an oligopoly in itself can lead to exactly the same results as a market in a state of perfect competition. The Bertrand competition model is a perfect example of this possibility. However, in order to achieve this level of competition a price war is needed.

Instead of starting a price war with which none of the firms on the market is better off since in the end they will make very little or no profits, it would be very beneficial for the firms if they could all set a price at the monopoly level. Even more because all firms on the wholesale market recognise their interdependence. In order to achieve this level of pricing, firms in an oligopoly can make (tacit) collusive arrangements on e.g. the price level. The wholesale roaming market satisfies all four prerequisites for a successful collusive arrangement and that is why it seems likely that tacit collusion exists in the wholesale roaming market.

Except for possible collusion, a further characteristic of a market in a state of oligopoly is the fact that there is a large chance that the market will show signs of price rigidity [*DIE96: p.381*]. Price rigidity in the wholesale/retail roaming market is not only present from a practical point of view (comparison of retail tariffs), but also from a theoretical approach (kinked demand curve).

To conclude, it can be said that in fact it is possible that the market for wholesale roaming services shows the same competitive level as a market in perfect competition. However, the conduct on the market gives rise to believe that tacit collusion is present and that the framework in which the operators have to do business leads to price rigidity.

3.7 Conclusions, Structural & Behavioural Impediments to Competition

Based on the previous paragraphs, extensive insight has been gained into the structure and conduct of both the retail and wholesale roaming markets. This chapter started with the goal of stating which impediments to competition exist in these markets and this is exactly the purpose of this paragraph: to summarize the various impediments/barriers to competition that have been brought forward throughout this chapter.

The origins of the impediments can be quite divergent. They can stem from purely technical grounds, from purely structural causes or from purely behavioural reasons. Table 3 gives an overview of all the impediments that were identified in the previous sections and the reason why they influence competition. The table classifies the impediments according to the distinction between the retail and the wholesale market. All impediments are summarized in more detail after the table.

Impediments			Result
Wholesale	Technical	Directing traffic is difficult	Hard to guarantee traffic → few discounts
Impediments			Result
Wholesale	Framework by the GSMA: <ul style="list-style-type: none">• Barriers to entry• High transparency and price rigidity		Only direct roaming agreements with other full MNOs Framework establishes very transparent and rigid wholesale market
	Lack of wholesale substitutes		This lack of substitutes can be seen as an impediment to competition in the wholesale market. If more wholesale substitutes would be available, foreign MNOs could use these to bypass the wholesale services offered by the MNOs.
	No incentive to compete		High IOT is carried by end-users and lower IOT does not necessarily result in more traffic.
	The effects of the wholesale oligopoly		MNOs recognise interdependence leading to price rigidity and possible tacit collusion.
Retail	Inelastic retail demand <ul style="list-style-type: none">• No manual network selection• Still not informed about prices• Roaming tariffs not a reason for selecting operator/pricing plan		No manual selecting of networks → limited competition Limited use of roaming, no switching Does not stimulate operators to make better offers
	No retail substitutes		There are no real substitutes for retail roaming services, switching is not possible.
	Limited transparency		Transparency of retail tariffs is still limited
	Averaged retail tariffs		Averaged retail tariffs do not stimulate the selecting of the cheapest (wholesale) network
	Roaming Tariffs part of retail bundle		No selection based on roaming tariffs is possible for end-users
	Retail – wholesale paradox		Competing in the retail market with a subsidiary of a roaming partner on the wholesale market.

Table 3. Overview of impediments to competition on the wholesale and retail market.

3.7.1 Impediments for the Wholesale Market

The impediments listed below are impediments that relate only to competition in the wholesale markets. These can be of structural, behavioural or technical nature.

- Wholesale competition is hampered because it is complicated to direct traffic to a specific foreign network; it is hard to guarantee a certain amount of inbound roamers and mobile originated calls for a foreign network. Due to this technical limitation it is difficult to get discounts.
- Wholesale competition is hampered because of the fact that operators have no real incentive to compete, to find/arrange lower wholesale tariffs because:
 - The burden of high wholesale costs is carried by the end-users of the foreign operator.
 - A lower IOT does not necessarily mean more inbound roaming users on the network because traffic cannot be directed.
 - Furthermore there is no incentive to compete because of the relationship between the foreign wholesale market and the national retail market. As was demonstrated throughout the chapter, MNOs are to a large extent not responsible for their own retail roaming tariffs since the highest input cost is the IOT charged by the foreign operator. Responsibility can be shifted to the foreign MNO. This barrier to competition is inherent to IMR services.
- The framework by the GSMA for International Roaming limits competition.
 - It limits the possibility for MVNOs and service providers to enter the market for wholesale roaming services. The wholesale markets have been foreclosed by the sector itself by means of the GSMA framework.
 - It limits the competition on the wholesale markets in their current forms. This is because of the rigid, non-discriminatory (IOTs and discounts to IOTs) and very transparent (publishing of IOTs) character of the framework. The STIRA does not provide any stimulus for competition between operators.
- The oligopoly on the wholesale markets limits competition because the operators recognise their interdependence since they rely on each other for their wholesale profits. The threat of a permanent undercutting of the current IOT price level, which results in significantly less profits for all operators, encourages the current status quo.

The fact that contacts between the firms are very frequent could be seen as an impediment to wholesale competition. The reason why this is not considered a real impediment is given in Appendix 3.

3.7.2 Impediments for the Retail Market

In contrast to the impediments listed above, the following reasons for little competition only relate to competition in the retail markets. Again, these can have a structural, behavioural or technical nature.

- On the retail market there are no real substitutes for mobile international roaming services; this limits possible competition.
 - Domestic mobile services offered by the foreign MNO are not considered an effective substitute for both incoming and outgoing roaming services at this moment. It may require the unlocking of the mobile phone, it gives the requirement of having to buy a new SIM-card

- when being abroad and it results in having to use a different mobile number to receive calls.
- The other option would be to use multiple SIM-cards at the same time. Because of the higher subscription costs, this type of substitution is only attractive to a limited target group such as frequent travellers. Over more, it is impossible to use the home mobile number abroad. This type of substitution can be effective, but probably in a limited fashion.
 - The final type of substitution could spring from fixed networks. A roaming user could use the foreign fixed network instead of roaming. However, this is not considered to be an effective substitution, because roaming has the added mobility over a fixed network.
- Retail competition is weakened because of the “retail – wholesale paradox”. It can be rather difficult for an operator to fiercely compete on the national retail roaming market with another operator that is its roaming partner on the wholesale level. This will dim a competitive impetus that an MNO might have. Only when the gains of competing are very high, fierce retail competition might take off.
 - The customer limits the level of competition himself. All these arguments relate to the fact that demand for IMR services can be considered to be very inelastic; this hinders an increase in competition.
 - Not making extensive use of the possibility to manually select the foreign network whilst roaming¹⁹ [SAL02: p.10]. The customer shows the MNOs that the current level of service and price is sufficient.
 - By not trying to be well-informed about the costs of roaming abroad.
 - By not making the roaming tariffs part of the criteria for selecting an operator/pricing plan.
 - Competition is being limited by the limited transparency of the current tariffs for IMR. The various prices are still very unclear; one never knows exactly what a roamed telephone call costs.
 - Because of the usage of averaged retail roaming tariffs by the MNOs, the subscriber is not motivated anymore to select the cheapest network in terms of the lowest IOT. The chance is very large that when a subscriber roams abroad, he/she will roam on a network that is not cheapest in terms of having the lowest IOT.

This leads to the vicious circle that more transparent tariffs would increase manual network selection (manual traffic direction) and would increase competition. But by making use of the averaged retail tariffs, this increased transparency is completely annulled.
 - Competition on retail roaming tariffs might be hampered due to the existence of retail bundles that include roaming services. No selection based on roaming tariffs is possible for end-users. Other services such as domestic mobile calls or messaging services are all available in distinct amounts (e.g. 50 SMS messages per month for €5,-).

The next chapter will discuss a number of market trends and their impact on competition. If market developments are thought to improve competition in the near future, regulation will not be needed.

¹⁹ Approximately less than 10% of the roaming users make use of the possibility to manually select a foreign network.

4. MARKETS TRENDS

The analysis of chapter 3 led to a number of impediments to competition on both the retail and wholesale markets. They stem from structural or behavioural reasons, or have more technical backgrounds. This chapter treats three important market trends, namely the trends of mobile data services, market consolidation and traffic direction. The question is whether or not the market trends will solve the impediments and will lead to more competition.

4.1 Trend of Mobile Data Services

A trend that can be seen across the wholesale and retail markets is the movement towards more and more data services. Operators seeking to increase their ARPU come up with new services that make use of their GRPS network and in the future the Third Generation (3G) Universal Mobile Telecommunications System (UMTS) network. The current SMS services are a great success and operators are trying to extend this with services such as MMS that rely more on the capabilities of GRPS. Accessing the Internet or the company's network through a GRPS-connection will be likely to become more popular as prices for transferred data go down. Other trends are more 'portal-like' mobile services such as KPN's I-mode or Vodafone Live.

These data services are not really within the scope of this research, however a trend of roaming is perceived in these services as well. When a user wants to access his company network while roaming, the home and foreign operators need to have a GRPS-roaming agreement. Domestic GRPS capabilities are available for a rather long time already, however GRPS-roaming has only took off since 2002.

When looking at the domestic tariffs for 1MB of GRPS traffic (sending or receiving) this lies approximately around €2.50 [TMOB03/1], whereas once the same user travels to e.g. Germany this can become as expensive as €12.00 per MB [TMOB03/2]. MMS messages of maximally 30Kb cost around €0.50 when sent in the home network [TMOB03/1]; receiving MMS messages is free. However, once a user sends or receives an MMS messages whilst being abroad this will often cost a fixed amount for the MMS (e.g. €0.59) and an additional mark-up for the GRPS-roaming traffic: e.g. €0.39 for every 10Kb. [CONN03/2].

The current regime of GSM-roaming is carried on into the market for data services. Specific IOTs exist for GPRS-roaming and the mark-ups are likely to be of the same level. When looking at how long it took operators to implement GPRS-roaming and the problems that exist(ed) with billing these services, the system of IOTs is probably not convenient for the MNOs anymore; however, this framework will still be used for GPRS and possible for UMTS.

Tariffs for data services whilst roaming are not only very high, choice is often limited because many foreign networks presently do not support GPRS. Even if more than one network supports GRPS, GRPS-roaming is often only possible with the same member of the group. The third current problem on the market is that prices are very intransparent. Accessing the Internet using GPRS or sending an MMS from abroad can result in very high bills if users do not closely watch how much traffic they generate and which services they use.

Whereas the introduction of these data services could have meant a complete review of the roaming framework initiated by the operators themselves, the market instead shows the same conduct that led to an uncompetitive wholesale market for voice IMR services. This trend will not solve any of the impediments identified above.

4.2 Wholesale Trend towards Consolidation

There is a big trend towards consolidation and internationalisation in the sector for mobile telecommunications. One of the reasons for this are the prices many operators paid for their UMTS licences which resulted in enormous debts. This leads to the trend of consolidation in order to improve the financial strength of many operators. Furthermore, operators are able to gain economies of scale as a result of consolidation. For example in the use of pan-European commercials, arranging higher discounts with manufacturers of network equipment and offering the same services throughout Europe. The trend towards large European or international conglomerates of MNOs contributes to speeding up the process of directing traffic because operators want to retain the important roaming traffic and revenues within their own group.

More recently, three large operator groups Telefónica, T-Mobile and TIM have created an alliance to be able to compete more strongly in cross-border markets. The press announcement of the alliance states that “the first outcome will be that, via roaming agreements, the partners will be able to develop new joint offers in voice, data and mobile internet in order to gain new customers...regardless of the country of the operator” [TEL03]. The members of the alliance are aiming to offer international services such as “recharging pre-paid accounts abroad, sending photos via MMS, and accessing Customer Care in the client’s home language...” Furthermore, this alliance might result in lower prices because the members expect to gain cost savings.

4.3 Wholesale Trend towards Directing Traffic

The third trend that can be seen is that there are now more possibilities for operators to direct traffic to specific foreign networks. This could help to resolve the technical impediment that was identified in the previous chapter. How these technological developments work and if they will improve competition, is described in the next section.

4.3.1 Technical Solutions to Directing Traffic

This section discusses three possible ways in which an operator could increase the control it has on traffic flows of outgoing roaming users.

Operator Specific Mobile Equipment

The most simple technical solution an operator could choose in order to partially stimulate the direction of traffic is to procure operator specific mobile phones from a manufacturer. Since a mobile phone is programmed to search for network coverage with certain regularity, the frequency of searches for the preferred network could be increased. If a user would accidentally drop off the preferred network, the mobile phone would switch back to this network more quickly than normal. This reduces the chance that the user makes or receives a call on a network that is not in the group. This solution needs operator customized internal phone software. Furthermore, many subscribers do not make use of a phone supplied by the operator; directing the users to the right network will be impossible in this case.

Using the SIM Application Toolkit

In the newer GSM standards (GSM Phase 2+), many more new services and possibilities are reached with GSM. The Phase 2+ SIM-card now has a SIM Application Toolkit (SAT). By using the SAT, it is possible to run operator specific (software) applications on the mobile station. Through the SAT, the SIM is able to control some parts of the mobile equipment as well.

By making use of the SAT (possibly combined with OTA), it is feasible to take a more active approach to directing users to certain networks. Since the SAT is able to communicate with, and give orders to the mobile equipment it is possible to make the SAT give a command to actively switch networks whilst roaming. The SAT could actively switch networks for instance based on the current visited country or based on the current time of day (to have the cheapest peak/off-peak tariffs). When the SAT would receive an OTA message that contains e.g. the prices for certain types of calls or services, the SAT could display price information or actively switch networks when the user wants to send an SMS, while making sure that user sends the message through the cheapest network.

Directing Traffic through Over-The-Air Programming

With the arrival of the GSM Phase 2+ standard the amount of files on the SIM-card increased and the SAT started to be used. However, the two most important files for roaming, the preferred PLMN (PLMNsel) and the Forbidden PLMN (FPLMN) lists, are still used in the same manner. With the introduction of SAT capable SIM-cards it became possible to download information into the SIM which led to the result that files on the SIM are capable of being managed and changed remotely by the network operator. This is called Over-The-Air (OTA) programming and it allows files on the SIM to be changed and updated without the SIM having to be reissued by the MNO. This gives MNOs a reduction in cost for managing their existing fleets of SIM-cards. OTA can be used for instance, to automatically and remotely enter the right setting into a mobile station for the use of the new Mobile Messaging System (MMS).

OTA gives rise to promising new scenarios in respect to roaming: either in changing the roaming files on the SIM or by using the SAT; both in order to direct the users to specific foreign networks,

For instance, the PLMNsel file can be updated remotely whenever a new roaming agreement has been concluded, when marketing propositions change or because of any other reason. Furthermore, the files on the SIM can be changed at any point in time, fully at the control of the MNO. By changing the PLMNsel file, the mobile station will always try to register with the correct preferred network.

Except for remotely changing the PLMNsel file, for roaming purposes it is also possible to remotely change the FPLMN file. Originally this file had a limited capacity [RED98] “blocked” or forbidden networks but with the increase in SIM memory this is no longer a problem. For every country a network could be specific (by means of its Mobile Network Code) with which the mobile station is not allowed to register. If there is one network that has full coverage, all other networks could be blocked in that country so that the roamers only register with the preferred network. Directing traffic with the use of OTA could possibly be successful in as much as 70% of the cases. For more specific details on the network nodes used for OTA, see Appendix 7.

4.3.2 Advantages of Over-The-Air Programming

If operators belong to a group or have just joined an alliance, it is possible to change the preferred lists of all OTA capable SIM-cards active in the field. In respect to roaming, OTA can be also used in case a better roaming agreement has been concluded. All roaming users could be directed to a specific network that is cheaper for the end-users. By exploiting this new OTA possibility, all roaming users will try to register with the best partner network first. This results in less roamers dropping off the

preferred network and in less roamers selecting a network with higher roaming tariffs (or a higher IOT which would be unfavourable for the home operator; see paragraph 3.5.3). OTA could be beneficial to both the MNO (group/alliance) as well as to the mobile subscribers. Both the roaming files and SAT scenarios mentioned above have the following three main advantages to the operators [SMA03]:

1. They retain the roaming income within the operator group or alliance
If the home operator is part of a group or alliance, the roamers can be directed to a foreign network that is part of this group. The revenues generated from inbound roamers will stay within the group.
2. They give a stronger position when negotiating roaming agreements
By being able to direct traffic to a specific network, it is easier to arrange discounts on IOTs of foreign operators. The uncertainty of the traffic going to a more expensive operator (e.g. that does not offer any discounts) is removed.
3. They strengthen global branding and services
An operator with activities in many European countries could supply exactly the same services across all the countries by implementing an OTA/SAT solution. This could lead to the fact that users of this network will see exactly the same name of the MNO in the display, even when travelling abroad. Value Added Services will be accessible in exactly the same manner as in the home country. This adds considerably to the European or even global image/brand name and user experience for this type of operators.

4.3.3 Impact of Consolidation and Directing Traffic on Wholesale Competition

It has become apparent that OTA and SAT can be favourable to MNOs. However, after having presented OTA as a market trend as well as a possible remedy to the technical impediment, the question that remains is why a broader use of OTA would increase competition. This section aims to make clear that OTA/SAT combined with consolidation could be a driver for competition on the wholesale market but that there is no certainty.

A foreign MNO has no incentive to lower its wholesale price (IOT) because the decrease does not guarantee more inbound roamers. The amount of inbound roaming traffic (which is very important for operators) is not linked strongly to the level of the IOT. If it would be possible to strengthen this link, competition in the wholesale market might increase; this can be done with OTA.

By directing traffic to a foreign member of the group through OTA, it has become possible to retain traffic within the group. With more operators starting to use OTA, chances are that competition on roaming will start to grow between groups of operators because in the (near) future, the large groups will not receive much inbound roaming traffic from each other anymore. The situation in which all operators charge approximately the same high IOT might change because groups will be almost sure that none of their 'valuable' roaming traffic will flow off to competitors in the foreign wholesale market.

