

Unclassified

DSTI/ICCP/TISP(99)11/FINAL



Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 16-May-2000
Dist. : 19-May-2000

PARIS

DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY
COMMITTEE FOR INFORMATION, COMPUTER AND COMMUNICATIONS POLICY

Or. Eng.

Unclassified
DSTI/ICCP/TISP(99)11/FINAL

Working Party on Telecommunication and Information Services Policies

CELLULAR MOBILE PRICING STRUCTURES AND TRENDS

91220

Document complet disponible sur OLIS dans son format d'origine
Complete document available on OLIS in its original format

Or. Eng.

FOREWORD

In November 1999, this report was presented to the Working Party on Telecommunications and Information Services Policy (TISP) and was recommended to be made public by the Committee for Information, Computer and Communications Policy (ICCP).

The report was prepared by Dr. Sam Paltridge of the OECD's Directorate for Science, Technology and Industry. It is published on the responsibility of the Secretary-General of the OECD.

Copyright OECD, 2000

Applications for permission to reproduce or translate all or part of this material should be made to:

Head of Publications Service, OECD, 2, rue André-Pascal, 75775 Paris Cedex 16, France.

TABLE OF CONTENTS

MAIN POINTS.....	6
CELLULAR MOBILE PRICING STRUCTURES AND TRENDS.....	8
Introduction.....	8
MOBILE PENETRATION RATES.....	14
CHANGING MARKET STRUCTURE.....	16
Market structure and growth.....	17
PRICING TRENDS.....	22
Roaming Prices.....	23
Pre-paid cards and roaming.....	25
INTUG Survey of roaming prices.....	27
CONVERGENCE WITH FIXED NETWORK PRICING.....	29
Local mobile and local fixed network pricing.....	32
CALLING PARTY AND RECEIVER PARTY PAYS.....	35
Receiving party pays and growth rates.....	39
Impact of change from RPP to CPP in Mexico.....	40
Calling opportunities and pricing structures.....	41
THE PRICE OF FIXED NETWORK TO MOBILE NETWORK CALLS.....	44
Fixed to mobile network pricing in countries with calling party pays.....	45
Fixed to mobile pricing and competition.....	46
Regulatory action in CPP markets.....	47
Transparency and fixed to mobile pricing.....	49
Fixed network to mobile network interconnection rates.....	50
TROMBONING.....	53
PRE-PAID CARDS.....	56
Pre-paid card pricing structures.....	57
Pricing of pre-paid card service.....	58
Card validity.....	60
Pre-paid cards, called and receiving party pays.....	61
SHORT MESSAGE SERVICE.....	63
SMS Pricing.....	64
SMS Pricing: comparisons and implications.....	65
International SMS and roaming.....	67

SMS and the Internet	67
SMS and access.....	69
IMT-2000 LICENSING UPDATE.....	70
Commencement of service	70
Number of operators.....	70
Method of allocating licences.....	71
NOTES	97

Tables

Table 1. Comparison between CPP and RPP.....	37
Table 2. Prepaid users in selected Europe mobile operators, June 1999	72
Table 3. Mobile cellular subscribers in OECD countries	73
Table 4. Mobile subscribers per 100 inhabitants in OECD countries.....	74
Table 5. Mobile subscriber increase per 100 inhabitants per annum, 1991-1998.....	75
Table 6. Number of mobile operator equivalents in OECD countries.....	76
Table 7. OECD mobile subscriber penetration rankings, 1990-June 1998.....	77
Table 8. Personal basket of digital cellular service, August 1999	79
Table 9. Business basket for digital mobile service.....	80
Table 10. INTUG Survey of European roaming prices, 1999	81
Table 11. Fixed network pricing in Denmark, July 1999	81
Table 12. Mobile subscribers as a percentage of access lines	82
Table 13. Cellular mobile growth in Mexico.....	83
Table 14. Network calling opportunities	83
Table 15. Price of calls between fixed and mobile networks.....	84
Table 16. Interconnection charges between fixed and mobile networks in OECD countries.....	85
Table 17. Mobile pricing and service innovation	86
Table 18. Prepaid card pricing in OECD countries	87
Table 19. Selected mobile card conditions and duration	89
Table 20. SMS growth in Europe	91
Table 21. Short message service (SMS) pricing in OECD countries	92
Table 22. Radiolinja pricing for SMS roaming	93
Table 23. OECD Member countries and IMT-2000.....	95

Figures

Figure 1. Rolling three-year average growth rates in different market structures.....	19
Figure 2. OECD mobile basket prices time series	22
Figure 3. BT fixed network to mobile network.....	50

Boxes

Box 1. Select glossary of mobile terms.....	9
Box 2. Finland: Mobile penetration update.....	15
Box 3. European Union mobile licensing	16

Box 4. Key cellular mobile policy initiatives in Japan	18
Box 5. Receiving party pays regulatory update	21
Box 6. Removing regulatory barriers to CPP.....	39
Box 7. Mobile traffic and revenue patterns in Spain.....	43
Box 8. European Commission investigations of pricing between fixed and mobile networks.....	49
Box 9. Pre-paid card use in Sweden.....	57
Box 10. Lock-in	61
Box 11. SMS Messaging and 'hz.com'	66

MAIN POINTS

Mobile communications is one of the tremendous success stories of the telecommunications industry. By June 1999 there were 293 million mobile subscribers in the OECD area, or around one mobile phone for every four inhabitants. Current growth continues to exceed most past projections. The benefits wrought by mobility in communications are increasingly evident in terms of both economic and social development. Moreover, the potential for using wireless networks as a platform for electronic commerce and increasing infrastructure competition are some of the most promising developments on the communications horizon.

If there is a caveat, amidst such a tremendous success story, it is that the very rapid growth of mobile communications has tended to conceal large performance differences across the OECD area. There is an ongoing need to examine performance, however meritorious in national terms, against fast moving international benchmarks. Without such analysis the challenges to mobile communications meeting wider policy goals, in relation to electronic commerce and local infrastructure competition, will remain impervious to critical review. In addition, high growth rates have tended to mask some problem areas where there has been insufficient price competition.

This is not to argue for increasing regulation of mobile communications. From a policy perspective, tremendous benefits have been achieved in an environment characterised by less regulation than traditional telecommunication networks. Indeed, in many countries the mobile communications sector has been used to pioneer liberalisation. Nevertheless, it is incumbent on policy makers to continually review regulatory frameworks. The report emphasises a number of areas for policy review and decision:

- Analysis clearly shows a strong correlation between market growth and market openness. During the 1990s, those markets that had liberalised the most, and had four or more operators, have consistently outperformed markets with monopolies, duopolies or three operators. In the United States, for example, some markets have seven networks in direct competition. In Japan, Korea and the Netherlands up to five operators are competing in the same markets. This is important in relation to third generation mobile licensing where policy makers should strive to open markets as rapidly and as widely as possible to this new technology.
- Important price reductions have taken place in mobile services. However, there is evidence that in many countries prices remain high and there is still scope for price reductions. If growth slows and operators start competing against each other for existing customers, more rapid price declines can be expected. However, there has been an insufficient price reduction in the pricing of calls from fixed-to-mobile networks in countries with calling party pays. The lack of competition in this price segment is due largely to the market power of mobile companies. Prices in this market segment appear to be well above cost and should be reviewed by regulators who should require cost-based pricing.
- The relatively high termination charges on mobile networks are leading to bypass at the national level via fixed network and international re-routing of traffic. This has led to recommendations to seek increases in international termination charges to prevent such bypass. Such action would not rectify the root of the problem, which is based on high mobile termination charges.

- Prices for international roaming appear to bear little relation to cost. This reflects insufficient competition in the roaming market to a large extent due to the relative small size of the international roaming market.
- Successful growth and diffusion of mobile communication services is focusing greater attention on how mobile relates to fixed networks. Accordingly, it is necessary for regulatory authorities to review current frameworks in those instances where regulation might impede the offering of certain pricing structures, such as calling party pays. This issue is critical in putting fixed and mobile networks on an equal footing, so the potential for competition between networks can be exploited. Testing the demand for new pricing structures can be left to the market.
- Successful growth and diffusion of mobile communication services is focusing greater attention on how mobile communication relates to the Internet and electronic commerce. This report reviews and benchmarks the pricing of emerging services such as short message services. These services are the harbingers of 'third generation' information services over mobile networks, and policy makers need to review current regulatory frameworks to enhance pricing innovation and competition in the provision of these services.

CELLULAR MOBILE PRICING STRUCTURES AND TRENDS

Introduction

The OECD has considered cellular mobile communications pricing on several occasions as the sector has grown in importance over the past decade.¹ In 1992, the OECD analysed the question of whether the pricing of mobile communication services would be complementary or in competition with fixed network services.² In 1995, the OECD examined the pricing strategies used by mobile telecommunication operators in different markets in the OECD area.³ This study included the then novel trends toward flexible pricing packages and selling blocks of airtime in advance of use. That report also found that higher growth rates had been achieved in competitive markets.

Based on this analysis, and the increasing experience with liberalisation in Member countries, the OECD's Information Computer and Communications Policy Committee released a statement on the benefits of competition in mobile communications in terms of market growth, increasing employment, furthering universal service applications and reducing prices.⁴ Since that time the evidence for these benefits has strengthened. By 1998, mobile communications had grown to represent more than 20% of the total communications market in the OECD area. Mobile operators directly employed more than 260 000 people and have created many more jobs among resellers and related businesses.⁵

Earlier OECD work also noted the potential for mobile communications to enhance universal service. Recently, mobile communication penetration rates have begun to exceed those of fixed networks, in a growing number of OECD countries. In fact, new wireless technologies are increasing access in many and varied ways. In Sweden, mobile phones are also being developed which enable speech and hearing-impaired users to take advantage of communications mobility.⁶ The technology enables real-time text-phone conversations over mobile networks. However the importance of mobile networks is not limited to increasing access to communication services. The ability to utilise mobility is greatly enhancing social developments in areas such as personal security and emergency services. In the United States, for example, some 98 000 calls are made every day from mobile phones to emergency services.⁷ Combining this with new services, such as location finding, will further improve the ability for emergency services to respond to distress calls.

This report examines mobile pricing structures and trends. It also updates previous analysis and seeks to confirm the earlier observation, that higher growth rates are strongly correlated to increasing liberalisation. It does this by comparing growth rates for different markets structures with monopolies, duopolies, three operators and four or more operators. Mobile growth rates are also updated, as these data are important for comparing the performance of the sector across different OECD countries and informing regulatory authorities and policy makers as they consider new issues. The report also updates the evolving market structures for the provision of mobile service and projects market structures to the end of 2000. This is relevant at a time when many OECD governments are considering the licensing arrangements for IMT-2000 (International Mobile Telecommunications system - refer glossary in **Box 1**). The importance of wireless networks in promoting infrastructure competition at the local access level is a key issue for OECD Member governments.

Box 1. Select Glossary of Mobile Terms

There are several glossaries of mobile terms available on the Internet including those of Wireless Week at: <http://www.wirelessweek.com/industry/terms.htm>, the Personal Communications Industry Association at: <http://www.pcia.com/wireres/glossary.htm>, and the Canadian Wireless Telecommunications Association <http://www.cwta.ca/indguide/glossary.htm>. Some of the definitions below have been taken from these sites.

Airtime: Actual time spent using a wireless phone.

Airtime charges: Charges to users of wireless networks based on a flat rate or on the actual time used. In cellular/PCS networks, charges are typically on a timed basis.

Bundling: Grouping various telecommunications services -- wireline and/or wireless -- as a package to increase the appeal to potential customers and reduce advertising, marketing and other expenses associated with delivering multiple services. For example, a bundled package could include long distance, cellular, Internet and paging services.

Calling opportunities: The sum total of possible connections (and therefore calls) on telecommunications networks (fixed and wireless).

Calling party pays (CPP): This service bills the originator of a call to a wireless device rather than the receiver.

CDMA (code division multiple access): A spread spectrum air interface technology used in some digital cellular, personal communications services and other wireless networks.

Dual band: Describes a handset that works on 800 MHz cellular and 1900 MHz PCS frequencies.

Dual mode: Describes a handset that works on both analogue and digital networks.

Equivalent mobile operators: This is a way of counting the number of operators in countries where regional licensing applies. If a country has 10 regions, each with three operators, the number of mobile equivalent operators for that country is three. In countries where there are different numbers of operators in different regions, the largest number of operators in the same market is used to determine the national equivalent.

GSM (global system for mobile communications): A digital cellular or PCS network.

PCS (personal communications services): A two-way, 1900 MHz digital voice, messaging and data service designed as the second generation of cellular.

Pre-paid: A system allowing subscribers to pay in advance for wireless service.

PSTN: Public Switched Telephone Network.

Roaming: (1) A service offered by mobile communications network operators which allows a subscriber to use his/her radio or phone while in the service area of another carrier. Roaming requires an agreement between operators of technologically compatible systems in individual markets to permit customers of either operator to access the other's systems. (2) Travelling outside a carrier's local area.

Box 1. Select Glossary of Mobile Terms (*cont'd*)

Receiving party pays (RPP): This service bills the receiver of a call to a wireless device. The originator of the call may or may not be charged depending on the pricing structure of the network.

SIM (subscriber identity module): Synonymous with smart card.

Smart card: A plastic card containing important data about a person's identity to allow access to a network or premises. Also, a card containing subscriber information, often inserted into GSM phones for roaming to different countries.

SMS: Short Messaging Service. A wireless messaging service that involves the transmission of a short text message and its receipt by a wireless terminal.

Spam: Electronic 'junk mail' or junk newsgroup postings mostly commonly associated with the Internet.

Termination charges: Fees that wireless telephone companies pay to complete calls on wireline phone networks or vice versa.

Tromboning: Sending domestic fixed-to-mobile traffic via international routes to bypass domestic interconnection rates.

IMT-2000: International Mobile Telecommunications system sometimes referred to as Universal Mobile Telecommunications System (UMTS) or third-generation mobile services (3G).

The report also provides a comparison of prices for baskets of digital mobile service. Another area of mobile pricing considered is that of roaming, an area of growing significance to business users. The report also considers convergence with fixed network pricing but not just from the perspective of mobile pricing as has been the case in the past. In this respect, the report details the changes occurring to the fixed network market which are related to higher mobile network penetration rates. In a growing number of OECD countries the penetration rate of mobile service is approaching or has surpassed that for fixed networks. This has contributed to the elimination of long distance pricing on the fixed network in some of these countries.

The report also considers one of the most challenging new issues facing telecommunication regulators in Member countries -- the pricing of calls from fixed networks to mobile networks. In some countries, in Europe and the Asia Pacific, this relates to the level of pricing of calls from fixed networks to mobile networks and the degree of competition in this market segment. For countries in North America it relates to the structure of pricing between networks and consideration of the introduction of calling party pays (CPP). From a competition perspective, the key issue for policy makers is whether regulatory frameworks enable mobile networks to compete on equal terms with fixed networks.

In most respects these issues could have been considered in relation to earlier pricing structures, such as those examined in 1995. The primary differences are that mobile network penetrations have vastly increased and innovation in mobile pricing has continued since that time. Accordingly, the pricing of services between fixed and mobile networks has assumed a growing importance as the number of calling opportunities has increased. At the same time, the advent of pre-paid cards for mobile service has been the major pricing innovation subsequent to 1995.

The impact of pre-paid pricing cannot be stressed enough in considering changes to the market for mobile communications. Apart from pre-paid cards, mobile communication pricing structures are much the same

as those described in 1995. In other words, although prices have been reduced, the structures of the plans are much the same. There are exceptions, of course, such as services that bundle more than one subscription on the same bill, schemes that bundle elements of mobile service with fixed network pricing or attack a particular fixed market segment. Yet none of the pricing innovations, introduced since 1995, have had anything like the impact of pre-paid cards. In Sweden, for example, a country with one of the highest mobile penetration, some two years after the introduction of pre-paid cards they made up 25% of the entire market. In 1998, the Swedish mobile market grew by 30%. However, if pre-paid cards are excluded, the market grew by only 5%.

The impact in southern European countries, which historically had lower penetration rates than northern counterparts, has been even greater than in Scandinavia. Some mobile operators in Portugal and Spain have more than 80% of their subscribers on pre-paid tariff plans (**Table 1**). In Spain, over the first six months of 1999, Telefonica gained a net 1.6 million clients -- triple the number of new clients in the first half of the previous year -- taking the total customer base to 6.5 million.⁸ Telefonica's group of pre-paid products for digital mobile service was the main driver of growth, having proved popular with young Spaniards.

That being said, if pre-paid cards were only a pricing innovation, they would be of less significance to policy makers. The importance of this development also relates to pressing regulatory considerations in relation to the pricing of calls between fixed and mobile networks. The available evidence suggests that the advent of pre-paid cards has been the most important factor in countries with receiver party pays (RPP) forfeiting their historical lead, in terms of subscriber growth, over countries with CPP. Using the ratio of mobile subscribers to fixed access lines, to make allowance for other factors such as GDP per capita, the advent of pre-paid cards strongly correlates with countries with CPP overtaking the growth rates for those with RPP. In 1996, countries with RPP had 25 mobile subscribers per 100 fixed access lines compared to 20 for countries with CPP. By June 1999, countries with CPP had 61 mobile subscribers per 100 fixed access lines compared to 42 for countries with RPP.

Accordingly, the document aims to provide policy makers and regulatory authorities, in countries with RPP, information on pricing and subscriber trends related to pre-paid cards, as they consider the issues related to the introduction of CPP. At the same time the growth in the ratio between mobile subscribers and fixed access lines has brought the pricing of services between these networks very much to the foreground for regulators in countries with CPP. This issue is also significant for policy makers considering the introduction of CPP.

The report reviews the pricing of pre-paid cards. This includes an examination of the most important terms and conditions associated with pre-paid cards such as their duration of validity. This report also considers the wholesale and retail pricing of services between fixed and mobile networks. While the evidence indicates that increasing competition is bringing down the cost of mobile services, there are increasing concerns over the pricing issues arising between fixed and mobile networks. This includes the emerging issue of sending domestic fixed-to-mobile traffic via international routes to bypass domestic interconnection rates -- a practice known as "tromboning".

While prepaid cards have undoubtedly been a major factor in restructuring pricing in Europe there has also been a great deal of innovation in North America. For example, there is an increasing tendency to have uniform national and international rates for mobile service as represented by AT&T's Digital One Rate plan (and the possibility to include roaming in Canada in this option). Similar options are available in Canada for roaming in the United States. Arguably this has led to greater unification of the North American market pricing than in Europe where international prices for roaming on the same continent are higher.

The report is also mindful that policy makers are addressing the issue of the market structure for IMT-2000 in many OECD countries. Mobile communications already play a growing role in electronic commerce. The introduction of IMT-2000 services, from around 2002 onwards, promises tremendous advances in the ability to send and receive data over mobile networks. A rapidly increasing number of mobile operators are offering a range of information services and access to the Internet. IMT-2000 will enable substantial increases in the speed at which users can access these services. How these services will be priced, however, will be one of the biggest challenges for mobile communication operators. The advent of the Internet and the different patterns of use than telephony, have raised increasing questions, in many countries, about which fixed network tariff structures are suited for electronic commerce. The same challenges face the mobile communications industry in the coming years.

For the most part, the pricing of advanced mobile communication services is in the future. Notwithstanding this, it is clear from other mobile communication services, and the experience with Internet access over the fixed network, that competition leads to the type of pricing innovation necessary to drive electronic commerce. The experience with Internet is that competition speeds developments at a faster pace than many incumbent telecommunication carriers would have otherwise chosen in a monopoly environment. This is clearly the case for those services that have the potential to ‘cannibalise’ other existing products and services (*e.g.* xDSL substituting for leased lines for permanent Internet connectivity). In the case of mobile communication, the harbinger of many issues, related to the convergence between mobile networks and Internet services, may be the pricing of the so-called short message service (SMS).

For this reason, this report reviews SMS pricing and the challenges mobile operators are facing in pricing these services. The parallels with dial-up Internet access pricing, from *circa* 1995, are striking. In some countries the introduction of SMS services is very recent, the pricing structures are not very clear and exhibit tremendous differences across OECD countries. As with the Internet, the use of SMS is also undergoing tremendous growth. In the United Kingdom during May 1999, 22 million text messages were sent on Vodafone’s network, compared with 600 000 in January 1998.⁹ In August 1999, this number increased to 30 million.¹⁰ In Spain, Telefonica reports that the SMS has also undergone spectacular growth, and now stands at more than three times the level of the first half of 1998. In Italy, at the beginning of 1999 about 500 000 messages a day were sent by Telecom Italia’s mobile subscribers.¹¹ This has now risen to 2.8 million SMS per day. In 1999, Omnitel, Telecom Italia’s largest rival, has seen its daily message transmissions increase by 800% to 2.5 million per day.

Different actors in the mobile sector are also in the process of determining who will act as the “gatekeepers” in terms of access to networks. Much the same thing is occurring on the Internet. Consider for example, the much-publicised dispute between AOL and Microsoft, in mid-1999, over the so-called instant messaging service.¹² In the mobile network world an equivalent case involves different mobile operators deciding who can communicate, using SMS, with their subscribers.¹³ In some cases, mobile operators have blocked the capability of SMS communications between networks based on concerns such as “spam” or the fact that they were not setting the prices for a service which crossed their networks. In other cases it might simply be interpreted as anti-competitive behaviour.

Services such as SMS create such a complexity, in terms of tariffs, that they are likely to have the same impact on mobile pricing as the Internet is having on some fixed telecommunication pricing. Consider the following example: a user in Canada accesses the Internet, and the Website of a mobile operator in South Africa, and sends a message to a mobile user in Finland who happens, at that time, to be roaming in Australia. In this example the end users do not make a direct payment to the mobile operators involved. The Canadian user pays only for Internet access and the Finnish user does not directly pay to receive SMS. There may be roaming payments between the various mobile operators involved but generally the system

in place is sender-keeps-all for SMS. This bears little resemblance to traditional approaches to telecommunication pricing for a communication across four continents.

Mobile communications has undoubtedly benefited from a much more liberal environment than fixed networks. That an increasing range of issues is being placed before regulatory authorities, in relation to mobile communication, should not be a surprise as the significance of the sector increases. Following the liberalisation of fixed network services, the mobile sector is arguably more constrained in terms of market entry than its fixed counterpart. This is, of course, due to spectrum limitations. The available evidence confirms earlier findings of the benefits of increasing the number of mobile operators. In the United States, for example, some markets have seven networks in direct competition and the benefits are increasingly mirroring those of competitive markets in other sectors. It is for this reason that regulatory authorities, in a market that is not completely open due to spectrum limitations, are mostly concluding that competition is providing a more effective discipline than regulation could in the provision of mobile service. The challenge for policy makers, however, is to devise competitive frameworks for those market segments where the similarities to openly competitive markets are much less evident, such as calls from fixed networks to mobile networks.

MOBILE PENETRATION RATES

The growth of mobile communication services, in the 1990s, is one of the tremendous success stories of the telecommunication industry. By June 1999, the number of cellular mobile subscribers in the OECD area reached 293 million (**Table 2**).¹⁴ In 1998, the number of mobile subscribers increased by 45% and, based on the first half of the year, looks set for a similar performance in 1999. Between 1992 and 1997 the number of mobile subscribers grew at a compound annual growth rate of 52% in OECD countries.

High growth rates have vastly increased access to mobile communication and access to the benefits which mobility can bring to business and personal communications. In 1990 there was just one mobile subscriber per 100 inhabitants in OECD countries. By the June 1999 there were 26 mobile subscribers per 100 inhabitants (**Table 3**). Nevertheless, there are enormous differences in penetration rates across the OECD area. Finland continues to lead with more than 60 mobile subscribers per 100 inhabitants in June 1999 (**Box 2**). By way of contrast, Mexico had just five mobile subscribers per 100 inhabitants at that time. This being said, operators in Member countries with low penetration rates are expanding their subscriber base at very high rates.

In 1998, the four OECD countries with less than 10 mobile subscribers per 100 inhabitants all achieved growth rates higher than 85%. Poland's subscriber base grew by a massive 137%. Much of the strength of the mobile communications market has been generated by liberalisation. Poland was the only country, of the five with the lowest penetration rates, to have moved from a duopoly to having three operators in service by 1998.

High growth rates, however, are not just the preserve of Member countries with low penetration rates. Greece, the country with the second highest growth rate in 1998, shifted from a duopoly to having three operators in service in the same year. In 1998, Greece's penetration rate jumped from 8.6 to 19.5 mobile subscribers per 100 inhabitants. That being said the two outstanding performers of 1998 were Portugal and Korea: both countries recorded growth rates above 100%. Portugal's penetration rate leapt by an extraordinary 16 points (**Table 4**). Korea's performance was equally as good with an increase in mobile subscriber penetration of 15.5 points. In both cases high growth coincided with increased market liberalisation and carried Portugal and Korea to penetration rates of over 30 subscribers per 100 inhabitants. By June 1999, Korea had surpassed 40 subscribers per 100 inhabitants. In September 1999, the number of subscribers to mobile networks in Korea surpassed the number of fixed network access lines.

Box 2. Finland: Mobile Penetration Update

OECD Member countries continue to watch Finland to see developments in the market with the highest mobile penetration rate. Each recent year has brought a new landmark for the industry. In 1998, the penetration of Finland's mobile network surpassed that of the fixed network. In June 1999, the number of mobile telephones in Finnish households surpassed fixed telephones.¹⁵ Significantly, approximately every fifth household in Finland uses only a mobile phone.

The Ministry of Transport and Communications reports that, by July 1999, 78.5% of Finnish households owned a mobile phone and 75.8% had a conventional fixed telephone. Altogether 60% of households have both mobile and fixed telephones. Less than 5% of Finnish households do not have a telephone. In proportion to the population, the number of fixed subscriptions has not decreased, since one ISDN subscription is calculated to equal two conventional fixed subscriptions. The number of ISDN subscriptions as a proportion of all household fixed subscriptions has grown rapidly due, for example, to increased home use of the Internet.

One question raised by the Finnish experience to date, is how high mobile penetration may go over the next several years. In the first part of 1999 growth rates in Finland were considerably slower than in 1998. The main reason the Finnish market appeared to be slowing was that only one mobile company offered pre-paid cards. Sonera, the largest mobile operator, introduced pre-paid cards in July 1998. This could mean that the market segment being reached by pre-paid cards in other countries is already served in Finland, or that future growth is possible if more than one company begins offering this service.

It is also the case that the full benefit of a third operator had not come into play due to a dispute about roaming on existing networks. This dispute has now been resolved and Telia Finland, the new entrant, concluded in October 1999 a letter of intent with Radiolinja concerning the hiring of Radiolinja's network. This means that Telia's customers, who have a dual band mobile phone, can now use Radiolinja's GSM 900/1800 network outside of Telia's own GSM 1800 network coverage. In late 1999 the Ministry was drafting new regulation concerning national roaming between the GSM 900/1800 network and 3rd generation mobile networks. However the primary aim was that operators should commercially agree on national roaming.

CHANGING MARKET STRUCTURE

Between 1989 and 1999 the number of mobile operator 'equivalents', competing in the same OECD markets, increased from 35 to 94 (**Table 5**). These data show the number of operators with a 'live network' rather than when licences were granted. The concept of equivalent mobile operator is a way of counting the number of operators in countries where regional licensing applies.¹⁶ By the end of 2000 there are expected to be at least 105 mobile operator equivalents with 'live' networks in the OECD area. Around 2002 this number is expected to begin increasing again, as many governments view IMT-2000 as an opportunity to bring additional operators into the market.

The greatest increase in the number of mobile operators occurred in 1998 when some 14 new mobile operator equivalents entered OECD markets. That same year also witnessed the elimination of the last monopoly in the OECD area. By the year 2000 there are expected to be only three to four Member countries with duopolies. Indeed, more than half the OECD countries will have four or more operators by the end of 2000.

In 1999 two of the countries with duopolies -- Iceland and Luxembourg -- had the smallest populations among OECD Member countries. However, population may not be the relevant consideration as Liechtenstein, with a population of only 32 000, announced plans to licence four mobile operators in October 1999.¹⁷ In the European Union area all Member States have at least three or more mobile operators except Luxembourg. Those countries with duopolies complied with legislation dealing with further mobile licensing under the 1996 Article 90 Directive (**Box 3**) by licensing an additional operator using the DCS 1800 standard. As Luxembourg had a monopoly it complied by licensing a second operator using this standard.

Box 3. European Union mobile licensing

1. Without prejudice to Article 2 of Directive 90/388/EEC, and subject to the provision set out in paragraph 4 of this Article, Member States shall not refuse to allocate licenses for operating mobile systems according to the DCS 1800 standard at the latest after adoption of a decision of the European Radiocommunications Committee on the allocation of DCS 1800 frequencies and in any case by 1 January 1998.
2. Member States shall, subject to the provision set out in paragraph 4, not refuse to allocate licenses for public access/Telepoint applications, including systems operation on the basis of the DECT standard as from the entry into force of this Directive.
3. Member States shall not restrict the combination of mobile technologies or systems, in particular where multistandard equipment is available. When extending existing licenses to cover such combinations Member States shall ensure that such extension is justified in accordance with the provisions of paragraph 4.
4. Member States shall adopt, where required, measures to ensure the implementation of this Article taking account of the requirement to ensure effective competition between operators competing in the relevant markets.

The other two OECD countries with only duopolies in service -- New Zealand and Norway -- have spectrum available for new entrants. The policy of the New Zealand Government has never been to limit the number of mobile operators to a duopoly. In the early 1990s, Telstra the Australian telecommunication operator purchased spectrum, which could have been used to provide a third cellular mobile service in New Zealand. This service did not eventuate. Norway has also awarded a third licence to Telia. However the proposed merger between Telia and Telenor, with its existing mobile network, has meant that the development of a third network has been placed on hold.

In both the New Zealand and Norwegian markets the most promising opportunity for additional market entry appears to be IMT-2000. In 1999, New Zealand is holding an auction of radio spectrum. Some of the spectrum being auctioned is expected to be used for IMT-2000 services. Norway has awarded trial IMT-2000 licences. One of these licences has been given to a company that is not presently providing mobile cellular service.¹⁸ IMT-2000 services are not expected to be available until 2002 meaning that duopolies in these countries may continue until this time. For the same reason, Finland is shown in Table 5 with three operators up until 2000, although four IMT-2000 licences have been granted.

The United States has regional markets with the greatest number of competitors. Theoretically it is possible for up to eight mobile operators to compete in the same regional markets, referred to as Basic Trading Areas (BTA). This is possible if a potential six new entrants, using PCS technologies, were different entities to the existing cellular mobile operators in these BTAs. By 1999, some BTAs in the United States did have up to seven competitors.¹⁹ The number of people living in these regions was around 10 million. However, some 74% of the population of the United States has at least five mobile operators offering service in the BTA in which they live.

Apart from the United States, the countries with the most mobile competitors are Japan, Korea and the Netherlands. These countries have up to five mobile operators operating in the same markets. In Tokyo there were four cellular mobile companies in operation by 1994. The following year three PCS services commenced, one of which did not have an existing cellular operation. This meant Japan was the first country to have five operators competing in the same market. Korea has had five mobile companies in service since 1997 and the Netherlands since 1999. In 2000 these countries will be joined by Australia, which has licensed an additional three operators. This means that up to six operators could be competing in the same markets in Australia.

Other countries in which new operators are expected to commence service before the end of the year 2000 are Austria, Czech Republic, Hungary, Italy and Turkey. In Ireland there is a legal challenge to the awarding of the third licence but an operator is expected to be in service during this period. In Sweden a fourth licence was granted to Telenordia in 1996.²⁰ The licence stipulated that 50% of the Swedish population should be covered within four years. However this licensee had not commenced service by mid 1999 and the status was being reviewed in the light of the proposed merger between Telia and Telenor (the latter being a shareholder in Telenordia).

Market structure and growth

High mobile growth rates continue to strongly correlate with the stimulation provided by market liberalisation. The OECD last examined the relationship between mobile market structures and growth in 1995. At this time it was noted that, in 1994, the average growth in markets with three operators was, on average, three times higher than those markets with monopolies. The performance of duopolies fell roughly in between.

For this report it was decided to undertake the same analysis with one modification. This was to split out growth rates for countries that had introduced four or more operators from those with three. In other words the 'best practice' regulatory benchmark has been raised in line with increasing liberalisation in the OECD area.

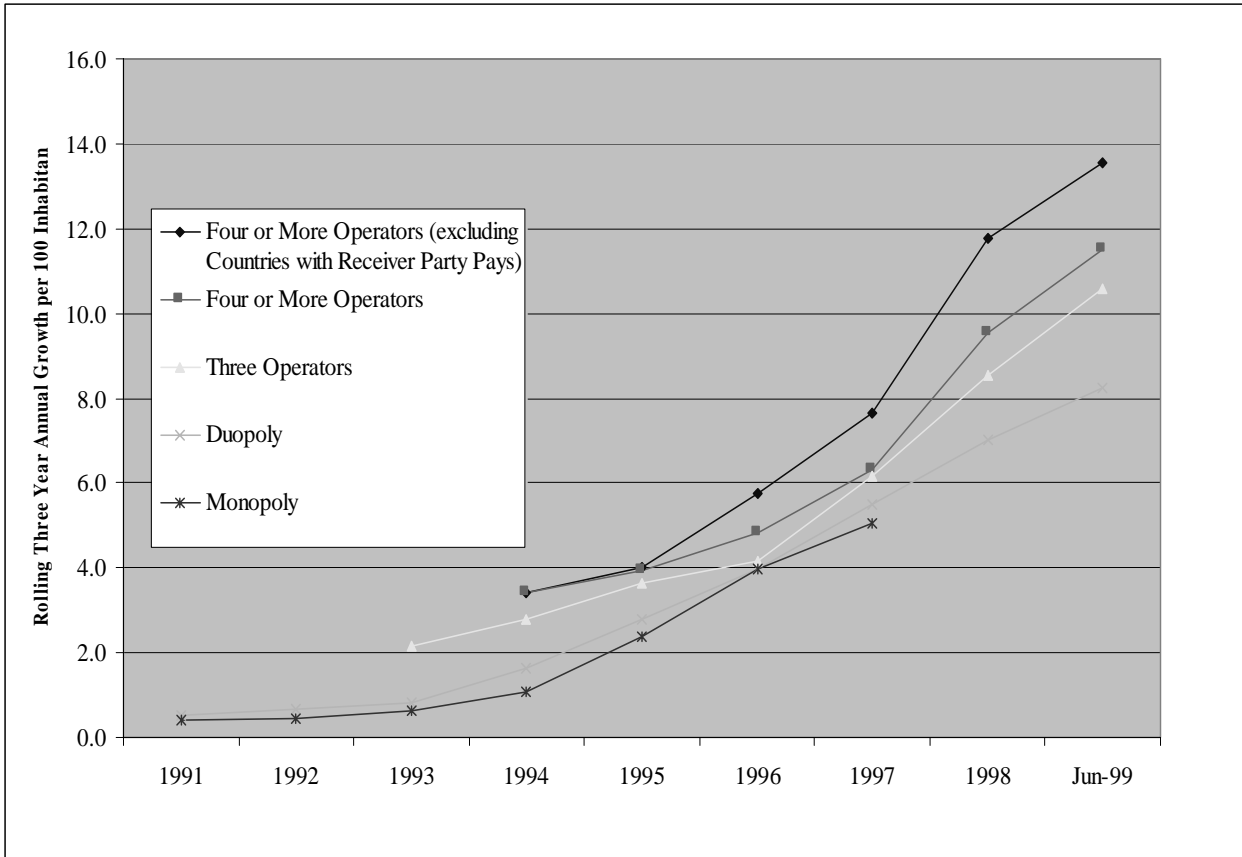
It can be observed, in **Figure 1**, that OECD markets with four or more operators have, on average, exceed the growth rates of those with three operators, duopolies or monopolies in every year since 1993.²¹ In addition, it is possible to exclude countries with receiver party pays from the markets with four operators. When this factor is taken into account those markets with four or more operators have vastly outperformed the other market structures. This presents a strong message to policy makers to seize future opportunities to increase the number of market players in countries with less than four operators competing in the same markets.

Box 4. Key cellular mobile policy initiatives in Japan

Japan provides another example where changes to market structure can be linked to growth. The Japanese government has been promoting liberalisation and competition policies since the beginning of cellular mobile telecommunication services in December 1979. In 1994 two additional operator equivalents entered the market bringing the total to four. In 1995 this number was increased to five. In the five years following 1994, fixed charge and usage charges were halved. During this time key policy developments included:

- In December 1990, multiple carriers started to provide services in the same area, which led to the reduction of the basic charges and fees for telephone calls.
- In December 1993, the deposit charge system was abolished.
- In April 1994, the COMA system (the terminal selling-off system) was introduced, which reduced the cost to users at the time of subscription, and let them choose terminal devices.
- The PHS services were started in July 1995 and the systems began to compete with mobile phones. As a result, each of the carriers made more efforts to provide better mobile phone services at lower prices, which led to the creation of a more competitive market structure. Provided with a wider range of options, the number of subscribers increased at an accelerated rate.
- In December 1996, a notification system was introduced for mobile phone charges, which gave carriers the freedom to set the charges according to their management decisions, and to provide services according to their users' needs.

By the end of August 1999 the number of mobile phone subscribers, including PHS, totalled 51.26 million. Japan is ranked second in the number of subscribers in the OECD area, and with a penetration rate of 40.5 per 100 inhabitants, Japan's penetration rate is comparable with northern Europe.

Figure 1. Rolling three-year average growth rates in different market structures

Source: OECD.

The growth rates in mobile subscribers also reflect trends in the pricing of services related to market structure. The first wave of growth, in markets with a higher number of operators, occurred due to tariff innovation. New entrants brought forth the innovation of flexible tariff packages aimed at different types of users. This period occupies 1993 through 1995 in markets with three or more operators. However most monopolies and duopolies moved to adopt flexible tariff schemes by 1996. During this period mobile markets were characterised by tariff innovation that led to reductions in costs for users rather than lower prices. In other words by selecting an appropriate tariff package, users could make mobile service more affordable for themselves without operators necessarily lowering their overall prices. This may go some way to explain why monopolies and duopolies narrowed the gap with countries with three operators in 1996. By way of contrast the growing number of countries with four operators continued to be the pacesetters.

In the final two years shown in **Figure 1** two other factors are evident and can be related to pricing. First is that the group of countries with four or more operators included two countries, Canada and the United States, with receiver party pays. In an environment following the introduction of pre-paid cards this appears to have lowered average growth in this group of countries, as by excluding these two countries there is a much higher average growth in the most liberal markets. Second is the remarkable impact of pre-paid cards on growth from 1996 onwards. The large number of countries shifting from duopoly to three operators in the period 1996-1999, often characterised by relatively low penetration rates, quickly

adopted pre-paid cards. In 1996 there were 16 duopolies and five countries with three operators. By 1999 this balance had reversed to seven and 14.

The stimulation provided by new entrants is also evident in the ranking of Member countries by mobile penetration (**Table 6**). In virtually all OECD countries, during the 1990s, the introduction of a new operator can be correlated with a lift in their ranking relative to other countries in the year that it occurred or in the year following. The two exceptions are Canada and the United States. Despite the introduction of new operators both countries' rankings have slipped relative to other OECD countries. The most likely explanation for this trend is that these two countries, along with Mexico, have had RPP pricing structures during the initial boom in pre-paid cards. In this respect it is likely that competitive market structures in Canada and the United States have, in recent times, been the main factor countering the impact of RPP. Both Canada and the United States are currently reviewing RPP (**Box 4**). Other factors may also be at work such as the pricing of the fixed network influencing perceptions of mobile pricing in markets with RPP. However, it has not been the experience in Scandinavia that inexpensive fixed network pricing has held back mobile growth rates.

This is not to argue that market structure is the only factor at work in different growth rates. However, while other factors are involved it is the element that has been in the hands of policy makers. It is, for example, evident that those countries that held onto their monopolies the longest, Iceland, Luxembourg, and Switzerland, witnessed their ranking lowered from 1990 to 1997. Yet, as Iceland and Ireland's experience illustrate, late reform can still lead to a rise in rankings in an environment where a great deal of tariff innovation has been pioneered in markets which liberalised in earlier years. Both Luxembourg and Switzerland are benefiting from the introduction of new operators in 1998 and improvements are evident in the initial data from 1999. In fact, Luxembourg recorded the highest growth of any country in the first six months of 1999. Switzerland's second network started operations in December 1998 and the third network in 1999. Swiss market performance has also substantially lifted in 1999.

The other notable feature is that traditional rankings, which typified fixed network indicators based on a century of monopoly development, are no longer a reliable guide. In the new environment those policy makers that have embraced liberalisation are witnessing extraordinary growth rates. There is no longer a 'North-South' or 'East-West' divide among OECD countries in terms of mobile penetration rates, as there has traditionally been with fixed networks. While the Scandinavian countries have led mobile communication developments, and continue to lead mobile penetration rates, Korea and Italy have joined the leading group of countries. In addition, Japan is yet to witness the full impact of pre-paid cards that have stimulated growth in many other OECD countries.

Box 5. Receiving party pays regulatory update

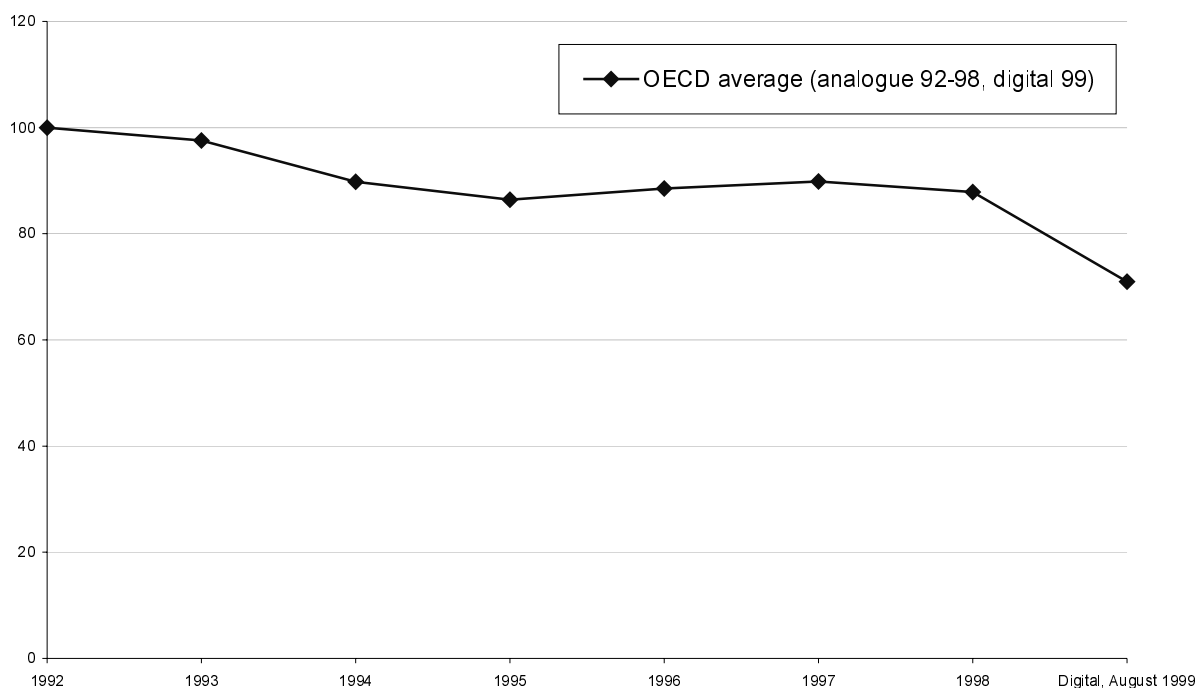
Canada and the United States were in the process of reviewing CPP at the time of writing. In Canada, the CRTC in Telecom Public Notice CRTC 97-23, Conditions of Call Originator Billing, called for comments regarding the appropriate terms and conditions for Call Originator Billing (COB) Service. Thus far, the Commission has approved the tariffs of five telephone companies that provide for market trials of CPP service to be offered. The CRTC has also given interim approval to proposals for the introduction of Paging Party Originator Billing, an optional billing and collection service available to local paging service providers. The 97-23 proceeding closed at the end of March 1998. Thus far the CRTC has not issued a Decision, however the CRTC has indicated that a ruling should be issued during the second half of 1999.

On 7 July 1999, the Federal Communications Commission released a Notice of Proposed Rulemaking (NPRM) in the CPP proceeding that invited interested parties to comment no later than 18 August 1999, and to reply to filings by other parties no later than 8 September 1999. The comment deadline in the CPP proceeding was later extended to the close of business on 17 September 1999, and the reply comment deadline extended to the close of business on 18 October 1999. In this proceeding the FCC has stated that it is seeking to remove regulatory obstacles to offering CPP. In its NPRM, the FCC said the wider availability of CPP has the potential to benefit the development of local competition and provide an important opportunity for consumers who have not previously used cellular mobile services. In the view of the FCC the success of CPP in the United States should reflect a market outcome rather than unnecessary regulatory or legal obstacles and uncertainties.

PRICING TRENDS

Between 1992 and August 1998 the index of the OECD's basket for cellular mobile service fell by 29% (**Figure 2**). The OECD index is for analogue service from 1992 to 1998 and digital service from 1999. The same usage pattern is retained over this time and the number of calls held at the same level.

Figure 2. **OECD mobile basket prices time series**



Source: OECD.

This trend conveys only part of the trend in mobile communication pricing. First, it does not capture the increased prevalence of flexible tariff packages from 1993 onwards. As markets were liberalised during the mid-1990s the range of tariff plans increased enormously. In many cases these tariff plans did not greatly reduce the price of mobile service but they did reduce the cost to the user. This was because they were better suited to different types of usage patterns. For example, someone making few calls but valuing 'communications mobility' could obtain mobile service for a lower monthly cost than with traditional pricing packages.

The benefits of flexible tariff packages are not fully reflected in a time series of one particular usage pattern. They are reflected in data that show lower average monthly bills for mobile service over recent years. The Cellular Telecommunication Industry Association's (CTIA) semi-annual survey shows the average local bill for mobile service, in the United States, has fallen steadily from USD 96.83 in December 1987 to USD 39.43 in December 1998.²² An important factor in the cost reductions during this period was the increasing range of tariff schemes increasingly tailored to meet user's needs. In response to increased competition the changes, in the most recent years, appear to be more attributable to price competition. In the United States, BLS data show the price index of mobile service in that country has fallen from 100 in 1997 to 85.8 in May 1999.²³ This is in line with the trend recorded in the CTIA survey where the average bill fell by around the same amount over nearly the same time period. Two other recent studies confirm mobile price decreases in the United States. A study conducted by the Strategies Group found that the average price per minute for mobile telephone service in the United States had fallen from USD 0.51 in 1993-94 to USD 0.33 in 1998. In addition a study conducted by the Yankee Group found that most of the top 25 regional wireless markets in the United States have experienced a price reduction of more than 35% since PCS carriers launched service.

Tracking the average monthly bill may not convey the full benefit of flexible tariffs for some users. In 1998 the Canadian Wireless Telecommunications Association (CWTA) put the average Canadian monthly mobile bill at USD 47.50.²⁴ One Canadian mobile company, FIDO, offers 200 minutes of local airtime per month for USD 16.60.²⁵ Thus for many users making only local calls on their mobile (with a mobile phone for personal rather than business use), USD 16.60 would be the total extent of their monthly bill for mobile service.

With this trend in mind, the OECD with Teligen (formerly the Eurodata Foundation) have been working to develop new mobile baskets. In addition, the focus of the baskets has shifted from the pricing of analogue service to digital service. In 1992 only four OECD countries had introduced digital services. This meant that subscribers to digital mobile services made up less than 1% of the total market. In 1995, the situation was starting to change but the vast majority of mobile users still subscribed to an analogue service. By the end of 1997, some 60% of mobile users subscribed to a digital service. Moreover two countries had, by that date, achieved 100% digital service and six had greater than 90% digital service.

In 1999, the average annual price for a personal basket of digital mobile service is USD 792 (**Table 7**). The average annual price for a basket of digital mobile service for a business user is USD 1 209 (**Table 8**). Following the OECD/Teligen workshop, in May 1999, these baskets are being further remodelled to better reflect usage patterns in the OECD area. At present the Personal Basket includes 568 calls per annum and the Business basket 1 169 calls per annum. For the moment, the interim baskets show Scandinavian countries continue to enjoy some of the lowest pricing for mobile service. In some countries more than one tariff option is shown to demonstrate the differences in price incurred by the same usage pattern under different tariff packages.

Roaming prices

If cellular mobile users make a call, when they are outside a billing area defined by their mobile operator, they are said to be 'roaming'. There is more than one type of roaming. One instance is when a user is at a location that does not have coverage by the network of their mobile operator. If this location does have network coverage provided by another operator, with whom their mobile operator has a roaming agreement, then they can make and receive calls. The other instance is where a mobile operator applies different prices to zones within its own network. In this case, if users make a call outside their 'home coverage zone', they are defined by their mobile operator to be roaming. The latter charges can often be confusing for users when they phone outside of their 'home service area'. In some cases they incur

roaming airtime charges, plus roaming toll charges, as well as any applicable taxes on usage. These charges vary, depending on where they roam.

Another level of the price of roaming service is related to the charges between operators. Domestic roaming charges have caused a number of issues to be placed before regulators in OECD countries. In Finland, the Finnish Competition Agency (FCA) has ruled that Sonera and Radiolinja, the established mobile operators, acted in an anti-competitive manner by failing to negotiate national roaming rates with newcomer Telia Finland. The FCA said: "...both companies have priced the national roaming to be so high, that Telia hasn't had any chance of providing national mobile services."²⁶

The regulatory issue raised increasingly across the OECD, is whether new entrants should receive access to existing networks, to enable national roaming, while they build their own infrastructure. When Telia Finland was unable to negotiate a roaming agreement with the two established mobile operators, the company launched its service using Sonera's network via a roaming agreement with Swisscom. For about three weeks, until Sonera suspended its roaming agreement with Swisscom, Telia Finland's customers could roam on Sonera's network.²⁷ Telia's action, in being willing to use international roaming agreements to provide a domestic service, highlights the importance of roaming for a new entrant.

In most OECD countries roaming charges, for end users, do not apply unless the user crosses a national border and therefore domestic mobile call charges are very clear. In other words the price of a call is the same irrespective of where the user is located in relation to the network. In countries where domestic charges apply to roaming there is an increasing trend toward standard rates being available for users roaming within national borders. This is most evident in the United States where increasing competition, since the end of regional duopolies, has brought national rates for mobile service such as AT&T's 'Digital One Rate' plan. For USD 89.99 users can make up to 600 minutes of calls per month under this plan (*i.e.* the equivalent of USD 0.14 per minute), before they incur additional charges. Such users do not pay roaming charges.

An ongoing concern among users, particularly business users, has been the price of international roaming services. Once again there are two types of international roaming service. One instance is for the user roaming between countries where there are different standards. In these cases users need to hire, or purchase, a mobile handset and a card from their mobile service provider. For example, an AT&T user can purchase a product known as "CellCard" for USD 49.99 a year. The AT&T CellCard is a "smart card" programmed with the user's AT&T wireless number and billing information that offers you automatic international roaming. This card can then be used in 90 different countries for USD 2.49 per minute for outgoing calls (plus long distance on calls received by the user).²⁸

The second form of international roaming involves networks using the same standard. This means that a user can log onto a foreign network without needing a different handset or card. For example if a British Vodafone user in Australia could log onto a network and roam within the coverage area of that Australian network. The cost to the Vodafone user to receive calls would be USD 1.50 per minute. If the British Vodafone user made a call from Australia back to the United Kingdom, they would be charged rates per minute ranging from USD 1.43 to USD 1.64 at peak times. The variation depends on which of the three networks in Australia the British user logged onto to make and receive calls.

If the Vodafone user made calls "In-Network", the rates would vary depending on the network the user chose to roam with, while in that country. For example, in the case of Australia, a call made within that country by the British roamer would incur Vodafone charges ranging between USD 0.42 and USD 0.53 per minute.

Roaming charges also apply when users travel through neighbouring countries. A British Vodafone user receiving a call in France would pay USD 0.94 per minute. To make a call to the United Kingdom, from France, the price would vary depending on which network they logged onto. A call made to the United Kingdom using the various networks in France would cost USD 1.12 (France Telecom or SFR) or USD 0.56 (Bouyges) per minute at peak rates. A call made within France would cost USD 0.78 (France Telecom or SFR) or USD 0.66 (Bouyges) per minute at peak rates.

Some pricing options are emerging for pan-European roaming. For example, BT Cellnet offers a plan entitled 'OneRate' for British users to roam in 14 European countries. The price to call the United Kingdom from these countries is USD 0.62 per minute.²⁹ The international alliances and mergers, which currently typify the mobile sector (*e.g.* BT and AT&T, BellAtlantic and Vodafone-Airtouch) suggest that, as with fixed markets, business demand for seamless services will increase international competition in this market segment.

International roaming charges have a similar structure in all OECD countries. As can be seen in the above examples international roaming always involves RPP. Even if the pricing structure is one of CPP for calls made from within national boundaries, any calls received by the user when roaming internationally incur an incoming call charge for voice services.

Pre-paid cards and roaming

Several mobile operators offer pre-paid cards that enable users to roam in other countries. These services are not seen as being competitive with local network services. This is because the local operators receive a payment for the use of their network. In addition the price per minute for using pre-paid cards is very high relative to roaming charges with more traditional subscriptions. While rates vary, BT Cellnet advises pre-paid users that the charge can vary from between USD 2.28 to USD 6.00 per minute.³⁰ These rates make the use of SMS extremely attractive for pre-paid users when roaming internationally. Many mobile operators do not offer pre-paid roaming because real-time credit checks are not available to determine the current entitlement of a pre-paid card.³¹

On the other hand the advent of pre-paid cards raises the question of whether by purchasing local cards they could be a substitute for roaming or provide competition to foreign networks. France is the country which receives the most international visitors per year (more than 60 million tourists annually).³² An international call made from France, with a France Telecom pre-paid card, would cost USD 1.00 to the United Kingdom, USD 1.15 to the United States and USD 2.01 to Australia. There are no off-peak discounts for this pre-paid card. If a British Vodafone user chose to log onto France Telecom's network they would pay USD 1.12 to call the United Kingdom, USD 1.15 to call the United States and USD 1.68 per minute at peak rates to call Australia. This means that the price of pre-paid cards for international calls is greater, in most cases, than the rate per minute for roaming from a home network.

Following the above example, there is a saving on domestic calls with pre-paid cards being priced at USD 0.69 compared to the Vodafone-France Telecom roaming price of USD 0.78 per minute at peak rates. In addition users would not pay for receiving incoming national or international calls, if they purchased a pre-paid card. The British Vodafone user would not pay the USD 0.94 per minute at peak rates to receive a call from the United Kingdom, while roaming in France, if using a pre-paid card.

The saving on national calls and incoming calls could justify the price of a starter kit (USD 38.73) for some users, with a readily available handset. However this option would not be practical for most business users. The main reason is that they would confuse customers by having two mobile numbers. Other potential obstacles, for some users, are the time it takes in some countries for service to commence and

whether a local address is required for registration. In addition, many business users travel to more than one country when using roaming. If the pre-paid card market becomes more competitive, with international roaming prices, this may be attractive for some users who regularly visit a particular foreign country. RSLCom, in Finland, offers a service to large cellular mobile customers regularly visiting a small number of countries, such as for a trucking company.³³ The company equips customers with different SIM cards for each country.

Some mobile operators view pre-paid mobile cards as an opportunity to substitute for direct roaming services where operators use different standards. Swisscom is marketing its international pre-paid roaming solution to service providers in the North American market.³⁴ These mobile operators can offer a pre-paid roaming service by reselling the Swisscom's "EasyRoam" product that offers access to more than 170 service providers in nearly 90 countries. Customers with the pre-paid card dial a three-digit prefix and the target number. Within seconds, the available credit is verified and a call-back is made to the customer so that the connection can be made. The remaining credit is displayed on the handset. Similarly, before pre-paid customers receive calls, a balance check is undertaken by the pre-paid billing system. When the call is completed, call data are transmitted and credits are deducted based on the call duration. Several options, including scratch cards, are available to reload a customer's pre-paid balance and credit card billing is planned. Swisscom say the benefits for users include avoiding costly hotel telephone access fees, cumbersome international calling card numbers or the regular monthly expense of post-paid global mobile phones. Swisscom say that network operators can generate revenues from these new market segments without incurring traditional billing and collections costs and without credit checks.

In June 1999, Swisscom said it is the first company to the market with this product. This raises the question of how such services might develop. One possibility is that the North American operators, targeted by Swisscom, will seek better deals from other companies as they begin to offer similar products. With up to seven mobile operators in some regional markets in the United States there is ample scope for providers to seek the best deal for their users. This could introduce some price discipline in international roaming for North American users.

The other aspect of the Swisscom service is that it employs call-back. This raises possibilities for increasing competition in the mobile sector. The use of call-back has not emerged in the mobile sector because of the use of RPP for international calls. When the receiver is paying for the incoming international call there is not an opportunity to by-pass location specific pricing. Nevertheless, the advent of pre-paid roaming does present the possibility that mobile operators could face international competition for roaming. Corporations, for example, with a large expenditure on international roaming, may be able to strike deals with foreign operators.

The other way arbitrage is emerging is to exploit the difference between an in-network charge and the cost of making foreign calls. For example, Vodafone charges British users USD 1.64 per minute, at peak rates, to call the United Kingdom or the United States while roaming in Australia. The same call to Asia, for the British user roaming in Australia, would also cost USD 2.96 per minute at peak rates. An 'in-network' roaming call within Australia is charged at USD 0.56. This raises the question of whether there is an opportunity to use pre-paid cards to exploit these differences. The lowest accounting rate between Australia and the United States is USD 0.10 per minute. Accordingly, as pre-paid technology evolves, a fixed network operator with its own switch could sell international roaming services. The user would make a local call at USD 0.56, plus the reseller's mark-up, and avoid the combination of two mobile operators' international charges.

Bypassing high roaming charges by combining the use of 'in-network' roaming capabilities and local fixed connections is occurring.³⁵ RSLCom Finland offers its customers the opportunity to call a local access code in countries where the company has a fixed network connection. A user dialing this service then receives a

dial tone and can make an international call. The cost to the user is made up of the in-network charge of the foreign mobile operator (billed via their home mobile operator) and RSLCom's international call charge.

INTUG Survey of roaming prices

Comparing overall prices for roaming services would be a very large task. This is because of the volume of prices that would need to be collected. For a comparison of international charges between fixed networks in OECD countries a matrix can be constructed with 812 cells (*i.e.* 29 x 28). For international roaming, it is necessary to add 'in-network prices' (29 x 28) and the prices for receiving calls (29 x 28). In addition there are prices for calling back to the 'home country' (29 x 28) and for calls to third countries, made while a user is roaming. In the latter case there would be 21 924 cells (*i.e.* 29 x 28 x 27). This is before consideration of peak and off-peak rates, as well there being multiple networks in most countries with different roaming charges.

An alternative approach is to compare the cost of international calls made in opposite directions (*i.e.* call pair methodology). Using this approach the price of an international call from a 'home country' mobile network is compared to the price of an international call made from a foreign network by a user roaming in that country. The International Telecommunications Users Group (INTUG) have used this approach to compare roaming prices in Europe (**Table 9**). INTUG's methodology was to compare the prices of two operators in 15 countries for a two-and-a-quarter minute call. This entailed collecting the prices of international outgoing mobile charges (2 x 15 x 14) and roaming charges (2 x 15 x 28).³⁶ As most prices in this report are presented per minute the INTUG prices have been converted to a one-minute rate.

INTUG found that the best practice rates for outgoing calls varied between USD 0.16 and USD 0.27 per minute. INTUG's initial conclusions were that prices over USD 0.45 per minute for mobile roaming in Europe were excessive. INTUG's preliminary results showed that some mobile operators were charging up to three times this amount. The average charge, from the INTUG survey, for roaming in the European Union area was USD 0.92 per minute. The survey also revealed that, in a few instances, mobile operators were charging more for home network users to make international calls than for foreign users roaming in their country.

In North America international roaming prices appear to be less expensive than Europe. In the United States, AT&T's "Digital One Rate" can be extended to include roaming in Canada and long distance calls to Canada. For an additional USD 19.95 per month, a user paying USD 89.99 per month for 600 minutes, can use this airtime in both the United States and Canada.³⁷ This translates into a rate of USD 0.18 per minute compared to the standard USD 0.15 for domestic calls. Even if a business user made use of only half their entitled airtime, the effective rate would still be lower than INTUG's benchmark (*i.e.* USD 0.36 versus USD 0.45). Yet many business users clearly do use their entitlement as evident by the fact that AT&T also offers bundles of 1 000 and 1 400 minutes.

It is also evident that mobile packages aimed at personal users can have a lower roaming cost in North America. The Canadian mobile operator FIDO charges users USD 0.50 per minute for roaming in the United States. The only mobile operator in Europe to come close to this pricing was Telecom Italia Mobile, which had an average charge of USD 0.55 per minute. Mobile operators in the Scandinavian countries generally had the next best prices for roaming but they were all significantly higher than INTUG's benchmark.

An examination of roaming charges in the rest of the OECD area would show that few mobile operators are presently meeting INTUG's benchmark. This has prompted INTUG to raise the question of whether

competition is working in this market segment and whether regulatory action is required. Certainly the data collected by INTUG indicates prices are far from cost oriented in most cases. However the experience in North America is that packages better tailored for business users needing to roam do emerge in strongly competitive markets. The problem for policy makers is that the prices are a result of how much competition there is in other countries as well as their own country. This being the case it is not clear that domestic regulatory intervention alone could improve the situation. The best immediate action would be for policy makers to examine licensing new operators to place additional pressure on roaming charges.

CONVERGENCE WITH FIXED NETWORK PRICING

The increasing liberalisation of the mobile communication has raised the question of when the pricing of mobile networks might converge with fixed networks. The response to this question is a more complex question than sometimes posited. When monopolies typified the provision of fixed networks, approaches to this question generally treated fixed network pricing as static and focused only on decreasing mobile prices. While mobile prices are being reduced it is also true that the traditional structure of fixed network pricing is undergoing a radical restructuring in a competitive environment. The best location to examine this trend is in Scandinavia where all fixed markets have been liberalised and mobile penetration rates lead the world.

In Iceland and Norway recent changes to tariff structures have extended local calling zones, for fixed networks, over the entire country. In other words there is no long distance pricing in either country and all domestic calls are made at the local call rate. Calls from mobile networks are much more expensive than the price of 'local' calls on the fixed network. In Iceland the difference between a three-minute call on the fixed and mobile network, anywhere in the country, is a factor of 7.5 at peak rates and 5.2 at off-peak rates. The same ratios in Norway are 4.4 at peak rates and 5.5 at off-peak rates.