Due to an increase in the usage of OTA and combined with more consolidation, it would become feasible for large European operators to cancel roaming agreements in countries where these operators have full coverage. This would completely prevent their roaming customers to fall off to their competitors. However, it would also considerably limit the amount of inbound roaming users this MNO would receive.

Appendix 7 shows the effect OTA has on the direction of traffic. The EC, DG Competition stated in a speech [EC01] that: “technical developments related to over the air programming of SIM-cards will allow increasing direction of roaming traffic by home country operators onto a particular preferred network abroad. Some operators claim this will be effective for over 70% of calls”.

Figure 22 shows the influence that implementation of OTA has on wholesale competition. It assumes that the use of OTA and SAT increases together with more consolidation. This increase seems likely since it gives MNOs advantages (see above). When OTA and SAT are being used more it becomes possible to direct traffic to the network with the lowest IOT. This will result in the fact that, e.g. smaller GSM 1800 operators will start offering lower IOTs in order to increase the amount of inbound roaming traffic they receive. This will increase wholesale competition.

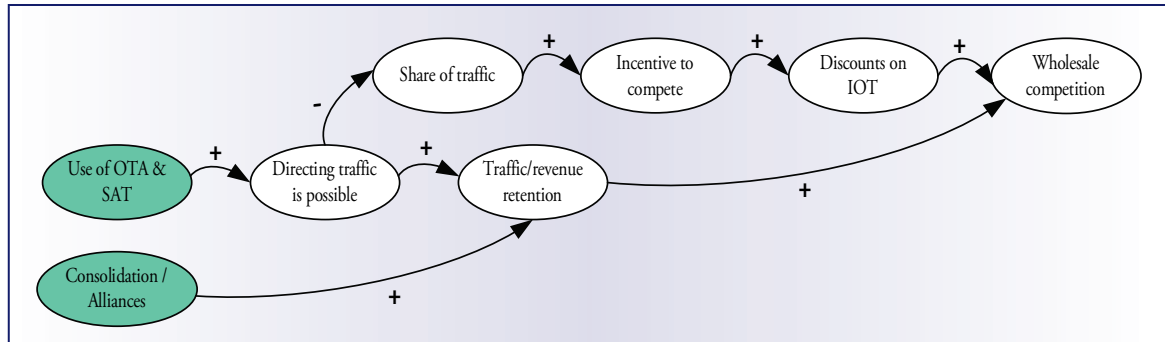


Figure 22. Impact of OTA, SAT and consolidation on wholesale competition.

4.4 Conclusion and Reflection on Market Trends

At first sight OTA might seem very promising; however I believe that three side notes on the effects of OTA have to be made.

First of all at this point in time, a customer travelling abroad enjoys a certain degree of freedom. He or she is able to actively select and change the network onto which the user roams. When OTA will start to be used more often or when roaming agreements will be cancelled, this freedom will probably be reduced or lost. This is likely to raise a number of serious doubts for users. Furthermore, NRAs might be alerted by the lack of choice abroad. However, I think that this trend of directing traffic could be strongly in favour of shaping the current wholesale market into a more competition environment. This 'restriction' in choice abroad could only benefit the customer in the end by leading to lower tariffs in the first place and to better services whilst roaming. Operators will have stronger incentives to create pan-European services; not only creating exactly the same user-experience abroad as at home but also making users benefit from new international services such as pan-European Location Based Services (LBS).

Secondly, it is far from certain that operators will not use OTA to increase their own revenues by keeping traffic within the group/alliance/partner networks and that OTA will purely be used to offer higher quality international services. If this would be the case, competition would be half successful: roaming with tariffs that are still high but with more innovative services.

The third remark is that OTA can also end in to a large reduction of inbound roaming revenues. Every operator will decide autonomously whether or not using OTA will be beneficial to revenues and profit. However, it seems likely that there are many operators who will not benefit from OTA at all. Even a very big group of operators might not find it beneficial to keep all traffic within the group because this will lead to other operators cancelling contracts with this group and this will result in significantly lower revenues from inbound roaming for the group. A question could be how large the customer base of a group should be before the 'break point' is reached; when will the group start cancelling roaming contracts and keep all traffic within the group? Since inbound roaming gives a higher profit than outbound roaming, this point might be reached only when the group has more than half of the market. If roaming users are being called more than they call themselves, then this point moves even farther away.

Because of these reasons I believe that OTA is quite promising in delivering more wholesale competition, but that it is a far too uncertain reason for NRAs not to intervene in the IMR markets. The next chapter discusses the legal framework within which an NRA has instruments at its disposal to regulate markets now that the market is not likely to resolve competitive issues itself.

5. **LEGAL REGULATORY FRAMEWORK**

This chapter gives an overview of the legal regulatory framework related to roaming and forms the beginning of the part of this research that looks into solutions. If an NRA would want to implement a certain remedy, it should fit within this framework. After describing what the legal aspects are, it will be possible to see if whether or not an NRA has remedies at its disposal that would be effective to introducing competition in the IMR sector.

General competition law relates to all competition issues that arise in any sector. That means that telecommunications, as well as roaming, falls under general competition law.

Article 81 of the Treaty establishing the European Community [EU02] prohibits: “all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the common market”.

Article 82 has a different focus because it looks at the misuse of a dominant position on the market. “Any abuse by one or more undertakings of a dominant position within the common market or in a substantial part of it shall be prohibited as incompatible with the common market insofar as it may affect trade between Member States”. Any possible solution to the competitive problems that are present in the roaming markets can possibly be solved under competition law as well. However, this is not the main goal of this report.

5.1 **Introduction to the New Regulatory Framework**

Under the 1998 regulatory framework, the market areas of the telecommunications sector that were subject to ex-ante regulation were laid down in the relevant directives, but were not markets defined in accordance with the principles of competition law. In these areas defined under the 1998 regulatory framework, NRAs had the power to designate undertakings as having Significant Market Power (SMP) when they possessed 25% market share, with the possibility to deviate from this threshold taking into account the undertaking’s ability to influence the market, its turnover relative to the size of the market, its control of the means of access to end-users, its access to financial resources and its experience in providing products and services on the market.

The New Regulatory Framework (NRF) package establishes a framework for electronic communications infrastructure and associated services with the aim of creating effective competition for electronic communications throughout the EU. The New Framework has to be implemented by the Member States by 25 July 2003.

The NRF for the electronic communications sector seeks to respond to convergence trends by covering all electronic communications networks and services within its scope. The aim is to reduce ex ante sector-specific rules as competition on the market develops and to make regulation more in compliance with general competition law. The NRF consists of:

- Five Directives: The Framework Directive, and Directives on Access & Interconnection, Authorisation, Universal Service and Data protection;
- European Commission Guidelines on market analysis and assessment of SMP.

The Framework Directive determines that NRAs in all Member States must conduct a review and analysis of markets and effective competition in the electronic communications markets. As stated in the Framework Directive, the analysis respectively consists of: defining relevant markets, evaluating effective competition and the presence of SMP on these relevant markets and finally assessing the need for ex ante regulation.

5.1.1 Defining Relevant Markets

The European Commission has published a final Recommendation of 18 markets on which ex ante regulation might be needed (14 wholesale and 4 retail markets) [EC03]. This list includes the market as was described in paragraph 3.2 of this report: The national market for provision of wholesale IMR to foreign mobile network operators.

This means that the following sections relate only to the wholesale roaming market and not to the retail roaming market. Legally, an NRA is not allowed to regulate the retail roaming market unless it would define it as an additional relevant market. The European Guidelines on Market Analysis state [EC02/2]: “when justified by national circumstances, other markets can also be identified by the NRAs, in accordance with the procedures set out in Articles 6 and 7 of the Framework Directive.” As will be shown in the chapter on remedies, this could be justified for the IMR retail market only if regulation on the retail market seems beneficial to competition.

5.1.2 Assessing Effective Competition

Next, the task of an NRA is to assess whether or not competition on the relevant market is effective. On all of these markets, NRAs will intervene to impose obligations on undertakings only where the markets are considered not to be effectively competitive as a result of such undertakings being in a position equivalent to dominance within the meaning of Article 82 of the EC Treaty [EU02]. Article 14(2) of the Framework Directive states dominance as: “An undertaking shall be deemed to have significant market power if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers.” Once an NRA has concluded that a relevant market is not effectively competitive, the SMP Guidelines state that: “they will designate undertakings with SMP on that market, and will either impose appropriate specific obligations, or maintain or amend such obligations where they already exist, in accordance with Article 16(4) of the Framework Directive.”

An NRA has to reassess a certain market after a period of approximately two years to investigate whether or not competition has increased. This timeframe also relates to the period that is discussed in this report.

An important note is that without the existence of a single or jointly dominant position of one or more undertakings on a certain relevant market, an NRA is practically incapable of imposing measures on market parties in that relevant market. This also applies to the relevant market related to roaming.

After having assessed the competitiveness of a certain relevant market, an NRA has a wide variety of instruments at its disposal. The next section will analyze the likeliness of a dominant position on the relevant national market for wholesale IMR services.

5.2 Single Dominance in Wholesale Roaming

When assessing a dominant position on the market for IMR services, it is required to first look into the likeliness of single dominance. A good indicator for this can be a high market share of approximately 50% or higher of one firm. Only if single dominance does not exist, it is needed to look into joint dominance (two firms with a joined market share equal or greater than 50%). The criteria that are mentioned by the NRF for investigating dominance can be found in Appendix 6.

In general, single dominance is determined by looking at the market shares of companies, the rise or decline in market shares over time and the ability of firms to price significantly higher than others. In respect to the wholesale IMR market, the European Commission's inquiry into mobile roaming [EC00] suggests that in The Netherlands (among other Member States) there might be operators with a market share of over 50%. However, there are a number of reasons why it seems unlikely that single dominance on the national wholesale market for IMR will continue to exist.

1. On the wholesale markets MNOs have roaming agreements with many other MNOs in other Member States. Because of this structure and because an MNO is at the same time a wholesale supplier and buyer, it seems unlikely for one firm in a given national market to have single dominance;
2. When looking at retail prices and their trends, it seems unlikely that any firm has a single dominant position that would imply the power to price significantly higher than other firms. All retail tariffs are approximately of the same level. This leads to the insight that it is unlikely that on the wholesale market there is a firm which is able to price significantly higher (all firms charge approximately the same retail mark-up [EC00]). Furthermore, because of the relationships between domestic and foreign operators (both are supplier and demander of wholesale services) it seems unlikely that one firm has a single dominant position on the wholesale market;
3. Finally, both the coverage of European mobile networks (900MHz and 1800MHz.) and the number of dual-band capable handsets have increased since the publishing of the EC findings in 2000. This has decreased the competitive edge the 900 networks might have had in the past²⁰. The roaming traffic will be shifted more to 1800 networks as well, meaning that the likeliness of a future trend of sustaining a single dominant position (for the 900 operators) becomes smaller.

In case the assessment of SMP for a single firm does not lead to a determination of a single dominant position and if the market under inspection is not effectively competitive, the other possibility is that more than one firm have SMP together; also called joint dominance. Since this is more likely for IMR services, joint dominance will be discussed in the next section

²⁰ Note that networks with stronger signals have a higher chance of being selected by a roaming user. Furthermore coverage of 1800MHz networks was worse for a long period of time. At this moment, both network types have, e.g. in The Netherlands, practically equal coverage and network quality.

5.3 Joint Dominance in Wholesale Roaming

Joint (collective) dominance is a complex concept. The EC considers: “two or more undertakings to be in a collective dominant position when they have substantially the same position vis-à-vis their customers and competitors as a single company has if it is in a dominant position, provided that no effective competition existed between them.” This means that certain links are in place between the companies, however “the existence of such links was not a prerequisite for a finding of joint dominance” [EC03, par 3.1.2, p.86]. In practice, the notion of “links” between companies can be interpreted as the notion of interdependence with the result that joint dominance comes close to the understanding of an oligopoly as it was described in paragraph 3.6. This ends in the fact that the notion of tacit collusion, the conduct of firms recognizing their interdependence and as a result coming to coordinated behaviour, relates closely to joint dominance. The European Commission states: “Two or more undertakings can be found to enjoy a joint dominant position not only where there exist structural or other links between them but also where the structure of the relevant market is conducive to co-ordinated effects, that is, it encourages parallel or aligned anticompetitive behaviour on the market” [EC02/3, recital 26]. In order to assess whether such a market exists, again a number of criteria could be used. These criteria can be found in Appendix 6. The section below briefly describes why it seems likely that joint dominance is present in the wholesale IMR market.

5.3.1 Economic Links and Joint Dominance

The European Commission [EC00, p.24] mentions that a number of economic links are in place between the firms on the wholesale markets for IMR services. All these links have been mentioned in depth in this report as well.

Not only interconnection agreements but also links by means of the GSMA in which the firms meet on subjects related to roaming such as billing or the technical aspects of roaming. Furthermore the firms have to cooperate in order to make e.g. number portability work. Another type of link between firms springs from the earlier mentioned contacts in organisations such as the 3GPP or the ITU. Another feature of the market that can be interpreted as a type of link is the fact that the MNOs offering wholesale roaming services follow the STIRA and the charging principles (IOT). Since all roaming is conducted within this framework it is considered quite a strong link.

However, the existence of links between firms is not a sufficiently strong reason to establish joint dominance in any type of market. The structure of the market has to be conducive to coordinated anticompetitive behaviour on the market as well. The following section will consider the question why the structure and conduct on the wholesale market could stimulate joint dominance.

5.3.2 Oligopoly and Joint Dominance

The term joint dominance and the market structure of oligopoly are closely related. In the Airtours/First Choice merger decision [AIR02] the European Court of First Instance (CFI) adjusted the definition of joint (collective) dominance as used by the European Commission, and changed it into “a situation in which it is economically rational and preferable for firms to adopt, on a lasting basis, a common policy on the market with the aim of selling above competitive prices” [ERG03/1]. Worded differently by an OXERA research into joint dominance [OX02]: “a situation of collective dominance arises when the adoption of a long-lasting common policy by the members of an oligopoly is possible, economically rational and hence preferable”. This results in the generally accepted idea that “This judgement realigns the concept of collective dominance with the theory of tacit collusion”. The CFI also provided clear conditions that should be met in order for a collectively dominant position to exist [ERG03/1]:

1. "Each member of the dominant oligopoly must have the ability to know how the other members are behaving in order to monitor the other members. It is therefore necessary for sufficient transparency for all firms in the oligopoly to be aware, sufficiently precisely and quickly, of the way in which other firms' market conduct is evolving."

Firms on the wholesale market are capable of exactly monitoring the price (IOT) that a foreign operator sets on a foreign wholesale market. All IOTs are published on a GSMA-website, probably originally to make concluding roaming agreements easy and quick, but with the side-effect of easy and quick monitoring of the oligopoly conduct. MNOs in the same country are supposedly not able to see each other's IOTs. However, because of the existence of many economic links and large groups of operators, it will not be difficult for an MNO to find out the IOTs of other domestic MNOs. The condition of transparency is met. The conditions of "sufficiently precisely and quickly" are also met since the published IOTs are exact and any change in IOT has to be announced through the GSMA 60 days beforehand. This ends in the fact that a change can be signalled very quickly.

2. "Any tacit co-ordination must be sustainable over time. Implicit in this is the view that a retaliatory mechanism of some kind is necessary, so that any firm that deviates from the co-ordinated practice would be met by competitive reactions by other firms."

There is no direct retaliatory mechanism present in the wholesale market. However, this condition presupposes that a firm would gain something from taking a more competitive stance. A firm has a positive incentive to not compete because it will run the risk of making no profits on roaming in the long run. Operators are free to set lower IOTs, but if this gives no additional benefit why would a firm do this? The firm knows which revenues it will make when it acts in line with the current behaviour of the market, in order for the firm to change its conduct it would need to have a very strong incentive. A retaliatory mechanism is not needed to bind the operators to the generally accepted conduct of the market.

An indirect retaliatory mechanism that could be present is the thought that once an operator would consistently lower its IOTs in order to 'rock the boat' other operators might cancel their roaming agreements with this operator. This would harm the deviant MNO in quite a strong way because the competing operator would miss the high revenues from inbound roaming users. Because no operator has rocked the boat yet, it is difficult to say if this retaliatory mechanism will be used, however it is a possibility.

3. "It is necessary that existing and future competitors, as well as customers, do not undermine the results expected from the common policy." This means that there should be barriers to entry, a low elasticity of demand and low buyer power.

Barriers to entry into the wholesale market are unmistakably present. To start a new full MNO is fairly impossible because of the limited amount of licenses and the high costs that are associated with building such a network. Starting a MVNO is possible, however concluding direct roaming agreements (with MNOs) is not allowed within the framework of the GSMA.

Low elasticity of demand is probably also present in the wholesale market. Since prices are rigid and since the IOT (costs for a foreign MNO) are fully passed on in the price to the end-user, it can be argued that an MNO is inelastic in its demand²¹.

²¹ Discounting on IOTs would be a sign that elasticity is indeed not low but no evidence has been found, by the EC in its sector inquiry, on the amount and frequency of discounting.

The last necessary condition is the lack of presence of buyer power. OFTEL in its review of the mobile wholesale voice call termination market states that [OFT03/2]: “Countervailing buyer power exists when a particular purchaser (or group of purchasers) of a good or service is sufficiently important to its supplier to influence the price charged for that good or service”.

Since many operators have roaming contracts with often 3 foreign roaming partners in a specific country, it seems unlikely that any MNO has strong buyer power over a foreign MNO.

The above section demonstrated the necessary conditions for the existence of a joint dominant position of firms in an oligopolistic market. A condition that is quite straight forward is the existence of an oligopoly. The wholesale roaming market can be seen as a homogenous oligopoly because it complies with the requirements of an oligopoly: few suppliers and buyers, interdependence between firms and high barriers to entry while at the same time the products of the various suppliers of roaming can be seen as substitutes. As Table 4 shows, the relevant wholesale roaming market complies with all the necessary conditions to joint dominance.