In Finland and Sweden the number of tariff bands has also been reduced over recent years. In Finland fixed network calls are priced in two bands. There are 13 'local' zones in Finland. These zones differ in size but a simple average across the country is a very large 26 000 square kilometres. All calls between these zones are made in the second pricing band. By far the majority of mobile calls are within the boundaries of the fixed network local zones. This means that for mobile prices to compete with the fixed network they would have to emulate local call pricing within the 'local zones'. For a three-minute call the price difference between a fixed and a mobile network is 6.6 at peak rates.³⁸

In Sweden, during 1997, Telia introduced a two-step rate structure. In this case the number of pricing bands was reduced from three to two, meaning that all domestic call prices were either local or national. While the price of national calls was reduced 23%, the new structure attracted criticism in terms of calls between adjacent trunk calling zones. The size of area codes varies in Sweden and critics thought the new pricing structure unfair. In 1998, Telia bowed to this criticism and introduced a new price for calls between neighbouring area codes. Under the modified structure Telia charges the price of a local call plus USD 0.003 for calls to neighbouring area codes. The response of Tele-2, Telia's largest rival, was to divide Sweden into eight areas within which its customers can make calls at local call rates. Prior to this, according to Tele-2, Sweden had more than 250 local call areas. A simple average of eight calling zones across Sweden is 56 000 square kilometres. For a three-minute call the difference between fixed and mobile networks can multiple up to 26 at peak rates.

In all these cases in Scandinavia fixed network pricing has been fundamentally restructured. It might be argued that this trend would have occurred as a result of developments associated with fixed networks such as technological change or liberalisation. However, the fact that such radical change has occurred in the four OECD countries with the highest mobile penetration rates is significant. Competition among infrastructure providers in the long distance markets of OECD countries has consistently reduced prices. But competition between fixed networks, alone, did not 'abolish' long distance pricing in any country. Rather it seems to be the case that when the mobile market reaches toward, or exceeds, the penetration of

fixed networks then fixed network pricing is radically restructured in an attempt to stave off the competition in a particular market segment (*i.e.* the former long distance market).

In fixed network long distance markets, following liberalisation, entrants priced services at a discount relative to the existing pricing, and the incumbent reacted by lowering prices, and so forth in a virtuous cycle. However the pricing trend was a little like Zeno's paradox -- consistent and welcome reductions but not quite reaching the target set by policy makers. The difference with mobile network entrants is that their primary market is not long distance but mobile service. For mobile companies, fixed long distance service is an additional market opportunity that has a history of monopoly pricing. Mobile operators can attack this particular market segment without undermining their own market. Accordingly, the radical restructuring of fixed network prices appears to be more in response to the potential for competition from mobile networks than other fixed network competitors.

In Iceland and Norway the changes mean that for mobile service to be seen as substitutable for fixed service, based solely on a comparison of prices, the price of mobile calls would have to greatly decrease to match the fixed network price. There is no 'long distance pricing window' to enable mobile operators to compete with the fixed network. In Finland and Sweden fixed network operators have achieved a similar position. The 'local' calling zones for the fixed market are so large as to make mobile service not substitutable for fixed service at a comparable price.

Developments in pricing designed to stave off competition may defend fixed network market share but not necessarily that of the incumbent. The recent experience of Denmark is worth recounting. Denmark also has a relatively high penetration of mobile users, albeit lower than the rest of Scandinavia. As in Sweden and Finland, the incumbent operator in Denmark reduced the number of pricing bands to two (*i.e.* one local and one long distance price). Given the experience of other Scandinavian countries it might have been expected that this would tend to lock out mobile operators from all but the remaining long distance segment in Denmark. In contrast, it is a mobile operator that has introduced even more radical pricing but using the fixed network.

In July 1999, Mobilix launched an offer for fixed network customers of TeleDanmark to take Mobilix local and long distance service. Although Mobilix is a cellular mobile operator, their offer takes advantage of Denmark's policy of unbundling fixed network components to promote competition. In other words the customer would retain the fixed line connection from TeleDanmark, but be billed for all calls by Mobilix. The pricing structure Mobilix launched to attract users was significant because it went further than TeleDanmark's pricing by completely eliminating long distance pricing. Mobilix's prices for all calls, anywhere in Denmark, are at the local call rate (**Table 10**). This means that as in Iceland and Norway, Danish users can make calls without paying any long distance rates. This development is clearly related to government policies designed to strengthen choice for fixed network users. Notwithstanding this fact, it is arguable that the same result would not have occurred without a competitive cellular mobile sector. The new pricing structure not only cut the price of long distance calls by 37%, at peak and off-peak times, but was a large step toward eliminating long distance pricing in Denmark.

The elimination of long distance pricing as a distinct market segment in countries with high mobile network penetration rates, raises the question of how fixed network operators are adapting to the new environment. The profitability of carriers continues to be robust, despite the changes to long distance pricing. This is due to a number of factors such as an increased volume of long distance calls, improved efficiency in response to competition, falling technology costs and the earlier rebalancing of local charges (*e.g.* the introduction of call set-up fees or higher fixed line rentals). It is also the case that calls between fixed and mobile networks have increased and this has developed into a major new market for fixed networks and their cellular subsidiaries.

The price of calls between networks is an important factor, often overlooked in consideration of the substitution of mobile service for fixed service. In some cases the pricing of mobile networks is undoubtedly attractive, relative to the fixed network, in terms of substituting 'mobile calls' for 'fixed calls'. However in countries with CPP, electing to wholly substitute mobile service for fixed service would impose much higher charges on calling parties. While certain users might want to give up their fixed connection for a mobile connection, they need to take into account the very large increase in cost to users wanting to call them. While fixed-to-mobile network prices remain relatively high, compared to fixed-to-fixed network charges, there is deterrence for users to give up their fixed line.

A further factor to be taken into consideration is that the service capabilities of both networks are evolving. Users currently rely on telecommunication connections, whether fixed or mobile, for more than voice services. The applications built around the Internet protocol provide obvious examples. For the next several years fixed networks will offer the potential for much faster connections to the Internet than mobile networks. This means that users wanting to access the Internet are unlikely to wholly substitute mobile service for fixed network service.

The pricing of Internet access over fixed and mobile networks adds to the reasons why users will retain fixed network connections for the foreseeable future. In most OECD countries the price of accessing the Internet via the PSTN is less than the price of a local call. This is due to telecommunication carriers, where measured local call prices exist, introducing discount schemes aimed at Internet users. In addition there is growing demand, in countries with measured local call pricing, for unmeasured and 'always-on' service over the fixed network to the Internet. This option is newly available, for example, from several telecommunication service providers in the United Kingdom at off-peak times. This means that the large differences between the current pricing of fixed network calls and mobile calls are even greater in respect to local calls to the Internet.

While the pricing of fixed network access to the Internet has been a large challenge for fixed network operators it promises to be more so for mobile networks. From the perspective of users the price of different communications services largely determines whether they are 'substitutable'. Network operators sometimes apply a different term for the same concept -- 'cannibalisation'. From the perspective of network operators the convergence between different types of communication networks and capabilities can bring forward less expensive options for users and undermine existing revenue streams. It has been argued that some services are held back by telecommunication carriers, where they enjoy an effective monopoly, because they threaten to undermine the pricing of existing markets (*e.g.* xDSL versus ISDN and leased lines). In mobile markets the same tensions are evident in the pricing of Short Message Service, the harbinger of Internet-like services over wireless networks. Mobile network operators want to encourage the use of this relatively new service, and increase the total size of the market, but not price this service in a way that it will not significantly 'cannibalise' voice service.

The problem for mobile networks is not only are they more constrained than fixed networks, in terms of access speeds they can offer to the Internet, but they are starting from a much higher pricing threshold than the fixed network. Users will undoubtedly be prepared to pay a premium for mobility, as has been proven for voice services. However the extremely inexpensive nature of Internet services, relative to even traditional PSTN pricing, means that the price of mobility would need to come down considerably for the services to be seen as substitutable. Some options, such as pricing by volume rather than time, lend themselves better to some Internet services than others. Nevertheless, mobile network providers have demonstrated a strong capability for innovative pricing and this will be much needed as their networks converge with the Internet. Some of the most innovative mobile tariffs have been in the area of local service.

Local mobile and local fixed network pricing

The preceding section documented how fixed network providers are eliminating long distance tariffs as mobile penetration rates approach or surpass that for the fixed network. By having a uniform local tariff across the whole country, or extremely large local calling areas, it is difficult for mobile providers to compete in terms of substituting mobile originated calls for fixed network calls. This raises the question of how mobile pricing is developing in countries where local calls are unmeasured, (*i.e.* Canada, New Zealand and most parts of the United States), or made at a flat rate per call as in Australia.

One reason forwarded for lower cellular mobile growth rates in countries with unmeasured local calls, relative to the OECD average, is the perception that mobile service is expensive relative to the fixed network. In Europe, on average, a fixed network local call costs USD 0.05 per minute at peak rates and USD 0.03 at off-peak rates. In Canada, New Zealand (residential users) and the United States unmeasured local calls are the norm. Accordingly, it has probably been easier for mobile operators in Europe to market measured rates for local mobile calls than in countries with unmeasured local rates on the fixed network. This factor is significant because the majority of calls made by users would fall within the local area if fixed network boundaries were applied. While most users willingly pay a premium for the advantages of mobility, the pricing of local calls on fixed networks probably influences their perceptions of mobile pricing.

Ironically, the first cellular mobile company to exploit this difference, in a country with measured local rates on the fixed network, was in the United Kingdom. In 1993, One-2-One began offering users unmeasured off-peak calls. In a country familiar with measured local rates for fixed and mobile calls the offer proved popular but was eventually discontinued for new subscribers. Part of the reason was that One-2-One needed to pay interconnection charges with other networks. In the absence of unmeasured local rates on fixed networks users would opt for One-2-One, for all off-peak local calls including those of longer duration, even if a fixed line was readily available. Those One-2-One users who can still make unmeasured local calls continue to give that network much higher traffic volumes than the other mobile networks in the United Kingdom.

In countries with unmeasured local rates for fixed networks, the inclusion of unmeasured local airtime, at off-peak times, has become the norm for cellular networks. Many believe that penetration and usage patterns of mobile service are directly related to the extent to which consumers are accustomed to measured service already. In other words mobile penetration rates tend to be lower where local fixed network calls are unmeasured. That being said, until 1997 the average mobile penetration rate for countries with unmeasured fixed-network local calls was higher than those with measured local calls on fixed-networks. Since 1997 growth of mobile service has been much faster in those markets with measured rather than unmeasured fixed network local calls. This may mean the impact is greater, in countries with unmeasured fixed-network service, as an evolution occurs from a business to a consumer market. This has meant that many of the mobile service packages in countries with unmeasured local service, such as Canada, New Zealand and the United States, have had to be more innovative than countries with measured local service. Moreover, in contrast to the discontinuation of the unmeasured local mobile service in the United Kingdom, these unmeasured mobile offers, in countries with unmeasured fixed service, have been improving over time. In 1994, BC-Tel offered a package called 'Home Free' for USD 36.76, which included unmeasured local calls on weekends. During weekdays calls could be made at USD 0.44 per minute. In 1999, BC-Tel offered a package entitled Freedom Unlimited.³⁹ For the payment of USD 33.33 a user could make unlimited local calls on weekends and weeknights. At peak times calls could be made at USD 0.25 in the local and regional area. Accordingly, not only did call rates decrease by 44% at peak times but the period for free off-peak calls was extended to cover weeknights.

The major factor influencing the different evolution of local mobile tariffs for Canada and the United Kingdom was how local calls on the fixed network are priced. BC-Tel's tariffs have evolved to be more attractive relative to the fixed network whereas One-2-One's off-peak charges gravitated toward the measured pricing model of the fixed network. In 1999, One-2-One users can call each other at off-peak times for around USD 0.03, a rate that matches the fixed network at certain off-peak times.

Mobile operators are increasingly offering packages that compete against the fixed network for certain types of users. For example, a business user might justify the cost of a mobile service directly against their business or job. Mobile operators bundle 'free' airtime at off-peak rates to attract these types of customers. In countries where long distance charges still apply, or where local measured rates apply, it is less expensive for these types of customers to use their mobile phone than a fixed line for personal off-peak calls. In this respect mobile companies are competing directly with the fixed network. However, one caveat remains in countries with CPP. Users considering giving up their fixed line have to be prepared to accept that they are imposing a higher cost on others calling them from the fixed network. The decision then rests on the amount of friends and family having a mobile service and being able to avoid the high fixed-to-mobile network charges. In Finland, where the mobile penetration is very high this is becoming increasingly feasible because users will make mobile-to-mobile network calls. Nevertheless users giving up their fixed lines are still imposing a higher cost on the calling party.

The pricing of calls from the fixed network to mobile networks also influences the provision of unlimited local airtime. Both Canada and New Zealand have unmeasured local calls for residential users. A major difference, however, is that pricing in Canada has traditionally been via RPP while CPP applies in New Zealand. In other words calls, from fixed-to-mobile networks, are generally uncharged in Canada but are charged for in New Zealand. Accordingly, BC-Tel can offer unlimited local calling at off-peak times and not undercut its fixed network pricing. If Telecom New Zealand offered the same deal there would be a very large incentive for fixed network users to call mobile users and ask them to call back. While Telecom New Zealand includes 200 off-peak minutes per month, in one of its tariff offerings to make the service more attractive in an environment of unmeasured local calls, it does not offer unlimited options as in countries with RPP. In Australia, where a flat rate per call applies to local calls, Optus offers a five minute off-peak mobile call for the same amount as the price of a call on the fixed network.⁴⁰

In the United States, where the majority of regions have unmeasured local calls, local mobile pricing has evolved in a similar way to Canada and in contrast to the United Kingdom and New Zealand. Mobile operators in the United States are increasingly offering pricing plans designed to compete in markets with unmeasured local service. One such service is Leap Communication's 'Cricket' package.⁴¹ For USD 29.95 per month users can make an unlimited number of calls within their local area surrounding Chattanooga, Tennessee. The longest distance in the area covered by the 'Cricket' service is approximately 54 kilometres.⁴² There is no charge for incoming calls. However users can not roam beyond the service area and need to purchase pre-paid cards for long distance calls.

For some users the tariff packages offered by services such as 'Cricket' may offer a substitute for a fixed line. In the United States the national average monthly cost of a fixed line with unmeasured local service is USD 19.85.⁴³ Accordingly, for a user who only very rarely makes long distance calls, and does not want the additional capabilities of the fixed network in terms of Internet access, it would be possible to substitute a mobile service for fixed service for around USD 10 per month.

An additional charge applies to second residential lines in the United States. In 1999 the subscriber line charge for a non-primary residential phone was USD 5.88 compared to USD 3.55 for a primary residential line.⁴⁴ This means the difference in pricing between mobile and fixed narrows in terms of users considering the purchase of a second network connection. Accordingly, at present, packages such as

'Cricket', are more likely to compete in the 'second line market' rather than substitute for a primary fixed connection.

In the United States mobile pricing seems to be evolving in a way that is complementary to fixed pricing in that there is an evolution toward unmeasured service, and no roaming or long distance charges. This is not to argue that it will not be competitive in certain market segments for some users. The best available local packages arguably place a discipline on local pricing, in an area such as second lines, but they do not offer a wholly substitutable service for most users. Simply put, in local markets, it is difficult to compete head-to-head with unmeasured local calls. Notwithstanding these challenges for some high and even medium-volume users, the price per minute for mobile wireless service is increasingly becoming competitive with the per-minute price of fixed local service, taking into account the advantages of mobility and the availability of service options under which the first minute of an incoming call and/or all calls between family members are free of charge. In the long distance and interstate market mobile pricing is becoming a potential substitute for fixed line service for large users. For a business user of mobile communications, AT&T's mobile service offers national services for USD 0.09 per minute (1 400 minutes at USD 149.99), USD 0.12 per minute (1 000 minutes at USD 119.99) and USD 0.15 per minute (600 minutes at USD 89.99). Alternatively, a user could opt to pay USD 29.99 and receive local mobile calls for USD 0.10 per minute. These rates compare to AT&T's USD 0.07 per minute for fixed line long distance or interstate calls.

Depending on a user's location the evolving mobile pricing might enable them to bypass the regional toll charges of the local exchange carriers (*i.e.* intra-LATA rates⁴⁵). Regional toll calls can be the most expensive fixed line calls in the United States. The same company, with local and long distance subsidiaries, might charge USD 0.08 per minute for long distance calls but USD 0.014 for intrastate calls. Whereas the average price of long distance and interstate calls continues to fall, regional toll calls have recently held their pricing level constant. Between December 1997 and May 1999, long distance charges fell by 2.5%, interstate toll service by 3.6% but intrastate toll service rose slightly by 0.2%. During the same period cellular telephone prices fell 14.2%. Accordingly, placing the issue of the receiver paying for calls to one side, mobile networks offer the potential to compete head-to-head with regional intra-LATA charges.⁴⁶

Payphones

The other area in which mobile communications are competing with the fixed network is in the area of payphones. This issue was raised in the *Communications Outlook 1999* and goes beyond the scope of this document. In summary, in some OECD countries the price of pre-paid cards is lower than the price of calls from a public payphone. In other countries the price of pre-paid cards is more expensive than public payphones. This is a significant factor in countries where some elements of the provision of payphones are treated as an element of universal service. In future it will be necessary for regulatory authorities to consider any obligations placed on operators in respect to payphones, in relation to the pre-paid market for mobile communications.

CALLING PARTY AND RECEIVER PARTY PAYS

The most common pricing structure for mobile communications, in the OECD area, is known as calling party pays (CPP). Under this pricing structure the person initiating the call pays the entire cost of the call. If a call is made between two mobile users, then the person making the call pays the entire cost of the call. In the same way, if a call is made from a fixed network to a mobile subscriber then the user on the fixed network pays the entire cost of the call. In both these examples of CPP, the user receiving the call does not pay directly for reception of each call.⁴⁷

The CPP system operates in all OECD countries but is not predominant in Canada and the United States. In these countries there are pockets of CPP use but the most common pricing structure is one of 'receiving party pays' (RPP). In Mexico, CPP was introduced on 1 May 1999.⁴⁸ Since then, mobile subscribers in Mexico have been able to elect whether they receive services under CPP.

Under the RPP system the receiver directly contributes to the cost of the each call. This can be considered by way of the same examples as above for CPP. For a call between two mobile users, the person initiating the call pays part of the cost of the call and the person receiving the call pays part of the cost. In respect to calls between fixed networks and mobile networks, RPP is a little more complex. In this situation both parties generally pay the same amount they would if their call was to another user on the fixed network or from another user on the mobile network.

The way RPP operates can be illustrated by some practical examples where the price of a one-minute call to and from a mobile network is USD 0.30:

- The first example is a one-minute call between two mobile users on the same network. In this situation both users would be charged USD 0.30. The total cost billed by the mobile operator is USD 0.60.
- The second example is a call between two mobile users, on different networks, where the price of airtime on the originating network and the price of airtime on the receiving network is the same. In this situation, each mobile operator would charge their customer USD 0.30. In other words the total cost of the call would be USD 0.60 but each user would only pay USD 0.30.
- The third example is a call from a mobile network to a fixed network. In this case the total cost of the call is USD 0.30. The mobile network charges this tariff to its customer. There is no charge to the fixed network customer. The total cost of the call is USD 0.30, which is paid by the mobile user.
- The fourth example is a call from fixed network to a mobile network. In this situation the mobile network would bill their customer USD 0.30 for the one-minute call. However the fixed network would only charge the standard local call rate. If the fixed network offered unmeasured local service there would be no direct charge per call. In this case the total charge for the call would be USD 0.30 paid solely by the mobile user.

- Variations occur for any calls where roaming is involved on the part of the mobile user. In this instance, any additional roaming charges are billed to the mobile users in the above examples. The fixed user's charges do not vary in these examples if the mobile user is roaming.

The system of RPP, where it exists in the OECD area, has generally been in those countries with unmeasured local calls on the fixed network. The exceptions are Australia which has a flat rate for local calls, and New Zealand which has unmeasured local calls for residential users. In both these countries CPP applies to all calls to and from fixed and mobile networks. In Canada and the United States local service is typically unmeasured. In Mexico, residential users receive the first 100 local calls in credit each month from the fixed operator (*i.e.* Telmex).

The major reason for the adoption of RPP was that it was relatively easy to graft onto the existing fixed network pricing structure. By way of contrast CPP was relatively easy to adopt in countries with measured rates. In both cases, the first issues considered were the availability of mechanisms to alert users to the fact that they were calling a mobile user and whether systems were in place to measure and bill usage. Once the decision was made to adopt RPP or CPP, then other related elements, such as the numbering system, were determined. For example, in countries with CPP, the numbering systems has generally evolved to allocate different prefixes to mobile service as one way to alert users to the fact that they are calling a mobile number and that different charges may apply. This same distinction was not needed in countries with RPP.

Apart from the ease of integrating RPP and CPP with existing network pricing the two systems have a number of advantages and disadvantages (**Table 10a**). The main advantages of the RPP system are:

- Mobile communication pricing is independent of fixed network regulation. In an era when monopolies typified the fixed network, RPP was a way to introduce competitive pressure on mobile prices.
- One of the main advantages of RPP, relative to CPP, is that charges for call termination can be constrained by competition because charges for both incoming and outgoing calls are paid by the same individual who chooses the network operator, and who therefore has the ability to switch to a different operator to obtain better rates.
- RPP pricing is transparent in that each operator charges the user only for their network's service. Under CPP the fixed network operator may charge rates, to the fixed user, determined by the mobile operator. In this example, users would not generally realise that the mobile operator determines this price.
- Some business users like the fact that they can prepay for their customers to call their mobile number. In principle, this works in the same way as an '800' number on the fixed network. As large amounts of minutes have been bundled with service, at increasingly lower rates, the attractiveness for business users has increased. For the same reason, some fixed network users prefer RPP because they can call business users with mobiles by paying unmeasured rates.
- From the perspective of the mobile operator there are no by-pass opportunities with RPP. In markets with CPP high fixed-to-mobile prices encourage bypass.

The main disadvantages of RPP are:

- It reduces the accessibility of mobile subscribers because it creates an incentive for subscribers to switch off their mobile phones when not placing calls to avoid being charged for incoming calls, and also discourages them from giving out their phone numbers.
- Users have to budget their pre-paid airtime to allow enough minutes to receive calls. If they go over their monthly allowance, with traditional subscriptions, they may face higher per minute charges. If incoming calls exhaust an entitlement on a pre-paid card users need to purchase a top-up, which may not be convenient or be beyond their budget for that period.
- Due to a combination of the first two reasons pre-paid cards appear to be less attractive to users in markets with RPP, limiting the scope and use of this option for operators and users.
- The system acts as a barrier to mobile wireless providing a competitive alternative to the fixed network. This is because mobile service with RPP is not competing, with an equivalent pricing structure, with the fixed network operating with CPP.

Table 1. Comparison between CPP and RPP

	CPP	RPP
User preference	Mobile users can control costs because they only pay for outgoing calls. However users calling from the fixed network may resent the introduction of CPP, in markets currently having RPP.	Some users resent being responsible for charges over which they have no control. Moreover users need to budget airtime to a greater extent than CPP. Some business users favour RPP because their customers can call them from the fixed network free of charge (this option can be retained in a hybrid system).
Prepaid cards	CPP appears more favourable to budget conscious consumers with a preference for the structure of prepaid card pricing.	RPP appears less favourable to budget conscious consumers who prefer the structure of prepaid card pricing.
Transparency	Who sets rates for fixed-to-mobile network calls may not be transparent to users.	Who sets all rates is transparent to users.
Competition	Competitive pressure exists between mobile operators on outgoing call prices. Little competition exists between mobile operators on call termination.	Competitive pressure exists between mobile operators on incoming and outgoing call prices.
Fixed network regulation	Lack of competition in fixed-to-mobile network calls raises the question of market power of mobile operators and whether regulation is required on the termination of calls.	Independent of the fixed network regulation.
Convergence	'Level playing field' for competition between mobile and fixed networks.	Potential barrier to competition with fixed network, as both networks are not competing with the same pricing structure.
Integration	Some challenges exist in transition from RPP to CPP, such as the need for adequate signaling and billing.	Initially, simpler to implement in a country with unmeasured fixed network local pricing.
Bypass	Potential bypass of mobile pricing (<i>e.g.</i> Tromboning)	No bypass of mobile pricing.
Roaming	Hybrid CPP/RPP system operates for international roaming in all OECD markets.	

Source: OECD.

In countries where RPP is the predominant pricing model, there are supporters and opponents of change based on the above considerations. In the United States, the CTIA neither supports nor opposes CPP, but believes wireless phone providers should be able to offer this service option and allow the marketplace to determine its value.⁴⁹ The CTIA's position is that some wireless companies have been reluctant to offer consumers a CPP option for several reasons. First, there is no standard for notifying the caller that they will pay for the air-time. Second, some state telecommunications regulations, in the United States, can be interpreted as prohibiting CPP. Third, no framework exists for CPP that would set industry guidelines, establish consumer rights, and protect wireless phone companies.

The FCC's consideration of the issues relating to the removal of regulatory barriers to CPP are ongoing at the time of writing (refer Box 4).⁵⁰ This includes the technical and regulatory obstacles that need to be overcome to enable mobile operators to introduce the option of CPP (**Box 5**). These issues range from bypass (sometimes called leakage), notification of the calling party, and arrangements for billing information to be passed between operators. While these issues are challenging for industry and regulators in countries with RPP, the most significant findings of the FCC review were that CPP has the potential to help both the mobile market and local infrastructure competition to grow. This finding is consistent with the experience of OECD countries where CPP is predominant.

The CEO of Vodafone-AirTouch is on record as saying the CPP has accelerated mobile subscriber penetration rates in those markets where it is in operation.⁵¹ Vodafone-AirTouch's CEO says this is one of the main reasons European growth rates have exceeded those in North America. Vodafone-AirTouch, which has a substantial presence in Europe and the United States, says that 40% of European mobile phone use comes from inbound calls, as opposed to just 20% in the United States.⁵²

Accordingly, the company has initiated a trial in Colorado in the belief that growth rates can be increased in the United States. In this trial Vodafone-AirTouch have added a feature in which a message will inform users that they are calling a cell phone. They will also be told the cost of the call. Other new features include an option in which recipients agree to bear the cost by setting up a list of people for whom they always pay for a call. Nevertheless, some mobile operators and industry analysts are not enamoured with CPP and past trials have not been reported as successful in the United States.⁵³ Yet even critics of CPP acknowledge that it is an important factor in the pre-paid card market.⁵⁴ In addition, one element that the FCC and CTIA have identified as being important to the successful introduction of CPP is a nation-wide framework. This element has not, of course, been available in local trials.

In an era when the mobile communications industry was primarily focused on providing services to business users, the difference between RPP and CPP in terms of growth of subscribers and of traffic was not substantial. Indeed, the evidence in the following section suggests that markets with RPP, until recent years, outperformed those with CPP. However, as the mobile sector expanded its focus to include personal communications, the evidence indicates that growth rates in countries with CPP have greatly outperformed those with RPP in terms of subscriber growth. Nevertheless, in proposing reform to enable the introduction of CPP the FCC is right to note the regulatory issues raised in other Member countries in connection with the pricing of calls from fixed-to-mobile networks.

Box 6. Removing regulatory barriers to CPP

There are a number of obstacles to the introduction of CPP, as an optional pricing structure, for countries where RPP has been the predominant pricing structure.⁵⁵ Two of the leading challenges are ensuring there is adequate notification for users and necessary billing systems for telecommunication operators.

Users need to be notified that they are being charged, or charged at a different rate, to call a mobile number. This can be achieved by a signal, such as a distinctive tone, or message to the calling party, indicating they are calling a mobile number, when they initiate the call. In some countries this is indicated by the numbering system (e.g. a particular prefix is used for mobile numbers). Any of these options involve providing adequate information for users and the need for industry to co-ordinate nation-wide notification systems. There are some disadvantages with any system for notifying users. Changes to numbering plans invariably involve a cost and some disruption or confusion for users. Some users may be irritated by messages, indicating information such as the name of the carrier and per minute charge, when they call a mobile phone. An important consideration, in these changes, is ensuring minimal differences between mobile and fixed networks in terms of promoting competition between networks. It is also necessary to co-ordinate regulatory reform, in areas such as notification, with state based regulatory authorities.

The introduction of CPP also requires arrangements for billing and collection services. This requires industry to work together on the technical standards necessary to collect and pass the information needed to bill the calling party. Some argue that it is necessary for all fixed network operators, serving the calling party, to co-operate in providing billing and collection. Others take the view that alternatives, such as credit cards, are available. It is necessary, however, that the fixed network operator provides the data needed for billing. Once again an important consideration for regulatory authorities is ensuring the new arrangements enable competition between mobile and fixed networks.

Receiving party pays and growth rates

The main difficulty in undertaking a comparison of the growth rates between countries with RPP or CPP is isolating the relevant factors. There are, of course, many elements influencing the growth rates for mobile service in different OECD countries. One factor might be user's perceptions of mobile prices based on fixed network pricing structures in a particular country. Another factor that analysts commonly associate with general telecommunication development is the relative wealth of a country. To make allowances for the latter factor it is possible to compare the growth in the number of mobile subscribers against the number of fixed access lines. This approach assumes that some of the factors that impact on mobile growth, such as GDP per capita, have had a similar impact on fixed network development.

An examination of the relative growth rates in countries with RPP and CPP, using the ratio of mobile subscribers to fixed network connections, shows that countries with RPP had a higher ratio until 1996 (**Table 11**). At the end of 1996, countries with RPP had 25.1 mobile subscribers per 100 fixed access lines compared to 20.5 mobile subscribers per 100 fixed access lines for countries with CPP. The year of 1996 is noteworthy because EuroTel, a mobile operator in the Czech Republic, introduced the option of CPP for its customers. In that year the ratio of mobile subscribers to fixed access lines jumped from 1.9 to 7.9 in the Czech Republic. This increase of 273% is the third largest annual increase, in this measure, in the 1990s. While building on a small base it is significant that this occurred in the sixth year of mobile service. The only two larger increases, in other countries, occurred in the second year of service and were unrelated to changes in the structure of pricing.⁵⁶

Over recent years it is clear that countries continuing with RPP have had much slower growth rates than those with CPP. By the end of 1998 there were 51 mobile subscribers per 100 fixed access lines in countries with CPP. By way of contrast there were 38 mobile subscribers per 100 fixed access lines in countries with RPP. Between January 1999 and June 1999, the gap widened with the average number of

mobile subscribers per 100 fixed access lines for countries with CPP rising to 61 compared to 42 for countries with RPP.

This raises the question of why growth rates in countries with CPP have been much faster over recent years than those with RPP. It also raises the question of why this factor seems to have become more significant over time and to have exerted a particularly strong influence from the mid-1990s. The two most likely explanations for these trends involve how RPP and CPP, respectively interact with the changing structure of 'calling opportunities' and the introduction of pre-paid cards.

Impact of change from RPP to CPP in Mexico

In November 1998, Cofetel, the Mexican telecommunication regulatory authority announced that CPP would be introduced in the following year. Some of main reasons, for taking this decision, were the belief that it would increase growth rates and increase access infrastructure in a country with a low telecommunications penetration rate. Telmex initially opposed the introduction of calling party pays. Telmex is the incumbent fixed network operator and the main shareholder in Telcel, the largest cellular mobile operator. Telmex said it opposed the introduction of CPP because the proposed charge for calls from the fixed network to mobile networks was too high.⁵⁷ Telmex also stated that it did not make sense to alter the operational framework of an industry growing by more than 80% per annum and that based on such growth rates the sector did not need additional incentives.

Although data are available for only several months, at the time of writing, it is worth an initial examination of the experience in Mexico. In terms of subscribers joining the mobile network the introduction of CPP coincides with record growth. The availability of CPP commenced 1 May 1999. In May 1999, the monthly growth was 7.6%, which exceeded any previous month (**Table 12**). In June 1999, the monthly growth rate increased further to 8.2%. In July 1999, the monthly growth rate increased again to 9.4%. In other words Mexico's cellular networks had three record breaking months of growth adding more than 1.1 million subscribers between May 1999 and July 1999. Strong growth continued during the rest of 1999. From August 1999 to November 1999 the successive monthly growth rates were 7.4%, 5.7%, 5.7% and 7.2%.

The month prior to the change and the month in which the change actually occurred, also scored high growth rates of 7.3 and 6.5%. The figures for these months may also have been influenced by the launch of a third mobile operator in Mexico. PEGASO launched commercial service in Tijuana, in February 1999, and plans to launch in Mexico's three other largest markets -- Mexico City, Monterrey, and Guadalajara -- in 1999.⁵⁸ PEGASO was the first PCS licensee to enter the market and expects to be one of only two mobile carriers with a national footprint. However, as the company's coverage area is presently limited, and excludes Mexico City, it would appear that the major reason for increased growth rates has been the introduction of CPP.

In terms of traffic, the introduction of CPP has also coincided with record growth. Preliminary data showed that in May 1999 the total traffic on the cellular network increased between 4 and 10%, depending on mobile firm studied. However CPP is a new modality of mobile service which requires time for users to become familiar with the new system. Revised data from Cofetel confirmed that in May 1999, the month in which CPP was introduced, total traffic increased 17.4%. The following months have also shown significant increases in total traffic with the exception of September 1999. In August 1999, Telmex was reporting technical difficulties in Mexico City due to the increase in traffic generated under the CPP system with some network overloading occurring. The company said it was responding to the problem area by introducing a new exchange with 20 times the capacity of the one it replaced. In September 1999,

Cofetel said there were continuing problems as very high traffic and subscriber growth rates continued and that mobile operators were working to upgrade their networks to cope with the surge in demand.⁵⁹

Cofetel's analysis of these data found that traffic originating on the cellular network was responsible for most of this growth.⁶⁰ However, they also found that traffic from the fixed network to cellular networks increased at a moderate rate. Part of the reason for the latter phenomenon is not only the increasing calling opportunities but also it may reflect the greater willingness of cellular mobile users to accept calls. Before the introduction of CPP the balance between cellular traffic had been 63% outgoing and 37% incoming. During May 1999 this was modified to 60% outgoing and 40% incoming.

For a call from the fixed network to the mobile network, under the new arrangements in Mexico, since 1 May 1999, Telmex pays an interconnection rate of USD 0.20 per minute to mobile operators. Fixed network users pay USD 0.26 per minute for making a call to a mobile phone. This tariff includes interconnection costs as well as billing and collection expenses. The monthly rent is USD 14.63, since July 1999, and includes 100 free calls per month. Metered service is USD 0.137 (MXN 1.307) per call. Accordingly, while Telmex would be making a lot more money from the increase in subscribers and traffic coinciding with CPP, the company's reluctance to embrace CPP may also involve other factors. The most significant of these may be the longer term potential for cellular networks to compete with the fixed network in certain market segments. In any event, the initial experience has endorsed Cofetel's decision to introduce CPP.

Calling opportunities and pricing structures

In 1990, mobile subscriptions made up just 2.5% of total fixed and mobile connections. This meant there were a vastly greater number of 'calling opportunities' between fixed networks than involving mobile networks (**Table 13**). Calling opportunities are the sum total of possible connections (and therefore calls) on telecommunications networks (fixed and wireless). In 1990, the number of fixed-to-fixed network calling opportunities represented 95% of all calling opportunities. At the same time, the calling opportunities between fixed networks and mobile networks were much greater than between mobile networks. By June 1999, the balance had changed significantly in the OECD area. By then, fixed-to-fixed network calling opportunities represented only 42% of the total calling opportunities between networks in the OECD area. This meant that some 58% of calling opportunities involved mobile networks.

Two caveats need to be inserted in discussing calling opportunities. The number of fixed access lines understates the number of fixed line calling opportunities, due to the possibility of having multiple users share access lines, whereas mobile subscriptions generally coincide with calling opportunities. Second, calling opportunities do not correspond to traffic. Even though the number of calling opportunities involving mobile networks has increased there are still tremendous differences between the cost of calls in most instances and this still influences calling patterns. In addition, the volume of traffic carried by fixed networks is burgeoning due to the Internet (the impact of which is yet to be felt on mobile networks).

Finland leads the way, in terms of mobile penetration, in the OECD area. The changes occurring in calling opportunities are most advanced, in terms of domestic calling opportunities, for Finnish users. In Finland, mobile-to-mobile calling opportunities represented 27.4% of total domestic calling opportunities by June 1999. More than three-quarters of all calling opportunities, involve mobile networks in Finland.

The pattern of calling opportunities suggests that the pricing of some types of calls was initially more important than others for mobile users. Initially, because most calls were between fixed-and-mobile networks the price of these calls was more significant to users than mobile-to-mobile network prices. There is no structural difference between RPP and CPP, in terms of calls made from mobile-to-fixed

networks as in both cases the mobile subscriber pays. However, as the proportion of fixed-to-mobile and mobile-to-mobile calls grows the characteristics of CPP and RPP may have a greater positive or negative impact on actual calling patterns.

As the share of fixed-to-mobile and mobile-to-mobile calling opportunities increase as a percentage of total calling opportunities, cellular mobile service becomes increasingly valuable where it is 'free' to receive calls (*i.e.* CPP). This encourages users to join mobile networks in countries where CPP exists. By way of contrast there is a drag on the uptake of mobile service, at least for some personal users, where the mobile users pay to receive calls (*i.e.* RPP) from others networks.

Mobile operators using CPP have a much wider revenue base to draw on than operators in markets with RPP. This is because users from fixed networks are part of their revenue base and contribute to meeting the cost of the mobile operator in terminating a call. In markets with RPP fixed network users are not making a direct contribution to the costs incurred by the mobile network in completing the call. The receiver of the call meets this cost. Thus, mobile operators in countries with CPP have an additional revenue source, and can potentially be more flexible in pricing services. The proportion of revenue gained by mobile operators, from traffic from other networks, is very significant (**Box 6**). In France, for example, mobile operators make about one-third of their turnover on revenue from incoming calls.⁶¹

The value of having a mobile subscription increases as the number of mobile-to-mobile calling opportunities increase. Mobile operators often price these calls less expensively than calls between fixed and mobile networks. The ability to draw revenue from a wider user base enables mobile operators in countries with CPP to offer tariffs aimed at keeping traffic within their network. Mobile operators in countries with RPP also attempt to do this, so they can bill two subscribers, but face a harder task because of some users' reluctance to pay for incoming calls.

The above factors are important because of the changing nature of mobile communications. Originally mobile communications were used predominantly by business users and, generally, regarded as expensive for personal use. In other words mobile communications was seen as a business-to-business service. The first interaction with the consumer market occurred in RPP countries. In these countries consumers took advantage of the low fixed network charges to call business users with mobile subscriptions. Even today, many business users like RPP because their customers can call them from the fixed network at very inexpensive rates (particularly if the business user pre-purchases large amounts of minutes). By way of contrast, in countries with CPP, the costs to call a mobile user from a fixed network have generally been similar to mobile charges. In an environment where mobile communications were viewed as a business tool, and most calling opportunities involving mobility were between fixed and mobile networks, this reinforced their value to business users in RPP markets. In countries with CPP, however, mobile services had to prove themselves on the basis of the benefits of mobility rather from any initial advantage related to fixed network pricing and the weight of calling opportunities.

Moreover as flexible tariff packages emerged with new entrants, many were aimed at winning a larger share of the business market. For example, in the United States, it is possible to purchase large amounts of mobile airtime in advance of its use for as low as USD 0.10 per minute. This means, for example, that a residential fixed network user can typically call a mobile phone without charge while the business user pays USD 0.10 per minute. The problem with the initial advantage of RPP, in terms of the pricing of fixed-to-mobile calls, is that an increasing amount of the calling opportunities are mobile-to-mobile. Thus the residential user is likely to be paying a much higher rate (*e.g.* USD 0.30) if they call the business user from their mobile phone. In the later case the total cost of the call would be USD 0.40 per minute instead of USD 0.10 in the earlier example.

Of course, residential users in a country with CPP would also have to pay to call the business user. However in the latter case they would not pay to receive a call in the opposite direction, a factor increasingly important as the share of calling opportunities between mobile and fixed networks increases. This is most evident in the case of users of pre-paid cards, and the relative take up of this service in countries with CPP and RPP. In countries with CPP, pre-paid cards are emerging as the pricing structure being selected by most new users for personal communications.

To better understand the impact pre-paid cards are having on markets with RPP and CPP it is necessary to describe their development in the OECD area. However before turning to that subject it is also necessary to examine the pricing of fixed-to-mobile calls in countries with CPP. The main problem with CPP is that it is lacking the competitive element RPP markets can provide; the prices of calls from fixed to mobile network have been relatively high in markets with CPP.

Box 7. Mobile traffic and revenue patterns in Spain

In 1998, 58% of traffics, involving mobile networks in Spain, was between fixed and mobile networks.⁶² The balance was made up of a further 39% of traffic being between mobile networks. The remaining 3% of traffic was between mobile networks in Spain and foreign networks. Of this traffic, some 66% occurred at peak rates and 32% at off-peak rates (a further 2% occurred at the lowest off-peak rate). For Telefonica, the foregoing traffic pattern means that 75% of mobile revenue was derived from termination and roaming services. The next largest categories were voice mail with 16% and SMS with 3%. Other sources were responsible for 6% of revenue.

THE PRICE OF FIXED NETWORK TO MOBILE NETWORK CALLS

In the majority of OECD countries fixed network users pay to call mobile network users. The exceptions are in countries where the predominant pricing structure is one of RPP. Just as regulatory authorities are reviewing RPP arrangements in Canada and the United States, they are also increasingly reviewing the price of calls from fixed-to-mobile networks in countries with CPP. This raises questions, such as who sets the retail price for calls from the fixed network to mobile networks, the level of competition they face and what actions regulators are taking in this market segment.

In some countries with CPP, mobile network operators set the retail price of a call from the fixed-to-a-mobile network. In one sense this is the same as countries with RPP (*i.e.* mobile operators set the fee for reception) but there are substantive differences. In the case of CPP the mobile operators are setting the tariffs to be paid by the fixed network users, whereas in countries with RPP they are setting the tariffs for their own customers. In other countries with CPP, the fixed network operator sets the retail price after an interconnection agreement is made between fixed and mobile operators. Within these two main approaches there are a number of variations evident in the following examples.

(i) Mobile operators set the retail price of fixed network to mobile network calls

In a number of countries the mobile operators set the price billed by the fixed network operators for calls originating on the fixed network and terminating on the mobile network. This occurs, for example, in France and Portugal. France introduced this system in 1991. In a market where there were multiple mobile operators, and one incumbent fixed network operator, this approach had the potential advantage of injecting competition into the market for fixed-to-mobile calls (*i.e.* in the same way the potential exists in RPP markets). In countries with this system the price of calls, from the fixed network, can vary depending on which mobile network is being called. In Portugal, for example, the rate to call different mobile networks from Telecom Portugal's fixed network varies.

In markets where the fixed network operator sets the fixed-to-mobile network prices, and has monopoly power, it would have otherwise implied that this pricing should have some degree of regulatory oversight. One reason for this is that users generally have little choice in terms of their fixed network provider. Apart from a small number of OECD countries the incumbent fixed network operator generally provides more than 99% of fixed connections and many countries do not offer pre-selection for calls from fixed-to-mobile networks.

(ii) Mobile and fixed operators agree a retail price

In some countries each mobile operator negotiates an interconnection arrangement with each fixed operator. This includes the retail rate and the share of revenue each party receives. In the Netherlands, for example, there are numerous fixed operators such as Versatel, Esprit Telfort, A2000 and KPN. There are also five mobile networks. This means there can be different rates for calls between fixed and mobile networks. In mid 1999, KPN the incumbent fixed network provider, agreed with four of the five mobile operators (one of which belongs to KPN) to lower the price of fixed network to mobile network calls. One

of the five mobile operators, Telfort Mobile, did not agree at that time that KPN should lower the rate for calls from KPN's fixed network to the mobile network. This meant that calls from KPN's fixed network to mobiles were uniform for four mobile operators and higher for a fifth operator.

In some respects the Dutch system mirrors those of France and Portugal with mobile operators being the most important arbiters of the price between fixed and mobile networks. This is evident in one mobile operator not agreeing to a lower retail price for calls to its network. As in all countries with CPP the mobile operators retain by far the largest share of the retail price for calls from fixed to mobile networks. While costs differ between mobile and fixed networks for termination of calls, the question is still raised as to what incentives there are for mobile operators and fixed operators to agree to lower charges. In the Netherlands, the existence of multiple fixed operators may create pressure to lower retail prices for calls to mobile networks. This will also be increasingly the case in other OECD countries. However, if regulators determine that retail prices should be uniform, in the absence of adequate information for users to make choices, then there is less incentive for all operators to compete in this market segment.

(iii) Fixed network operators set the retail price of fixed network to mobile network calls

In some OECD countries the fixed network operator sets the retail price for a fixed-to-mobile network call. They do so after the interconnection rate has been formulated for calls terminating on the mobile network. In these countries there is typically direct regulatory supervision or review of the mobile termination charge or fixed operator's retail tariff. This system is in operation, for example, in Australia, Denmark, Italy, Sweden and the United Kingdom. Fixed network operators in a number of other countries have expressed a preference for this system. For example, France Telecom has also declared that fixed-line operators should be the party determining fixed-to-mobile rates.⁶³

Fixed to mobile network pricing in countries with calling party pays

In OECD Member countries with CPP, on average, it costs USD 0.38 per minute to make a call from a fixed to a mobile network at peak times (**Table 14**). At off-peak times, as represented by the price at 20:00 hours, during weekdays, the price drops to USD 0.29 per minute. For fixed network users these are generally the most expensive domestic calls. In February 1999, the price of calls from fixed-to-mobile networks was, on average, three times the price of calls over the longest national distance.

The least expensive calls from fixed-to-mobile networks, in countries with CPP, are in Denmark where the rates, for peak and off-peak times, are USD 0.20 and USD 0.10 per minute respectively. TeleDanmark's retail rate for fixed-to-mobile calls at peak rates, appears to be made up of USD 0.17 termination payment to its mobile network and USD 0.03 to cover origination costs and to provide a return on capital. The lowest weekend rate for fixed-to-mobile calls is for BT fixed network users calling BT Cellnet users on weekends (USD 0.03 per minute).

The reasons why fixed-to-mobile network calls, in some OECD countries, are much higher than the Danish prices raise questions that need to be addressed. When taken together with interconnection pricing data, examined in a following section, the questions become more pressing. The average call from fixed-to-mobile networks at peak rates (*i.e.* USD 0.38) costs USD 0.10 more than the combined average for the mobile termination charge (USD 0.26) and fixed termination charge (*i.e.* USD 0.02 used as proxy for fixed origination charge). This suggests that users making calls from the fixed-to-mobile networks during business hours are meeting a very steep additional cost.

The price of calls from fixed to mobile networks can also be compared to the cost of calls in the opposite direction. While the balance varies across countries with CPP it is, on average, more expensive to call

from a fixed network to a mobile network than in the opposite direction. In some cases there are major differences. Sometimes, for prices at 20:00 hours, these differences are due to different peak and off-peak times on fixed and mobile networks. Notwithstanding this factor the difference at peak rates, and off-peak rates for most countries raises the question of whether the higher tariffs on the fixed or mobile networks, for calls to the other network, are cost oriented. Why, for example, is it more expensive to call from a fixed to a mobile network in off-peak times than to make a call in the opposite direction?

Fixed to mobile pricing and competition

Determining that mobile operators should set the retail price for fixed to mobile networks has not abated the concern of regulatory authorities and users over the high price of calls from fixed to mobile networks. This raises the question of why the greater competitive potential of this system has not lived up to expectations. There are probably several factors at work. First is that although there is an increasing number of mobile operators in different markets, some 21 of the 26 CPP markets were limited to two or three operators by mid-1999. The fixed network incumbent generally owns one of these mobile operators. Accordingly the number of players could not be said to correspond with a market characterised by open entry and this has resulted in insufficient price competition.

In markets with a higher number of mobile operators some regulatory authorities have taken the view that these operators have a monopoly over the termination of calls on their own networks. OFTEL, for example, argues that mobile operators have such a monopoly position because when someone wants to make a call to a mobile phone, the calling party has no choice but to call the network to which the called party has subscribed.⁶⁴ This means, OFTEL reasons, that mobile operators, in common with other network operators, do not face significant competitive pressures in reference to setting call termination charges.

In practice, when mobile operators set the price for fixed-to-mobile calls they will probably do so in reference to mobile pricing. In other words mobile operators determine the price for mobile service and then set the price for calls from fixed-to-mobile networks. The actual cost of the fixed network component, for a call to a mobile network from a fixed network, would appear to be a minor part of this equation. The latter conclusion can be drawn from an examination of termination charges on the fixed network for mobile-to-fixed network calls.

The problem, from a regulatory perspective, is whether mobile operators, in a rapidly growing market, have an incentive to bring down the price of calls from fixed-to-mobile networks. In countries with CPP, mobile subscribers do not choose their operator based on the cost of calls from fixed-to-mobile networks. The price of a call from a fixed to a mobile network does not appear in the prices listed by mobile operators but rather in the prices listed by the fixed network operator. For the user it may not be readily apparent that the mobile operator determines the price of a call, from a fixed to a mobile network. Thus, the situation exists, in some CPP markets, of a small number of firms setting the retail price for another firm's customers. Accordingly, mobile operators are not competing on the basis of the price a fixed user pays to call their mobile network. This does not mean there is no potential for competition in this area. However, it does seem to be a somewhat unique situation in that one firm is setting the retail price for another firm's customers.

Based on the foregoing it is not surprising that the price of calls from fixed to mobile networks is attracting increasing attention from regulatory authorities. This is not based on their assessment of the competitiveness of the mobile sector but rather on a concern that competition is not yet evident between mobile operators in their pricing of different elements of fixed-to-mobile calls.

Regulatory action in CPP markets

Between February 1999 and August 1999, significant reductions in the price of calls from fixed-to-mobile networks occurred in Australia and a number of European countries. In a number of instances these reductions were as a result of regulatory authorities asking for the price of calls from fixed-to-mobile networks to be lowered. In addition, a growing number of regulatory authorities are designating mobile operators as having significant market power in respect to the termination of calls to mobile networks.

The Australian Competition and Consumer Commission (ACCC) has declared mobile terminating services as an area where mobile operators have significant market power.⁶⁵ These are the services for which all other carriers and service providers pay to terminate a call on a mobile network. The ACCC can, if needed, determine the terms and conditions, including prices, for supply of these services. The other significant feature of the Australian situation is that the ACCC mandated, in December 1998, that carrier pre-selection arrangements apply to calls from fixed-to-mobile networks.⁶⁶ This meant that a user selecting a carrier for their long distance service, would also be billed by that carrier for calls from fixed-to-mobile networks. Previously the carrier providing the local loop had a monopoly on the provision of calls from that fixed line to mobile networks. This is still the case in many OECD countries where pre-selection is not offered for calls from fixed-to-mobile networks.

In Denmark, the fixed and mobile operators negotiate an interconnect agreement between their networks. TeleDanmark, the incumbent fixed network operator, then sets the retail rate for fixed-to-mobile network calls. To meet regulatory requirements, TeleDanmark needs to document the originating fixed network costs in setting the retail rate and not differentiate prices for calls to mobile networks. Another fixed network operator, in Denmark, who was adjudged not to have SMP, could differentiate their prices. Whether mobile operators have SMP, in respect to termination on mobile networks, is under review in Denmark.

ART, the French telecommunication regulatory authority, decided in June 1999 to ask mobile operators to begin to lower their retail prices.⁶⁷ The operators were left to decide the precise arrangements and time-scale for the reductions. ART recommended a cut of about 20% between June 1999 and October 1999. The situation in France will be reviewed with the mobile operators in March 2000, in order to make arrangements for further reductions. Following the request by ART, France Telecom reduced the price of calls from fixed to mobile networks by 21%.

In Italy, for a call from a fixed-to-mobile network, the telecommunication regulatory authority has established the principle that prices should be determined by the operator from which the call is originated. On this basis the regulatory authority evaluates the content of interconnect agreements and in particular the relationship between the level of out-payments Telecom Italia makes to mobile operators for having calls terminated on their networks and Telecom Italia's proposed retail prices. In October 1999, Telecom Italia Mobile and Omnitel Pronto Italia, the two largest Italian wireless telephone companies, were found guilty and fined by the Italian Antitrust Authority, for colluding to set identical prices on calls from traditional fixed line phones to mobile phones.⁶⁸

In June 1999 OPTA, the telecommunication regulatory authority in the Netherlands announced that it intended to designate the two longest established mobile operators, KPN and Libertel, as having significant market power (SMP).⁶⁹ OPTA said this decision was a consequence of the observation that the tariffs for telephone calls from a fixed to a mobile phone network are higher than in many other countries. OPTA also found that fixed-to-mobile calls were much more expensive than mobile-fixed calls. They concluded from this difference in pricing, that the subscriber on the fixed network appeared to subsidise the mobile subscriber. OPTA further concluded this was an inappropriate way to 'finance' competition in the mobile market.

OPTA can give an SMP designation to operators with more than 25% of the market. OPTA decided to speed up the SMP-procedure because the market itself had not lowered the tariffs for fixed-to-mobile calls to the levels in other mature markets. OPTA said that in most other EU member States the dominant mobile network operators are already designated as having significant market powers. OPTA added that it expected it could stimulate further reduction without a direct intervention in tariffs.

During 1998, the Swedish telecommunication regulator (PTS) established that Telia Mobile had significant market power in national interconnect markets. That meant that Telia's right to remuneration had to be cost based. Previously, Telia were entitled to pursue market-based remuneration. PTS then initiated a review of Telia's costs.⁷⁰ In April 1999, PTS decided that termination rates with Telia's mobile network should be lowered as at the beginning of June 1999. The charge was USD 0.29 per minute at peak rate and USD 0.17 at off-peak rates. These charges were reduced to an average maximum of USD 0.20 per minute for traffic terminated on Telia's digital network, and rates of USD 0.15 and USD 0.19 for analogue. The regulatory authority made this decision after a review which indicated that the costs of customer support, marketing and sales had been included when Telia calculated the previous price.⁷¹

In the United Kingdom, retail prices are set by fixed network operators after commercially negotiated interconnect arrangements are reached with mobile operators. A major component of the price charged to BT customers for calling a mobile phone is the interconnection payment, which BT makes to the mobile operator for terminating the calls to the mobile phone users. After studying this issue OFTEL concluded that mobile operators have monopoly power over the termination of calls on their networks. Based on this monopoly power, OFTEL's analysis led it to conclude that interconnection prices for calls between fixed and mobile networks were higher than would be the result in a competitive market. A Monopolies and Mergers Commission inquiry followed with which BT co-operated fully.⁷² This resulted in reductions of both the payment to the mobile operators and the amount of money that BT retains.⁷³ On 30 April 1999, BT's prices for calls to mobile telephones fell by around 25%.

In the FCC's recent Notice of Proposed Rulemaking on calling party pays, the FCC noted that direct competitive pressure on rates does not exist in the case of a call to a calling party pays subscriber because the caller does not select the terminating carrier and does not have the ability to switch to a different carrier to obtain a better rate for completing the call. The caller can only elect to complete the call at the price charged by the mobile carrier that serves the called party or end the call prior to its completion to avoid any charges. The FCC also stated, however, that there is no evidence to date before the FCC to suggest that calling party pays pricing will in fact be problematic if implemented on an extensive basis in the United States. The FCC did note Oftel's recently imposed price caps on the amount BT charges its wireline customers for calls to wireless phones, and the amount the two largest wireless carriers, Vodafone and Cellnet, charge BT to terminate calls on their wireless networks.

In July 1998 the European Commission decided, under Community competition rules, to open a number of investigations concerning the retention charge applied by incumbent fixed network operators and the termination charges of mobile operators for calls from fixed-to-mobile networks.⁷⁴ This was based on concerns from users, and some new fixed network entrants, that the rates for terminating calls between networks were too high (**Box 7**). Subsequently the European Commission issued tariff principles to clarify Community rules and develop guidance for national regulatory authorities. The responsibility for implementing the principles rests with the regulatory authority in each European Union Member State.

In September 1999, it was reported that the European Commission would begin an investigation into claims of excessive pricing by cellular phone companies.⁷⁵ This investigation is focused on leased lines and international roaming, not the entire cellular sector. A European Commission spokesperson was reported to say the investigation would focus on the cost of access to local networks formerly held by monopolists, the 'roaming' charges for using mobile phones outside the country of registration and the differences in the

prices of leased lines. This investigation had been foreshadowed in May 1999 (**Box 7**). The European Commission has also contracted several studies to be undertaken in this area.⁷⁶

Box 8. European Commission investigations of pricing between fixed and mobile networks

After an inquiry initially involving 45 companies in the 15 EU Member States, the Commission decided in July 1998 to open 14 cases where the situation indicated a possible distortion of market conditions. Those cases fell within three categories:

i) Mobile to fixed termination rates: Cases concerning a possible discrimination by incumbent telecommunications operators towards mobile operators with regard to the fees demanded for termination of mobile phone calls in the public telephony network. The Commission opened four cases regarding the incumbent telecommunications organisations in Germany, Spain, the Netherlands and Italy respectively.

ii) Fixed operators' retention on fixed to mobile calls: Cases concerning the retention applied by incumbent operators on the calls from their fixed public switched telecommunications network (PSTN) to mobile networks. The Commission opened eight cases, namely in regard of the incumbent operators in Belgium, Ireland, United Kingdom (BT), Austria, Spain, Netherlands, Italy and Germany respectively.

iii) Mobile termination rates: Cases concerning the termination fees charged by mobile operators for terminating calls in their networks. The Commission opened five cases, one per mobile operator in Italy (two companies) and Germany (three companies).

In November 1998, the European Commission decided to close some of these investigations.⁷⁷ The Commission closed further investigations in May 1999.⁷⁸ These decisions followed the announcement of pending action by national regulatory authorities or announcements by operators of reduced charges. In terms of the charges applied by the fixed operators to the mobile operators for termination of mobile calls in the PSTN, prices declined significantly in four of the six cases under investigation, by up to 82%. In terms of the margin retained by the fixed operators on the price of fixed-to-mobile calls, the decline in percentage of the 1998 retention rates compared with the 1999 rates, in the cases investigated, was 31 to 80%. Following the conclusion of the investigation into mobile / fixed telephony prices, the Commission intends to pursue the scrutiny of competitive conditions within an overall sector inquiry of telecommunications, on key issues including current roaming conditions between mobile operators.

Transparency and fixed to mobile pricing

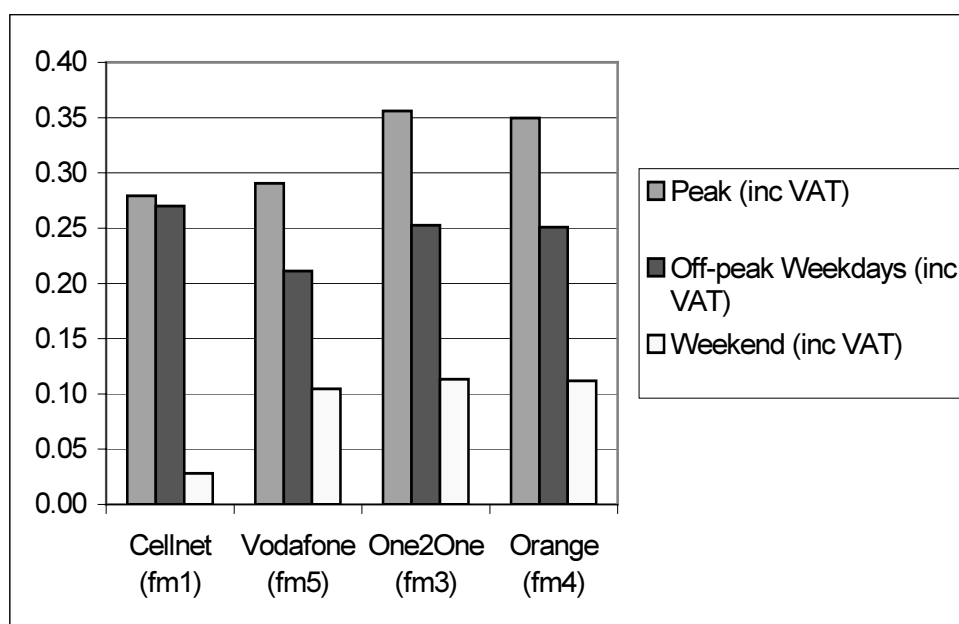
An issue which has arisen in countries with CPP, is the transparency of fixed to mobile pricing. In the United Kingdom, OFTEL initially proposed that the largest fixed network operator's (*i.e.* BT) retail price for calls from the fixed network to mobile networks should be at the same rate. OFTEL's view was based on the fact that the fixed network users would otherwise not know the rate at which they were being charged.⁷⁹ In the United Kingdom, it is not possible to determine which mobile network is being called based on the numbering system. OFTEL said that there was already confusion on the part of fixed network users, in the United Kingdom, because the number system did not, at that stage, indicate whether a call was to a fixed or mobile network.

The regulatory authority said numbering portability would further complicate this issue because users may shift networks and retain their mobile number. This meant that a fixed network user could not be certain that the rate for previous calls to the mobile user applied on their new network. On the other hand, BT Cellnet, while agreeing that customer confusion should be avoided, suggested that growing complexity was an inevitable part of a competitive market. OFTEL's view was that this was not necessarily a disadvantage provided the complexity of choice is supported by adequate and fair information.

By mid-1999, BT charges for calls from the fixed-to-mobile networks were set at different rates (**Figure 3**). At peak rates BT's charges to Cellnet are slightly lower than those to Vodafone and considerably lower than to Orange and One2One. At off-peak times during weekdays BT's charges are higher to Cellnet than to the other three networks. The largest difference is during the weekend where BT charges USD 0.03 to call Cellnet but more than USD 0.10 to call the other networks. Significantly, if a mobile customer changes network, but retains the previous number, then fixed-to-mobile calls to that customer are still charged at the rate to that number and not at the rate to the new network's own number ranges.

Figure 3. **BT fixed network to mobile network**

(USD per minute)



Source: OECD.

Fixed network to mobile network interconnection rates.

The consulting company Ovum surveys fixed-to-mobile interconnection charges. The price of interconnection in this segment of the telecommunication sector, in countries with CPP, varies from USD 0.15 to USD 0.36 per minute at peak times (**Table 15**). In countries with RPP, the interconnect rate for calls terminating on the mobile network is typically two or three cents. The difference is because mobile operators charge the receiver of a fixed-to-mobile network call to cover their network costs for terminating the call.