Conditions	Compliance of roaming:
Existence of an oligopoly	✓
Transparency	✓
Retaliatory mechanism(s)	✓
Barrier(s) to entry	✓
Low elasticity of demand	✓
Low countervailing buying power	✓

Table 4. Necessary conditions for joint dominance.

The SMP Guidelines mention other criteria that are closely linked to the fact that joint dominance exists on the market. The criteria as listed in Appendix 6 and below are not necessary conditions but can be used additionally when assessing joint dominance.

- An additional criterion of “similar cost structures” is also valid for the national wholesale roaming market. All operators in The Netherlands (and other Member States) have a high percentage of coverage and (wholesale) cost differences between 900 and 1800MHz networks are rather similar (e.g. maintaining the network);
- Another additional criterion is “lack or reduced scope of price competition”. This condition is met because price competition, at least at the retail level, is very limited and as a result it can be argued that price competition in the wholesale market is just as rigid. This argument of price rigidity is backed up by many previous sections in this report (e.g. 3.4.3 and 3.4.4)

Firms in an oligopoly could easily make tacit collusive arrangements on e.g. the price level. The wholesale roaming market satisfies all prerequisites and that is why it seems likely that tacit collusion exists in the wholesale roaming market.

5.3.3 Conclusion on Dominance in Wholesale Roaming

The question whether or not dominance (single or joint) is present in the wholesale market for IMR services is a vital question to NRAs. Without the existence of either single or joint dominance, roaming would be hard to regulate.

After looking into the two forms of dominance, single and joint dominance, it seems likely that joint dominance is present in the wholesale market. As was shown above, the wholesale roaming market satisfies all essential conditions such as the existence of an oligopoly, high transparency and a retaliatory mechanism. This is backed up by the fact that the European Commission stated that: “the inquiry showed high concentration ratios with a combined market share of above 90% for the two initial GSM 900 operators in most national wholesale markets”. It should be remembered that this market share is on the wholesale market of supplying IMR services.

5.4 Single and Joint Dominance in Retail Roaming

Currently, retail roaming has not been defined as a relevant market with the result that an NRA is not be able to use any instruments in order to e.g. “make the retail roaming market more transparent”. The first step for an NRA is again to define the relevant market in accordance to the Guidelines. Doing the market analysis of the retail roaming market is outside the scope of this report.

The question of dominance will also be important for the retail roaming market. Without specific data from market parties, predicting the existence of dominance will be difficult. Single dominance on the retail roaming market might be possible. Looking at the current retail market shares of the operators, using The Netherlands as an example, there is no operator with more than 50% market share. But when taking into account that it appears logical that the incumbent or the GSM 900 operators have the largest share of business users who roam more often, it might be possible that one of these operators has a market share of over 50% purely for retail roaming services.

Following this same argumentation, presence of joint dominance is more likely than single dominance when using market shares as an indicator. The two largest operators both have market shares considerably above those of their competitors. Furthermore, these two operators are generally thought to have the highest percentage of business users as being the original “high-end” operators.

However, it is obvious that the above reasoning draws conclusions too quickly and that is why the possibilities of defining the retail roaming market as a relevant market and of assessing single/joint dominance on that market need to be further investigated. This becomes more important when the chapters on remedies, show that some type of regulation on the retail IMR market proves to be beneficial.

The next section will not look deeper into the question of the existence of any form of dominance but it will assume that joint dominance is indeed present on the wholesale market. By making this assumption, it becomes feasible to look at the possible remedies that an NRA has at its disposal.

5.5 Regulatory Instruments

This section gives an overview of the various regulatory instruments that an NRA could impose on network operators that have been designated as having SMP under the NRF. An NRA could use an instrument that falls outside the overview that will be given below. However, before that is possible the NRA would require specific authorisation from the European Commission³.

The table below gives an overview of the allowed regulatory instruments under the NRF. A distinction is made between instruments that affect the structure of the market and instruments that would focus more on the conduct of firms.

Regulatory instruments, Structure	Meaning
Vertical separation: • Accounting separation	A requirement for a vertically integrated firm to produce separate accounts for the different stages of its operations, with costs allocated accordingly.
Regulatory instruments, Conduct	Meaning
Availability/publication of information	A requirement for providing information to the NRA, consumers and to competitors.
Regulatory monitoring of: • The effectiveness of competition • Companies' behaviour	The role of the NRA is to monitor the effectiveness of competition.
Consumer rights and scrutiny	Actions to improve consumers' awareness of their rights and the ability to exercise these rights.
Price transparency	Actions to increase the transparency of prices of regulated firms.
Quality-of-Service regulation	Measures to introduce more competition on the quality aspects of services offered.
Non discrimination rules	Rules that prevent the regulated firms from discriminating among their customers.
Unfair pricing rules	Rules preventing regulated firms to price in a predatory way that would eliminate existing competition and increase entry barriers.
Access regulation and requirements	Actions to ensure end-to-end connectivity and to increase effective competition in network provision
Price / Cost regulation	Measures to prevent excessive pricing and to improve efficiency

Table 5. Regulatory instruments. Source: Framework Directives and OXERA [OX03].

5.6 Conclusion on Legal Regulatory Framework

This chapter has given an overview of the New Regulatory Framework with which firms on the market and NRAs are confronted. The final goal of this chapter was to present a list of possible instruments that an NRA could use in order to regulate a certain relevant market. This list of instruments can be used as a guide when developing solutions to the impediments on the wholesale and retail markets. An important note that should be made here again is that an NRA is not allowed to impose any measures upon firms in any other market than the “relevant market”.

Before an NRA is able to use most of its instruments, the relevant markets have to be defined first, then effective competition needs to be evaluated (including SMP) and finally the need for ex ante regulation should be considered. Only then the NRA is allowed to use the instruments at its disposal. The question of assessing SMP is an important one because, under the new framework, an NRA is almost incapable of acting without one or more firms having a dominant position.

Having looked at the two types of dominance, single and joint dominance, it seems likely that joint dominance is present on the wholesale and possibly on the retail roaming market. As was shown in this chapter, the wholesale roaming market satisfies all essential conditions for joint dominance such as the existence of an oligopoly, high transparency and a retaliatory mechanism. The retail market will require further analysis in case it seems worthwhile.

The next chapters will look at possible solutions to the impediments on the wholesale and retail markets. Even though regulating the retail IMR market would require defining it as a relevant market and assessing dominance, retail regulation is a possibility to increase competition. After having described the legal framework this option is also not completely ruled out and therefore retail remedies will be discussed in 7. First, chapter 6 will give an overview of remedies on the wholesale IMR market.

6. REMEDIES TO WHOLESALE IMPEDIMENTS

The analysis in chapter 3 led to a number of impediments to competition on both the wholesale and retail markets. This chapter will consider remedies on the wholesale market for IMR. Table 6 shows the various impediments.

Impediments	Result
Framework by the GSMA: • Barriers to entry	Only direct roaming agreements with other full MNOs.
Framework by the GSMA: • High transparency & price rigidity	Framework establishes a very transparent and rigid wholesale market.
The effects of the wholesale oligopoly.	MNOs recognise interdependence, possible tacit collusion.
Lack of wholesale substitutes.	The lack of substitutes is an impediment to competition in the wholesale market. If more wholesale substitutes would be available, foreign MNOs could use these to bypass the wholesale services offered by MNOs.
No incentives fight wholesale prices.	A high IOT is carried by the foreign end-users, a lower IOT does not necessarily result in more traffic and responsibility of high retail prices can be shifted to wholesaling foreign MNO.

Table 6. Overview of Impediments to Wholesale Competition.

Remedies could be fitting not only in the sector specific legal framework, but it will also be investigated whether some remedies would better fit the general competition law. However, the IMR markets in respect to general competition law is not the main subject of this chapter.

The first section of this chapter will link to the market trends and will show that a regulatory intervention is indeed required. Afterwards, the sections that follow will discuss remedies to the impediments as mentioned above in Table 6.

6.1 No Regulatory Intervention

In practice, it is best when a market reaches a more competitive state by itself. Three trends/developments are listed below that might improve market conditions. The reasons why I believe these will not have a major influence on the competitiveness of the markets in the near future are given as well.

1. The market trends of OTA and consolidation increase the possibilities an operator has to keep traffic within the group and as a result increase the incentive to compete.
Consolidation is already quite strong on the markets and this has not resulted in competition on price or (quality of) services of IMR. The newly formed alliance of TIM, Telefónica and T-Mobile is a recent example of consolidation and seems to focus on offering pan-European services instead of starting price competition. No effect has been demonstrated yet.

2. The increase in use of OTA will probably be a stimulus; however it is far from certain that OTA will be the ultimate solution. OTA could for instance be used as a mean to generate more revenue for the MNOs. Furthermore, NRAs have no authority to ensure OTA implementation leading to the incentive for lower wholesale prices.
3. The third possibility springs from Vodafone possibly starting to compete more strongly on roaming tariffs. In the merger case of Vodafone/Mannesmann [*VOMA00: p.14*] in 2000, the EC decided that Vodafone was allowed to merge with Mannesmann only if: "The provision of a roaming tariff and/or wholesale services will be made on a non-discriminatory basis between operators of the merged entity's group and other MNOs. The non-discrimination principle will apply to both pricing and quality of the service."

This decision has now expired and would allow Vodafone to internally charge lower IOTs than to other MNOs. This could give Vodafone a considerable competitive edge for IMR services. If Vodafone takes advantage of the expiration this would be good for wholesale competition and because other pan-European operators could do the same, competition problems for IMR would not be expected in the near future. Nevertheless there is no certainty that Vodafone or any other group of MNOs would use this chance to start competing on wholesale prices in the near future. As was described before, inbound roaming revenues are very important to operators (Vodafone included). When an operator-group would start competing in the way described above, it would lose many of these revenues leading to the insight that it might not be profitable at all to keep all traffic within the group.

The above reasons made clear why, in my opinion, more effective competition will not start in the near future. No market trends towards more competition are evident and the incentive for operators to charge high wholesale prices still remains.

Besides, operators are far more active in introducing new data services that increase the ARPU of their customers; services such as GRPS (roaming) and MMS are supposed to generate large revenue streams. More competition in roaming would certainly decrease this ARPU, would decrease operator's revenue and as a result would lower the stock market price.

Finally, there is not a single substitute for wholesale IMR services. This means that an operator wanting to give its customers access abroad does not have another option but to choose wholesale services of the national MNOs.

To conclude, it has become obvious that competition is not likely to start without any stimulation or intervention coming from outside the market. This stimulation could be provided by a new entrant or by measures of NRAs or National Competition Authorities (NCAs). The next sections will discuss the impediments to competition as shown in Table 6 above.

6.2 Remedy to Barriers to Entry

Barriers to entry are determined by the framework established by the GSMA. It does not allow operators to conclude direct roaming agreements with other parties which do not have a full licence. This results in the fact that an MVNO or service provider is currently not able to negotiate about the price their customers pay when roaming abroad. Furthermore not many new entrants will appear that would start to compete because due to the following reasons:

- Additional spectrum is not likely to be issued/auctioned, and licences for UMTS were mainly sold to all established MNOs;
- The framework by the GSMA restricts roaming agreements to be concluded only between full MNOs; this excludes MVNOs or service providers;
- High costs are associated with starting up an MVNO offering European roaming services;
- Investors and financial means are harder to acquire in a situation worldwide economic decline.

6.2.1 Possible Remedies

The most straightforward solution would be to issue more spectrum. However it seems highly unlikely to me that this would solve anything at all in the nearest future because constructing a new network is both expensive and time consuming. Coverage is high across Europe and so is penetration of mobile telephony. The fact that roaming agreements can only be concluded with other full MNOs that are a member of the GSMA limits the chances for a potential new full MNO.

The second solution would be to enable an MNVO to enter into the profitable wholesale roaming business. The MVNO would first have to get access to a domestic mobile network; this is usually not a problem. This type of barrier to entry is comparable to that of a normal MVNO. The MVNO would have to build its network, give out SIM-cards and do marketing to attract customers.

However, the most important barrier to entry for an MVNO to be able to offer wholesale roaming services, is a different one. An MVNO makes use of the mobile network of a full MNO. This means that also when an MNVO would offer roaming services to a foreign party, the mobile network of the 'higher' MNO would still be used. In the current situation, this MNO would simply refuse or block the users from its network. This current situation could be changed only when MNOs would be obliged to open their networks to roaming partners of MVNOs or service providers. The MNO would not do this on its own initiative because it would hurt its own wholesale roaming business²³. Three scenarios appear if the market would be opened for MVNOs. The scenarios are shown in Figure 23. The MVNO could start to:

1. Supply wholesale roaming to other MNOs.
Other MNOs could buy wholesale roaming services from the MVNO instead of directly from the MNO itself. The foreign MNO would bypass the traditional roaming agreements.
It does seem strange that a domestic MNO would give access to the MVNO if this new entrant would damage the profitable wholesale roaming business of the MNO. The operators themselves will not implement this solution and therefore it can only be enforced by NRAs or by the Commission. Once the market has been opened up, there is no obligation on the MNO to buy wholesale roaming services from these, probably cheaper, MVNOs. The MNOs will have the largest client bases and if they would (collectively) refuse to buy from the MVNOs, roaming would still be just as expensive. This threat is quite real because the MNOs themselves do not carry the burden of a high wholesale price.
2. Offer pan-European roaming services themselves within one company.
This would require a pan-European presence of a large MVNO. The MVNO could supply the wholesale roaming services internally in order to create competition vis-à-vis the large groups of operators.
There is no MVNO currently active in all European countries and with the current state of the market it does not seem likely that such a new entrant will appear because it would require high investments for networks and marketing.

²³ If an MNO would decide to start price competition (which seems unlikely) than the MNO could start doing this without needing an MVNO.

3. Supply wholesale roaming to other MVNOs.

MVNOs are present in some European countries (for instance the United Kingdom, The Netherlands, Germany etc.). All these MVNOs could start to offer each other wholesale roaming services. If the market would be opened up, this could become an actual possibility. An MVNO in country A will be able to let its customers roam on an MVNO in country B.

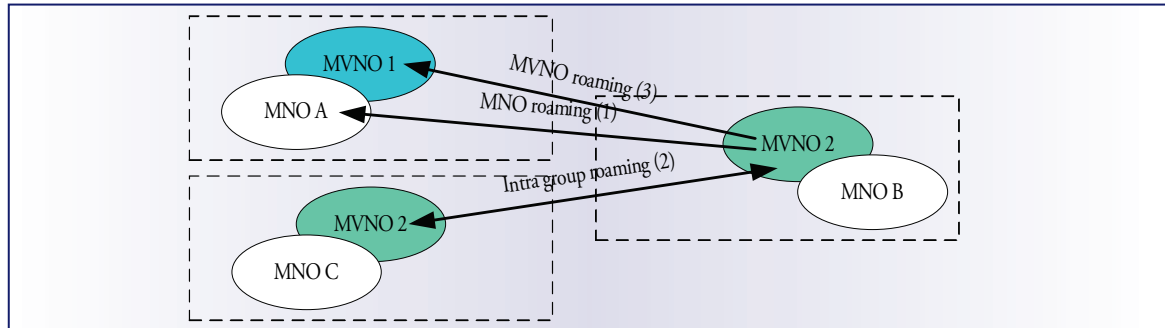


Figure 23. Diagram of Wholesale MVNO Roaming.

Scenario number 3 appears to be most promising in the near future when the wholesale roaming market would be opened up. There are points of criticism that remain when thinking of the removal of the entry barriers as being a good remedy.

The first point is why the MVNOs will start to strongly compete with the MNOs. It could be a big advantage for the MVNOs themselves if they could offer retail roaming rates that are only slightly lower than those of the MNOs, while at the same time being able to make the same profit margin. The MVNOs could join in the current conduct of the market.

The second point is that the MVNO would still be ‘tied’ quite strongly to the higher operator that supplies its wholesale services. The MVNO will rely for a large part on the services the higher operator supplies. It does not seem likely that this operator would give a good deal to the MNVO under the current market behaviour.

Finally an important question that remains is how much of an impact MVNOs would really have on the current conduct on the wholesale market. In my view this impact will be fairly limited. Mainly because the wholesale buying power will be small (few roaming users) and because the power that the new entrant will have to acquire customers will be very small compared to that of the full MNO. An MNVO entering the wholesale market with all the big players is not likely to upset the market.²⁴

6.2.2 Conclusion Removing Barriers to Entry

In conclusion I believe that the current barrier to entry for MVNOs determined by the GSMA is unfair, is indeed limiting competition and should be removed. Removal will create better chances for entrants into the market.

Removal of the entry barriers should be done by NRAs and should be aimed at the framework within which roaming is conducted at present. Under the Access and Interconnection Directive, an NRA can impose a measure on the operator to supply access (wholesale roaming) to any other entity (e.g. MVNO) whenever it makes a reasonable request. The operator has to offer these access services at reasonable, non-discriminatory terms and conditions.

Although removing this impediment will create a market that is more susceptible to competitive impulses, it is not going to have a major impact on competitiveness of the market as a whole. When implemented on its own, it will not strongly increase wholesale competition and bring down wholesale prices resulting in lower retail prices.

Secondly, coordination between NRAs is recommended. This will be treated in section 7.8.

²⁴ Note that customers do not only want to be able to use roaming services but also require innovative domestic (data) services; the question is whether a price-fighter for roaming is able to offer this type of additional services.

Impediments	Remedy	Actor & Solution Type
Barriers to entry	Allow roaming with new entrants (non-MNO)	NRA – Legal. Impose Access obligations on operators.

Table 7. Overview of Remedy: Reducing Barriers to Entry.