In relation to the foregoing discussion of setting retail rates it is notable that Denmark has one of the lowest interconnect rates for mobile termination and France and the Netherlands among the highest. The vast range of interconnect rates has several possible explanations. Either the tariffs are cost oriented, and there are major differences in efficiency levels, or mobile operators are using monopoly power to charge well above cost oriented rates. The latter explanation appears to be more plausible. For countries with CPP **Figure 4** shows a correlation between the price of calls from fixed to mobile networks and penetration rates. There is a tendency for those countries with lower charges to have higher penetration rates. The

relationship is, however, not as strong as might be expected. This is probably because users in countries with CPP do not make a choice to join a mobile network based on fixed network to mobile network prices.

Some regulatory authorities have generally accepted that there are higher costs in terminating a call on a mobile network than on a fixed network. It would be useful for further analysis of this proposition to be conducted and greater indications of the magnitude of any differences to be made available. In countries with RPP this cost is made up from charging the receiving party as well as the calling party. In countries with CPP this cost is reflected in higher termination charges on the mobile network than on the fixed network. On average fixed network operators pay 11 times more to terminate a call on a mobile network than mobile networks pay to terminate a call on a fixed network (**Table 15**). While the cost of establishing, expanding and digitising networks is a recent or ongoing expense for many mobile operators, the current multiples appear inconsistent with the notion that wireless network costs are converging with fixed network costs.

In markets where one party has monopoly power over the pricing of call termination, it is not surprising that it should attract the interest of regulatory authorities. The increasing attention also reflects the growing significance of mobile communications. As the mobile penetration rate increases so do the number of calling opportunities between fixed and mobile networks. This raises the question of how retail prices for calls from fixed-to-mobile networks compare to interconnect charges. An indicator worth examination is whether the average retail rate is significantly greater than the combined charge for originating a call on the fixed network and terminating a call on the mobile network. In the absence of other data, the cost of using termination charges on the fixed network may be used as a proxy for the cost of originating calls on the fixed network. The Danish and Norwegian interconnect and retail prices appear to validate the use of this proxy. However in other cases there are often significant differences between the mobile termination charge and the retail price to users. This occurs when fixed network charges include a high retention rate.

The negotiation of mobile termination has one fundamental difference from fixed-to-fixed network negotiations. In the case of fixed-to-fixed network negotiations, the new entrant wants to strike a lower price to increase the margin between its retail price and the amount it pays to terminate traffic on another network. The incumbent has an incentive to ask for a higher interconnect price to decrease the proportion of the retail price received by the new entrant and leave the new entrant less scope to reduce prices. Both negotiating parties are concerned with the impact the rate for interconnection will have on competition. In the case of the fixed-to-mobile market the question is raised as to whether both parties have the same incentives.

In the case of fixed-to-mobile network negotiations, the incumbent fixed network operator is, in most OECD countries, the owner of one of the largest cellular mobile networks. This implies several things. First is the possibility that by agreeing to a higher interconnection rate, the fixed network operator sets a floor on retail pricing and limits competition with the fixed network. At the same time a mobile operator may agree to a high interconnect fee because this represents a higher revenue outcome than a lower interconnect fee. The fundamental difference, in terms of the mobile operator in countries with CPP, is that they do not need to negotiate a lower interconnect price for fixed-to-mobile calls to compete in certain market segments such as local or long distance. The mobile operator's ability to compete in this market segment is determined to a greater extent by the interconnect arrangements for calls from mobile-to-fixed networks. Mobile-to-fixed interconnection rates average around USD 0.02 in countries with CPP, in contrast to much higher interconnect rates for the reverse direction. The latter termination charges are very low compared to mobile retail pricing. This means that fixed network termination rates are of less concern to mobile operators than for new fixed network entrants who have a greater incentive to negotiate low rates.

The resulting high prices for mobile termination have given rise to an increasing incentive to bypass these charges. In at least one OECD country, business users are bypassing high fixed-to-mobile charges by undertaking their own traffic re-routing to mobile-to-mobile traffic. This process works in the following way. A business user collects their fixed-to-mobile traffic, from its own network, but does not transfer it directly to the fixed network for transfer to the mobile network. Instead, the business user has equipment on its premises that re-route the traffic as if it were originating from a mobile connection. This can save up to 70% of traffic costs but users may experience a lower quality and they have to purchase the necessary equipment. The savings are possible because mobile-to-mobile rates are generally much less expensive than fixed-to-mobile rates (particularly for large businesses receiving volume discounts). An alternative way to bypass fixed-to-mobile charges is to send the traffic via a second country.

TROMBONING

In fixed network telecommunications it is sometimes less expensive for a network operator to send traffic through part of the backbone infrastructure of another network to reach a point of interconnection with a third network. At the international level this phenomenon is known as “refile”. Refile emerged where telecommunication carriers had an incentive to route traffic around high accounting rates. At the national level the same phenomenon sometimes occurs in respect to high interconnect charges. This is known as “tromboning”.

In times past, and currently for the most part, international accounting rates have been much higher than national interconnection charges. This has meant there has been little incentive for operators to send national traffic over international routes to avoid a certain domestic interconnect rate or take advantage of an international termination rate. This has kept “tromboning” and “refile” as distinct phenomenon. As the international accounting rate system has been superseded by developments such as international simple resale, this has created the possibility that the negotiated rate for terminating international traffic between networks in different countries could fall below the termination rate between a fixed and mobile network in the same country.

The phenomenon of international tromboning has been recognised by OFTEL in the United Kingdom. OFTEL has noted,

“... some of the existing competition for BT comes from operators routing fixed-to-mobile calls in the UK via other countries (tromboning) to exploit artificially low termination charges arising from historical international accounting arrangements. The future of these arrangements for international fixed-to-mobile calls, and of the competition that relies on them, is uncertain.”⁸⁰

ART, the French regulator, noting that international re-routing of calls from fixed phones to mobiles is developing quickly, has also commented on this issue. In France the rate paid to the mobile operator for terminating an international incoming call, via France Telecom, is around USD 0.05. This rate is based on the settlement received by France Telecom from a foreign operator regardless of whether the call is to a fixed or mobile network. The traditional accounting rate agreements between telecommunication carriers in different countries did not differentiate between fixed and mobile networks.

For terminating calls from neighbouring countries, France Telecom receives a payment of between USD 0.08 and USD 0.09. From this amount France Telecom passes around USD 0.05 to a French mobile company for an incoming call from a foreign country. This rate is much lower than the USD 0.33 France Telecom would pay to a mobile operator for a domestic fixed-to-mobile network call. This means there is a tremendous incentive for fixed network operators, in France, to route calls to French mobile networks via foreign fixed networks. These operators can charge retail prices that are less than half the standard rates, set by the mobile operators, for calls made from the fixed-to-mobile networks (*i.e.* USD 0.43 in February 1999).

Both OFTEL and ART commented that tromboning was ‘artificial’. This is based on the conclusion, of both regulators, that the termination charge for incoming calls is lower than the mobile operator’s cost. Furthermore ART suggested that while users might receive this development in a positive way, this

interpretation was not taking into account that the weak remuneration to the mobile operators would not constitute a healthy base for the development of the market. This led ART, in June 1999, to recommend an immediate and, "... considerable increase in the rates charged for delivering international calls to mobiles, in order to combat international re-routing."⁸¹ ART added that in the longer term, the international termination rates should be realigned with national rates.

The foregoing raises a very large number of questions policy makers in various OECD countries will have to consider closely. While regulators may accept there are higher costs for terminating calls on mobile networks this does not mean that those charges are currently cost oriented. Indeed, users are increasingly questioning the cost orientation of mobile pricing structures. INTUG has, for example, pointed out that the average investment per subscriber has fallen well below that of the fixed network.⁸² In addition, INTUG points out that the average operational cost per subscriber, on many mobile networks, has also fallen below those of the fixed network in the same country. The fact that mobile-to-mobile rates are often far lower than fixed-to-mobile rates lends support to the view that fixed-to-mobile tariffs are far from cost oriented. The difference can not be accounted for by the costs incurred on the fixed network for originating the call as these are relatively minor (*i.e.* roughly equivalent to fixed network termination charges, in the order of USD 0.02 to USD 0.03 per minute).

Certainly, all regulatory authorities may not reach the same conclusions regarding whether the termination charges on foreign networks are cost oriented. For example, in mid-1999 KPN announced its intention to raise the tariff for calls to a mobile network abroad by USD 0.21 (excluding VAT). OPTA did not initially approve this increase. The issues raised are extremely relevant to the positions different regulatory authorities may take on this issue. OPTA's reticence to approve the increase was based on its analysis which showed that the Dutch consumer would, in some cases, be subsidising the foreign operators rather than paying the actual costs. OPTA stated that one of its tasks is to protect the Dutch consumer against unreasonable tariffs. The regulator noted that the tariffs for calls to the mobile networks outside the Netherlands were insufficiently cost-orientated. Accordingly, in July 1999, OPTA ruled that KPN could charge additional amounts on a country by country basis -- but it is not allowed to charge a uniform additional charge for calls to foreign mobile networks. OPTA also stated that it is going to investigate the real costs for termination in the various countries, and KPN agreed to co-operate on this issue. Furthermore, OPTA has stated that it will endeavour to get foreign mobile operators to lower the termination fees for mobile networks.

The positions taken by the various regulatory authorities raise the question of whether they will be any more successful in intervening in mobile termination than they have been in the area of international accounting rates. For example, will operators in one country be able to convince those in another country to part with higher termination charges in an environment where these international settlement and termination rates have been coming down? On the other hand, will regulatory authorities concerned about far-above-cost mobile termination charges be able to exert more effective pressure than they have with bringing down accounting rates?

If international termination rates are differentiated for fixed and mobile communications it raises a number of questions. First, does this imply that the prices end-users pay -- 'collection charges' -- to make international calls will also be differentiated? If this is the case how will operators signal this to international users? One of the major considerations in countries moving from RPP to CPP is being able to signal to users on fixed networks that they are calling mobile networks at a different rate. Second will telecommunication operators use the domestic mobile termination rates as a benchmark below which accounting rates can not fall? The trend in OECD countries is toward lower international settlement rates but this issue raises the possibility that some operators may argue for higher international termination charges.

If OFTEL's line of reasoning is correct and mobile operators do have monopoly power over termination charges, regulatory authorities need to be cautious in accepting higher international termination charges. It is arguable that termination rates for fixed-to-mobile traffic, in many countries, are far from being cost oriented and that normal competitive disciplines either do not apply or are insipid. In addition the termination charges or accounting rates for fixed networks are published by only a small number of OECD countries. Denmark, New Zealand the United Kingdom and the United States, are the only OECD countries to publish rates for traffic exchange with other countries. It has long been suggested that publication of these data by other countries would help to add greater transparency to international traffic exchange. In the new environment it would also assist policy makers and industry to better understand national traffic exchange between networks. This would certainly be the case if operators in some countries begin charging different rates for the termination of traffic on different networks. In this regard the OECD continues to recommend that Member countries give increased transparency to termination charges or accounting rates in markets where monopoly power exists.

PRE-PAID CARDS

The most recent OECD report, focussing wholly on mobile pricing, was prepared in 1995. Since that time the pace of innovation in pricing and billing has continued (**Table 16**). The major innovation in the pricing of mobile services has undoubtedly been the introduction of pre-paid cards. In prior years very few mobile operators were offering pre-paid service and none were offering pre-paid card service. In 1995, the first pre-paid card services were introduced in Germany and Switzerland.⁸³ These cards could not be recharged (*i.e.* they were disposable after use). The cards were also very expensive relative to standard mobile call charges and were aimed mainly at international business travellers rather than developing the domestic market.

In September 1995 Telecom Portugal (TMN) introduced the first mobile pre-paid card which could be recharged and made this feature readily accessible from automatic teller machines.⁸⁴ The impact of this service was immediately apparent with revenue from mobile services increasing 65% in 1996.⁸⁵ In 1997, TMN's number of subscribers grew by 129%, compared to 1996, and Telecom Portugal attributed this success achieved to their pre-paid products. By the end of 1997, 63% of TMN's customers used pre-paid products.⁸⁶ By June 1999, some 85% of TMN's users were pre-paid.

While Southern European countries were not the first countries to introduce pre-paid service, they were leaders in adapting the concept to card services. Telecom Italia Mobile (TIM), in Italy, followed TMN's innovation in pre-paid cards the following year. The impact in growing the Italian market was immediate during 1996 and further innovations followed in 1997. These included rechargeable cards for analogue mobile handsets and the introduction of international roaming. In Italy in June 1999, some 80% of TIM's users were pre-paid.

By 1997, most mobile operators had launched a pre-paid service in countries with CPP, but it is noticeable that the early adopters were mostly in countries that were not leading mobile penetration rates. In 1995, for example, Portugal's penetration was around half the OECD average and Italy about equal to the OECD average. Much of the tremendous growth in these markets, since that time, is attributable to the success of pre-paid cards expanding the attractiveness of mobile pricing. By June 1999, Italy had reached 42.8 subscribers per 100 inhabitants and Portugal 38.3 per 100 inhabitants. Both far exceed the OECD average of 26.8 mobile subscribers per 100 inhabitants at that date.

In Northern Europe, where penetration rates were much higher than the OECD average, mobile operators began to offer pre-paid card services in 1997. In Finland, which leads the OECD in terms of mobile penetration, Sonera launched its first pre-paid card in July 1998.⁸⁷ On the other hand, Radiolinja, the second largest mobile operator in Finland, did not offer pre-paid cards by July 1999. This suggests leading operators in Finland have felt less need to bring pre-paid cards to the market. That being said, pre-paid cards have proved popular in other Scandinavian markets with high penetration rates (**Box 8**). In 1997, Sweden's Comviq sold 190 000 pre-paid cards in the first nine months after the launch of the service.⁸⁸ In July 1999, Telia's Mobitel Refill card service had been in operation for 12 months. During that time Telia has sold more than 550 000 Refill cards.⁸⁹

Pre-paid service is an increasing part of the subscriber base of most mobile operators and pre-paid cards are the largest part of the market. In Norway, at the end of the first quarter of 1999, the number of

Telenor's digital subscribers was 1.4 million.⁹⁰ The net increase in that quarter was 139 000, of which 119 000 subscribed to the pre-paid service. In Spain, by June 1999, Telefónica had reached more than 3 million pre-paid users, representing almost 50% of the company's more than 6 million customers. At that stage more than three-quarters of Telefónica's monthly registrations were for pre-paid services.

Pre-paid service is also a growing part of the market in North America. Pre-paid service accounted for one quarter of AirTouch's net cellular and PCS subscriber gains in the second quarter of 1999.⁹¹ In Canada, in the fourth quarter of 1998, pre-paid mobile phone subscribers accounted for 42% of new subscribers added in the quarter.⁹² In the second quarter of 1999, 70% of those who bought Microcell's "Fido" PCS service chose pre-paid.⁹³ However, while pre-paid formed a growing part of the market, the overall growth rates in Canada and the United States were lower than in countries with CPP. This appears to be as a result of pre-paid cards being less attractive to users in markets with RPP. In addition some mobile operators in Canada have been reluctant to offer pre-paid cards.⁹⁴

Box 9. Pre-paid card use in Sweden

Tele2 was the first company in Sweden to launch a pre-paid card service in 1997 followed by Europolitan in the same year. Telia launched its pre-paid card service in July 1998. In 1997, a total of 235 000 pre-paid subscriptions were sold and in 1998 some 1 023 000. Over this time several innovations have been introduced as well as additional services being added to pre-paid card capabilities.

In a report prepared for the Swedish National Posts and Telecom Agency, two significant features of the pre-paid market in Sweden were noted.⁹⁵ First, that a relatively large amount of pre-paid cards are sold but not activated. Mobile operators in Sweden say that between 15 to 20% of cards sold are not activated. The most likely reason for this is that users are purchasing new cards for existing subscriptions and for subscriptions that have not been activated.

Second, although cards were originally intended for personal use by users making few calls and with an eye to more direct control over costs, they are also being used by business users. Swedish mobile operators reported that up to 15% of pre-paid cards are sold to companies. These operators report that the primary business users of pre-paid cards are in professional groups where incoming calls far exceed outgoing calls. The examples given were craftsmen and security guards.

Pre-paid card pricing structures

One trend that demonstrates the striking difference of pre-paid cards compared to traditional telecommunications, is that some mobile operators are willing to sell the pre-paid cards of other operators. In the United Kingdom, BT Cellnet sells the pre-paid cards of all four mobile operators.⁹⁶ BT Cellnet can do this because with pre-paid cards users do not pay a fixed monthly charge and do not receive a regular bill. Pre-paid cards operate in the following way. Users pre-purchase blocks of airtime via rechargeable cards or so called 'scratch cards', with numbers which allow them to access entitlements. This airtime must generally be used within a specific time. In countries with CPP the airtime must be used make calls within the period of the card's validity but operators frequently extend the time available to receive calls. If the card is not recharged, within a certain time, the user forfeits the use of the service including the telephone number. Some pre-paid cards still have restrictions on certain services that are available with traditional subscriptions, such as international roaming, but this is less and less the case. Although the per minute charge for airtime may be higher than a subscription package, the cost of entry for the pre-paid customer is lower.

The attractiveness of pre-paid cards for users is evident in a number of different facets. The most obvious advantage is that, without a fixed monthly charge, users have greater control over their costs. From the

perspective of operators, there are less customer acquisition and billing costs in servicing pre-paid card users. In addition, the advent of pre-paid cards has enabled mobile service to be available for many users who would not otherwise have had a credit rating sufficient to qualify for a traditional pricing package. In Australia, 40% of people wanting a conventional digital mobile service were refused because they could not meet the credit checks.⁹⁷ This led the Australian Government to note, after the introduction of pre-paid service in June 1997, that pre-paid service can meet the needs of those people because there is no credit relationship or billing system required.

Pre-paid cards are also attractive for users paying for mobile services for other users. For example, parents can purchase pre-paid cards for children and feel secure in the knowledge that they have the advantages of mobile service with known cost. In some countries mobile operators have specifically tailored packages aimed at parents with this application in mind. In Greece, Panafon markets *à la Carte Junior* with a handset designed for younger children.⁹⁸ With this handset children can dial a maximum of six predetermined numbers as well as free access to emergency numbers. Each key on the telephone has a different colour associated with a predetermined number. The price of calls is slightly lower than the least expensive off-peak rate for pre-paid cards but available at all times of the day. BT Cellnet's pre-paid card also has a noteworthy pricing feature. Under BT's 'Pay & Go' scheme users can nominate one fixed network number that can be called without charge. This means, for example, that parents might nominate a home number and there is no charge for children to 'phone home'.

A number of innovations have also been introduced in association with pre-paid cards. In Portugal users can top up their cards at automatic tellers. In Sweden users of Telia's Refill pre-paid cards can purchase additional airtime by making payment over the Internet. Telia encourage pre-paid card subscribers to use the Internet by offering an additional 15% airtime for payments made in this way.⁹⁹ In France, users can top up their card over a public phone with a credit card.

Pricing of pre-paid card service

The price of using pre-paid card services varies a great deal, across the OECD area, and there are several different ways comparisons between charges could be approached. Most mobile operators offer ready-to-go starting kits. These kits generally include a handset and SIM card. The average kit price across the OECD is USD 109 but they are available in Norway for USD 23 and in Sweden for USD 35 (**Table 17**). The comparison of the price of starting kits is not meant to be definitive. The price of kits can vary, of course, depending on the type of handset included. The prices shown in **Table 17** are for the lowest priced kit or the lowest priced handset sold by the mobile operator if this is done separately. In addition, it needs to be noted that kits usually contain a specific number of initial minutes or credited airtime. The actual duration of the time included in kits varies depending on whether they are used at peak or off-peak times.

To undertake a comparison of pre-paid airtime in the OECD area several different methods are possible. First, as there are no fixed monthly fees it is possible to simply compare the price per minute at peak and off-peak times. Even here there can be caveats. Although most pre-paid cards have no fixed charges there are exceptions. In addition, the times at which peak and off-peak rates are available vary considerably. For the comparison shown in Table 17, where different tariff options were available for pre-paid cards, the OECD chose the package with the lowest off-peak tariff. This is based on the assumption that most users of pre-paid cards are going to be making use of this service for personal rather than business reasons and are budget conscious.

The amount of time chosen for the OECD comparison was 30 minutes of airtime for a pre-paid user. The assumed usage pattern was based on 20% of calls being made at the peak rate or the long distance rate, 40% at off peak or local rate and 40% at the least expensive rate (e.g. lowest off-peak or weekend). The

results of this comparison show Telecom Iceland and KPN have relatively inexpensive options for this usage pattern. The average price in the OECD area for 30 minutes of service for pre-paid cards is USD 13.43.

Vodafone, in the United Kingdom, is also shown with an inexpensive rate for pre-paid service but the product is not strictly comparable to the others. Vodafone's pre-paid card service works in a different way to other services. To use Vodafone's service a user needs to purchase a service and calling credit option. A user can choose the length of service ranging from two months to 12 months. The price increases with the length of time and amount of airtime. Whereas other pre-paid cards offer airtime equivalent to the face value of the card, Vodafone's pricing structure is akin to having a fixed charge (top-up cards can be purchased with airtime equivalent to the face value).

Vodafone's off-peak rate is the least expensive rate that can be accessed by a pre-paid user. However, if the full amount of fixed charge was levied on the OECD's 30-minute comparison the true cost to the user would be USD 0.70 per minute instead of USD 0.07 per minute at off-peak times. Vodafone's pricing structure is aimed at users who are going to have a higher usage pattern than 30 minutes and is not comparable with the other pre-paid cards shown. The charges of Orange do have a comparable pricing structure to the other operators and are a better representation of the price users might pay in the United Kingdom. However it is noticeable that Orange limits the duration of calls to only one month. This means that even though there is no fixed charge a user has to buy a card every month for continuous service.

The lowest per minute rate for a pre-paid card is TIM's lowest off-peak rate of USD 0.07 per minute in Italy and Vodafone's off-peak rate of USD 0.07 in the United Kingdom. There are significant differences. As noted Vodafone's prices exclude a service charge. In addition, Vodafone's off-peak rate is available from 18:00-8:00 Hours, whereas TIM's lowest off-peak rate is from 22:30-7:30 Hours. On average users pay USD 0.40 per minute at off-peak times (*i.e.* 20:00 hours). The peak rates shown are those for packages selected on the basis of having the lowest off-peak prices. Therefore the peak rates are generally the highest tariffs in place for pre-paid cards.

It is also possible to spread the cost of pre-paid card kits over a certain number of minutes. The figure of 1 080 minutes was chosen to reflect a usage pattern of 30 minutes per month over three years. It was assumed, once again, that 20% of calls were at peak times and 80% at off-peak times. In this example the average per minute price was USD 0.49 per minute. Poland has the most expensive rate, in this comparison; USD 1.07. It is worth noting that Poland has the longest waiting list for a fixed line connection in the OECD, and some users may see this as an interim option until they receive a fixed connection. In countries with CPP and long fixed line waiting lists, such as Poland, users may be prepared to pay a premium in the knowledge that they can receive incoming calls without additional charges.

The value of pre-paid cards, in terms of users being able to receive calls in markets with CPP, needs to be taken into account. In markets with CPP, users can receive calls on these cards without direct payment. With traditional mobile subscriptions, in CPP markets, users did not make direct payments to receive calls but did contribute to meeting this cost via a fixed monthly charge. As noted from the experience in Sweden, this makes pre-paid cards very attractive for users that have a high proportion of incoming calls. The opposite impact, however, may be found in countries with RPP. This is because the users of pre-paid cards generally make few calls (if they start making a significant amount of calls traditional tariff packages are generally more economic). Accordingly, if a user purchases a small amount of airtime, in a market with RPP, they have to budget this airtime to include incoming calls.

Card validity

An important aspect of pre-paid card service is how long the cards remain valid. Most operators limit the duration of the card's validity from the date of the first call. In other words users can make and receive calls for a certain number of days or months after which they must renew their card. EuroTel, a mobile operator in the Czech Republic, sells pre-paid cards with a duration of 18 months for making calls. The benefit of a long card validity time is reflected in the high kit price charged by EuroTel. It is worth noting that the Czech Republic has the second longest waiting list for a fixed line connection in the OECD. As in Poland, some users in the Czech Republic may see this as an interim option until they receive a fixed connection.

In Austria, PTT allows users to make calls for up to 13 months. In Germany, Italy, Norway the Netherlands and the United Kingdom some operators allow users to make calls for up to 12 months. At the other end of the scale some mobile operators in Belgium, Ireland, New Zealand, France and Japan limit the validity date for making calls to just two months after the first call is made. In a large number of other countries, such as Australia, Canada, Luxembourg, and the United States, some operators limit making calls to three months. Significantly the duration of card validity has become an element of competitive service. In August 1999, Airtouch increased the duration of their pre-paid card from three months to six months in the United States.¹⁰⁰ France Telecom extended the duration that cards are valid to receive calls to six months in mid-1999.

It is also the case that in some of countries, where cards of relatively short duration are the norm, the validity date can depend on the price of the card. In other words a higher priced card (*i.e.* with more usage time included) often carries a longer validity date. In the examples given in **Table 17**, the option with the longest duration was chosen in these instances. The only operator that does not place a restriction on the duration of a pre-paid card's validity is Swisscom. The main difference between this pre-paid option, and those of other operators, is that Swisscom charge users for incoming calls. Thus although Switzerland has a CPP structure for mobile pricing, Swisscom's pre-paid card operates with RPP.

In around two-thirds of OECD countries mobile operators set the same duration on cards for making and receiving calls. In other countries mobile operators give a longer duration for receiving calls than making calls. In these cases, a user may be able to continue to receive calls for several months even though the time limit on making calls has expired. In Germany and the Netherlands, users can continue to receive calls for three months after their right to make calls has expired. The benefit to the user of being able to continue to receive calls only applies, of course, in countries with CPP.

The length of time allowed by operators for users to make and receive calls is an important element for any comparison of the value of different offerings. There are definite advantages to users of services providing a longer duration. If the lifetime of a card with a relatively short duration expires prior to the use of call time then it may penalise users. On the other hand a number of mobile operators allow users to carry over unused call time to their next card. This eliminates the downside of pre-paid service, which is that it is sometimes difficult for users to optimise their entitlement. Being able to carry over credits, under a pre-paid service plan, is an extremely important element of service. Another aspect of service is the duration of the lock on SIM Cards sold in pre-paid kits (**Box 9**).

In some countries, there is regulation for fixed and mobile networks concerning the terms under which disconnection can occur and in respect to access to emergency numbers and so forth. The terms and conditions for pre-paid cards in this respect vary widely across the OECD and some selected examples are given in **Table 18**. It is a significant public service that most pre-paid cards offer free calls to emergency services, and that this generally continues even when the airtime allowance has elapsed. That being said Telsim charges users for calls to emergency numbers offered by Turk Telecom.

Box 10. Lock-In

With some mobile systems there can be country locks, network locks, provider locks and SIM card locks.¹⁰¹ An earlier regulatory concern with mobile communications was whether 'locking handsets' was anti-competitive. In some cases service providers were reported to be permanently locking handsets.¹⁰² In 1996 regulatory authorities took the view that locking the SIM cards in handsets made it harder for users to switch service suppliers.¹⁰³ On the other hand some mobile operators argued that locking SIM cards provided greater security for consumers because a lost or stolen handset could be remotely disabled. In the United Kingdom up to 45 mobile phones are mislaid on London's buses and trains every day.¹⁰⁴ In 1999 the number of mobiles phones separated from their owners on public transport in the United Kingdom looks likely to hit 13 000 compared with the 11 000 umbrellas lost in 1998. Mobile operators in some countries also said that locking SIM cards was necessary to ensure the retention of customers receiving subsidised handsets. The latter practice varies from country to country. In some cases, such as Finland, regulatory authorities prohibit operators from locking SIM cards. This deters mobile operators from subsidising handsets. In others countries handsets are sometimes available for as little as USD 1 in return for a long-term service contract with a locked SIM card. In these cases users pay higher usage charges over the contract period.

Concern has tended to lessen in respect to this issue as the price of handsets has fallen and some mobile operators advertise the duration of the 'lock-in' period. In France, for example, the phones contained in France Telecom's "Mobicarte" kits can only be used on their network. France Telecom will supply the unlocking code on request. A charge of USD 66.35 is made for this service during the first six months following connection, it is free of charge thereafter.¹⁰⁵ Unlocking of the Mobicarte kit for use with a different France Telecom mobile service is free of charge. Models such as France Telecom's are based on industry discussions with the EC Directorate General for Competition on this issue.¹⁰⁶

Pre-paid cards, called and receiving party pays

The only country in which CPP is the norm but which uses RPP for pre-paid cards is Switzerland. All other countries place a limit on the duration of cards. In countries with RPP users of pre-paid cards pay for outgoing and incoming calls (with the exception of calls to emergency numbers). For example, users of Airtouch's pre-paid cards pay USD 0.35 per minute whether they are the called or calling party. However, an increasing number of mobile operators in the United States are offering the first minute of a call free to the receiving party. The reason they are doing this is to overcome the resistance on the part of some users to accepting calls when the receiving party pays part of the cost of the call. An alternative strategy is that of Bell Atlantic, where mobile customers are offered the possibility to pay USD 10 per month in addition to their tariff plan. In return there is no charge for calls made to or from other Bell Atlantic Mobile cellular phones while both are in the Washington/Baltimore calling area.¹⁰⁷

One of the advantages of pre-paid cards is to an extent negated by RPP. For many users of pre-paid cards the main advantage is greater ability to control expenditure. For these users one drawback with RPP is that unless they switch off their handsets, users are required to pay for incoming calls from their allowance. As mobile communications have shifted from being primarily a business service to one of personal use, resistance to RPP appears to have grown. This seems to be one explanation for why the growth rates for countries with CPP have markedly outstripped those with RPP in recent years.

A critical factor in countries with RPP is that users have to budget pre-paid airtime for incoming as well as outgoing calls. This factor may not be as much of an obstacle for pre-paid cards for other pre-paid options. For example if a user runs out of time on a pre-paid card they can purchase a refill, in markets with RPP and CPP, assuming that this is conveniently available. However in the case of relatively small amounts of monthly pre-paid airtime the rates increase substantially after the inclusive airtime has been consumed. Accordingly, users pay higher rates if they do not budget their airtime to allow for incoming and outgoing calls. For example a Powertel user in the United States can prepurchase 100 minutes for USD 20 per

month or 200 minutes for USD 30 per month. This works out to an effective per minute rate of respectively USD 0.20 or USD 0.15 per minute. However users pay USD 0.35 for every additional minute over their inclusive allowance.

The perceived resistance of prospective mobile consumers to RPP, in terms of the pre-paid market, has led many mobile industry operators to call for the implementation of CPP. This is based on the belief that growth rates will be considerably strengthened. The evidence from OECD countries is limited because most are started from a CPP regime. When EuroTel introduced the option of CPP in the Czech Republic in 1996 it coincided with a very large increase in the mobile penetration rate. More recently, in May 1999, Mexico shifted to calling-party-pays regime and has also recorded record growth in subsequent months.

SHORT MESSAGE SERVICE

The Short Message Service (SMS) is the ability to send and receive text messages to and from mobile telephones. SMS messages can be up to 160 characters in length. The first SMS was reported to have been sent from a PC to a mobile terminal in 1992.¹⁰⁸ Popularity of the service has, however, only recently burgeoned. One reason for this is that mobile operators have not, in the past, strongly marketed this service. Until recently mobile operators have viewed themselves as being in the voice telephony business with short text messages being part of the paging business. From this perspective it would seem to have made little sense to market SMS, ahead of voice, and against a very competitive paging sector in OECD countries.