6.3 Remedy to Wholesale Transparency and Rigidity

The current framework within which IMR is conducted is very transparent internally to all MNOs on the market. In 1996 the European Commission has given partial approval to the STIRA by means of a Comfort Letter. The EC mentions the following reason [EC97/2]: “The Commission found that the agreement presents a number of clear benefits and it also secured changes which ensure that the standard agreement will not have anticompetitive effects”. At that moment the EC looked strongly at the positive effects the STIRA could have. It was supposed to facilitate the conclusion of bilateral agreements between the operators with the result that end-users would be able to enjoy roaming services across Europe as quick as possible.

In relation to any competitive problems arising, the EC mentioned that: “nothing in the agreement prevents a consumer in one country from taking out a subscription with a network operating in another country if the tariffs are financially more attractive. Secondly the parties undertake to ensure that commercially sensitive information provided to other operators in the context of these agreements will only be available in the interest of roaming and not for anticompetitive purposes”. The fact that the EC at that point in time stated that the framework seemed to be beneficial, does not mean that it is impossible to review the STIRA.

In my opinion it is very important to remove the detrimental effects that the STIRA has on competition in the wholesale market. The framework strongly facilitates the possibilities the firms have to monitor each other’s price levels and changes in price. Apart from that, the framework increases the rigidity because price changes cannot only be very quickly detected, but also have to be announced 60 days in advance. This removes the possibilities for operators to secretly lower their wholesale price and to start competing. Further still, the wholesale conditions are by obligation non-discriminatory. This result in the fact that special deals with foreign operators are impossible.

6.3.1 Possible Remedies

Without looking at the legal/regulatory feasibility, I believe that the conditions of the STIRA should be changed on certain aspects. Since the STIRA can save a great deal of work for MNOs and since it makes the administrative part of roaming easier, plainly abolishing the STIRA will not be beneficial. The list below gives three suggestions to changes in the STIRA that increase wholesale competition:

1. Remove the obligation of non-discrimination.
Once this obligation has been removed, it will become attractive for operators to give higher discounts to certain foreign operators. For instance because these operators would generate more traffic (through OTA) or because of marketing/branding reasons.
2. Remove the 60 days notice.
Objectively, the period of nearly two months is far too long to allow any dynamic price making. The original thought appears to be that this period would give the foreign operator(s) enough time to adjust retail tariffs. However, the consumer currently already does not know what he pays abroad, and retail roaming tariffs can already be changed at any random point in time; thus

completely removing this period would be beneficial to competition. Another, less strict possibility would be to enforce that the announcement is made only to operators with whom a contract was signed, and not to all other operators; this would also remove transparency, only less strongly.

3. The question is why all IOTs need to be openly published to operators. In theory, the transparent publishing of tariffs could increase competition because the operators are better informed about prices and can therefore select the cheapest foreign partner. However, when operators use this instrument for monitoring each other's prices and adhering to the general price level, then the instrument has a very adverse effect of maintaining the conduct of the oligopoly.

My proposal would be to remove the full publishing of IOTs and its conditions for operators active in Europe. The result would be that extensive monitoring of wholesale prices would not be possible anymore. Only on an individual level, for instance by asking for a special bid from a foreign operator, will it be possible to find out the exact wholesale price. This will also make it feasible to conclude special deals, to give special discounts and to possibly start price competition.

This solution would have negative side effects as well, because operators from outside the European Union (EU) searching for a new roaming partner in the EU, might have more problems selecting the best one. Furthermore, the operators outside the EU could still continue to monitor each other's prices²⁵. This could result in the fact that the IOTs in those countries will remain considerably higher than in the EU.

6.3.2 Conclusion on Remedy to Transparency and Rigidity

When it comes to the implementation of these solutions, two different routes come to the fore: either to review the framework for roaming under sector specific rules or under general competition law. When looking at the possible options that an NRA has, the required remedies do not fit the competencies of an NRA. None of the instruments listed in Table 5 are capable of accomplishing what is needed.

- Removing the non-discrimination obligation in the STIRA is not possible for an NRA, it can only make sure that operators do not discriminate; in the case of IMR it would exactly be beneficial for competition to remove this obligation;
- Removing the 60 days notice does not seem possible, neither under the NRF;
- Prohibiting operators to publish their wholesale prices openly to other operators is another remedy for which NRAs lack the competence.

The only option remaining is to review the framework for roaming under general competition law. This investigation would be very complex, lengthy and would need to prove that firms illegally fix prices or share confidential information. Such an investigation has to be conducted by the EC because it covers all Member States. In my opinion using this as the only remedy would not be a preferred solution because the duration of such an investigation is very long. NRAs have to search for other instruments in order to increase IMR competition.

Impediments	Remedy	Actor & Solution Type
High transparency & price rigidity	<ul style="list-style-type: none"> • Remove non-discrimination • Remove 60 days notice • Prohibit publishing of IOTs 	EC – Legal. Review the framework under competition law.

Table 8. Overview of Remedy: Reducing high transparency and rigidity.

²⁵ Roaming with a European mobile phone to countries outside the EU is often even more expensive. This could mean that countries outside the EU charge even higher IOTs or that the retail mark-up is higher.

The best non-legal option would be to openly discuss changes with the GSMA. It would be best if the GSMA, the EC and the NRAs would look at the changes to the framework that are needed to increase competition. Because NRAs and the EC have means to regulate, conversation might be a good way for the GSMA and operators to avoid any legal remedies. Discussing possible changes to the current conduct on the market with the GSMA might be a good opportunity for both parties to propose solutions.

6.4 Remedy to the Effects of the Wholesale Oligopoly

When looking at the impediments to competition that are formed by the existence of an oligopoly on the wholesale market, it is possible to introduce more competition in three ways: either by preventing the oligopoly from existing in the first place, by curing the oligopoly totally, or by removing the detrimental effects of the oligopoly [*CPB03: p.8*].

6.4.1 Possible Remedies

An oligopoly currently exists on the wholesale market and preventing the oligopoly from coming into existence is therefore already impossible.

Curing the oligopoly completely could be done by removing the facts that there are few suppliers on the market and that it is difficult to enter the market. These barriers can only be solved by reducing the barriers to entry. As was said above, this would give the opportunity to MVNOs to enter the market but it would not resolve competitive issues.

The other source of the oligopoly is the fact that all firms recognise their interdependence. This will remain because a firm always needs a foreign firm in order to offer IMR services. The only development that would resolve the interdependence is consolidation up to a point that there are large groups of operators that do not need wholesale access anymore from a foreign operator that is not within the group.

This shows that the only option that is left would be to remove the effects of the oligopoly. There are two effects of the oligopoly that are harmful to competition: price rigidity and possible tacit collusion.

Price rigidity can be partially resolved by removing the 60 days notice that is present in the framework. The other cause of price rigidity lies in a combination of few suppliers (see kinked demand curve) and the lack of the ability to direct traffic (OTA). However, the amount of suppliers cannot be increased substantially and when OTA will start to be used more, it does not necessarily result in more price competition.

Possible tacit collusion is again the result of a number of factors in the structure and conduct of the market: few suppliers (unsolvable), the interdependence of actors (unsolvable) and high transparency of the market (solvable under competition law).

6.4.2 Conclusion on Remedy to Oligopoly Effects

The review of the impediments resulting from the oligopoly leads to the insight that it will be very difficult to find a solution. The structure of the market cannot be changed under general competition law or sector specific regulation. The high transparency and price rigidity of the market could only be partially changed under general competition law by removing the impediments that are incorporated in the framework for roaming. Sector specific rules could only use access regulation to stimulate entry into the market.

Impediments	Remedy	Actor & Solution Type
Oligopoly – Price rigidity and Possible tacit collusion	None • No remedy for causes of oligopoly • Only slight remedies for effects	NRA and NCA – Do not possess the means to act.

Table 9. Overview of Remedy to Oligopoly.

6.5 Remedy Increasing Wholesale Substitutes

The lack of substitutes is an impediment to competition on the wholesale market. If more wholesale substitutes would be available, foreign MNOs could use these to bypass the wholesale services offered by MNOs. Such substitutes would increase the competitive pressure on the wholesaler because foreign operators could select the substitute.

The analysis of the relevant market explained why there are no substitutes for wholesale roaming services. I believe that there will be no party or source that will be able to provide a competitive substitute for wholesale roaming access in the near future. It is possible to gain access to a network abroad, however there is always the lack of either mobility (e.g. fixed networks) or coverage.

The MNVO will be left out here for the same reasons as above. The remaining possibility comes from alternative networks. Since a GSM network is the only mobile network with nation-wide coverage, IMR services will only work well on this type of network. If competition on this infrastructure is not possible, the other chance comes from alternative networks. At this moment the only infrastructure that seems promising are the Wireless Local Area Networks (WLANs) that are appearing more and more on the mobile scene. Currently many technological issues still need to be solved in respect to roaming between these WLANs and between WLANs and GSM networks, so called “seamless roaming”. Operators are seeking to integrate WLAN into their business cases and to possibly converge current mobile telephony with WLAN (e.g. roaming on WLANs with a SIM-card). Despite the fact that hotspots for WLANs mushrooming all over the world, I believe that access to these networks will not become a real substitute to the current GSM roaming the near future.

If new networks appear, existing networks have the obligation to interconnect to the new networks (under the Access Directive); to oversee this interconnection is a task of NRAs.

Under general competition law and under sector specific rules there are no direct ways of stimulating the appearance of this type of substitute. Only by not limiting these alternative networks in their development can NRAs make sure that these will in fact appear and grow to become full substitutes. Conducive policy by NRAs could encompass coming to quick decisions in case alternative networks operators are unable to get interconnected with the mobile operators.

Impediments	Remedy	Actor & Solution Type
Lack of wholesale substitutes	Create good conditions for alternative networks to appear and to interconnect with other networks.	NRA and NCA. Policy can be conducive but not more.

Table 10. Overview of Remedy: Increasing Wholesale Substitutes.

6.6 Remedy to Few Incentives to Fight Wholesale Prices

The fact that operators have no incentive to start compete on prices is an impediment to competition that really consists of three separate parts. First of all the operators on the wholesale market do not have an incentive to compete on prices because the result of a high IOT is carried by the end-user. Secondly, there is no incentive to compete because a lower IOT does not necessarily mean that the operator will attract more inbound roamers on its network (see technical impediments). And thirdly, due to the system of IOTs, MNOs are to a certain extent not responsible for the high retail tariffs they charge; responsibility can be shifted.

Because of a trend towards consolidation and through the increased usage of OTA, it is likely that a stronger incentive for operators to compete will arise. However, the question is whether or not this trend will be stronger than the second argument: more wholesale competition is being restricted because the end-user is presented with the result of a high wholesale price. That is why operators currently have an incentive to keep wholesale prices high. This will assure the wholesaling operator of high revenues on roaming and it will guarantee the retailing operator a higher margin. It seems probable to me that, even with the increased usage of OTA and traffic direction, operators would still prefer to keep IOTs high simply because it would generate more revenue and because responsibility can still be shifted.

6.6.1 Possible Remedies

A solution that would increase the incentive for operators to compete on the wholesale level is not likely to come from the MNOs themselves because there is an interdependence (see oligopoly) and because a higher wholesale price is beneficial to all MNOs.

The only solution to this is to change or to break the link between the foreign wholesale market and the retail market. When operators will start to use OTA, they might have an incentive and also the possibility to attract more traffic by lowering IOTs. However the incentive to have a high IOT still remains. As was said before, breaking this link is not possible on the level of “products”; retailing operators will still need foreign wholesaling operators and that is why the link will continue to exist; it is embedded in the nature of IMR.

The NCA could act in accordance to general competition law if there is (tacit) collusion/if illegal agreements have been made between operators, for instance to not compete on price. However, as the main view of this report is on the instruments an NRA can apply and as the cause is likely to be in the structure of the market, there is only one possible instrument for an NRA to remove, to change or to regulate the link between the wholesale and the retail market, that is: using sector specific rules to regulate prices on the markets. This price regulation could take place on the wholesale market, on the retail market or even on both.

Wholesale Price Regulation

When looking at regulating prices, the first option would be to regulate prices on the wholesale market. This could be done for instance by building a cost model of wholesale IMR services and determining a ‘reasonable’ mark-up. All operators would then have to lower their wholesale prices and would maximally make a certain profit margin. Operators wanting to compete more strongly could choose to offer even cheaper services. This type of remedy certainly reduces wholesale prices and could reduce retail prices by the same amount if operators fully pass the lower costs on to the end-users.

However, seen from the perspective of the retail operator, there is no obligation to fully pass this reduction in wholesale prices on to the end-user. The retailing operator could simply increase its retail margin! This adds a bit of uncertainty to a solution that is otherwise understood as being a very certain way to decrease high wholesale prices leading to lower retail prices as well.

A reflection on this last point can be added however, since the retailing operators would have to increase their margins significantly it seems plausible that there will be operators who will pass these lower IOTs on to their retail customers and thus increase competition leading to lower retail prices as well.

Retail Price Regulation

Retail price regulation presupposes that the NRA will determine what the price for roaming should be, e.g. by determining a maximum mark-up, by setting maximum tariffs or by prescribing an obligatory decrease in the retail prices that home operators charge their customers for roaming abroad.

Before retail price regulation could be implemented on the retail roaming market, the retail market should first be defined as being a relevant market and single/joint dominance should be assessed. The effect that this remedy has, except for lowering retail prices for end-users, is that it is likely to create wholesale competition as well. If the retail price is bound to limits, retail operators will more quickly select the cheapest foreign wholesaling operator and will try to arrange more discounts because now suddenly the height of the IOT is important to the retailing operator; the complete IOT cannot be calculated on to the end-user anymore.

If retail price regulation were to be selected, the instrument should be designed very carefully. There is a chance that wholesaling operators would lower their IOTs exactly enough to cope with the lower retail price, that the IOTs would end up approximately at the same level and that discounts will not be used more than in the current situation. Outcome: lower retail prices, no retail competition and no wholesale competition.

Retail & Wholesale Price Regulation

The final option I believe has the highest chance to succeed in creating wholesale competition would be to combine both forms of price regulation simultaneously but in a moderate form. Implementing this instrument would consist of two steps:

The first step would be to regulate the wholesale prices so that a first impetus is given in the direction of lower IOTs.²⁵

The second step would be to fix the retail mark-up at a certain amount (e.g. €0,10, not 10%). This would give an indirect incentive to the retailing operators to start searching for the cheapest wholesaler. This would remove the incentive for the retailing operator to select a high IOT. Subsequently the mark-up is no longer a percentage of the wholesale price, but has become a fixed amount that is independent of the height of the IOT. Selecting a lower IOT would be better for the home operator because it would eventuate in better retail tariffs for its users.

Impediments	Remedy	Actor & Solution Type
No incentives to compete	Regulation of wholesale roaming tariffs combined with enforcing a fixed retail mark-up (in €)	NRA – Legal. Price regulation, wholesale and retail.

Table 11. Overview of Remedy: Increasing Incentives to Compete.

²⁵ This could be in the form of determining a reasonable wholesale price for e.g. 2005. With a rather small decrease of x% every year from now.

6.6.2 Conclusion on Price Regulation

To conclude, a combination of both retail and wholesale price regulation could be a way to increase incentives to compete on price. This option has the highest chance of success because it will tackle both the problems in the wholesale market and it will prevent the problems from leaking into the retail market. However, the solution of introducing retail regulation as a means to make the wholesale market more competitive might not be allowed under the regulatory framework. Applying only wholesale price regulation would be the way to go in that case.

Price regulation is fully feasible under the New Regulatory Framework. However there are a number of initial limitations. First of all, the retail roaming market has not yet been defined as a relevant market and secondly price regulation (wholesale and/or retail) could also be applied only to those operators that would have a (joint) dominant position on the retail roaming market. The effect of this last limitation at first sight is rather uncertain. What would happen if only the largest dominant operators on retail and/or wholesale level would be obliged to lower their prices or to apply a fixed mark-up?

It seems logical that in the short run other operators active on the market (non-dominant players) would start to procure cheap wholesale roaming access only from these regulated firms. By using OTA they could direct traffic to exploit these lower tariffs. “Unattractive” operators who did not lower their wholesale tariffs will initially still receive some inbound share since not all operators will be able to direct traffic. This will change quickly through the use of OTA or marketing campaigns on how to manually select the cheapest network. The non-dominant operators will lose their inbound share and this leads to the reaction that other these wholesaling operators will lower their wholesale prices as well.

The same argument is valid for the retail side. If the dominant retailing operators have to apply a fixed retail mark-up, this will result in considerable lower retail roaming tariffs. The non-dominant operators will follow this drop in price because, unlike now, the gap in retail prices between the dominant and non-dominant firms will be large.

In my opinion, a combination of both retail and wholesale price regulation is a valid remedy but a number of disadvantages to price regulation in general still exist:

- Price regulation could stimulate competition but could also stagnate any market initiatives or development;
- Market parties will heavily oppose the remedy which could end in a long legal trial;
- Price regulation puts a heavy burden on the regulators to determine the desired retail price, the real wholesale costs and the reasonable wholesale mark-up.

However, since the lack of an incentive to compete is an important problem for IMR and since the only real remedy that fits within the framework is to regulate on prices, it might be interesting to solve this problem in a completely different way than using the standard regulatory toolkit.

6.7 Remedy, Designing a New Wholesale Market

Having looked at the previous impediments and their possible solutions it has been shown that a remedy to barriers to entry exists and could be implemented easily by NRAs. Other impediments such as a high transparency of the market and price rigidity are harder to tackle. Price regulation could be the final remedy that would take away the effects of the fact that firms do not have an incentive to compete.

The remedies that were described so far took the current market conduct as a fixed starting point and tried to regulate it in such a way that a more competitive outcome seems likely. Another approach is to discard the current market completely and to think of a better market place for wholesale IMR services.

I believe that it might be better to design a completely new wholesale market that would provide a more dynamic price setting. In the current situation, supply and demand are matched only at a very limited amount of time points; namely when the contracts are concluded. A wholesaling MNO offers capacity for foreigners to roam onto its network. Under the current GSMA framework, this good is not linked to a certain price. This could change when a market place would be created in which offers for combinations of price and capacity can be made.