In April 1999, users in Europe sent more than one billion SMS messages and some operators were reporting 800% increases in the number of messages over the previous year (**Table 19**). Several factors have combined to raise the profile of SMS. These include technological developments, Internet expansion, the changing profile of mobile users due to pre-paid cards, rapidly increasing applications for electronic commerce and the fact that the service appears to be superseding paging as mobile penetration rates increase.

The capabilities of mobile handsets have evolved such that they can send and receive SMS (older handsets were sometimes 'receive only'). This means that mobile handsets can not only be used for 'broadcasting' data services (such as stock market quotes or sports results) but also for users to compose and send messages. This means users can utilise SMS in those circumstances where there is an advantage to using text instead of voice or in addition to voice. These can include situations when the use of text is less intrusive, or more private, through to locations where it is difficult to hear a voice conversation. SMS can also be combined with other voice services. When combined with cellular Voice Mail, SMS lets users key in a call back number as well as leave a voice message. The call back feature then automatically displays the number on the handset screen.

Beyond the evolving capabilities of mobile communication technology the expansion of the Internet has put the means to send an SMS into the hands of vastly more users. In other words the number of potential users is not only increasing in proportion to the growth of mobile subscribers but also from every PC connected to the Internet. This means the positive externalities ascribed to increasing access to any network are 'snowballing'.

The capability to link the Internet to SMS has prompted a growing number of operators to place SMS on their Websites. For example, users of BC TEL Mobility's Website, select 'Send-a-Message', type in a digital mobile phone number followed by a message.¹⁰⁹ BC-Tel's digital mobile customers automatically receive an email address (*e.g.* 604290xxxx@message.bctm.com). Anyone with a PC connected to the Internet can then send messages directly to the email address of these BC-Tel customers. Operators in the United States are adopting similar practices. For example, all Omnipoint subscribers are automatically assigned an Internet address (Your Omnipoint phone number@omnipoint.net).¹¹⁰ In this way, computer users around the world with Internet access can communicate directly with users having an Omnipoint handset. On many other operators' Websites, such as Belgacom's, users simply input the telephone number.¹¹¹

Mobile operators, such as Sonera in Finland, are offering an increasing range of services related to electronic commerce including mobile banking.¹¹² SMS is also being increasingly used for some electronic commerce applications. These include payments, job despatch, remote point of sale, remote monitoring (e.g. monitoring vending machines) and so forth.¹¹³ Mobile workers can send messages to their office (e.g. “task #123 complete en-route to next”). Offices can send information to mobile workers such as for pick up and delivery addresses. This information can be combined with information from other sources, as in the following example,

“The Short Message Service is ideal for sending Global Positioning System (GPS) position information such as longitude, latitude, bearing and altitude. GPS information is typically about 60 characters in length, leaving room for other information such as the vehicle registration details, average speed from the tachometer and so on to be transmitted as part of the same short message. Because the position updates are automatically generated, mobile network operators find that vehicle positioning applications are amongst the leading generators of short messages.”¹¹⁴

Placing the growth in access to SMS and new applications to one side the main driver of SMS take up is undoubtedly due to the changing profile of mobile users. Innovative tariff options have brought a lot more young people, and users who are budget conscious, into the market for mobile service. Pre-paid cards are the most obvious example of a tariff option, which has stimulated the use of SMS. Industry analysts report the SMS service is popular with young users who quickly learn to use the technology and are adept at using keypads to originate messages. In addition the price of sending an SMS is, in many instances, much less than a voice call.

One analyst has reported that an increase in SMS traffic of 100% (sometimes more) is not unusual when SMS for prepay is introduced.¹¹⁵ As such it is perplexing that some Mobile Operators do not offer SMS as an option for pre-paid customers. The link with pre-paid cards is evident from analysis of usage by subscribers to different tariff plans (Table 19). In February 1999, Vodafone’s pre-paid customers sent an average of 16 SMS messages per month. By way of contrast customers subscribing to more traditional post-paid services sent an average of only 2.1 messages per month. Clearly, SMS is far more attractive to customers using pre-paid cards than users of more traditional tariff structures. This raises the issue of how SMS pricing is evolving.

SMS pricing

In Europe the most common method of charging for SMS is a per message rate. Under this system users pay an individual charge for each message sent and there are no separate subscription or connection charges. The charge does not vary with the number of characters, with the limit, in most cases, being 160. There is no charge to receive a message. In the European Union area the average price to send an SMS message is USD 0.16 (**Table 20**). Mobile operators in Australia, New Zealand and Korea also have this pricing structure.

By way of contrast a number of mobile operators in Canada, Japan, Mexico and the United States sell SMS as a value-added service. In these countries, users pay an additional fixed monthly charge for the right to send a certain number of messages or unlimited messages. The price of the fixed charge ranges from USD 0.55 in Japan (NTT Docomo), USD 1.67 in Canada (Microcell-Fido), USD 5 in the United States (Powertel) to USD 8.40 in Mexico (Telmex). The Canadian and Mexican offers are for an unlimited number of messages. Powertel’s service includes 200 messages per month (users pay USD 0.10 per message after this level). On the basis of 200 messages per month the charges in these countries are the equivalent of between USD 0.01 and USD 0.06.

There are generally no differences in the price of sending SMS for a pre-paid or a post-paid customer. Telecom Iceland is one mobile operator that does differentiate the pricing of SMS service in this manner. For a 'pre-paid user' Telecom Iceland charges USD 0.11 per SMS message sent. For a pre-paid customer the first three SMS messages within 24 hours are free, after which a user pays USD 0.17 for every additional message sent.

SMS pricing: Comparisons and implications

Several approaches can be taken to comparing SMS prices across the OECD area. One method is simply to compare the pricing of countries with a per message rate. Under this comparison Korea, Denmark and Germany are the leaders with respective rates of USD 0.03, USD 0.05 and USD 0.07. At the other end of the scale are operators in Hungary, Sweden and Austria, and Ireland where the price is higher than USD 0.25. Even within this comparison, limited to per message rates, the range of SMS pricing is extremely large.

Another approach is to compare the prices of all operators over different numbers of monthly messages, namely 10, 50, 100 and 200. Under this approach, for 10 messages per month, Japan still has one of the least expensive rates in the OECD and Canada's rate is around the OECD average. For a user sending only 10 messages per month charges in Mexico and the United States are much higher than in countries with per message rate charging. However it is unlikely that a user would take the service only to make a small number of SMS each month. As users begin to make greater use of the service the flat rate options come strongly into their own. Whereas a user in the United States would pay USD 5 for between 100 to 200 messages, a user in Sweden would pay from USD 29 to USD 58 for the same service.

The most striking thing about SMS pricing is the similarities to Internet access pricing for dial-up users in different regions. In North America flat rates are the norm and, many argue that this structure has encouraged faster take-up of service and greater consumer use of electronic commerce. At the same time, it might be challenging to market an 'Internet like' service with traditional mobile pricing in North America. On the other hand, users in Europe are accustomed to paying prices that increase with usage. The European pricing model is an inheritance from measured voice service and is based on the notion that users are predominantly sending messages to other users (*i.e.* telephone network pricing was developed for voice calls between users not Internet access). Accordingly, some may see the comparisons between North American and European pricing as superfluous based on the view that users will only send a relatively small number of SMS to other users. However, it is necessary to take into consideration how patterns of use, and incentives to develop services, will occur under the different pricing regimes.

It is true that at very low message rates the different approaches to pricing do not make a large impact -- in the same way that different ways of charging for a three-minute telephone call did not make a large impact before the Internet. One example of a service which might generate many messages with the North American pricing model is 'hz.com' (**Box 10**). The free information applications available from this provider range from practical business and personal services, through to entertainment.¹¹⁶ Under North American 'unmeasured pricing' a user will most likely interact with, and use, such services a great deal more than a user with measured pricing.

Of course many mobile operators are offering similar information services. The main difference is that mobile operators charge for these value added services, in addition to their carriage charges, whereas there are many free information services on the Internet. This reinforces a point that fixed network operators have encountered with the onset of the Internet, but which is only just beginning to impact on mobile operators. Once a network is connected to the Internet it is no longer possible for an infrastructure

provider to act as the sole gateway to information services. This means the infrastructure provider is no longer the only actor setting the price for accessing value added services.

The other factor likely to be significant in the pricing of mobile access to e-commerce services will be the role of RPP. While the trend for voice services is toward CPP, in OECD countries the balance of traffic will be a consideration for IMT-2000 networks. Currently the 160-character limit on SMS messages means there is not an imbalance in traffic sent and received by users. In future, a simple request such as the one used by 'hz.com' may generate larger data flows from the service provider to the user. This means that current retail and network pricing approaches, such as calling party pays or sender-keep-all will be subject to increasing scrutiny by mobile operators.

As SMS and other mobile data services emerge, the structure of pricing will need to evolve to suit the demands of the market. At this stage regulatory authorities should take the view that these prices are initial offerings and competition will gradually discipline higher prices for different levels of usage irrespective of the underlying structure. This trend was clearly evident in the first offerings of Internet Service providers for dial-up Internet access. In 1995, the initial ISP pricing of these accesses services was as diverse as SMS pricing is in 1999. As ISP services became more widespread, and new competitors entered different markets, prices quickly fell across the OECD to a more uniform level. Accordingly current practices of the same company charging three times the amount for SMS service in one country than another should quickly disappear. Nevertheless, the current differences in European charges will invariably give rise to concern that the SMS rates in some countries are high because there is insufficient competition. The pricing structures, and level of pricing, will also be critically examined to see if they promote or form barriers to electronic commerce. Two areas of particular interest will be the SMS and roaming, and SMS and the Internet.

Box 11. SMS Messaging and 'hz.com'

By using a digital mobile handset to send SMS commands as an e-mail message to pi@hz.com, users can request information from 'hz.com'.¹¹⁷ The 'hz.com' service is free of charge. The user therefore pays his or her mobile company for sending an SMS e-mail. As incoming SMS is not charged for, by mobile operators, the user does not pay for receiving messages.

Auctions: Users can check on a current bid, number of bids, highest bidder and how much time is left in an auction from e-commerce businesses like Amazon and Ebay. The system also indicates if the reserve has been met or not if it is a reserve price auction. By including the agent option the system will automatically track the progress of the auction until completion and send a message when new bids are received and when the auction ends.

Parcel tracking: Users can check on the status of package delivery by Federal Express. If the agent option is included the service will track the status of the package and send a message whenever there is a change. The system will continue to track the package until it is delivered.

Flight information: Users can request information about a specific flight. For example, if a user was interested in the next available flight between San Francisco and Denver Airport they would use the command: **NEXTFLIGHT SFO: DEN**. The user would then receive back a list of available flights and if available the lowest price ticket.

Stock Market: Users can track quotes and prices with a 20-minute delay. Up to five stocks can be requested in a single message.

Weather: Users can retrieve information for a particular city or country around the world.

Others: Users can send messages to request functions such as those provided by a Calculator or Dictionary. For example the message **CALC 74.50*1.2/4**. Would return a message saying: **CALC: 74.50*1.2/4=22.35**. Information can also be received on lottery results, dates, times, television programmes and so forth.

International SMS and roaming

Where SMS pricing is not always clear is in respect to roaming and for the reception of messages from other networks. Generally operators have little or no information available on the pricing of SMS roaming in their pamphlets or on their Web pages setting out tariffs. One analyst who has studied SMS pricing says that "...network operators typically charge the same to send a short message to someone in the same room as they do to someone travelling overseas with their mobile phone."¹¹⁸ In the United Kingdom, BT Cellnet's charges for SMS do not vary if the customer is sending a message from a domestic location to any other location. In other words a user can send an SMS message to another user in the United Kingdom or elsewhere for the same charge of USD 0.17 per message. By way of contrast Telefonica charges USD 0.19 to send an SMS domestically but USD 0.76 to send an SMS to an international location.

BT Cellnet users can also receive SMS messages at no charge whether they are in the United Kingdom or roaming in another country. Radiolinja, in Finland, also offers users the ability to freely receive messages whether they are in Finland or roaming in another country. As with BT Cellnet the price to send an SMS does not vary from USD 0.14 whether the user is located in Finland or roaming. To the extent that this experience can be generalised across OECD countries, SMS pricing is a relatively inexpensive way for users to communicate when travelling. It enables all the functionality and convenience of SMS service, with additional advantages such as being able to communicate as convenient across different time zones.¹¹⁹

Accordingly, the available information appears to indicate that most operators do not vary the price of sending an SMS from a domestic location. They also do not vary in offering free reception of SMS, whether the user is at a domestic or foreign location. However, where charges do vary with SMS is for users sending messages from an international location. Radiolinja is one mobile operator that publishes the price of sending an SMS to Finland from a foreign location, when one of their users is roaming.

The most striking feature of SMS pricing is that it can cost a Radiolinja user much less to send a message, while roaming in a foreign country, than if the user was in Finland (**Table 21**). For example if a Radiolinja user was roaming in Australia and sent an SMS to a user in Finland it would cost USD 0.10. Yet, the price for two users in Helsinki to exchange an SMS is USD 0.14. An SMS sent by a Radiolinja user roaming in Denmark (USD 0.08) or the United Kingdom (USD 0.08) and a number of other countries, costs much less than an SMS sent and received within Finland. At the same time the Radiolinja user can often send SMS messages back to Finland much less expensively than two users can send SMS domestically in some countries.

This situation occurs where the foreign network charge for sending an SMS is less expensive than Radiolinja SMS rate and the foreign operator does not differentiate that charge for a foreign destination. Another factor can be the relative strength of currencies. The Radiolinja user pays for the service in Finland even though it is consumed in a foreign country. If the currency of the foreign operator is weaker than the Finnish currency, then the cost to a Radiolinja roamer of sending an SMS from a foreign country to Finland can be less than sending a message within Finland. The situation for Radiolinja would not be very different from that of other operators. This is because "postalised" rates, (*i.e.* rates that are uniform irrespective of distance) for SMS are the most common method of pricing.

SMS and the Internet

An area where SMS pricing can be unclear is for messages sent from the World Wide Web to cellular mobile users. For Internet users, in most cases, there is no cost to send SMS messages to a mobile subscriber. As noted above a growing number of mobile operators have a Web page that enable any user with access to the Internet to send an SMS message to one of their subscribers. In mid 1999, the only

mobile operator that charged for sending SMS messages to their mobile customers from their Website, was France Telecom's Itineris service.¹²⁰

In August 1999 France Telecom charged users USD 4.30 per month for the possibility to send five SMS messages per day from their Website to the company's mobile subscribers. The service was known as "Mini-Mess@ge". The charge represented an average cost of USD 0.03 per message if the full monthly entitlement was used. If the person sending the message copied more than one mobile subscriber on the same SMS, their credit decreased by an additional USD 0.03 for each user copied. Any unused portion of the daily allowance was forfeited. France Telecom called the 'Mini-Mess@ge' service a trial, so it was unclear, at the time of writing, if the pricing structure would continue in that form.

The pricing of the France Telecom trial is interesting in a number of respects, both from the perspective of users and mobile operators. First, it is contrary to most Internet user's expectations that they can send and receive messages, via interaction with the World Wide Web, without additional charge. Users are also not accustomed to paying more for copying additional users on e-mails. Nor, with the possible exception of action against 'spam', are users accustomed to being subject to limits on the number of messages they can send per day or forfeiting entitlement if not used within a day. At the same time subscribers to a communication service are not usually in the situation of having their individual correspondent's ability to send them messages capped. Nor are they generally limited to sending message to only one network (*i.e.* the same Website can not be used to send messages to the users of other mobile networks).

On the other hand it is also interesting to look at SMS from the perspective of mobile operators. Unlike ISPs, mobile operators almost always charge for voice and data services. An ISP would generally not differentiate their charge for Internet telephony, e-mail or browsing the World Wide Web. By way of contrast a Mobile Operator would not only charge for voice and data services, but would also charge different rates for these services. Accordingly, as mobile communication and Internet services converge they bring with them two fundamentally different approaches to pricing communication services.

While the eventual pricing of new 'Internet-like-services' is unclear they are much more likely to be demand led than in times past. This is because mobile communication markets are being increasingly liberalised throughout the OECD area. Whereas a monopoly operator could impose a particular pricing structure on a market, this likelihood decreases with liberalisation. In the case of the trial linking France Telecom's mobile service to the Internet, France Telecom had to consider that its largest cellular mobile rival offers this service free of charge. Any user, around the world, with access to the World Wide Web can send an SMS message from the SFR Website to an SFR subscriber. This service is without additional charge to either the SFR user or the Web user. In addition the Web users were not limited in the number of messages they could send to the SFR subscriber.

The France Telecom's approach, with its Mini-Mess@ssage service, is to act as the gateway between the World Wide Web and the 7 million subscribers to its mobile network. By way of contrast there are also some Websites, which allow users to send SMS to multiple networks. MTN, a mobile company in South Africa, has a Website that enables users to send SMS to over 50 networks around the world.¹²¹ MTN does not offer SMS connections to all mobile networks around the world. Since the beginning of the MTN service the list of corresponding networks has changed considerably. Some networks have been withdrawn from the free SMS service, although MTN still has roaming agreements with these networks, and others have been added.

The blocking of SMS from MTN's Website is presumably due to the fact that some operators would prefer people to use their 'Website SMS gateways'. Sonera is one company that began blocking traffic from MTN. Sonera says they do this because they do not receive revenue for carrying this traffic.¹²² The reason for this, according to Sonera, is that the SMS signal is only registered at the point at which it enters a

network. It is not registered again irrespective of how many networks it crosses. Accordingly, only the originating network has the potential to bill the customer. This means, in practice, that SMS has a sender-keep-all arrangement for financing traffic exchange. This is the reason that most mobile operators do not charge a different rate for sending SMS internationally from their national rate.

As most mobile operators do not specify that there is a fee to receive SMS messages, even when roaming, neither the sender nor receiver of the MTN SMS is paying directly for this service. This means, for example, that a user anywhere in the world with an Internet connection can send a message, via MTN's Website in South Africa, to a mobile subscriber on SFR's network in France. They would do so without charge, and SFR's subscriber would not be charged.

It could, of course, be argued that mobile users subscribing to a tariff plan, with a fixed charge, are indirectly paying for the ability to receive messages. Even here there do seem to be anomalies. For example the MTN site enables Internet users to send, without charge, an SMS message to the cellular mobile customers of Swisscom. Swisscom charges its subscribers for sending but not receiving SMS messages. Moreover Swisscom's pre-paid mobile card tariff plan is exceptional in that it has no time limitation. This difference is due to Swisscom subscribers also paying for incoming voice calls. As Swisscom's pre-paid users are not paying to receive SMS messages, and do not face a time limitation on their pre-paid cards, there is not a contribution from a fixed charge.

There may be payments generated by SMS traffic between mobile operators depending on roaming or other traffic exchange agreements they negotiate between themselves. However most are believed to be sender-keep-all. Other sources of revenue are opened by the convergence with the World Wide Web. For example, one company in Switzerland is offering advertisers the opportunity to sponsor SMS for a particular country or network. While the company proposes the service would be free for users, advertisers would pay USD 0.06 per message to insert additional text.¹²³ At the same time SMS may attract similar problems to the Internet such as 'spam'. This has caused some operators to block SMS messages from certain networks.

SMS and access

In mid 1999 a high profile debate was occurring between certain communication service providers over instant messaging over the Internet (*i.e.* the dispute between AOL and Microsoft). A parallel debate was emerging in some countries in respect to SMS over mobile networks. In Switzerland two mobile operators were reported to be in dispute over the transmission of SMS.¹²⁴ According to news reports, Swisscom blocked the SMS service to DiAx, from its mobile users. However, it was also reported that DiAx had managed to find a way of transmitting SMS messages to Swisscom customers. At this time Swisscom did enable its users to send SMS to Orange, the third mobile operator to enter the Swiss market. Moreover news reports indicated that Swisscom had configured public payphones to send SMS but only to its own mobile network. Other players in the Swiss market adjudged this to be anti-competitive and an abuse of monopoly power. On the other hand as SMS was not considered as a basic telecommunication service in Switzerland it was arguably not within the regulator's power to take action. In October 1999, Swisscom unblocked the ability of its customers to send SMS to DiAx users. This case is worth highlighting, not just because of the familiar competition issues involved, but because of the issues it raises for interconnection of different networks at a time of convergence.

IMT-2000 LICENSING UPDATE

IMT-2000, the international mobile telecommunications system utilising frequencies around 2000 MHz, is the third-generation mobile telecommunications system aimed at providing global access and multimedia communications. It is also called UMTS (universal mobile telecommunications system) in Europe. Another common term is '3G' standing for the third-generation mobile phone system.

Two general approaches can be observed among the Member country policies on IMT-2000 (**Table 22**). European countries and Japan take an approach where the government assumes a role of planning and scheduling a co-ordinated introduction of the commercial services. In Europe, there is also an EU Decision that directs the EU Member States to establish an authorisation system for UMTS by the end of 1999 and to introduce the UMTS services by 1 January 2002 in their territories.¹²⁵

The second approach, which relies more on market forces, is evident in countries such as Canada, New Zealand and the United States. The governments in these countries do not set timetables and co-ordinate specifically the introduction of IMT-2000 services in their markets. They leave the timing of service commencement and the number of operators up to the market forces and the operators' decisions.

In addition, there are countries (Australia, Hungary, Iceland and Ireland) whose policy is yet to be developed. It should be noted that some countries (Austria, Belgium, France, Ireland, Portugal, Sweden, and Switzerland) are in the public consultation process, and therefore their policies are provisional as of the beginning of September 1999.

Commencement of service

Japan is going to launch commercial IMT-2000 services in 2001, which may be the first in the world. In Korea the deadline for bids is September 2000, with the winning bidders to be unveiled in December 2000, and full start-up due at end-2000.¹²⁶ European countries (Austria, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, and Switzerland) aim to introduce the commercial services by 1 January 2002, in compliance with the EU timetable for their Member States. Italy, having a reservation to the EU decision, might postpone for one year the start of authorisation procedures. This is due to a problem of clearing the already occupied frequencies to be utilised for UMTS. On the other hand, Canada, New Zealand and the United States have left these decisions to the existing and potential PCS operators expecting that they will upgrade their systems in response to consumer demand.

Number of operators

Regarding the number of players to compete in each market, European countries (Austria, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, and the United Kingdom) plan to have as many national operators as the technical availability of the frequency can accommodate. This is expected to be between three to five national operators. In these countries a decision in favour of allocating national licences has been taken. On the other hand, Japan and Sweden plan to licence regional operators with up

to three operators per region based on spectrum availability. Canada, New Zealand, and the United States do not plan to pre-designate the number of the operators.

Method of allocating licences

Finland has already awarded four national licences for IMT-2000 through a comparative tendering process. It is the first country in the world to have awarded IMT-2000 licences. Some other European countries (Denmark, France, Italy, Norway, Poland, Spain, Sweden) and Japan also plan to use comparative tendering as a method to allocate licences for IMT-2000. Other European countries (Austria, Germany, Netherlands, the United Kingdom) and Korea plan to use auctions.

Canada, New Zealand and the United States will not create a specified licence for IMT-2000; rather, they will allow incumbent PCS operators to upgrade their systems to IMT-2000. These Member countries have used auctions for allocating spectrum that can be used for mobile services.

Table 2. Pre-paid users in selected Europe mobile operators, June 1999

Country	Operator	Pre-paid Subscriptions (%)	Country	Operator	Pre-paid Subscriptions (%)
Austria	MaxMobil	40	Luxembourg	P&T	NA
Austria	Mobilcom	NA	Luxembourg	Millicom	24
Austria	One	NA	Netherlands	KPN	44
Belgium	Belgacom	20	Netherlands	Libertel	52
Belgium	Mobistar	NA	Netherlands	Dutchtone	Majority pre-paid
Czech Republic	EuroTel	NA	Netherlands	Telfort	Majority post paid
Czech Republic	RadioMobil	NA	Netherlands	Ben	NA
Denmark	TeleDanmark	NA	Norway	Telenor	36
Denmark	Sonofon	30	Norway	Netcom	38
Denmark	Mobilix	60	Poland	Centertel	NA
Denmark	Telia Denmark	NA	Poland	Era	23
Finland	Radiolinja	0 (Pre-paid service not offered)	Poland	Plus	25
Finland	Sonera	NA	Portugal	TMN	85
Finland	Telia Mobil	NA	Portugal	Telecel	72
France	France Telecom	NA	Portugal	Optimus	80
France	SFR	NA	Spain	Telefonica	49
France	Bouyges	30	Spain	Airtel	40
Germany	T-Mobil	12	Spain	Amena	NA
Germany	Mannessmann	15	Sweden	Telia	20
Germany	E-Plus	25	Sweden	Europolitan	17
Germany	Viag	NA	Sweden	Comviq	51
Greece	Panafon	45	Switzerland	Swisscom	38
Greece	Telestet	44	Switzerland	DiAx	NA
Greece	Cosmote	26	Turkey	Turkcell	3
Hungary	Westel	NA	Turkey	Telsim	NA
Hungary	Pannon	10	United Kingdom	Cellnet	28
Iceland	Iceland Telecom	14	United Kingdom	Vodafone	46
Iceland	TAL	19	United Kingdom	Orange	31
Ireland	Eircell	NA	United Kingdom	One2One	46
Ireland	Esat	NA			
Italy	Telecom Italia Mobile	80			
Italy	Omnitel	NA			
Italy	Wind	NA			

Source: Public Networks Europe (Vol. 9 No 8, September 1999).

Table 3. **Mobile cellular subscribers in OECD countries**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	Jun-99
Australia ¹	184 943	291 459	440 103	682 000	1 096 836	1 920 341	3 882 097	4 748 477	5 858 000	6 426 000
Austria	73 698	115 402	172 453	221 450	278 749	383 535	598 804	1 164 270	2 242 800	3 122 850
Belgium	42 880	51 420	61 460	67 771	126 944	235 000	478 172	974 494	1 748 000	2 186 500
Canada	583 000	786 000	1 022 754	1 332 982	1 865 779	2 589 780	3 420 318	4 206 992	5 320 000	6 000 000
Czech Republic	0	1 242	4 651	11 151	27 357	45 725	200 315	521 469	965 500	1 288 854
Denmark	148 220	175 943	211 063	357 589	503 500	822 370	1 316 592	1 444 016	1 760 000	2 291 700
Finland	225 983	283 051	354 221	459 074	675 565	1 039 126	1502003	2162574	2946948	3 123 410
France	283 200	375 000	436 700	467 000	803 000	1 439 900	2 440 139	5 754 539	11 210 000	14 218 400
Germany	272 609	532 251	974 890	1 768 000	2 466 400	3 733 000	5 782 200	8 175 500	13 925 000	17 400 000
Greece	0	0	0	28 000	154 000	550 000	700 000	900 000	2 057 000	2 804 860
Hungary	2 645	8 477	23 292	45 712	142 000	261 000	473 000	705 000	1 073 000	1 278 500
Iceland	10 010	12 889	15 251	17 409	21 845	30 883	46 302	65 746	106 000	145 310
Ireland	25 000	32 000	44 000	57 065	81 666	132 183	290 000	510 747	946 000	970 000
Italy	266 000	568 000	783 000	1 206 975	2 239 700	3 925 400	6 413 412	11 733 904	20 480 000	24 500 000
Japan	868 078	1 378 108	1 712 545	2 131 367	4 331 369	10 204 023	20 876 820	38 253 000	47 308 000	49 702 000
Korea	80 005	166 198	271 868	471 784	960 258	1 641 293	3 180 989	6 895 477	13 982 919	20 500 000
Luxembourg	824	1 130	1 139	5 082	12 895	26 868	45 000	67 208	94 000	164 000
Mexico	63900	160900	312600	386100	571800	688 513	1 021 900	1 740814	3 349475	4 935560
Netherlands	79 000	115 000	166 000	216 000	321 000	537 012	1 016 000	1 688 550	3 347 000	5 018 915
New Zealand ¹	54 100	72 300	100 200	143 800	186 000	328 311	422 800	606 200	710 000	789 900
Norway	196 828	227 733	280 000	368 100	582 500	980 300	1 261 445	1 676 763	2 121 000	2 387 520
Poland	0	0	2 195	15 699	38 942	75 000	216 900	812 000	1 928 000	3 070 502
Portugal	6 500	12 600	37 262	101 231	173 508	340 845	663 651	1 506 958	3 075 000	3 752 327
Spain	54 700	108 451	180 296	257 261	411 930	928 955	2997 212	4 330 282	7 051 000	10 809 000
Sweden	461 200	568 200	652 000	785 000	1 381 000	2 008 000	2492 000	3 169 000	4 109 000	4 414 000
Switzerland	125 047	174 557	215 061	259 200	328 300	446 000	662 700	1 044 400	1 672 300	2 240 000
Turkey	31 809	47 828	61 395	84 187	175 471	436 549	806 339	1 609 808	3 506 100	5 585 700
United Kingdom	1 114 000	1 260 000	1 507 000	2 215 820	3 940 000	5 670 000	6 817 000	8 344 000	14 874 000	16 795 000
United States	5 283 055	7 557 148	11 032 753	14 712 000	22 550 000	31 400 000	44 042 992	55 312 293	69 209 321	76 859 770
OECD	10537234	15083287	21076152	28874809	46448314	72819912	114067102	170124481	273497363	292780578

1. Australian series is for June and New Zealand for March.

Source: OECD.

Table 4. **Mobiles subscribers per 100 inhabitants in OECD countries**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	June-1999
Finland	4.5	5.7	7.0	9.1	12.8	19.9	29.2	45.6	58.0	60.7
Norway	4.6	5.3	6.5	8.6	13.5	22.6	29.0	38.4	48.6	54.7
Iceland	3.9	5.0	5.9	6.6	8.2	11.5	17.1	24.0	38.7	53.0
Sweden	5.4	6.6	7.5	9.0	15.8	22.8	28.3	35.8	46.5	49.9
Korea	0.2	0.4	0.6	1.1	2.2	3.7	7.0	15.1	30.6	44.8
Denmark	2.9	3.4	4.1	6.9	9.7	15.7	25.1	27.5	33.5	43.7
Italy	0.5	1.0	1.4	2.1	3.9	6.9	11.2	20.5	35.8	42.8
Japan	0.7	1.1	1.4	1.7	3.5	8.2	16.7	30.4	37.7	39.6
Luxembourg	0.2	0.3	0.3	1.3	3.2	6.6	10.9	16.1	22.5	39.3
Portugal	0.1	0.1	0.4	1.0	1.8	3.5	6.8	15.4	31.4	38.3
Austria	1.0	1.5	2.2	2.8	3.5	4.8	7.4	14.3	27.5	38.3
Australia	1.1	1.7	2.5	3.9	6.2	10.7	21.5	26.0	32.1	35.2
Netherlands	0.5	0.8	1.1	1.4	2.1	3.5	2.0	10.8	21.4	32.0
Switzerland	1.8	2.5	3.1	3.7	4.6	6.2	9.2	14.4	23.0	30.8
United Kingdom	1.9	2.2	2.6	3.8	6.8	9.8	11.7	14.3	25.6	28.9
United States	2.1	2.9	4.3	5.6	8.5	11.8	16.3	20.4	25.5	28.3
Ireland	0.7	0.9	1.3	1.6	2.3	3.7	8.2	14.4	26.6	27.3
Spain	0.1	0.3	0.5	0.7	1.0	2.3	7.6	10.9	17.8	27.2
Greece	0.0	0.0	0.0	0.3	1.5	5.3	6.7	8.6	19.5	26.7
France	0.5	0.7	0.8	0.8	1.4	2.5	4.2	9.8	19.1	24.3
New Zealand	1.6	2.1	2.9	4.1	5.3	9.2	11.7	16.6	19.5	21.7
Belgium	0.4	0.5	0.6	0.7	1.3	2.3	4.7	9.6	17.2	21.5
Germany	0.3	0.7	1.2	2.2	3.0	4.6	7.1	9.9	16.9	21.2
Canada	2.1	2.8	3.6	4.6	6.4	8.8	11.5	14.1	17.8	20.0
Hungary	0.0	0.1	0.2	0.4	1.4	2.6	4.7	7.1	10.7	12.8
Czech Republic	0.0	0.0	0.0	0.1	0.3	0.4	2.0	5.1	9.4	12.5
Turkey	0.1	0.1	0.1	0.1	0.3	0.7	1.3	2.6	5.6	8.9
Poland	0.0	0.0	0.0	0.0	0.1	0.2	0.6	2.1	5.0	7.9
Mexico(1)	0.1	0.2	0.4	0.4	0.6	0.8	1.1	1.8	3.5	5.1
OECD	1.0	1.4	2.0	2.7	4.3	6.7	10.5	15.6	22.6	26.8

1. Mexico's penetration rate had grown to 7.1 per 100 inhabitants by November 1999.

Source: OECD.

Table 5. Mobile subscriber increase per 100 inhabitants per annum, 1991-1999

	1991	1992	1993	1994	1995	1996	1997	1998	June-1999 ¹
Luxembourg	0.1	0.0	1.0	1.9	3.4	4.3	5.2	6.4	16.8
Iceland	1.1	0.9	0.8	1.6	3.3	5.6	6.9	14.7	14.3
Korea	0.2	0.2	0.4	1.1	1.5	3.4	8.1	15.5	14.3
Austria	0.5	0.7	0.6	0.7	1.3	2.6	6.9	13.2	10.8
Netherlands	0.2	0.3	0.3	0.7	1.4	3.1	4.3	10.6	10.7
Denmark	0.5	0.7	2.8	2.8	6.1	9.4	2.4	6.0	10.1
Spain	0.1	0.2	0.2	0.4	1.3	5.2	3.3	6.9	9.5
Switzerland	0.7	0.6	0.6	0.9	1.6	2.9	5.2	8.6	7.8
Greece	0.0	0.0	0.3	1.2	3.8	1.4	1.9	11.0	7.1
Italy	0.5	0.4	0.7	1.8	2.9	4.3	9.3	15.3	7.0
Portugal	0.1	0.3	0.7	0.7	1.7	3.3	8.6	16.0	6.9
Norway	0.7	1.2	2.0	4.9	9.1	6.4	9.4	10.2	6.1
France	0.2	0.1	0.0	0.6	1.1	1.7	5.6	9.3	5.1
Belgium	0.1	0.1	0.1	0.6	1.1	2.4	4.9	7.6	4.3
Germany	0.3	0.5	1.0	0.8	1.5	2.5	2.9	7.0	4.2
Sweden	1.2	0.9	1.5	6.8	7.1	5.4	7.6	10.6	3.4
Turkey	0.0	0.0	0.0	0.2	0.4	0.6	1.3	3.0	3.3
United Kingdom	0.2	0.4	1.2	3.0	3.0	2.0	2.6	11.2	3.3
Australia	0.6	0.8	1.4	2.3	4.5	10.8	4.5	6.1	3.1
Poland	0.0	0.0	0.0	0.1	0.1	0.4	1.5	2.9	3.0
Czech Republic	0.0	0.0	0.1	0.2	0.2	1.5	3.1	4.3	3.1
United States	0.9	1.3	1.4	2.9	3.2	4.6	4.0	5.1	2.8
Finland	1.1	1.4	2.0	3.7	7.2	9.3	16.4	12.4	2.8
Canada	0.7	0.8	1.0	1.8	2.4	2.7	2.5	3.7	2.3
New Zealand	0.5	0.8	1.2	1.1	3.9	2.5	4.9	2.9	2.2
Hungary	0.1	0.1	0.2	0.9	1.2	2.1	2.4	3.7	2.1
Japan	0.4	0.3	0.3	1.8	4.7	8.5	13.8	7.2	1.9
Mexico	0.1	0.2	0.0	0.2	0.1	0.3	0.7	1.6	1.6
Ireland	0.2	0.3	0.4	0.7	1.4	4.4	6.2	12.2	0.7
OECD	0.4	0.6	0.7	1.6	2.4	3.7	5.1	7.0	4.2

1. The growth rates for June 1999 are from the previous year. Australian data are for the year ending June 1999 (except Vodafone, which is since March 1999). New Zealand data is since March 1999. The UK growth rate shown for June 1999 is since March 1999. Data for June 1999, in some cases, is taken from *Public Network Europe*, (Volume 9, No. 8). By November 1999, Mexico's annual increase was 3.6 compared to the previous year.

Source: OECD.

Table 6. Number of mobile operator equivalents in OECD countries

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
United States	2	2	2	2	2	3	6	6	7	7	7
Japan	2	2	2	2	4	5	5	5	5	5	5
Korea	1	1	1	1	1	1	2	5	5	5	5
Netherlands	1	1	1	1	1	1	2	2	4	5	5
Canada	2	2	2	2	2	2	3	4	4	4	4
Denmark	1	1	2	2	2	2	2	2	4	4	4
Germany	1	1	2	2	3	3	3	3	4	4	4
United Kingdom	2	2	2	3	4	4	4	4	4	4	4
Australia	1	1	1	3	3	3	3	3	3	3	6
Austria	1	1	1	1	1	1	1	2	3	3	4
Sweden	2	2	3	3	3	3	3	3	3	3	4
Italy	1	1	1	1	1	1	2	2	2	3	4
Belgium	1	1	1	1	1	1	2	2	2	3	3
Finland	1	1	2	2	2	2	2	2	3	3	3
France	2	2	2	2	2	2	3	3	3	3	3
Greece	0	0	0	2	2	2	2	2	3	3	3
Ireland	1	1	1	1	1	1	1	2	2	3	3
Mexico	2	2	2	2	2	2	2	2	2	3	3
Poland	1	1	2	2	2	2	2	2	3	3	3
Portugal	1	1	2	2	2	2	2	2	3	3	3
Spain	1	1	1	1	2	2	2	2	2	3	3
Switzerland	1	1	1	1	1	1	1	1	2	3	3
Hungary	1	1	1	1	2	2	2	2	2	2	4
Turkey	1	1	2	2	2	2	2	2	2	2	4
Czech Republic	1	1	1	1	1	1	2	2	2	2	3
Iceland	1	1	1	1	1	1	1	1	2	2	2
Luxembourg	1	1	1	1	1	1	1	1	2	2	2
New Zealand	1	1	1	2	2	2	2	2	2	2	2
Norway	1	1	1	2	2	2	2	2	2	2	2
OECD	35	35	42	49	55	57	67	73	87	94	105
Monopoly	22	22	17	14	10	10	5	3	0	0	0
Duopoly	7	7	11	12	14	13	16	17	13	7	4
Three Operators	0	0	1	3	4	4	5	4	8	14	11
Four or More Operators	0	0	0	0	1	2	3	5	8	8	14

1. This table indicates when networks commenced, or were expected to commence, offering service. Numbers in bold indicate new operators had not commenced service at the time of writing. The number of mobile operators in service ranks the countries in 1999, with a secondary ranking by the number expected in 2000. Some countries have licensed additional IMT-2000 or UMTS operators but they are not expected to be in commercial service by the end of 2000.

Source: OECD.

Table 7. OECD mobile subscriber penetration rankings, 1990-June 1999

	1990	1991	1992	1993	1994	1995	1996	1997	1998	June 1999	Did new entrant coincide with a lift in ranking?
Finland	3	2	2	1	3	3	1	1	1	1	Yes. Ending monopoly brought No. 1 Position.
Norway	2	3	3	3	2	2	2	2	2	2	Yes. Ending monopoly regained No. 2 Position.
Iceland	4	4	4	5	6	6	6	7	4	3	Yes. Ending monopoly reversed steady decline.
Sweden	1	1	1	2	1	1	3	3	3	4	Yes. Introduction of 3 rd Operator regained No. 1 position in 1994-95. Ranking has slipped, as 4 th operator has not launched service.
Korea	21	20	19	19	18	19	19	13	10	5	Yes. Ending monopoly brought immediate improvement.
Denmark	5	5	6	4	4	4	4	5	7	6	Yes. Ending monopoly brought immediate improvement. New entry in 1998 strengthened market.
Italy	17	14	14	14	12	12	12	8	6	7	Yes. Ending monopoly brought lifted ranking from mid-field to leaders.
Japan	14	13	13	15	14	11	7	4	5	8	Yes. Entry of new operators in 1994-95 lifted ranking from mid-field to leaders. However NTT, the largest cellular operator, had not introduced pre-paid cards by mid-1999.
Luxembourg	20	21	24	18	15	13	13	11	16	9	Yes. End of monopoly, in 1998, lifted ranking.
Portugal	23	24	22	20	20	20	20	12	9	10	Yes. Ending monopoly brought immediate improvement in 1992 and new operator in 1998 lifted ranking.
Austria	12	12	12	12	13	16	17	17	11	11	Yes. Ending duopoly significantly lifted ranking in 1998.
Australia	11	11	11	9	9	7	5	6	8	12	Yes. Ending monopoly brought immediate improvement. However position has slipped due to operators not marketing pre-paid cards strongly until 1999.
Netherlands	15	16	17	17	19	21	25	20	17	13	Yes. Ending monopoly brought immediate improvement. The entry of new operators in 1998 and 1999 brought a substantial lift in ranking.
Switzerland	9	8	8	11	11	14	14	14	15	14	Yes. Late liberalisation and consequent decline in ranking. Liberalisation in 1998 has lifted rank in 1999.
United Kingdom	8	9	10	10	7	8	10	16	13	15	Yes. Early liberalisation brought leading position but ranking weakened prior to end of duopoly. End of duopoly and 4 th entry brought immediate boost. Pre-paid cards boosted position in 1998 but no new entry since 1994 has impacted on this market.

Table 7. OECD mobile subscriber penetration rankings, 1990-June 1999 (cont'd)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	June 1999	Did new entrant coincide with a lift in ranking?
United States	7	6	5	6	5	5	8	9	14	16	No. Early liberalisation brought leading position but ranking has slipped. Possibly due to receiving party pays.
Ireland	13	15	15	16	17	18	15	15	12	17	Yes. Ending monopoly brought immediate improvement.
Spain	22	22	21	23	25	24	16	19	22	18	Yes. End of monopoly brought an immediate lift. Subsequent decline has been reversed by the entry of a new operator in 1999.
Greece	29	29	29	26	21	15	21	24	18	19	Yes. Ending duopoly brought immediate improvement in 1998.
France	16	18	18	21	23	23	24	22	20	20	Yes. Declining ranking reversed by the end of the duopoly.
New Zealand	10	10	9	8	10	9	9	10	19	21	Yes. Ending monopoly brought immediate lift but no new entrant since 1993 has been translated into a declining rank.
Belgium	18	19	20	22	24	25	23	23	23	22	Yes. End of the duopoly lifted ranking two places. New entrant in 1999.
Germany	19	17	16	13	16	17	18	21	24	23	Yes (1992/3). Ending monopoly brought early lift but ranking has declined. New entry in 1998 has lifted position in 1999.
Canada	6	7	7	7	8	10	11	18	21	24	No. Declining ranking seemingly due to receiving party pays impact on pre-paid take-up.
Hungary	26	26	25	24	22	22	22	25	25	25	Yes. Ending monopoly lifted ranking.
Czech Republic	27	27	27	28	28	28	26	26	26	26	Yes. Ending monopoly lifted ranking.
Turkey	24	25	26	27	27	27	27	27	27	27	Ending monopoly has held ranking constant.
Poland	28	28	28	29	29	29	29	28	28	28	Yes. Entry of 3 rd operator in 1996 lowered ranking in subsequent year.
Mexico	25	23	23	25	26	26	28	29	29	29	Yes. However ranking declined over duopoly that remained in place until 1999. Receiving party pays could be a factor.

1. Greece introduced a cellular mobile service in 1993 with two operators. Numbers in bold indicate a new network operator commenced service in that year.

Source: OECD.

Table 8. **Personal basket of digital cellular service, August 1999**

Basket results	Fixed	USD Usage	Total	Fixed	USD PPP Usage	Total
Australia, Telstra, PocketSaver 35	275	303	577	323	356	679
Austria, MobilKom, Geschäft	378	130	508	350	120	471
Belgium, Belgacom, ProxiPro	355	410	764	344	398	742
Canada, BellMobility, All-Out Weekend	459	86	546	567	107	674
Canada, BellMobility, RealTime 650	496	33	529	613	40	653
Czech Republic, EuroTel, Global	334	161	495	795	384	1 179
Denmark, Tele Mobil, Privat Plus	173	384	557	132	293	425
Finland, Sonera, Classic	46	401	447	39	340	379
France, FT, Declic	218	725	943	193	641	835
France, FT, Loft Forfait 5H	723	42	765	640	37	677
Germany, T-Mobil, ProTel-D1	472	415	886	421	370	791
Greece, CosmOTE, Basic Program 2	131	620	751	152	721	873
Hungary, Westel 900, Eurofon 1	183	489	672	406	1087	1 494
Iceland, PTT, Standard	101	375	476	83	307	390
Ireland, EirCell, Eirtime 250	1 212	28	1 240	1 237	29	1 265
Italy, T.I., EP120	882	199	1 081	959	216	1 175
Japan, NTT, DoCoMo A	495	418	912	328	277	604
Luxembourg, PTT, Business	499	222	721	494	220	714
Mexico, Telcel, Plan Junio	574	99	693	861	144	1 005
Netherlands, KPN, Flexibel Premium	276	339	616	261	320	581
New Zealand, Vodafone, Daytime 200	894	41	935	1 077	50	1 126
New Zealand, Vodafone, Talk 40	127	727	854	153	876	1 029
Norway, Telenor, Primaer	248	259	507	188	196	384
Poland, ERA, Blue	387	402	789	744	773	1 517
Portugal, TNM, Normal	385	413	798	500	536	1 036
Spain, MoviStar, Personal	189	451	641	225	537	763
Sweden, Telia, Pott	231	687	918	194	578	772
Sweden, Telia, Volym	250	588	837	210	494	703
Switzerland, Natel Swiss	211	530	742	155	390	545
UK, Cellnet, Regular Caller +	504	154	658	438	134	572
UK, Vodafone 30	359	389	747	312	338	650
USA, Sprint, PCS Free & Clear Plan	396	84	480	396	84	480
USA, US West, Business 150	396	47	443	396	47	443
Average	364	323	684	383	347	617

1. Including VAT and volume discounts. Excluding international calls. The basket includes 568 calls.

Source: Eurodata.

Table 9. **Business basket for digital mobile service**

Basket results	Fixed	USD Usage	Total	Fixed	USD PPP Usage	Total
Australia, Telstra, PocketSaver 35	275	816	1 091	323	960	1283
Austria, MobilKom, Geschäft	315	269	584	292	249	541
Belgium, Belgacom, ProxiPro	293	890	1 183	285	864	1148
Canada, BellMobility, All-Out Weekend	399	401	800	493	495	988
Canada, BellMobility, RealTime 650	431	142	573	533	175	707
Czech Republic, EuroTel, Global	318	542	860	757	1291	2048
Denmark, Tele Mobil, Privat Plus	138	751	889	106	573	679
Finland, Sonera, Classic	38	787	825	32	667	699
France, FT, Declic	181	1 710	1 891	160	1513	1674
France, FT, Loft Forfait 5H	600	170	770	531	150	681
Germany, T-Mobil, ProTel-D1	407	792	1 198	363	707	1070
Greece, CosmOTE, Basic Program 2	111	1004	1 115	129	1168	1297
Hungary, Westel 900, Eurofon 1	146	843	989	325	1872	2197
Iceland, PTT, Standard	81	684	765	67	561	627
Ireland, EirCell, Eirtime 250	1 002	400	1 402	1 022	408	1430
Italy, T.I., EP120	735	623	1 358	799	677	1476
Japan, NTT, DoCoMo A	480	1 103	1 583	318	731	1049
Luxembourg, PTT, Business	434	391	825	430	387	816
Mexico, Telcel, Digital 300	844	169	1031	1223	245	1468
Netherlands, KPN, Flexibel Premium	235	700	935	222	660	882
New Zealand, Vodafone, Daytime 200	795	284	1 079	957	343	1300
New Zealand, Vodafone, Talk 40	113	2 057	2 169	136	2478	2614
Norway, Telenor, Primaer	202	475	677	153	360	513
Poland, ERA, Blue	317	829	1146	610	1593	2203
Portugal, TNM, Normal	329	699	1029	427	908	1336
Spain, Movistar, Personal	163	973	1136	194	1159	1353
Sweden, Telia, Pott	185	1535	1720	155	1290	1445
Sweden, Telia, Volym	200	1062	1262	168	892	1060
Switzerland, Natel Swiss	196	1071	1267	144	787	932
UK, Cellnet, Regular Caller +	429	1001	1430	373	871	1244
UK, Vodafone 30	305	1214	1519	265	1056	1321
USA, Sprint, PCS Free & Clear Plan	360	482	842	360	482	842
USA, US West, Business 150	360	255	614	360	255	614
Average	325	675	978	365	813	1198

1. Excluding VAT. Including volume discounts and international calls. The basket includes 1 169 calls.

Source: Eurodata.

Table 10. INTUG Survey of European roaming prices, 1999

	Average international outgoing mobile call to European Union area (USD per minute)	Average international roaming mobile call from European Union area to home Country (USD per minute)	Ratio
TIM	0.50	0.55	1.11
Radiolinja	0.76	0.62	0.82
Comviq	0.38	0.65	1.73
max.mobile	0.39	0.67	1.74
Omnitel	NA	0.71	NA
Telia Mobile	0.47	0.71	1.50
Mobilkom	0.39	0.72	1.85
Sonera	0.62	0.72	1.16
Tele Danmark Mobil	0.55	0.75	1.37
Telenor Mobil	0.19	0.79	4.16
EirCell	0.72	0.80	1.10
TMN	0.16	0.81	5.03
Esat Digifone	0.65	0.83	1.28
Netcom	0.27	0.87	3.29
Airtel	0.64	0.89	1.38
Telefonica	NA	0.90	NA
SFR	NA	0.95	NA
Mannesmann	0.83	0.96	1.15
Telecel	NA	0.98	NA
Sonofon	0.58	1.00	1.74
France Telecom	0.49	1.04	2.10
T Mobil	1.01	1.04	1.03
TeleSTET	0.78	1.05	1.34
KPN Telecom	0.30	1.06	3.54
Panafon	0.90	1.15	1.27
Vodafone	1.44	1.19	0.83
Libertel	0.44	1.20	2.71
Mobistar	1.28	1.24	0.97
Cellnet	1.35	1.28	0.95
Belgacom	0.98	1.35	1.37
European Union Average	0.66	0.92	

1. The original INTUG survey has been converted from a two-and-a-quarter minute call to a per minute rate.

Source: INTUG.

Table 11. Fixed network pricing in Denmark, July 1999

	Local (Peak)	Local (Off- peak)	Long distance (Peak)	Long distance (Off- peak)
TeleDanmark	0.025	0.013	0.040	0.020
Mobilix	0.025	0.013	0.025	0.013

1. Price per Minute excluding call set-up of USD 0.011 per call. Mobilix prices are for use of the fixed network.

Source: OECD.

Table 12. Mobile subscribers as a percentage of access lines

	1990	1991	1992	1993	1994	1995	1996	1997	1998	Jun-99
Finland	8.5	10.4	12.9	16.6	23.2	36.2	53.0	81.9	104.9	109.9
Italy	1.2	2.5	3.3	5.0	9.1	15.8	25.4	45.7	78.8	94.3
Portugal	0.3	0.5	1.2	3.1	5.0	9.4	17.4	37.7	74.7	91.1
Iceland	7.6	9.5	10.9	12.1	14.7	20.8	30.2	42.3	65.4	89.7
Norway	9.2	10.4	12.3	15.8	24.4	40.3	49.5	61.3	77.6	87.3
Korea	0.5	0.9	1.4	2.3	4.6	7.6	14.0	29.0	58.8	86.2
Japan	1.6	2.4	3.0	3.6	7.2	16.7	33.9	63.6	78.6	82.6
Austria	2.3	3.5	5.0	6.2	7.6	10.2	15.8	31.2	56.1	78.1
Sweden	7.9	9.5	11.0	13.3	23.1	33.4	41.3	52.7	68.4	73.4
Australia	2.4	3.6	5.3	8.0	12.4	21.2	42.3	50.8	60.8	66.7
Spain	0.4	0.8	1.3	1.8	2.8	6.2	19.4	27.3	43.3	66.4
Denmark	5.1	6.0	7.0	11.7	16.1	25.7	40.5	43.2	50.8	66.1
Ireland	2.5	3.1	4.0	4.9	6.6	10.1	20.9	34.0	59.1	60.6
Luxembourg	0.4	0.6	0.6	2.4	5.8	11.5	17.4	24.0	32.1	56.0
Netherlands	1.1	1.6	2.2	2.8	4.1	6.7	12.1	19.1	35.8	53.8
United Kingdom	4.4	4.9	5.8	8.1	13.9	19.3	22.2	26.5	47.3	53.4
Greece	0.0	0.0	0.0	0.6	3.1	10.7	13.1	16.6	37.2	50.7
Mexico	0.7	2.8	4.6	5.1	6.7	7.8	11.6	18.9	33.3	49.7
Switzerland	3.2	4.3	5.1	6.0	7.5	10.1	14.5	22.3	34.8	46.6
Belgium	1.1	1.3	1.4	1.5	2.8	5.1	10.1	19.7	34.5	43.1
United States	3.9	5.4	7.7	9.9	14.7	19.7	26.5	30.9	38.6	42.9
New Zealand	3.7	4.9	6.6	9.4	11.7	19.8	23.7	32.9	38.0	42.2
France	1.0	1.3	1.5	1.5	2.5	4.4	7.3	17.1	33.0	41.8
Hungary	0.3	0.8	1.8	3.1	8.0	12.1	17.8	22.2	33.7	40.2
Germany	0.9	1.6	2.7	4.7	6.2	8.9	13.1	18.1	29.9	37.4
Poland	0.0	0.0	0.1	0.4	0.8	1.3	3.3	10.8	21.9	34.8
Czech Republic	0.0	0.1	0.3	0.6	1.3	1.9	7.1	15.9	25.8	34.4
Canada	3.8	5.0	6.3	8.0	10.8	14.7	18.9	22.8	28.8	32.5
Turkey	0.5	0.6	0.6	0.7	1.3	3.1	5.1	9.2	19.9	31.8
OECD	2.6	3.6	4.8	6.3	9.7	14.7	22.3	31.9	45.7	54.2
EU Area	2.0	2.6	3.4	4.8	7.7	11.9	18.1	27.0	45.8	56.8
Receiving Party Pays	3.7	5.2	7.4	9.4	13.8	18.4	25.1	29.6	37.5	42.3
Calling Party Pays	1.8	2.5	3.2	4.4	7.2	12.5	20.5	33.3	50.8	61.5
Fixed Access Lines share of total connections (%)	97.5	96.6	95.4	94.1	91.1	87.2	81.8	75.8	68.6	64.9
Mobile Subscribers share of total connections (%)	2.5	3.4	4.6	5.9	8.9	12.8	18.2	24.2	31.4	35.1

1. For some countries the number of mainlines used in 1998 and June 1999 is for 1997. This includes Canada, Japan, Norway, Sweden, Turkey, the United Kingdom and the United States.

Source: OECD.

Table 13. Cellular mobile growth in Mexico

	Subscribers (000)	Minutes (000)	Monthly increase in subscribers (%)	Monthly change in traffic to and from cellular networks (%)	Net Monthly change in subscribers (000)	Net Monthly change in Minutes (000)
Jan-98	1 836.4	168 105	5.5	8.9	95.60	13 755
Feb-98	1 931.4	185 606	5.2	10.4	95.00	17 501
Mar-98	2 042.8	190 113	5.8	2.4	111.40	4 507
Apr-98	2 148.5	198 485	5.2	4.4	105.70	8 372
May-98	2 269.3	212 647	5.6	7.1	120.80	14 162
Jun-98	2 409.7	227 662	6.2	7.1	140.40	15 015
Jul-98	2 549.2	223 644	5.8	-1.8	139.50	-4 018
Aug-98	2 700.6	236 803	5.9	5.9	151.40	13 159
Sep-98	2 831.5	253 495	4.8	7.0	130.90	16 692
Oct-98	2 974.1	265 839	5.0	4.9	142.60	12 344
Nov-98	3 123.2	290 292	5.0	9.2	149.10	24 453
Dec-98	3 349.5	310 855	7.2	7.1	226.30	20 563
Jan-99	3 516.1	296 339	5.0	-4.7	166.60	-14 516
Feb-99	3 711.9	319 912	5.6	8.0	195.80	23 573
Mar-99	3 984.4	345 076	7.3	7.9	272.50	25 164
Apr-99	4 241.5	339 462	6.5	-1.6	257.10	-5 614
May-99	4 563.1	397 241	7.6	17.0	321.60	57 779
Jun-99	4 935.6	417 670	8.2	5.1	372.50	20 429
Jul-99	5 397.2	439 153	9.4	5.1	461.60	21 483

1. CPP was introduced on 1 May 1999.

Source: Cofetel.

Table 14. Network Calling Opportunities in OECD Area

	1990	1991	1992	1993	1994	1995	1996	1997	1998	Jun-99
OECD Area										
Fixed to Fixed (%)	95.04	93.25	91.08	88.52	83.04	75.95	66.90	57.51	47.11	42.08
Fixed to Mobile (%)	2.45	3.31	4.35	5.56	8.09	11.20	14.89	18.33	21.53	22.79
Mobile to Fixed (%)	2.45	3.31	4.35	5.56	8.09	11.20	14.89	18.33	21.53	22.79
Mobile to Mobile (%)	0.06	0.12	0.21	0.35	0.79	1.65	3.32	5.84	9.83	12.34
Finland (Domestic)										
Fixed to Fixed (%)	85.00	82.02	78.43	73.53	65.91	53.90	32.24	30.21	23.81	22.69
Fixed to Mobile (%)	7.19	8.54	10.13	12.22	15.28	19.52	24.54	24.75	24.99	24.94
Mobile to Fixed (%)	7.19	8.54	10.13	12.22	15.28	19.52	24.54	24.75	24.99	24.94
Mobile to Mobile (%)	0.61	0.89	1.31	2.03	3.54	7.07	18.68	20.28	26.22	27.42

1. Data shown are as a per cent of total calling opportunities.

Source: OECD.

Table 15. Price of calls between fixed and mobile networks

	Calls from a Fixed Network to Mobile Network, USD PPP (February 1999)(1)		Calls from a Mobile Network to a Fixed Network USD PPP, (February 1999)		Ratio of Mobile Price to Fixed Price (February 1999)		Ratio of the price of Calls from Fixed to Mobile against the price of the Longest Distance on Fixed Network (February 1999)		Pricing change between February 1999 and August 1999 for calls from Fixed to Mobile (%) (2)	
	11:00	20:00	11:00	20:00	11:00	20:00	11:00	20:00	11:00	20:00
Time of day	11:00	20:00	11:00	20:00	11:00	20:00	11:00	20:00	11:00	20:00
Australia	0.30	0.16	0.31	0.17	1.01	1.06	1.11	1.07	-20	-17
Austria	0.31	0.20	0.37	0.23	1.18	1.18	1.57	2.82		
Belgium	0.38	0.17	0.32	0.13	0.83	0.75	2.14	1.72	-11	0
Canada	0.00	0.00	0.17	0.08						
Czech Rep.	0.49	0.49	0.44	0.27	0.90	0.56	1.35	1.11		
Denmark	0.19	0.10	0.22	0.11	1.16	1.17	4.12	3.92		
Finland	0.24	0.15	0.24	0.12	0.99	0.80	4.65	2.87	+3	+4
France	0.43	0.22	0.22	0.22	0.50	1.00	1.58	3.19	-21	-21
Germany	0.47	0.24	0.68	0.27	1.44	1.17	3.83	11.50		
Greece	0.47	0.47	0.38	0.38	0.80	0.80	1.06	1.06		
Hungary	0.53	0.35	0.63	0.46	1.18	1.30	2.00	3.31		
Iceland	0.20	0.16	0.18	0.13	0.89	0.77	9.00	6.30		
Ireland	0.26	0.17	0.28	0.14	1.05	0.79	2.42	1.82		
Italy	0.40	0.15	0.27	0.15	0.68	0.98	1.51	1.51	-12	-12
Japan	0.28	0.28	0.20	0.12	0.71	0.43	1.82	1.08		
Korea										
Luxembourg	0.35	0.21	0.10	0.10	0.29	0.48	4.00	8.00	-30	-12
Mexico(3)	0.29	0.29	0.27	0.15	0.91	0.51	1.10	1.10		
Netherlands	0.42	0.24	0.34	0.14	0.82	0.58	5.00	3.53		
New Zealand	0.41	0.41	0.35	0.22	0.84	0.54	0.73	0.81		
Norway	0.18	0.18	0.16	0.15	0.91	0.81	5.12	6.77	-1	-1
Poland	0.69	0.69	0.53	0.29	0.78	0.42	1.47	1.08	-7	-7
Portugal (4)	0.50	0.50	0.34	0.34	0.67	0.67	1.83	1.83	-25.5	-25.5
Spain	0.34	0.34	0.62	0.28	1.84	0.83	1.86	1.21		
Sweden	0.35	0.23	0.49	0.17	1.42	0.74	10.48	6.30	-18	-12
Switzerland	0.38	0.26	0.36	0.24	0.94	0.92	2.96	1.96		
Turkey	0.42	0.42	0.25	0.25	0.60	0.60	0.75	0.45		
UK	0.36	0.24	0.39	0.12	1.11	0.50	4.16	2.40	-25	-25
USA(4)	0.00	0.00	0.31	0.31						
OECD	0.37	0.28	0.34	0.21	0.94	0.78	2.96	3.00		
Average (5)										

1. Calls charges include any set-up charge for fixed and mobile networks spread over five minutes excluding VAT. The prices are for weekdays and weekend rates are not shown.
2. The operators in several countries put up their prices in line with inflation. Only real increases are shown.
3. Data for Mexico is for August 1999.
4. The prices used here are for TMN. It is also possible to do a weighted average of the three operators in Portugal. The average prices for the three operators, weighted by traffic volume, and expressed in PPP, were the following: (1) Fixed to mobile calls USD 0.54, USD 0.54 and USD 0.48 at 11:00, 20:00, and off-peak times respectively. (2) Mobile to fixed calls were USD 0.48 at all three times. If exchange rates are used to make the comparison instead of PPPs, the prices for fixed to mobile calls were USD 0.44 and USD 0.39. Using the same criteria the price for mobile to fixed calls was USD 0.39.
5. The mobile pricing is for Sprint in Washington DC. The fixed to mobile call rate is for a residential subscriber with an unmeasured local fixed service. The call would be paid for by the user on the mobile network receiving the call. A business user might expect to pay around USD 0.06. Receiving party pays charges are not included in the average for fixed services.
6. The average for fixed network to mobile network calls is for countries with CPP.

Source: OECD, Eurodata.