For instance, when the framework for roaming is redesigned, a wholesaling operator should be able to offer 100.000 roaming minutes of access for foreign users onto its network. This 'airtime' offer should be linked to a certain price that the operator wants to receive per minute. Another wholesaling operator, from the same country, would be able to offer only 50.000 minutes of airtime but for a lower price. Retailing operators in search of a good deal could then choose to buy the capacity from the cheapest or could choose to buy the larger amount leading to e.g. less risk. This type of market would come close to a spot market [WAE03] for electricity (so called Power Exchanges) that is currently active in a number of Member States [AEPX03] [APX03]. A spot market is "a market in which goods, services, or financial assets are traded for immediate delivery".

A difference with the old framework for roaming is that this new market place would be far more dynamic. A number of aspects of the roaming market would change:

- Operators would not be likely to conclude roaming agreements with as many as possible foreign wholesalers anymore. Firms will now only buy the amount that they predict they need in a given country;
- The amount of inbound roamers depends on the offered wholesale price and amount, not on the number of roaming agreements;
- Operators will be likely to select the cheapest wholesaler since they are now responsible themselves;
- Market conduct will become more dynamic since 'contracts' can be concluded any time;
- The market price for roaming will follow demand more closely;
- The build-up of roaming tariffs will be more transparent both to all firms and to external parties (e.g. end-users who can check the average price on the wholesale market);
- Retail offers will be able to become more 'fit to the customer', e.g. cheap roaming in Northern and Eastern Europe or during the summer;

This type of wholesale roaming model would come closer to what has become standard in fixed telephony: buying a large amount of international minutes for instance to the United States in order to offer a cheap retail rate for international calls from The Netherlands to the US. A wholesale spot market or exchange that is organised in this way is a large stimulation for operators/carriers to offer

cheap rates. All firms will be able to put orders on this exchange, either to buy or sell capacity. One of these exchanges for wholesale fixed telephony is Arbinet that was founded in 1996 [ARB03]. Operators who trade on this marketplace can easily get an overview of the various offers on the market (e.g. for termination of a call to France). At the same time the exchange can take care of the payment settlement. In this respect the roaming brokers/clearinghouses have approximately the same task.²⁷

Such a new market place for wholesale roaming services would create more incentives for competition and would remove the current price rigidity. As far as transparency of the wholesale market is concerned, transparency will probably increase further. In theory this could create more chances for firms to collude, however I believe that the market will become too transparent to collude. All offers placed by firms could be monitored by NRAs, NCAs or even end-users; counter intuitively this will raise barriers to collude.

The question however is which type of body would have the authority to enforce such a new market structure. NRAs are unlikely to have the legal authority to implement this type of solution. The EC or NCAs could play a role in starting the process of designing a new wholesale market by prohibiting the current long-term roaming contracts. By doing this, short trading will come forward automatically as an alternative. Market parties could give proposals on how the new wholesale market should function. In the light of possible wholesale and/or retail price regulation, market parties might be willing to propose a more dynamic market structure. Again, it would be best if these competition rules could be planned out in cooperation with the GSMA or the operators themselves.

However, caution is needed because this type of market should be designed carefully due to the susceptibility to strategic actions of market players. Smart rules should be used to prevent misuse of the new market place. One of these rules could be that firms are free to publish offers any time of the day but that all these offers will be made public at the same time. This rule fights possible strategic behaviour by players.

Impediments	Remedy	Actor & Solution Type
<ul style="list-style-type: none"> • No incentives to compete • Price rigidity 	Create a new market place for trading a combination of roaming minutes for a certain price.	Create a new market place for trading a combination of roaming minutes for a certain price.

Table 12. Overview of Remedy: New Wholesale Market.

²⁷ This exchange/spot market was initiated by market parties/firms themselves and was not mandated by any government. Explanation for this fact is easy to find; fixed carriers gained many advantages from such a market, for instance the added settlement and possibility to route traffic via cheaper routes and to sell excess capacity.

6.8 Conclusion on Wholesale Remedies

Various remedies to wholesale impediments have been discussed in this chapter. An important conclusion is that actions from outside the market are indeed needed to introduce more competition. Without external intervention, competition on the wholesale level will not start.

The most important conclusion of this chapter is that there is no such thing as a perfect solution to all impediments that are present in the wholesale market. There are two remedies that seem most promising: either regulation on price or to design a complete new wholesale framework for roaming. The table below shows the various remedies and the impediments to which they form a solution.

	Wholesale Impediments					
Wholesale Remedies	Barriers to entry	High transparency	Price rigidity	Tacit collusion	No incentive	Substitutes
Allow roaming with new entrants	✓					
Remove non-discrimination		✓		✓		
Remove 60 days notice		✓	✓	✓		
Prohibit publishing of IOTs		✓				
Price regulation of wholesale and/or retail			✓		✓	
Create a new market place	✓		✓	✓	✓	

Table 13. Overview of Wholesale Remedies and the various Wholesale Impediments.

7. REMEDIES TO RETAIL IMPEDIMENTS

A number of barriers to competition on the retail market were identified next to impediments on the wholesale market. This chapter will cover remedies on the retail market; Table 14 gives an overview.

Impediments	Result
Inelastic retail demand <ul style="list-style-type: none"> • No manual network selection • Still not informed about prices • Roaming tariffs not a reason for selecting operator/pricing plan 	No manual selecting of networks → limited competition Limited use of roaming, no switching Does not stimulate operators to make better offers
Limited transparency	Transparency of retail tariffs is still limited.
No retail substitutes	There are no real substitutes for retail roaming services, switching is not possible.
Roaming tariffs part of retail bundle	No selection based on roaming tariffs is possible for end-users, could limit retail competition.
Averaged retail tariffs	Averaged retail tariffs do not stimulate the selecting of the cheapest (wholesale) network.
Retail – wholesale paradox	Competing in the retail market with a subsidiary of a roaming partner on the wholesale market.

Table 14. Overview of Impediments to Retail Competition.

The first section below discusses the impediments of an inelastic retail demand together with a limited transparency of retail tariffs. Section 7.2 looks at the fact that there are no retail substitutes. Sections 7.3 to 7.5 look into remedies for the remaining impediments of bundling, averaged retail tariffs and the relationship between the retail and wholesale market.

7.1 Remedies Increasing Elasticity of Retail Demand and Transparency

End-users could be stimulated to become more aware of prices for IMR and other possibilities that exist. A number of possibilities are present for NRAs to increase retail elasticity, perhaps together with other actors. Strongly related to the demand is the possibility in which end-users are able to get information, make comparisons of tariffs etc. Transparency of the retail market is important.

A remedy to increase transparency is to develop a code of conduct for retail roaming tariffs. The current retail tariffs can differ in peak/off-peak or differ in regions (Western-Europe, Eastern-Europe etc.). Because of these differences, the retail tariffs between operators are very difficult to compare quickly. In many cases there is not one foreign network that is cheapest for all services; e.g. SMS might be cheaper with provider A, MO calls are cheaper with operator B etc. If all European NRAs would develop or adopt a framework for retail roaming tariffs, this would certainly improve transparency. For instance,

it would be contribute to transparency if all operators would use the same geographical regions and if they would all charge per second.

It should be said that operators themselves identified transparent retail tariffs to be important as well. The GSMA developed a code of conduct (CoC) in 2001 that looks into the transparency of retail roaming tariffs for European operators [GSMA01]. This CoC contains intentions of operators to provide end-users with accurate roaming information through customer care services and websites. The CoC does not give best practices in the field of pricing, charging etc. that could improve transparency of retail roaming tariffs. Furthermore, this CoC has not been updated anymore since 2001. OVUM [OVU02] conducted a research into the adoption of the CoC and came to the conclusion: “the information available to Europe’s end-users on retail roaming prices and coverage is now significantly better than it was at the start of the monitoring process”.

In my opinion retail information to end-users has improved, however the current CoC is not ambitious enough in the respect of increasing transparency. Except for using the customer care services and the websites, the handsets could also be used to increase transparency. Providing billing information on the display of the mobile is possible almost in real-time after every call by letting the billing system send an SMS to the mobile phone. It is also possible to beforehand ask how much a certain call will cost. This can be implemented by MNOs for instance by having users send an SMS, containing the destination number, to a special short code (e.g. 987). An SMS with the tariffs is then sent back as a reply.

Another remedy that would improve elasticity of retail demand as well as transparency is to make users more aware of exactly how much they currently pay for roaming. This could be done by publishing comparisons of roaming tariffs every month. The Dutch consumer union published an overview in June 2003 just before summer holidays [CON03/2]. However, these initiatives are insignificant and done too late. A more structural comparison should be made, to remind end-users of the high tariffs and to have up-to-date information. This is done in telecommunication magazines such as Connect [CONN03] (German) that publish summaries of roaming tariffs more than once a year. Once end-users are better informed they are likely to be more interested in the price of roaming and are more likely to choose the best provider/tariff for IMR. An example of the type of information is given below.

How to Roam Cheapest in an Easy Way...?

- Always make sure that the phone is registered with the correct partner network for cheapest roaming rates;
- Use SMS text messages instead of MO roamed calls. When using SMS, make sure to use the cheapest network (not necessarily the same as cheapest network for voice);
- Use SMS messages to ask for a ‘call-back’ from the home country, to avoid MO roamed calls;
- Buy a pre-paid card in the country in which is being roamed. Incoming calls are for free at that moment. A SIM-lock free phone is needed;
- Switch off the voicemail service when roaming. Listening to the voicemail is often billed as an international call and when message is left on the voicemail this is often billed as an incoming roamed call. To conditionally redirect to the voicemail when roaming is expensive (e.g. when out of coverage or when busy) because the call will be routed to the foreign country and will be stored in the mailbox there. To unconditionally direct incoming calls to the mailbox is far cheaper since the incoming call is not routed to the foreign country but remains in the home network. Network codes to switch voicemail off can be obtained from the MNO;
- Use a fixed telephone to call where possible. Preferably in combination with a ‘calling card’ that gives cheap international rates.

Box 19. How to Roam Cheapest in an Easy Way...?

Except for increasing transparency, a second step is to show how to actively and manually switch networks whilst roaming. The advantages of choosing the cheapest network are clear but it means that users should be given a short manual on how to change networks on the most used mobile phones. This could be done by the NRAs themselves; NRAs could discuss this with operators on a preferably voluntary basis. On the other hand, obliging operators to publish such lists might also be possible.

Impediments	Remedy	Actor & Solution Type
<ul style="list-style-type: none"> • Inelastic retail demand • Limited transparency 	<ul style="list-style-type: none"> • Create “Code of Conduct” to increase transparency; • Publish comparisons of retail tariffs; • Inform about manual network selection. 	<ul style="list-style-type: none"> • NRA – Legal. (Universal Service Directive). • Cooperate with consumer unions or magazines.

Table 15. Overview of Remedy: Increasing of Retail Demand and Transparency.

7.2 Remedy to Few Retail Substitutes

In the same way as on the wholesale market, the limited amount of good substitutes limits competition in the retail market because end-users are unable to switch to another. An overview of the possible ways in which high roaming tariffs can be reduced is presented below. These services are not necessarily full substitutes, but I believe that when end-users are fully aware of the roaming tariffs and alternatives, the services listed below become partial substitutes.

- The ‘call-back solution’ of for example Privacom [PRIV03]. For this substitute the user needs a new SIM-card. Whenever a call is initiated whilst roaming, the SIM-card sends the destination to the Home Network (HN) via the signalling links. The HN then establishes the connection and calls the roaming user back. In this way a call can be initiated whilst roaming without having to pay the expensive MO tariffs.
- The second option is calling a ‘toll-free’ 0800 number when roaming. Once connected, the user is able to enter the destination (e.g. a call to The Netherlands). Because this number is toll free, even when roaming, it is possible to substantially lower tariffs. An example of such a service is the Budget Phone Card that can be bought at Dutch post offices.
- The third and maybe most sophisticated method is to use a new SIM-card that gives lower roaming rates. This SIM-card would have multiple IMSI numbers allowing it to register as a ‘domestic user’ with certain foreign networks. For instance when travelling from France to the United Kingdom, the SIM-card has an IMSI number that belongs to one of the networks in the UK. The phone will register normally with the UK network as if it is its home country. Practically, the user is not roaming anymore and will be able to receive incoming calls for free. The problem with this solution is that more than one subscription needs to be paid and that multiple numbers are needed (e.g. for France and UK).

Transatel, a French MVNO has established this type of roaming service and offers it in France, the UK and Belgium [TRA03]. The service has coped with the problem of multiple numbers by making it possible to be reached under all of the numbers whilst ‘roaming’.

The same conclusion as on the wholesale market is valid; an NRA is not able to get more substitutes onto the market. What an NRA can do is give information about alternatives. Publishing this type of (unbiased) information would fit the legal framework and would help end-users to make better choices.

This type of action does not need coordination between European NRAs because the effects purely relate to the users of one country; however the overall effect it might have on operators is likely to be greater when NRAs coordinate such an initiative.

NRAs actively publishing comparisons of offers made by operators is a controversial subject. A solution that requires the NRAs to distinguish themselves less strongly is to cooperate with consumer unions to regularly publish articles about new substitutes for IMR services. The problem is that consumer unions are not focussed only on telecommunications or IMR. In this respect it would be better to cooperate with e.g. telecommunications magazines in order to publish independent information on IMR.

Impediments	Remedy	Actor & Solution Type
No retail substitutes	Publish more information on the alternatives to IMR.	<ul style="list-style-type: none"> • NRA – Legal. (Universal Service Directive). • Cooperate with consumer unions or magazines.

Table 16. Overview of Remedy to Few Retail Substitutes.

7.3 Remedy to Retail Tariffs Part of a Bundle

As was demonstrated in the analysis in chapter 3, offering IMR services as part of a retail bundle might limit retail competition and/or general welfare. On the other hand, it can be that offering the services in a bundled form is convenient for end-users or gives a cost benefit to the firm and is therefore beneficial. This also seems to be the case for IMR services. However, the fact that there are currently few options for choosing IMR tariffs separately from other mobile services at least limits choice for end-users and therefore limits retail competition.

An NRA has the competency to intervene in the pricing of certain services. Normally intervention in retail prices is considered to be a very heavy instrument. The Universal Service Directive mentions bundling as a possible reason for intervening on the retail market¹. Once again, this only applies to firms with an SMP position. It does not mean that the exact price level is determined by the NRA, but that the way in which the prices of the products are offered is regulated.

I believe that when NRAs would compel operators to also offer IMR services separately rather than in a bundled way, it would increase the amount of subscriptions without roaming. At the same time it would increase the amount of users that give preference to lower roaming rates and pay a higher monthly fee for that, without feeling that they overpay for domestic minutes they will never use. Practically, this remedy could be implemented by means of a Code of Conduct as well. Instead of only the way of pricing, the CoC could contain an obligation for offering unbundled roaming services next to IMR services as part of a bundle.

The impact of this remedy would not suddenly increase competition, but would increase the chances for users to show how sensitive they are towards roaming tariffs (their elasticity of demand). If users would start switching, operators might begin to compete more on the retail market. A question that surfaces is whether or not this will decrease prices of roaming and/or other services currently in the bundled subscription. In any case it will increase end-users' abilities to choose.

Impediments	Remedy	Actor & Solution Type
Roaming tariffs part of retail bundle	Oblige separate (unbundled) offering of roaming services.	NRA – Legal. (Universal Service Directive, art. 17).

Table 17. Overview of Remedy to Retail Tariffs part of a Bundle.

7.4 Remedies to Averaged Retail Tariffs

Averaged retail tariffs make it impossible for end-users to always select the network that charges the lowest wholesale rates. The average retail tariffs were introduced because organisations such as INTUG complained about the intransparency of these tariffs. The question is whether the impact that these tariffs have on limiting wholesale competition is bigger than the impact of increasing retail competition through greater retail transparency. Only if the answer to this question is positive, a change in the current retail pricing regime is beneficial.

Even if the conclusion would be to change the current retail pricing structure, it is a challenge to find a better solution. Going back to the old regime in which the same mark-up (%) is applied to IOTs that vary, again results in a big tangle of intransparent retail tariffs.

A solution to this problem is to make sure that operators base their averaged retail tariff on the IOT of their cheapest wholesaler. If a user roams on a network that has a higher IOT, the retailing operator makes a lower retail margin. This remedy would have the advantage of leading to an increase in wholesale competition while at the same time preserving the transparency effects for end-users. At the same time it stimulates the use of OTA and the preferred network file on the SIM in order to direct the user to the cheapest network.

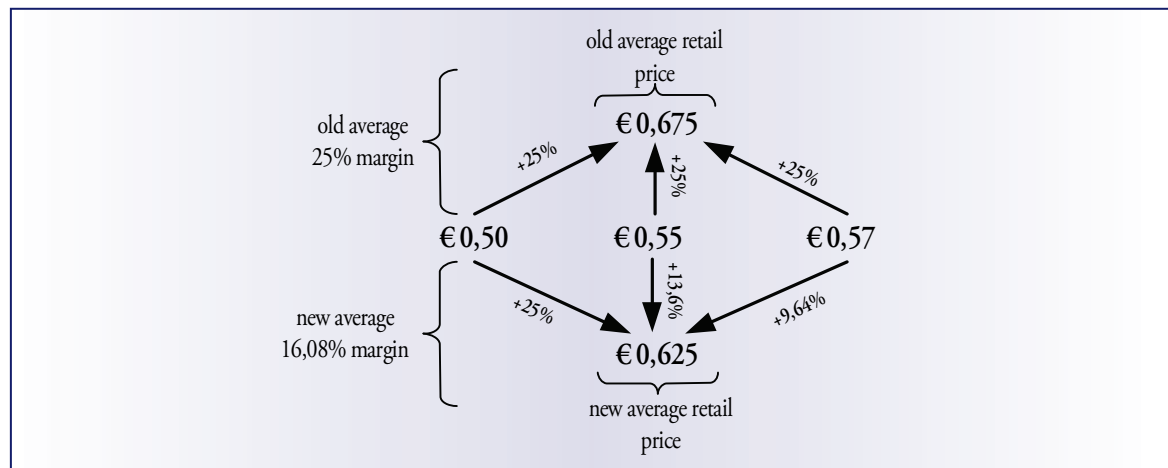


Figure 24. Remedy to Average Retail Tariffs.

It is rather uncertain if this type of remedy is permitted to be implemented by NRAs under the new framework. The problem is that it could be applied only to dominant operators, after other remedies have failed and with the effect of attacking the retail market with the goal of increasing competition on the wholesale market. Indirect regulation of this type is not a preferred option. I believe that the impact and legal feasibility of this remedy should be investigated in greater detail before it is taken into consideration. This remedy comes close to retail price regulation.

Impediments	Remedy	Actor & Solution Type
Averaged retail roaming tariffs	Oblige operators to base average tariff on cheapest wholesale rate.	Possibly NRA – Legal.

Table 18. Overview of Remedy to Average Retail Tariffs.

7.5 Remedies to Retail – Wholesale Relationship

This impediment is very difficult to solve. The nature of roaming is that access to a foreign network is granted to a user. This presupposes contacts between firms operating on the retail market with firms operating on the wholesale market. The only way in which this could be solved is by removing the ‘intermediary’; the retailing operator.

If a customer would be able to travel abroad with his mobile phone, to simply select a foreign network and that payments would be made directly to the foreign MNO, the services of the home operator would be avoided. In practice this could mean that GSM roaming comes closer to roaming in (Wireless)LANs. Currently new users on a WLAN are automatically assigned a new IP-address by which the user is identified and can be reached. The same type of address is assigned for roaming (compare the MSRN and TMSI, section 2.2). The only two reasons why the home operator is involved, is to link the real telephone number (MSISDN) to the current location of the roaming user and for authentication of the user.

In theory the home operator has a small task and in my opinion should supply these services free of charge. In that case, a model could be invented in which the roaming user is able to pay directly to the foreign operator. For instance, by having to send a premium SMS to a certain standardised number in the foreign network with which access is gained for e.g. 20 minutes of calls. The costs linked to this SMS would then be billed to the user through the home operator.

This type of model would drastically change the conduct on the market because the foreign operators are now able to make direct offers to foreign retail customers. It would considerably lower retail prices; it would increase competition on prices but would also increase choice for customers. A negative result could be limited transparency because of all different offers made to foreign users.

Impediments	Remedy	Actor & Solution Type
Wholesale – retail relationship	Remove the retailing home operator from the current roaming model.	Uncertain

Table 19. Overview of Remedy to Retail – Wholesale Relationship.

This remedy has a link with the impediment on wholesale level “no incentive to compete” resulting in high wholesale prices. The discussion above showed that removing the retailing operator from the roaming model can increase competition. One way of doing this is by price regulating the retail market by limiting the retail mark-up (see section 6.6).

7.6 Conclusion on Retail Remedies

Various remedies to retail impediments have been discussed in this chapter. The most important conclusion is that there are many instruments an NRAs could actively use in the retail market. However, all instruments are variants to two general possibilities: to increase transparency and to regulate the prices/pricing of retail services. Transparency can be improved for all operators on the market whereas only the prices of dominant firms can be regulated.

Retail Remedies	Retail Impediments					
	Inelastic demand	Limited transparency	No Retail substitutes	Bundling	Averaged tariffs	W-R relation
Show how to switch networks	✓					
New framework for retail tariffs (CoC)	✓	✓		✓		
NRA publishes information itself	✓	✓	✓			
Cooperation with Consumer unions, magazines etc.	✓	✓	✓		✓	
Retail pricing regulation				✓	✓	✓

Table 20. Overview of Retail Remedies and the various Retail Impediments.

7.7 Evaluation of Remedies

These previous sections described a number of remedies on both the wholesale and retail markets. A corresponding remedy was thought of for each of the impediments. However, the remedies can be applied simultaneously as well. The following chapter on conclusions will show that I believe that a parallel implementation of more than one remedy is the best solution. In theory, all remedies could be used parallel to each other; the effect of one remedy do not decrease the effect of another remedy (see also Figure 25.). In practice however, this might not be possible because some instruments cannot be used by the NRA but only by the NCA.

Another remark that can be made is that the identified remedies seem to be rather focussed on an NRA's command and control possibilities. This was done deliberately because only remedies that are legally feasible will withstand the resistance of operators. Solutions that are created more in cooperation with the market, such as together with the operators and the GSMA could yield good results only if the market parties are willing to discuss changes that might be unfavourable to them in the short term.

7.8 Coordinated or Separate Remedies of NRAs?

Various remedies to wholesale and retail impediments have been discussed in this chapter. An important aspect of remedies for IMR services is the international context. Discussion on IMR in the ERG/IRG context often led to the conclusion that if regulation is needed, this always needs to happen in an internationally coordinated way. An explanation in favour of this idea as well as a counter argument is possible.

1. The positive explanation relates to the insight that a wholesale remedy should be implemented in all Member States approximately at the same time. If a remedy would be used in only a number of countries, this would create a considerable disparity in circumstances between national markets and in positions of firms (often of the same group) operating in those markets. Secondly, it would not benefit national consumers if a national wholesale market would be regulated²⁸.
2. The counter argument is that since conditions in Member States can differ (e.g. there is single dominance instead of joint dominance) and since it is likely to take a rather long time before all market analyses and assessments have been completed on a European level, it might be more effective to start regulating in a small number of countries.

Coordinated Remedies

Two bodies in which NRAs can discuss their points of view are the Independent Regulators Group (IRG) and the European Regulators Group (ERG). The ERG describes itself as [ERG03/2]: "...an independent body of reflection, debate and advice in the electronic communications regulatory field. Composed of the heads of the relevant national authorities, it acts as an interface between them and the European Commission in order to advise and assist the Commission in consolidating the internal market for electronic communications networks and services. Among its main missions, the ERG aims at ensuring a consistent application of the new regulatory framework for electronic communications and services..."

The IRG [IRG03]: "was established in 1997 as a group of European National Telecommunications Regulatory Authorities (NRAs) to share experiences and points of views among its members on issues of common interest such as interconnection, prices, universal service, and other important issues relating to the regulation and development of the European telecommunications market". These two bodies are the perfect platform for coordinating remedies on roaming. Some problems could arise if members of the IRG/ERG have different national laws or are late with implementing the New Regulatory Framework.

Whereas it has become clear that a coordinated European action against roaming is the most effective solution (point 1. above), it is not necessarily the quickest way.

Separate Remedies

There is only one possible way that would result in a quicker solution as opposed to international delays; to start solving the roaming problems on a national level for instance by teaming up with a small amount of other Member States and regulating the wholesale/retail markets in these countries.

When for example The Netherlands, The United Kingdom and Germany coordinate their actions/regulation separately from other NRAs/Member States, this will create an 'island' within which roaming is considerably cheaper and where competition can start.

²⁸ Lower national wholesale prices benefit foreign consumers. In order to give this benefit to the consumers, prices on foreign wholesale markets should be lower.

A specific implementation of these separate actions could be the following:

1. To have the British, German and Dutch NRAs enforce removal of the barriers to entry in these national wholesale markets, e.g. based on the Access Directive. This gives at least the possibility of new entrants appearing on the market.
2. To regulate on wholesale prices in these three countries. This leads the most direct insight that roaming in these three countries becomes cheaper²⁹.
3. To stimulate an increase in retail transparency by publishing information and/or removing the current bundled retail roaming offers.

The only point that possibly has negative side-effects is point 2. First of all the dominance issue is still present. Only (joint) dominant operators will be subjected to wholesale price regulation. On the demand side this does not really form a problem because if the dominant operators lower the wholesale prices considerably, the other non-dominant operators will have to lower their wholesale prices as well simply due to the fact that foreign MNOs could cancel the agreements or direct traffic to the cheaper regulated MNO(s).

On the supply side the regulated operators will now have to offer the same wholesale price to foreign operators not within the regulated 'island' (non-discrimination in the STIRA). They will have a strong incentive to direct traffic only to their partner networks or to select the cheapest foreign wholesaling MNO³⁰. In this manner, the regulation of the IMR markets in only three Member States could energize competition in other wholesale markets. However, the risk is that the foreign operators will not give many discounts or lower their wholesale prices. This depends on how important the roaming users of the UK, Germany and The Netherlands are to those operators. If these operators of other Member States will persevere in their current conduct, the regulated operators will make substantial losses on wholesale roaming; this cannot be the goal of regulation.

Concluding, when a small number of Member States would start regulating the IMR market there is a chance that competition will start, not only in those countries, but also in other Member States. However, this effect cannot be completely predicted.

²⁹ *Assumed that operators pass on the lower wholesale charges to the end-customers.*

³⁰ *An expensive wholesale price of a foreign MNO has now become unfavourable to the regulated MNO because it can not compensate anymore with its own IOT; the operator pays far more than it receives and therefore makes a loss on wholesale.*

8. CONCLUSIONS AND RECOMMENDATIONS

This research has the goal to make an independent, multidisciplinary analysis of barriers to competition that might exist in the field of International Mobile Roaming (IMR). If the result of this analysis is that competition is not considered effective, the second goal is to analyze whether regulation is needed and which instruments are likely to relieve the impediments to competition.

Competition for IMR indeed proved limited, impediments to competition were identified and remedies were investigated.

8.1 Overview of Research

First, an overview will be given of how the preliminary conclusions in the foregoing chapters (impediments and remedies) were drawn. Except for giving a quick summary of the research, this final chapter also combines the acquired insights into one diagram that presents the coherence of impediments and the influence that remedies have on aspects of the market(s). However, it is first necessary to go back to the research questions that were stated in the first chapter.

Chapter 1, Introduction to Roaming & the Research

The research questions that are answered throughout this report are:

1. Does the structure and conduct of the market(s) for international mobile roaming hinder effective competition? If yes, which impediments to competition exist?
2. Will these barriers to competition be alleviated by market developments? If not, by which regulatory instruments can these impediments be removed?

Except for introducing the subject of this report, chapter 1 also gives a two motives for the research. The first motive can be derived from the tariffs for IMR services that are far too high compared to other types of international calls. Furthermore, in the past years the retail tariffs for IMR services have stayed at exactly the same level. More details about the tariffs can be found in Figure 1 to Figure 3. The second motive is the interest the Dutch National Regulatory Authority (NRA) OPTA has in objectively investigating the IMR markets.

Chapter 2, Technical Aspects of Roaming

The second chapter gives an introduction to the technicalities of IMR. It shows how a mobile phone registers with a (foreign) network, which nodes in the network are being used and which type of routing information is exchanged. An important conclusion is the fact that a standard mobile phone will register with preferred networks present in a list on the SIM-card but that at the same time an operator is not able to guarantee that this user will roam onto a certain foreign network. The user might drop off to other networks and the chance is high it will use more than one network to roam on.

Chapter 3, Market Structure & Conduct and Impediments to Competition

The first research question is answered by the analysis made in Chapter 3. This chapter initially introduces the players on the IMR markets such as the Mobile Network Operators (MNOs), the GSM Association (GSMA), service providers and MVNOs.

After that, the way in which roaming is conducted commercially is analyzed. Two distinct markets are identified and are used throughout this report: the wholesale market on which operators supply each other with and demand IMR services from each other, and the retail market where end-users have a demand for IMR services.

The analysis shows that roaming consists of contracts between a retailing and a wholesaling operator, that the wholesaling operator determines the wholesale price (IOT) and that the retailing operator charges a retail mark-up (generally 25%) to bill the customer. All roaming agreements are concluded within the framework that the GSMA has established for IMR. The framework is called Standard International Roaming Agreement (STIRA). All MNOs are a member of the GSMA and have to comply with the rules of the association.

Having analyzed both markets it has become clear that no effective competition is present on the wholesale market or on the retail market. A number of impediments are presented in the table below. It would take too far to explain all these impediments in great detail. The reason why a certain notion limits competition will be explained later on, together with the remedies.

Wholesale Impediments	Retail Impediments
Directing traffic is difficult.	Inelastic retail demand for IMR services.
The framework by the GSM Association creates barriers to entry and price rigidity.	Limited transparency of retail tariffs.
A lack of wholesale substitutes.	Roaming tariffs are part of a bundle.
High wholesale prices are carried by end-users and low wholesale prices do not lead to more revenue on wholesale.	Averaged roaming tariffs.
An oligopoly is present on the IMR markets leading to price rigidity and possible tacit collusion.	A lack of retail substitutes.

Chapter 4, Markets Trends

If market behaviour would be changing quite radically, a situation could arise in which these barriers to competition will be removed by the market itself resulting in the fact that regulation is unnecessary. That is why the first part of chapter 4 looks at market trends in the sector for IMR.

The first general market trend are new data services in mobile communication. Receiving high speed mobile data is now becoming possible with GPRS and UMTS. Using GPRS/UMTS abroad will become more important. Whereas the introduction of these services could have meant a complete review of the roaming framework initiated by the operators themselves, the market instead shows the same conduct that led to an uncompetitive wholesale market for voice IMR services. This trend will not solve any of the impediments.

The second trend that is discussed are possibilities to directing traffic due some technological developments (e.g. possibility to program SIM-cards over the air) and due to consolidation on the wholesale market. Consolidation could have the effect that large conglomerates will be able to keep traffic within the group, to take smaller margins, to decrease costs and to start competing. However, it appears more likely that the group will simply retain the large profits within the group and will not start competition. Consolidation is not a recent trend, and so far it has not led to more competition.

For the retail market the only trend with an impact was the fact that operators themselves affirmed transparency problems and that this was the reason that uniform and averaged roaming tariffs were introduced for most Member States. However, the height of the tariffs has not changed and retail substitutes have not really emerged. It seems unlikely on the wholesale market and on the retail market that market parties will start competition themselves.

Chapter 5, Legal Framework

Due to the fact that the market will not resolve competition problems itself in the near future, the possibility of regulation comes forward. The second part of chapter 4 is dedicated to describing the legal framework within which regulation of IMR can take place. The Dutch NRA OPTA first has to assess competitiveness on a certain market and only in case competition is not effective the NRA has a number of competencies that can be applied. The national wholesale IMR market has been pre-defined as a relevant market by the EC meaning that NRAs are obliged to investigate competition for IMR. The retail IMR market can only be regulated after a market analysis. The regulatory instruments range from increasing transparency, to imposing access obligations or non-discrimination to price regulation. For specific details on the legal framework see Chapter 5. Other legal possibilities can be found in general competition law but these are beyond the scope of this research.

Chapter 6 and 7, Wholesale & Retail Remedies

Chapter 6 and 7 looked at respectively the remedies for the wholesale and the retail impediments. Because it would take too far to explain all impediments and their remedies in great detail, a diagram was constructed that shows the relationship between barriers to competition and remedies. For a detailed description of all these impediments see chapter 3, for an in-depth discussion on remedies see chapters 6 and 7.

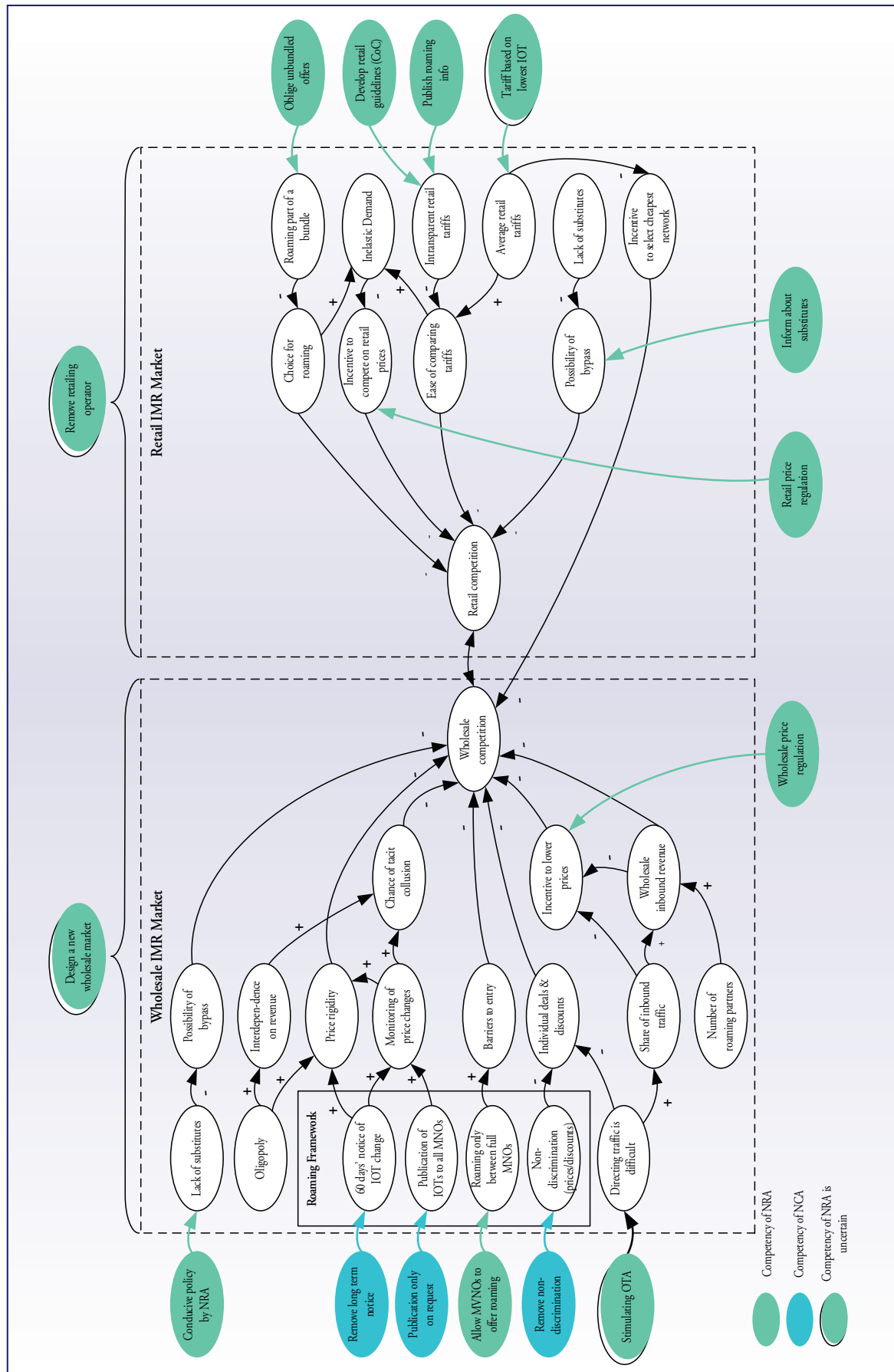


Figure 25. Wholesale and Retail Barriers to Competition and their Remedies.

8.2 Conclusions

Figure 25 gives an overview of the impediments on the wholesale and retail markets as well as remedies that were identified in this report. For a detailed analysis of all these remedies see chapter 6 and 7. The distinction between wholesale and retail remedies is carried through in this section. Even though this report has mainly looked at international mobile roaming of GSM voice calls, the current conduct is also shifted into the new data services such as GPRS/UMTS roaming as well as for MMS roaming. Generally, these conclusions can also be applied to these new services.

Wholesale Conclusions

The type of regulation that I believe would be most beneficial is regulation on the wholesale market. The first reason for this is that NRAs already have competencies geared towards this market because it was pre-defined by the EC. This means that implementation of an instrument could be done more quickly. The second reason lies in the fact that competition problems on the wholesale market largely determine the resulting retail prices.

When looking at what is achievable on the wholesale market a major chance lies in redefining the current framework for roaming. Removing for example the non-discrimination clause together with the 60 days notice in the STIRA would make the wholesale market more dynamic. Removing the barriers to entry might seem promising; however as was argued in this research, it does not seem likely that many and influential MNVOs will enter the market causing a shake-up. However, on the longer term removing the barrier to entry might prove beneficial. This type of intervention in the framework for IMR is not a competency of NRAs. It should be done under general competition law. This could be a lengthy and difficult research; however it is likely that this is the focus of the current ongoing investigation of the EC.

A second remedy that solves competition issues on the wholesale market is to design a new wholesale market place. In this new marketplace a wholesaling operator should be able to offer e.g. 100.000 roaming minutes of access for foreign users onto its network. This 'airtime' offer should be linked to a certain price that the operator wants to receive per minute. Another wholesaling operator, from the same country, would be able to offer only 50.000 minutes of airtime but for a lower price. Retailing operators in search of a good deal could then choose to buy the capacity from the cheapest or could choose to buy the larger amount leading to e.g. less risk. This type of market would come close to a spot market for electricity. The new market place would be far more dynamic. Some benefits of the new roaming market would be:

- Operators would not be likely to conclude roaming agreements with as many as possible foreign wholesalers anymore. Firms will now only buy the amount that they predict they need in a given country;
- The amount of inbound roamers depends on the offered wholesale price, not on the number of roaming agreements;
- Operators will be likely to select the cheapest wholesaler since they are now responsible themselves;
- Market conduct will become more dynamic since 'contracts' can be concluded any time;
- Retail offers will be able to become more 'fit to the customer', e.g. cheap roaming in summer.

However, it is not likely that this remedy fits the regulatory framework. It should be investigated further if NCAs or the EC have the possibilities to introduce this remedy under general competition

law. I believe that, except for this uncertainty, this could be a very good option since it gives the possibility to reconsider all impediments to competition that currently exist. Further investigation into this solution must be conducted, in specific into the legal implications and the specific rules of conduct of the new market. Input of market parties for the design of the new market should be taken into account as much as possible.

A third remedy that is fully within the capabilities of NRAs is to regulate wholesale prices. As operators currently have incentives to keep wholesale prices high, it is not likely that in the near future price competition will start on the wholesale markets. This is a very strong remedy leading to lower wholesale prices in any case.

If wholesale prices are regulated, retailing operators could in theory significantly increase their retail margins. This would call for retail price regulation as well. However, retail price regulation requires the retail market to be defined as a relevant market. This requires EC approval. Introducing retail price regulation as a means to make the wholesale market more competitive is not the first option under the NRF; retail should be regulated only if wholesale does not work. This should be investigated in greater detail.

Another complicating factor is that wholesale price regulation could only be applied to those operators that are (jointly) dominant (see chapter 5.2 and 5.3). In practice this means that only the (two) largest operators will have to lower its/their IOTs. In my opinion this will be enough to introduce more competition since foreign operators are now able to procure significantly cheaper wholesale roaming. Other (non-dominant) operators will also have to lower their IOTs to a competitive level.

Wholesale price regulation has a number of disadvantages the main of which is the fact that it can remove market dynamics and as a result not really increase competition. However, wholesale price regulation is the only remedy that fits the NRF and that would resolve the current anti-competitive outcome of the market (see also section 6.6.).

Wholesale Remedies

1. The remedy with a predefined outcome is to regulate wholesale prices, if legally possible together with a limitation in retail mark-ups.
2. Parallel to remedy 1, the current framework for roaming should be reviewed under general competition law and should lead to less transparency and more dynamics; this is reached by limiting the publication of IOTs, reducing/removing the notice period of price changes and by removing the barriers to entry.
3. The most advanced remedy is to design a new wholesale market keeping in mind all the current impediments.

Retail Conclusions

Except for remedies on the wholesale level, an NRA has instruments at its disposal that can be supportive to the implemented wholesale solutions. One very strong remedy could be to regulate retail prices, however in general this can only be used after defining the retail market as a relevant market, after having this approved by the EC and only after wholesale regulation has proved to be ineffective. When retail regulation would be used to limit the retail mark-ups (see wholesale remedies above), it could be a very effective instrument.

In my opinion the retail market is well suitable for instruments that increase transparency. An example could be to prohibit the bundling of roaming together with other services or to oblige unbundled offers, to create a new framework for retail roaming tariffs; e.g. a Code of Conduct that states that all roaming tariffs should be transparently calculated per second.

Besides these interventions in the way of pricing (not the price-level), an NRA has the right to publish information about tariffs and substitutes in order to make the retail market more transparent and to increase customer awareness.

Applying these instruments when instruments on the wholesale market are not being used seems to be rather useless because operators have little incentive to change their tariffs/pricing structure even when consumers are more aware or value their roaming tariffs more. This results in the following conclusion for the retail market:

Retail Remedies

A more pro-active role of NRAs is required on the retail markets to support measures taken on the wholesale level. This does not necessarily encompass retail price regulation but may also prohibit the current unclear ways of pricing/bundling and making the retail market more transparent by publishing information.

Coordination or Separate action?

A point of discussion for remedies is often the trans-border character of the services. This is believed to limit the effectiveness of instruments applied by national NRAs. As was discussed in this report (section 7.8) a coordinated action of NRAs is very likely to give the best results. When looking at the remedy of wholesale price regulation it is straightforward to see that if one NRA would regulate its domestic wholesale IMR market, this would give benefit to all other foreign operators and possibly consumers while at the same time substantially harming the domestic dominant MNOs.

However, there is a possibility of a small number of NRAs teaming up in order to regulate wholesale prices. This would create an 'island' in which the firms will have to lower wholesale prices due to price regulation. Even though the outcome of this type of regulation is a bit more uncertain than the result of a coordinated action, the current uncompetitive state of the IMR markets may justify a more swift intervention by a small number of willing NRAs.

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Appendix I. Transport / Travelling Trends

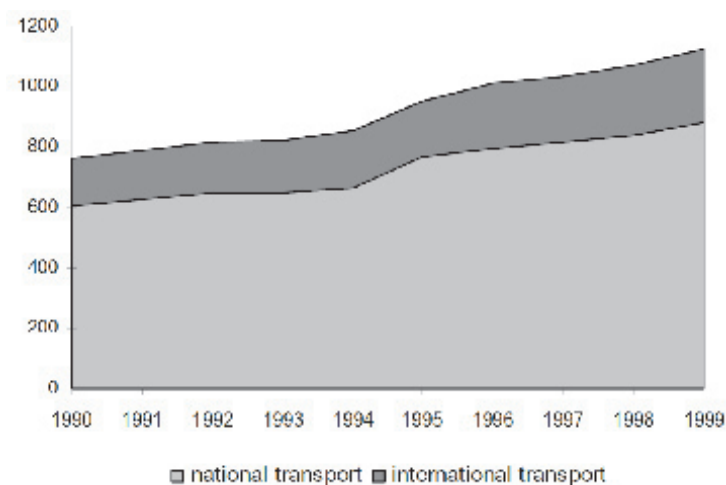


Figure 26. Trend of the contribution of national and international road transport 1990-1999, in 1000 million tkm. Source: [EUR99/1]

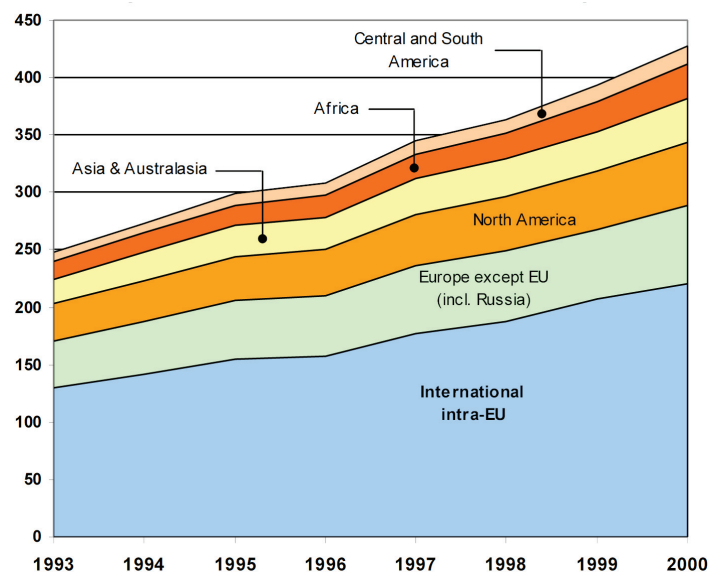


Figure 27. Development of international passenger air transport by world region between 1993 and 2000. In million passengers. Source: [EUR99/2].

The trends of growth in international air and road traffic can have significantly changed for the years 2002-2003.

Appendix 2. Discounts in the Wholesale Roaming Market

	Dutch Operators				
German Operators	KPN Mobile	Vodafone	T-Mobile	O2	Orange
E-Plus	0,74	0,87	0,84	0,80	1,00
T-Mobile	0,89	0,87	0,72	0,80	1,00
Vodafone D2	0,89	0,76	0,84	0,80	-
O2	0,89	0,87	0,84	0,70	-

Table 22. Comparison of retail Mobile Originated tariffs whilst roaming. Peak tariffs excl. VAT, February 2003. Source: Operator's websites.

Table 22 shows the end-user rates for a Dutch handset roaming in Germany³². This is the only publicly available information on roaming tariffs. Wholesale tariffs or discounts are not publicly available. Based on these tariffs and the differences in prices, it is very difficult to make a good prediction on the level of discounting in the sector and the height of these discounts. This is difficult for a number of reasons:

- The retail tariffs have been averaged, making any difference in IOT very hard to trace.
- Retail mark-ups can vary between operators e.g. between 15%-35%.

The fact that roaming partners that are part of the same conglomerate of MNOs charge lower retail roaming tariffs amongst each other can be explained as follows:

- First of all the visited MNO might favour the home MNO if both operators are part of the same large entity. The IOT that the visited MNO sets could in theory be a lot lower than the IOT that is charged to operators that are not part of this conglomerate. This could be called an "internal IOT". The question is whether this is already happening at the moment. Probably not, since the STIRA requires publication of the IOTs and because the discounts to IOTs have to be non-discriminatory. Moreover, the conglomerate would not benefit from a lower IOT since revenues from inbound roamers from other operator would be lower as well. This last argument is explained in more detail in paragraph 3.6.
- Secondly, the difference in retail tariffs could be explained by the fact that a lower retail mark-up is being charged by the operators that are part of the conglomerate. This is explained by Figure 28. Since the highest revenues are made on a mobile originated call in the visited network, this is of greatest value to an MNO and to the holding of the group of MNOs. The group could have decided to lower the retail margin while keeping the wholesale margin (margin part of the IOT) at the same level.

³² Germany was chosen because all networks have so called 'partner networks' in Germany and because it seems very probable that high percentages of Dutch business travellers go to Germany (much foreign trade with Germany).

Appendix 3. Lerner Index for MO Roamed Calls

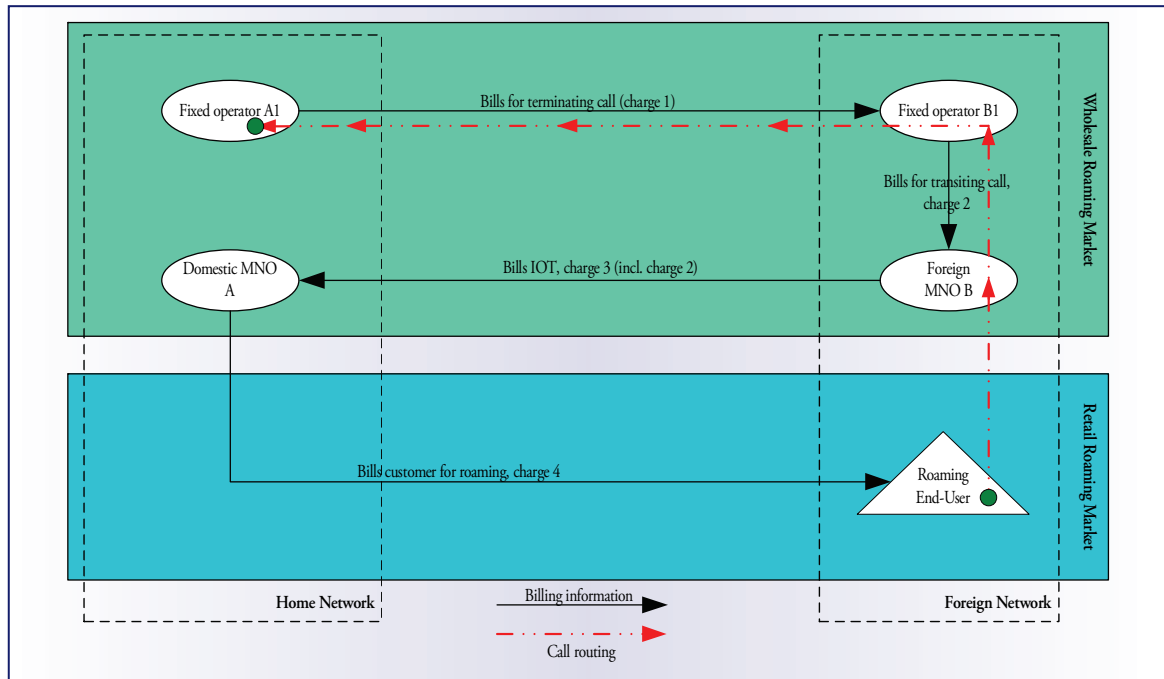


Figure 29. Inter Operator Charging for a mobile originated roamed call.

In the following sections the successive contributions of various charges to the final cost of an MO roamed call are considered without double-billing. All parties pass on their costs and add their additional charges as revenues.

Two notions need to be clarified: The Lerner Index and the mark-up. The Lerner Index is a measure of profit margins – it represents the percentage of the price taken by the retailing or wholesaling operator as profit. The mark-up on the other hand is a multiplier applied to the costs when a retailer or wholesaler supplies to its customer.

- Charge 1. This charge may be on the order of €0,05 [KPN03/2]. This is a representative retail rate exclusive VAT for international calls between two fixed end-users.
Note that this rate includes a profit margin for the fixed operator.
- Charge 2. This charge may correspond most with a domestic mobile-to-fixed call. An approximated representative retail value for this rate is €0,15 exclusive VAT. When subtracting the €0,05 this leaves €0,10 as profit which is used for discussion purposes.
- Charge 3. This is the IOT, and as noted is confidential to the operators. Charge 1 and 2 may be considered costs in the wholesale market. Further calculation of the IOT value is postponed for a moment. First the end-charge to the customer is considered.
- Charge 4. Making a call to the home fixed network whilst roaming is generally priced around €0,90 to €1,00 [KPN03/1]. An intermediate value of €0,95 is taken for discussion.
Excluding 19% VAT this is €0,80. It is on public record that the profit margin of the domestic MNOs is between 15 and 35% [EC00]. For the purposes of calculation this value is set to 25%.

The value, the ratio between profit margins and cost, is also known as the Lerner index. Charge 1 to 3 may be considered the costs of the domestic MNO, and charge 4 its profit. The following formulas are used to impute the level of the IOT based on assumptions of charges.

Equation 1 – Lerner Index for the Retail Market

$$L_R = \frac{(P_R - C_R)}{P_R}$$

The assumed charges are now substituted into the formula for the Lerner Index, given values in the literature and in publicly available tariffs. In the formulas below C1, C2, C3, C4 represent the respective four charges discussed above. The Lerner index is generally known as the relative mark-up or the ratio between the profit margin and the price [TIR02: p.66] and represents the gross profit margin.

Equation 2 – Substitution of Estimated Charges into the Lerner Index

$$L_R = \frac{(C_4 - C_1 - C_2 - IOT)}{(C_1 + C_2 + IOT)}$$

$$0,25 = \frac{(0,80 - 0,05 - 0,10 - IOT)}{(0,80)}$$

Equations 3 – Imputed IOT

$$0,25 = \frac{(0,65 - IOT)}{(0,80)}$$

$$IOT = €0,45$$

The IOT is calculated at €0,45. The focus can now be shifted towards calculating the unknown wholesale mark-up. The calculation proceeds similarly as above, also using the Lerner index. The price of the wholesale supplier (Pw) is the IOT, and the costs faced are C1 and C2 (Cw).

Equation 4 – Lerner Index for the Wholesale Market

$$L_W = \frac{(P_w - C_w)}{P_w}$$

$$L_W = \frac{(IOT - C_1 - C_2)}{(IOT)}$$

$$L_W = \frac{(0,45 - 0,05 - 0,10)}{(0,45)}$$

$$L_W = \frac{0,30}{0,45} = 0,75$$

The Lerner Index is 75% – i.e. the wholesale supplier adds an additional 75% in passing costs along to the foreign retail supplier of roaming minutes. If these calculations are correct, then it suggests the majority of retail cost stems from the IOT. In addition, it suggests that the highest profit margins are made at the wholesale market by the foreign MNO. Regulatory or technological intervention in this marketplace might restore the greatest amount of lost welfare to the customer.

Following this argumentation would mean that a reasonable price level for such a call would be approximately the costs charge 1 and charge 2, plus a reasonable wholesale mark-up (MW) plus a reasonable retail mark-up (MR). This is given below:

$$\begin{aligned} PR &= ((C_1 + C_2) * MW) * MR \\ PR &= ((0,10 + 0,05) * 1,15) * 1,15 \\ PR &= 0,198 \end{aligned}$$

Alternatively, if the wholesaling and retailing operators would be allowed to make a 50% gross margin, and if the system of IOTs would be abolished, allowing the operators to distribute the margins as they wish, a reasonable price would be:

$$\begin{aligned} 0,50 &= \frac{(C_4 - C_3 - C_2 - C_1)}{C_4} \\ 0,50 &= \frac{(IOT - 0 - 0,10 - 0,05)}{(C_4)} \\ C_4 &= €0,30 \end{aligned}$$

This results in the fact that a retail price of €0,30 per minute, excluding VAT would be a normal and feasible retail price level. This corresponds to the price level indicated by operators for charging large corporate users. If this price level is used, it however does not mean that operators are completely without margins.

Appendix 4. Lerner Index for MT Roamed Calls

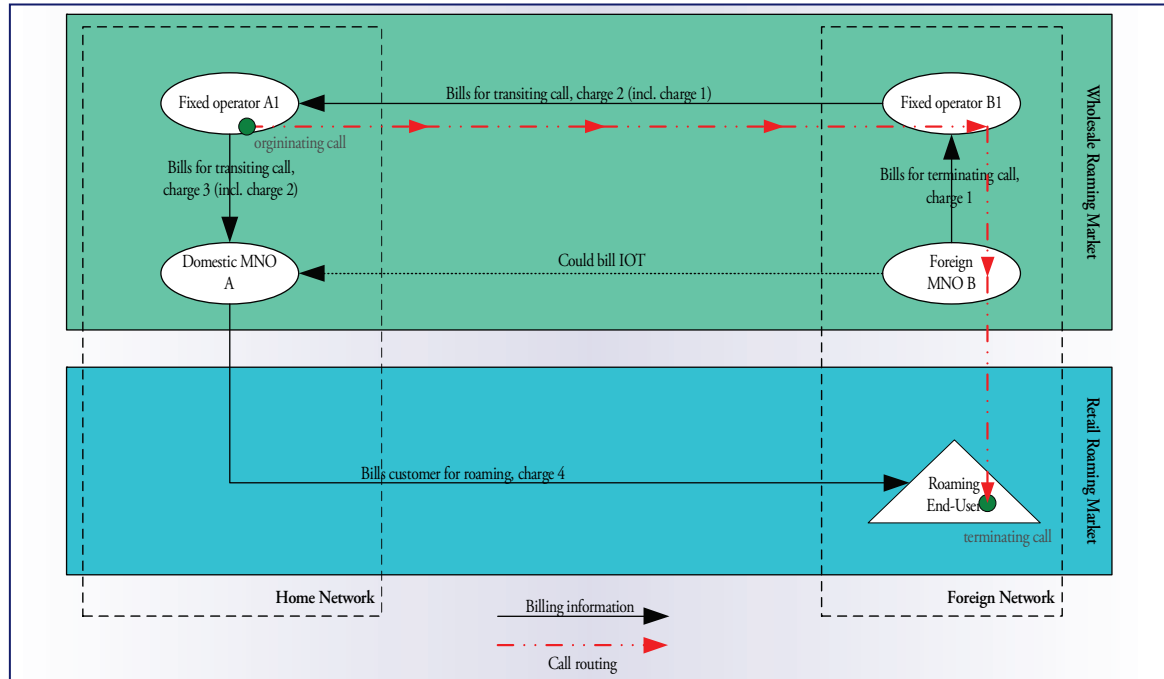


Figure 30. Inter Operator Charging for a mobile terminated roaming call.

- Charge 1. This charge can be compared to the MTA (Mobile Terminating Access) tariffs. The European average of this type of tariff is €0,1894/minute [EC02/4: chart 38, p. 42].
- Charge 2. This charge is the international fixed-to-fixed termination charge. Since a European international telephone call often does not cost more than €0,05/minute incl. VAT, a value of €0,042/minute is used; this is the charge excluding 19% VAT.
- Charge 3. Can be considered to be of the same level as charge 2.
- Charge 4. This is the final bill to the end-user. This bill includes all other charges as input costs. Receiving a call whilst roaming in Europe costs approximately €0,60 per minute. Excluding VAT this is €0,50/minute.

To find out the profit margin that is being calculated by the home MNO, the Lerner Index is used again in equation number 7 below.

$$L_R = \frac{(C_4 - C_1 - C_2 - C_3)}{(C_4)}$$

$$L_R = \frac{(0,50 - 0,1894 - 0,038 - 0,0)}{(0,50)}$$

$$L_R = 0,49$$

The Lerner Index is 49% – i.e. the retail supplier makes 49% profit of the price charged to its retail customers when receiving a mobile terminated call whilst roaming abroad. It should be noted that this profit margin is the result of the assumptions made above and that the Lerner Index will diminish quite strongly the higher the input costs (charge 1,2 and 3) are. It does not seem likely that the home operator (MNO A) will be charged with additional or higher charges than are shown in Figure 30.

Appendix 5. Frequent Contacts between Firms as an Impediment?

The frequency of contacts between firms could be identified as an impediment to competition in the wholesale market mainly because it might contribute to possible tacit collusion. This point is not made only in this report but has also been mentioned by the EC. Another, closely related argument is that it can become difficult to compete fiercely with parties that meet each other so very often as in the telecommunications sector.

Firms meet each other in many forums, organisations and associations mostly aimed at new technological developments and standardisation between networks. For example in meetings for the GSMA, GSM MoU, on trade fairs or for the 3rd Generation Partnership Project (3GPP) [3GP03]. It could be difficult to compete with companies that one meets very often in the field.

However, telecommunications is a highly innovative sector that would not be able to offer the services in the amount and quality of this moment without proper discussion on developments and standardisation. Standardisation plays an important role for international mobile roaming services as well; networks have to be able to exchange information such as billing files or signalling, this would not work well without proper standards.

This shows that, even though frequent contacts between firms contain a certain competition risk on tacit collusion, it is much needed in the telecommunications sector and therefore is not considered to be a real impediment to competition.

Appendix 6. Criteria for Assessing Single/Joint Dominance

Overall size of the undertaking	economies of scale
Control of infrastructure not easily duplicated	economies of scope
Technological advantages or superiority	vertical integration
Absence of or low countervailing buying power	a highly developed distribution and sales network
Easy or privileged access to capital markets/ financial resources	absence of potential competition
Product/services diversification (e.g. bundled products or services)	barriers to expansion

Table 23. Criteria for assessing single dominance.

Mature market	Absence of excess capacity
Stagnant or moderate growth on the demand side	High barriers to entry
Low elasticity of demand	Lack of countervailing buying power
Homogeneous product	Lack of potential competition
Similar cost structures	Absence of potential competition
Similar market shares	Various kind of informal or other links between the undertakings concerned
Lack of technical innovation, mature technology	Retaliatory mechanisms
Lack or reduced scope for price competition”	

Table 24. General criteria / market characteristics conducive to joint dominance.

When assessing single or joint dominance on a certain market, these lists of criteria are not exhaustive nor is it always required to use all these criteria in an assessment. It is the task of the NRA to make clear whether or not competition is effective and why it is so.

Appendix 7. Details of Over-The-Air Programming and the SIM Application Toolkit

Network architecture for OTA

Over-The-Air (OTA) programming needs a means of communication between the network and the mobile station. This is done by using OTA SMS messages. These messages are sent from the network and received by the mobile station where they are executed by the SIM-card (SAT). A normal SMS is visible to the user and contains plain text. An OTA SMS however, is invisible to the user, and is directly sent to the SIM. The OTA SMS contains execution code that would give orders on which files on the SIM to modify and in which way.

The SIM then processes the commands in the OTA message. This could for instance be the updating of the preferred PLMN list. If the SIM does not support the SIM Toolkit, the OTA message could be displayed as a regular SMS message on the phone.

Except for the need for an OTA capable SIM-card, the network should also be able to send OTA messages. The OTA content, the code to be executed by the SIM-card, is prepared by a backend system. It should contain the MSISDN of the subscriber to which the message will be sent. The message is then sent to an OTA Gateway that is able to translate the specific commands, into commands that the SIM-card will understand. An operator might use more than one brand of SIM-card (e.g. GemPlus and SchlumbergerSema³³) and every SIM-card interprets the commands differently. The OTA gateway then sends a formatted message to the SMS-Centre with the correct parameters as outlined in GSM Standard 03.48 [GSM03.48].

The SMSC is the Service Centre for Short Messages (SMS) exchanged between the OTA Gateway and the cellular network. The OTA message consisting of a maximum of 160 alphanumeric characters will be sent to a Mobile Station. If the Mobile Station is powered off or has left the coverage area of the network, the message is stored and sent again when the mobile is switched back on or has re-entered the coverage area [GEM01].

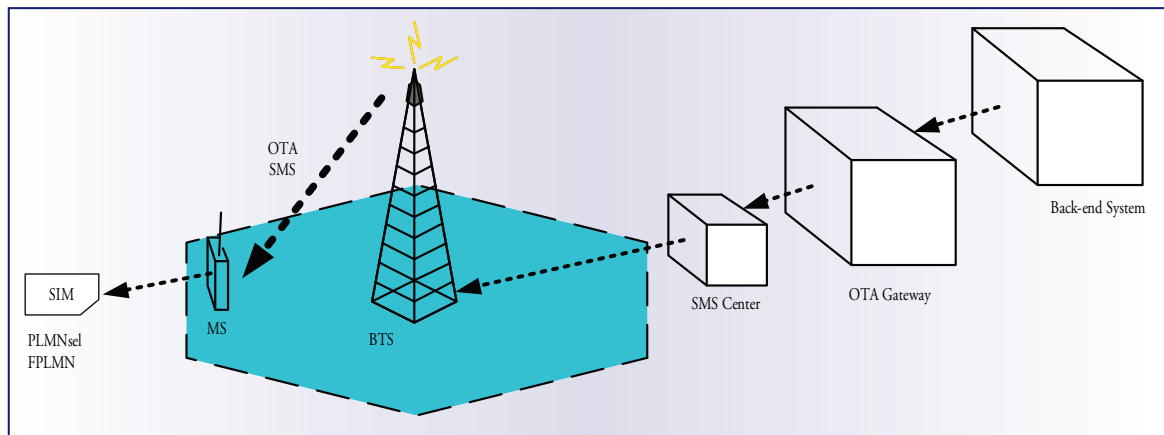


Figure 31. Changing the SIM-card through OTA.

Other well-known players in the SIM-card market are: Bluefish, Austriacard, Orga, Prism, Xponcard, Incard, Giesecke&Devrient. URL: http://www.schlumbergersema.com/telecom/ind_insight/simcard6.htm. All these SIM-card manufacturers are a member of the SIMalliance. "The SIMalliance tries to promote the benefits of SIM-cards and SIM-based services". URL: <http://www.simalliance.org/>

The SIM Application Toolkit

In the technical description of the standard GSM system, the SIM is seen as a kind of portable memory for storing telephones numbers et cetera. Furthermore it was used for selecting the network onto which the mobile station will roam. Based on two files that are located in the SIM-card (the preferred and the forbidden PLMN list), the mobile station selects the network.

These files on the SIM-card are filled with data on the issuing of the SIM. At a later point in time however, for instance when roaming agreements change, it could be very helpful to be able to change the information in these files.

In the newer GSM standards (GSM Phase 2+), many more new services and possibilities are reached with GSM. The Phase 2+ SIM-card has gained more capabilities especially due to increased memory (already 64 Kb. or higher) and due to the SIM Application Toolkit (SAT). By using the SAT, it is possible to run operator specific applications on the mobile station. Through the SAT, the SIM is able to control some parts of the mobile equipment as well. Many possibilities exist, but at this moment in time the SAT is mainly used for displaying operator specific menus on the mobile phone. An operator could program its own menu on its SIM-cards, with the own numbers of the helpdesk pre-programmed, with services for finding a restaurant et cetera.

It is also possible that the SIM takes a more proactive role. In the example above, the SIM will respond to a request of the mobile phone. However, another scenario is that the SIM will issue a request to the mobile phone itself. In that way, the SIM would be able to display text on the screen, to produce a sound through the mobile phone or even to setup a call to a specific destination. It should be noted that the GSM Phase 2+ standard is already available since 1995 and that most mobile phones currently on the market support these features. All mobile phones introduced during or after 1999 support the GSM Phase 2+ features [SIM03]. Therefore a solution that would be based on these technical features will be supported by a large part of the customers of a mobile network. OTA together with the SAT can be used to control roaming in two possible ways. How these two scenarios work and what exactly they do to accomplish direction of traffic is described below.

Changing the Roaming Files on the SIM

For instance, the PLMNsel file can be updated remotely whenever a new roaming agreement has been concluded, when marketing propositions change or because of any other reason. Furthermore, the files on the SIM can be changed at any point in time, fully at the control of the MNO. By changing the PLMNsel file, the mobile station will always try to register with the correct preferred network.

Except for remotely changing the PLMNsel file, for roaming purposes it is also possible to remotely change the FPLMN file. Originally this file had a limited capacity [RED98] “blocked” or forbidden networks but with the increase in SIM memory this is no longer a problem. For every country a network could be specific (by means of its Mobile Network Code) with which the mobile station is not allowed to register. If there is one network that has full coverage, all other networks could be blocked in that country so that the roamers only register with the preferred network.

Using the SAT

By making use of the SAT it is feasible to take a more active approach to directing users to certain networks. Since the SAT is able to communicate with, and give orders to the mobile equipment it is possible to make the SAT give a command to actively switch networks whilst roaming. The SAT could actively switch networks for instance based on the current visited country or based on the current time of day (to have the cheapest peak/off-peak tariffs). When the SAT would receive an OTA message that contains e.g. the prices for certain types of calls or services, the SAT could display price information or actively switch networks when the user wants to send an SMS, making sure that user sends the message through the cheapest network.

The Effect of Over-The-Air Programming on Traffic Flows

Figure 32 demonstrates the effect OTA could have on the flows of traffic and revenues between networks. In the left part of the diagram, OTA is not used with the result that operators belonging to a different group still receive quite a substantial amount of inbound roamers. The right part of the diagram shows the changed situation with the use of OTA. MNO A1 and MNO B1 are part of the same group and use OTA to direct traffic to each other. Only a small part of the roaming users of MNO A1 roams onto networks of B2 and B3. MNO A3 is showed purely as an example. This MNO could have cancelled all roaming agreements with the foreign MNOs and as a result would retain all roaming traffic within the group.

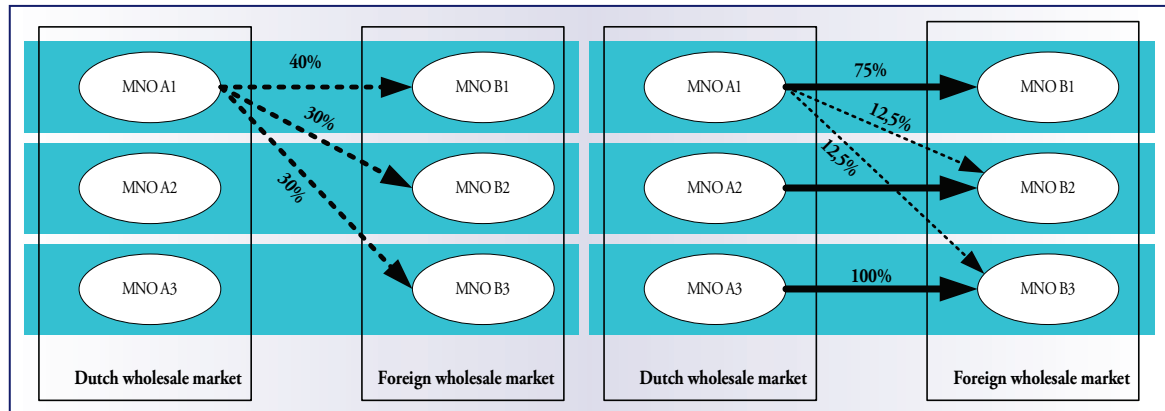


Figure 32. Effect of OTA, SAT and consolidation on traffic direction.

Appendix 8. Example of Retail Tariffs; KPN Roaming on E-Plus Mobilfunk GmbH

Network:	GSM 1800		
Network code:	262-03		
Display name:	E-Plus		
Calculation tariffs:	Calling with mobile		Being called on mobile
	To fixed German network	To Holland (fixed & mobile)	In Germany
Costs peak:	Per 30 sec.	Per 30 sec.	Per 30 sec.
Costs off-peak:	Per 30 sec.	Per 30 sec.	Per 30 sec.
Minimal unit:	60 sec.	60 sec.	N/a
Start tariff peak:	0.00	0.00	0.00
Start tariff off-peak:	0.00	0.00	0.00
Calling attempt:	0.00	0.00	0.00
Peak times:	Mon/Fri. 08.00-20.00 local time	Mon/Fri. 08.00-20.00 local time	All times
Off-peak times:	Other times	Other times	All times