Table 16. Interconnection charges between fixed and mobile networks in OECD countries, January 1999

	Network operator	Average interconnect rate for fixed -to- mobile (US cents per minute)	Average interconnect rate for mobile-to-fixed (US cents per minute)
Australia			
Austria	PTA	22.48	1.94
Belgium	Belgacom		2.15
Canada (RPP)	Bell Canada		0.70
Czech Republic			
Denmark	TeleDanmark	17.00	1.89
Finland	Sonera	18.66	1.77
France	France Telecom	32.91	1.92
Germany	Deutsche Telekom	35.35	1.40
Greece			
Hungary			
Iceland			
Ireland	Telecom Eireann		1.34
Italy	Telecom Italia	28.88	2.96
Japan	NTT	29.99	2.28
Korea			
Luxembourg			
Mexico	Telmex	20.00	3.00
Netherlands	KPN	34.50	1.69
New Zealand			
Norway	Telenor	15.62	1.80
Poland			
Portugal		(3)	3.62
Spain	Telefonica		7.72
Sweden	Telia	25.59	1.17
Switzerland	Swisscom	29.54	1.93
Turkey			
United Kingdom	BT	20.42	0.88
United States (RPP)	Nevada Bell	1.61	1.61
	Bell Atlantic	2.64	2.64
	Nynex (MA)	3.72	3.72
	Nynex (NY)	4.00	4.00
	Cincinatti Bell	1.07	1.07
	Ameritech	0.83	0.83
OECD average (Countries with CPP)		25.97	2.32

1. Ovum calculates the averages from the following distances, 5km, 20km, 50km and 200km. Ovum's fixed-to-mobile data for PTA, Deutsche Telekom, France Telecom and KPN are estimates based on information obtained by them in discussions with operators.
2. Telmex mobile-to-fixed data are for August 1999.
3. In Portugal mobile operators have been paying an origination rate for fixed-to-mobile calls, not a termination rate, and have been keeping all the revenues of fixed to mobile calls. These prices have been negotiated between the incumbent fixed network operator and the mobile operators. The average origination rate charged by Portugal Telecom in 1999 was USD 0.086.

Source: Ovum, Quarterly Update, January 1999. <http://www.ovum.com>

Table 17. **Mobile pricing and service innovation**

Company	Traditional fixed network approach	Traditional mobile network approach	Innovative mobile network approach.
BT Cellnet	Fixed telephone.	Mobile telephone.	One phone can be used as fixed line or mobile line.
BT Cellnet	Periodic billing (<i>e.g.</i> bi-monthly, quarterly).	Monthly billing.	With BT's "Advance", the cost of the phone, connection and a year's line rental are all included. A one-off payment means the user receives a single annual bill (unless they exceed included airtime).
BT Cellnet	Sell own services.	Sell own services.	Sell pre-paid cards of all operators in market.
Bell Atlantic	One line per subscriber.	One subscriber per subscription.	Bell Atlantic Mobile's "Share A Minute" plan gives groups of up to four users an opportunity to share bundled minutes. In Charlotte, N.C., for example, four users could share 600 minutes for USD88.96 a month.
Telecom NZ	Periodic billing (<i>e.g.</i> bi-monthly, quarterly).	Monthly billing.	If you stay "on the line" after the person you have been talking to hangs up, you will hear what the charge was for that call.

Source: OECD.

Table 18. Pre-paid card pricing in OECD countries (USD PPP)

		Kit price	30 minutes usage	Price per minute 1 080 minutes including kit and initial allowance(1)	Peak/ long distance	Off-peak 20:00 Hours/ Local	Lowest off-peak and weekend	Card validity outgoing/ incoming (months)(5)	
Iceland	Iceland Telecom (Frelsi)	121.80	5.23	0.28	0.29	0.17	0.12	6	6
Netherlands	KPN (Hi)	91.28	6.85	0.28	0.68	0.11		12	15
Australia	Telstra	147.41	8.00	0.29	0.74	0.15		3	3
Luxembourg	Luxembourg PTT (Tip Top)	164.20	8.44	0.43	0.72	0.17		3	3
Sweden	Telia (Refill - peak)	35.25	8.46	0.29	0.60	0.20		12	12
Spain	Telefonica	na	9.18	na (0.27)	0.61	0.31	0.15	9	12
Canada	Microcell (FIDO)	83.33	9.75	0.40	0.46	0.29		3	3
Denmark	TeleDanmark	76.31	9.83	0.38	0.55	0.27		6	9
Austria	Telecom Austria (B-Free)	56.43	10.29	0.31	0.70	0.30	0.21	13	13
Norway	Telenor (Ring Kontant)	22.42	10.50	0.37	0.68	0.39	0.19	12	13
United States	Powertel	69.00	10.50	0.41	0.35	0.35		3	3
United States	Airtouch	80.00	10.50	0.42	0.35	0.35		6	6
United Kingdom	Orange	98.58	10.56	0.44	0.35	0.35		1	3
Italy	TIM	155.13	10.83	0.30	1.40	0.14	0.07	12	13
New Zealand	Telecom NZ	97.39	11.57	0.42	0.65	0.32		2	2
Belgium	Belgacom (Proximus PayGo)	154.06	12.28	0.47	1.02	0.26		2	3
France	France Telecom (Mobicarte - Soir)	104.86	12.67	0.51	0.78	0.36		2	6
Ireland	Telecom Eireann	179.17	13.33	0.52	1.11	0.28		2	2
Finland	Sonera	57.75	13.45	0.50	0.46	0.46		6	6
Portugal	TMN (Mimo)	139.04	13.67	0.58	0.66	0.56	0.25	3	5

Table 18. Pre-paid card pricing in OECD countries (cont'd)

		Kit price	30 minutes usage	Price per minute 1 080 minutes including kit and initial allowance(1)	Peak/ long distance	Off-peak 20:00 Hours/ Local	Lowest off-peak and weekend	Card validity outgoing/incoming (months)(5)	
Germany	Deutsche Telecom (Xtra)	146.57	13.97	0.58	0.98	0.49	0.19	12	15
Switzerland(2)	Swisscom (Natel Easy)	141.46	14.93	0.61	0.54	0.49		Unlimited	Unlimited
Czech Republic	EuroTel	337.27	15.19	0.74	1.05	0.37		18	18
Korea	SKT	na	16.71	na (0.56)	0.56	0.56		5	5
Japan	Tu-Ka-Kansai	63.23	19.35	0.67	0.65	0.65		2	2
Hungary	Westel (Domino)	na	22.92	na (1.01)	0.95	0.72		na	na
Mexico (3)	Telmex (Amigo)	10.53	13.70	0.54	0.46	0.46		5	5
Greece	Panafon (a la Carte - Advance)	144.26	23.88	0.82	0.88	0.77		6	6
Turkey	Telsim (Practikhat)	62.17	25.08	0.88	0.84	0.84		4	4
Poland	Era GSM (Tak Tak)	146.57	30.00	1.07	1.47	0.88		6	6
United Kingdom (4)	Vodafone (Pay as you talk) (excluding service charge)	70.41	4.65	0.14	0.49	0.07		2, 4 or 12	2, 4 or 12
OECD	OECD	109.14	13.11	0.49	0.71	0.39	0.17	6.5	7.3

1. Based on 20% calls made at the peak rate or long distance rate, 40% at off peak or local rate and 40% at the least expensive rate (*e.g.* lowest off-peak or weekend). All companies in the table are included in the OECD average. In those countries where there are differences in the pricing of prepaid calls, to make calls to fixed or to mobile networks, the comparison uses the prices of calls from mobile-to-fixed networks.
2. RPP applies to Swisscom's pre-paid cards.
3. The starting kit price is just for the SIM Card and excludes a mobile handset.
4. Vodafone's tariff structure is more complex than the other pre-paid options shown. When users prepay for airtime they need to elect whether this is credited against calls or card validity time to receive calls. For this comparison it is assumed that a user would elect for 12 months service for making and receiving calls (refer to text for explanation of Vodafone pricing structure).
5. The card validity time is the longest available from each operator.

Source: OECD.

Table 19. Selected mobile card conditions and duration

Company (Tariff scheme)	Duration/Conditions
BC-Tel Mobility (Pre-paid Out of the Box) http://www.bctm.com/cellular/pre-paid2.htm	Cellular calling cards are non-refundable and expire after 90 days of inactivity. No credit is available for unused balances. The phone number and account will expire after 6 months of inactivity. Calls to 911 emergency and to #321 are free of charge. Cellular card balance: Every time a user makes or receives a call, the cost of the minutes used is automatically subtracted from the pre-paid calling card balance. A user can check their balance at any time by pressing #321 (a free call) on their cellular phone.
BT Cellnet (Easylife) http://www.cellnet.co.uk/1/index.html	The first UK pre-pay mobile users could use abroad. Users can make calls to the UK and receive calls from the UK in over 85 countries with BT Cellnet's Easylife. Holding down the '2' button on your phone displays your remaining credit balance. At the end of every call the balance is also automatically displayed. Users can continue to accept incoming calls with zero credit. BT Cellnet's text messaging allows you to send and receive text messages, turning the mobile phone into a two-way pager.
EuroTel (Go Card) http://www.eurotel.cz/czi/goe_prices.htm	After charging, validity of the GO voucher is 18 months. List of numbers that can be called free of charge in the Czech Republic, fire emergency, medical emergency, police of the Czech Republic, municipal police, EuroTel customer care centre, GO line. Note: The emergency phone numbers can only be called with a charged GO card.
France Telecom (Mobicarte) http://www.francetelecom.fr/vanglais/produits/pr od1.htm	Mobicarte can be used at any time during the 2 months following a user's first call. This credit is valid for 2 months to make calls and 6 months to receive calls. As long as users recharge their card at least every 6 months, the phone number is kept.
Telecom New Zealand (Go Pre-paid) http://www.telecom.xtra.co.nz/cgi-bin/TelecomBusiness.storefront/950452108/Product/View/BP13_3_1	60 days duration. Free calls will not use up any GO PRE-PAID call time. These include 111 Emergency Services, *126 Mobile Help and all 0800 calls.

Table 19. **Selected mobile card conditions and duration (cont'd)**

Company (Tariff scheme)	Duration/Conditions
Telia (Refill) http://www.mobitel.telia.com/summary_in_english/index.html	If the Refill account is not credited with airtime for a continuous period of 12 months, or if the customer fails to provide information in good time as set out in section 8 above, the account will immediately be closed. Once all of the customer's airtime has been used, outgoing calls on the account are blocked, with the exception of calls to the emergency services number 112 and Telia's automated customer service on 454 or 020-411 000, until more airtime is credited to the customer's account. A registered customer may apply to Telia to have his Refill account blocked, after which outgoing calls on the customer's account will be blocked, with the exception of calls to the 112 emergency services number. The customer may reopen a blocked Refill account and receive a new Refill card subject to an additional fee. The customer gives Telia the right to offset this fee against the airtime in his Refill account. If this fee exceeds the airtime in his account, the customer must purchase additional airtime equivalent to the fee before a new Refill card can be obtained.
Telsim http://www.telsim.com.tr/i/index2.html	Users are charged calls to the emergency or special numbers given by Türk Telekom.
Telstra (Zip) http://mobilenet.telstra.com.au/services/zip.htm	Three months. Free calls to directory assistance and various customer service numbers.
Vodafone (Pay as you talk) http://www.vodafone-retail.co.uk/	When the service credit runs out users are not able to make or receive calls (except to the Pay as you Talk Creditline or Pay as you Talk Helpline and emergency calls). Users can receive incoming calls while they have remaining days of Service Credit. If users do not top-up within 90 days they lose any unused Calling Credit. If users do not top-up within 180 days their number may be disconnected.

Source: OECD.

Table 20. SMS growth in Europe

Network operator	Date	Number of customers (million)	Number of short messages per month (million)	Average SMS per customer	Annualised growth rate (%)
Sonera	August 1998	1.2	20	17	800
Sonera	March 1999	1.6	40	25	200
Vodafone PREPAY Only	February 1999	1.2	19	16	NA
Vodafone POSTPAY Only	February 1999	3.8	8	2.1	200
Vodafone Total	February 1999	5	27	5.5	NA
Mannesmann D2	March 1999	5	100	20	800
Countries	Number of SMS in April 1999 (Million)				
Germany	200				
Italy	150				
Finland	75				
United Kingdom	70				
Norway	70				
Sweden	70				
Portugal	60				
France	60				
Spain	60				
Denmark	50				
Belgium	25				
Greece	15				
Total	1 000				

Source: GSM Association.

Table 21. Short message service (SMS) pricing in OECD countries

		Fixed monthly fee for SMS	Per message	Per 10 messages	Per 50 messages	Per 100 messages	Per 200 messages
Canada	Microcell (FIDO)	1.67		0.17	0.03	0.02	0.01
United States	Powertel	5.00		0.50	0.10	0.05	0.03
Mexico	Telmex	8.42		0.84	0.17	0.08	0.04
Japan	NTT DoCoMo	0.55	0.03	0.28	1.38	2.76	5.53
Korea	SKT		0.03	0.29	1.43	2.86	5.71
Denmark	Mobilix		0.05	0.55	2.73	5.46	10.92
Germany	Deutsche Telecom		0.07	0.73	3.67	7.35	14.69
United Kingdom	Orange		0.10	0.98	4.91	9.83	19.66
Greece	Panafon		0.10	1.02	5.08	10.16	20.33
Iceland	Iceland Telecom (Post-Paid)		0.11	1.12	5.59	11.18	22.35
Luxembourg	Luxembourg PTT		0.12	1.16	5.82	11.65	23.29
Turkey	Telsim		0.12	1.20	6.01	12.02	24.03
New Zealand	Vodafone		0.13	1.31	6.55	13.10	26.19
Portugal	TMN		0.14	1.40	6.99	13.97	27.95
Finland	Radiolinja		0.14	1.40	6.99	13.98	27.97
France	France Telecom		0.14	1.44	7.18	14.35	28.71
Switzerland	Swisscom		0.15	1.46	7.30	14.60	29.20
Norway	Telenor		0.15	1.46	7.31	14.61	29.23
Australia	Telstra		0.15	1.49	7.43	14.87	29.74
Belgium	Belgacom		0.15	1.54	7.72	15.43	30.86
Iceland	Iceland Telecom (Pre-paid)		0.17	1.68	8.38	16.76	33.53
United Kingdom	Vodafone		0.17	1.68	8.42	16.85	33.70
Italy	TIM		0.18	1.79	8.95	17.90	35.80
Spain	Telefonica		0.19	1.91	9.57	19.13	38.26
Czech Republic	EuroTel		0.22	2.23	11.14	22.28	44.56
Netherlands	KPN		0.23	2.29	11.45	22.90	45.80
Poland	Era GSM	4.90	0.24	2.45	12.24	30.37	54.83
Ireland	Telecom Eireann		0.26	2.55	12.77	25.55	51.10
Austria	Telecom Austria		0.26	2.57	12.86	25.72	51.43
Sweden	Telia		0.29	2.92	14.60	29.19	58.39
Hungary	Westel		0.36	3.58	17.91	35.81	71.62
OECD			0.14	1.50	7.19	14.54	28.89
EU Area			0.16	1.62	8.09	16.17	32.34

Source: OECD.

Table 22. Radiolinja pricing for SMS roaming

		Radiolinja price for sending an SMS from a foreign network USD ppp	Difference from the Radiolinja price for sending an SMS from Finland (%)	SMS as % of one minute peak price for voice service while roaming	SMS as % of one minute off-peak price for voice service while roaming			Radiolinja price for sending an SMS from a foreign network USD PPP	Difference from the Radiolinja price for sending an SMS from Finland (%)	SMS as % of one minute peak price for voice service while roaming	SMS as % of one minute off-peak price for voice service while roaming
Australia	Vodafone	0.10	-43.03	8	8	Luxembourg	LUXGSM	0.13	-14.76	13	26
Austria	Connect Austria	0.28	45.47	42	42	Netherlands	Ben	0.30	50.16	30	64
Austria	Max Mobil	0.28	45.77	42	42	Netherlands	Dutchtone	0.25	40.19	27	56
Austria	Mobilkom	0.30	50.41	36	36	Netherlands	KPN	0.25	40.19	24	50
Belgium	Mobistar	0.11	-33.37	11	14	Netherlands	Libertel	0.25	40.19	23	51
Czech Republic	EuroTel	0.10	-45.13	8	8	Netherlands	Telfort	0.25	40.19	26	59
Czech Republic	RadioMobil	0.17	12.66	17	17	Norway	NetCom	0.19	21.05	19	71
Denmark	Mobilix	0.08	-89.79	11	11	Norway	Telenor	0.22	31.94	25	43
Denmark	Sonofon	0.07	-119.31	8	21	Poland	Centertel	0.08	-89.79	9	11
Denmark	TDMOB	0.08	-89.79	15	17	Poland	Polkomtel	0.22	33.32	21	27
Denmark	Telia	0.09	-67.27	33	40	Poland	PTC	0.19	19.11	18	22
France	Bouyges	0.16	6.89	29	40	Portugal	Telemovel	0.23	34.21	33	33
France	Itineris	0.19	22.29	18	29	Spain	Airtel	0.80	81.27	109	125
France	SFR	0.19	22.29	18	29	Spain	Telefonica	0.33	54.73	49	51
Germany	D2	0.11	-33.37	12	23	Sweden	Comviq	0.30	49.90	48	48
Germany	DeTeMobil	0.07	-105.61	7	13	Sweden	Europolitan	0.27	43.93	40	65
Germany	E-Plus	0.08	-89.79	8	15	Sweden	Telia	0.28	46.65	39	53
Greece	Cosmote	0.11	-40.99	11	13	Switzerland	DiAx	0.24	37.54	30	36
Greece	Panafon	0.10	-49.53	8	11	Switzerland	Swisscom Mobile	0.22	31.46	24	30
Greece	Stet Hellas	0.22	33.32	25	32	Turkey	Telsim	0.09	-70.16	10	17
Hungary	Pannon	0.16	4.18	18	18	Turkey	Turkcell	0.07	-119.31	8	13
Hungary	Westel	0.19	21.67	23	23	United Kingdom	Cellnet	0.16	6.89	11	21

Table 22. Radiolinja pricing for SMS roaming (cont'd)

		Radiolinja price for sending an SMS from a foreign network USD ppp	Difference from the Radiolinja price for sending an SMS from Finland (%)	SMS as % of one minute peak price for voice service while roaming	SMS as % of one minute off-peak price for voice service while roaming			Radiolinja price for sending an SMS from a foreign network USD PPP	Difference from the Radiolinja price for sending an SMS from Finland (%)	SMS as % of one minute peak price for voice service while roaming	SMS as % of one minute off-peak price for voice service while roaming
Iceland	Landssiminn	0.16	6.01	22	24	United Kingdom	One-2-One	0.08	-86.21	7	8
Iceland	TAL	0.17	12.66	17	21	United Kingdom	Orange	0.09	-73.14	10	14
Ireland	Eiricell	0.25	40.90	27	33	United States	Omnipoint	0.74	79.82	46	46
Ireland	Esat Digifone	0.20	24.66	22	27		average	0.20	-2.59	23.25	31.95
Italy	Omnitel	0.13	-17.49	13	13						
Italy	TIM	0.16	8.62	27	36						

1. The prices are from June 1999. At that stage roaming agreements were not in place for SMS with Canada, Japan, Korea, Mexico and New Zealand.

Source: Radiolinja.

Table 23. OECD Member countries and IMT-2000 (UMTS & 3G)

	Commencement of service	Number of operators	Method to allocate licences	Source
Australia	TBD ¹	TBD	TBD	Australia: ACA: Media Release 09/02/99
Austria	1 Jan. 2002 (UC) ¹	4 (UC)	Auction (UC)	Telecom Control GmbH: Consultation document. 15/06/99
Belgium	UC ¹	UC	UC	BIPT: Consultation Paper
Canada (2)	<i>Laissez-faire</i>	<i>Laissez-faire</i>	No specific licence for IMT-2000	Correspondence
Czech Republic	TBD	TBD	TBD	
Denmark	2002	3-5	Comparative tendering	NTA: Status Report '98 10/98; UACG < www.spectrumauctions.gov.uk >
Finland	By 1 Jan. 2002	4	Comparative tendering	MTC: Press Release 16/03/99
France	2002 (UC)	4 (UC)	Comparative tendering (UC)	ART: Consultation Paper, Feb. 1999
Germany	2002	Limited by frequency	Auction	Ruling by the President's Chamber of 10 May 1999
Greece	n/a	n/a	n/a	
Hungary	TBD	TBD	TBD	Correspondence
Iceland	TBD	TBD	TBD	Correspondence
Ireland (3)	TBC	TBC	TBC	ODTR: Work Programme for January to December 1999 < www.odtr.ie >
Italy	By 1 Jan 2003 (4)	5	Comparative tendering	ICA < www.comune.napoli.it > 01/07/99
Japan	2001	3/region	Comparative tendering	MPT Press release 29/07/98
Korea	Early 2002	n/a	Auction	SK Telecom < www.sktelecom.com >
Luxembourg	n/a	n/a	TBD	European Radiocommunications Office < www.ero.dk >
Mexico	n/a	n/a	n/a	
Netherlands	1 Jan. 2002	4	Auction	MTPWWM: Policy intentions regarding the licensing of UMTS in the Netherlands 25/03/99
New Zealand	<i>Laissez-faire</i>	<i>Laissez-faire</i>	No specific licence for IMT-2000	Ministry of Commerce: New Zealand Telecommunications 1987-1998 December 1998
Norway (5)	By 1 January 2002	4	Comparative tendering	Correspondence
Poland	n/a	n/a	Comparative tendering	European Radiocommunications Office < www.ero.dk >
Portugal	UC	UC	UC	ICP: Consultation document 15/04/99

Table 23. OECD Member countries and IMT-2000 (UMTS & 3G) (cont'd)

	Commencement of service	Number of operators	Method to allocate licences	Source
Spain	n/a	4 (TBC)	Comparative tendering	Correspondence
Sweden	1 Jan. 2002 (UC)	3 /region (UC)	Comparative tendering (UC)	PTS: Consultation document of Feb. 1999 <firewall.pts.se>
Switzerland	1 Jan. 2002 (UC)	UC	UC	OFCOM: Consultation doc 01/04/99
Turkey	TBD	TBD	TBD	Correspondence
United Kingdom	Unspecified	5	Auction	RA: Preliminary Information Memorandum 23/06/99
United States (6)	<i>Laissez-faire</i>	<i>Laissez-faire</i>	No specific licence for IMT-2000	FCC: News Release of July 2, 1999
European Union	By 1 Jan. 2002	TBD by 1 Jan. 2000	TBD by 1. Jan. 2000	European Union: Decision No. 128/99/EC of the European Parliament

1. TBD: To be determined, TBC: To be subject of consultation, UC: Under consideration, NA: information not available.
2. Incumbent PCS operators are expected to offer IMT-2000 services based on their own decisions.
3. Consultation paper will be issued in September 1999 with the result to be reported in December 1999.
4. The Italian government (the Ministry of Communications) has expressed a reserve on the UMTS decision [of the EU]. This means that Italy might postpone one year the start of authorisation procedures. (Italian Communication Authority "The regulation of the telecommunications market in Italy" <www.comune.napoli.it/agcom/eng/regul_tlc.htm> at section 10.
5. It is reported that two licences to test UMTS, which run until August 2000, were issued. They won't give any indications about which parties will get a commercial UMTS licence. (Beate Schjolberg at Bloomberg News 28 June 1999 available from Total Telecom <www.totaltele.com>
6. "Operators of digital wireless telecommunications systems in the United States, under FCC rules, may upgrade their existing systems to the 3G technology of their choice at any time, based solely on commercial considerations." (FCC "United States Welcomes Progress in Global Standardization of New Wireless Telecommunications Technology" News Release of July 2, 1999).

Source: OECD.

NOTES

1. In this report cellular mobile communication is generally shortened to mobile communication.
2. OECD, "Mobile and PSTN Communication Services: Competition or Complementarity?", Paris 1995. http://www.oecd.org/dsti/sti/it/cm/prod/e_95-96.htm. The report was considered at a 1992 meeting of the Telecommunications and Information Services Working Party.
3. OECD, "Mobile Cellular Communication -- Pricing Strategies and Competition", Paris, 1996. This report was considered at the June 1995 meeting of the Telecommunications and Information Services Working Party.
4. OECD, "OECD Reflections on the Benefits of Mobile Cellular Telecommunication Infrastructure Competition", OCDE/GD(96)42, Paris 1996. http://www.oecd.org/dsti/sti/it/cm/prod/e_96-42.htm
5. Employment and revenue growth in the mobile sector, are not considered here because they have been integrated into regular reporting via the *OECD Communications Outlook*. Refer *OECD Communications Outlook* 1999, Paris 1999.
6. CNN, "Mobile phones for the deaf", 23 September 1999. http://www.cnnfn.com/1999/09/23/technology/deaf_telephony
7. CTIA, Wireless 9-1-1 and Distress Calls, <http://www.wow-com.com/statsurv/e911>
8. PR Newswire, "Telefonica Net Profit Rose 73% During First Half of 1999, to 1.020 Billion Euros", 1 September 1999.
9. Vodafone, "Get the message direct from Mobile to Pager!", Press Release, 22 June, 1998 <http://www.vodafone.co.uk>
10. Gareth Vaughan, "European mobile phone use tops 30%", 7 September, 1999. http://cbs.marketwatch.com:80/archive/19990907/news/current/europe.htx?source=htx/http2_mw
11. Paul Betts, "Text Messages: Italy in Love", *Financial Times*, 13 August 1999.
12. Jim Hu, AOL says to block Tribal Voice messaging users, CNET News.com, 7 September, 1999. <http://www.news.com/News/Item/0,4,41376,00.html>
13. RSDL, "Swisscom Clips Competitors' Messages", Abstracted from *Neue Zuercher Zeitung* by RSDL, Totaltele, 6 September 1999.
14. In this report cellular mobile subscribers is shortened to mobile subscribers.
15. Ministry of Transport and Communications, "Even Households Have More Mobile than Fixed Telephones in Finland - 20% of Them Own Only a Mobile Phone" Press Release, 26 August 1999. <http://www.mintc.fi/www/sivut/dokumentit/tiedote/viestinta/ti260899678eng.htm>

16. If a country has 10 regions, each with three operators, the number of mobile equivalent operators for that country is three. In countries where there are different numbers of operators in different regions, the largest number of operators in the same market is used to determine the national equivalent.
17. "Liechtenstein To Issue Four Mobile Phone Licences", Excerpted from *Neue Zuercher Zeitung* by RDSL for TotalTelecom, 15 July 1999.
18. Beate Schjolberg, "Norway Awards 1-Year Trial UMTS Licenses", Bloomberg News, Total Telecom, 28 June 1999.
19. Federal Communications Commission, Fourth Annual Report on State of Commercial Mobile Radio Services, Washington, June 1999, pp 19-20.
20. David Bentow, "Telenordia May Lose Swedish Mobile Phone License", Bloomberg News, Total Telecom, 21 May 1999.
21. A rolling three-year average is used based on the date a network commenced operations (two year averages are used at the beginning or end of series if a first or third year was not available). In other words if a market changed in structure in 1996 the average growth for that year included 1995, 1996 and 1997. This is because one-year snapshots may not fully capture the benefits of reform. This is for two reasons. First, the pending onset of new entry by an additional licence may stimulate the market. Second and more importantly, the full impact may not be borne out until the first full year of operation with the new market structure.
22. The CTIA survey results are posted at: <http://www.wow-com.com/wirelessurvey>
23. FCC, Monitoring Report, June 1999. http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/recent.html
24. CWTA, "Industry Facts", 1998, at <http://www.cwta.ca/indguide/facts.htm>
25. Microcell, "FIDO introduces enhanced price plan and banking of minutes", Press Release, 9 September 1999. <http://www.microcell.ca>
26. Vanessa Clark, "Finnish Mobile Operators Uncompetitively Exclude Telia", 23 September 1999
27. Vanessa Clark, "Finnish Mobile Operators Uncompetitively Exclude Telia", Op.cit.
28. AT&T information Callcard is available at: http://www.attws.com/personal/travel/index_cellcard.html
29. BT Cellnet, <http://www.cellnet.co.uk/1/content1.4.4.html>
30. BT Cellnet, <http://www.cellnet.co.uk/1/content1.1.6.1.html>
31. Joanne Taaffe, "Pre-paid services highlight drawback to GSM roaming", *CommunicationsWeek International*, 20 September 1999.
32. OECD, *OECD in Figures*, 1995, pp 71.
33. Joanne Taaffe, "A rude awakening", *CommunicationsWeek International*, 20 September 1999.
34. Swisscom, "Swisscom Offers World's First International Prepaid Roaming Solution for Mobile Phones", 14 June, 1999. http://www.swisscom-na.com/news/news_set-en.html

35. Joanne Taaffe, "A rude awakening", Op.cit.
36. A database has been assembled and the prices are online at <http://www.fl.dk>
37. Information on this plan is available at: http://www.attws.com/general/onerate/ca_calling.html
38. Comparison of Sonera 'Classic' mobile rates and Sonera fixed network charges including call set-up charge.
39. Unlimited local airtime applied to evenings (6pm-7am Monday-Friday) and on weekends (Friday 6pm until Monday 7am). The package included no long distance charges anywhere in BC and Alberta during unlimited evenings and weekends. Reference rates from <http://www.cellone-online.com/phones1.htm> in July 1999.
40. Optus, "Optus Launches 'Yes' Weekend", Press Release 28 July 1999. <http://www.optus.com.au/company/newsArticle.asp?articleId=125>
41. Information is available at <http://www.leapwireless.com/site/opcom/cricket.html>
42. The service area in August 1999 is shown at http://www.cricketcommunications.com/service_area/cricketmap.html. The distance between Bakewell, Tennessee, United States and Chickamauga, Georgia, United States, "as the crow flies" is 54 kilometres.
43. FCC, Monitoring Report, June 1999. http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/recent.html
44. Ibid.
45. In the United States LATA stands for "local access and transport area." LATA boundaries were defined in the Modified Final Judgment and specify the boundaries within which the incumbent local exchange carriers from the former AT&T Bell system can offer services.
46. Nick Goldin, "Users of Wireless Phones Find Unexpected Benefits", *New York Times*, 21 September 1999.
47. It might be argued that a fixed monthly charge contributes to the cost of receiving calls but this charge is not applied on a call-by-call basis.
48. Totaltele, "FCC Votes to Consider "Calling-Party-Pays" Policy", 11 June 1999. <http://www.totaltele.com/secure/view.asp?articleID=22686&Pub=TT&categoryid=627>
49. CTIA, "CTIA Issue Brief - Calling Party Pays", <http://www.wow-com.com/techops/cpp/brief.cfm>
50. FCC, Declaratory Ruling and Notice of Proposed Rule Making in the Matter of Calling Party Pays Service Offering in the Commercial Mobile Radio Services", Washington, 7 July 1999.
51. Blaise Zegera, "London Calling", *Red Herring Magazine*, August 1999. <http://www.herring.com:80/mag/issue69/news-london.html>
52. John Borland, "Wireless firms aim to revamp billing plans", Cnet, 27 September, 1999. <http://news.cnet.com/news/0-1004-200-205417.html?tag=st.cn.1fd2>
53. Ibid.

54. Mark Lowenstein, "Guest Opinion: Don't Expect Widespread CPP use in the United States", *WirelessWeek*, 20 September 1999. <http://www.wirelessweek.com/news/sept99/gopn920.htm>
55. The obstacles in the United States are extensively discussed in FCC, Declaratory Ruling and Notice of Proposed Rule Making in the Matter of Calling Party Pays Service Offering in the Commercial Mobile Radio Services", Opt.cit.
56. The two larger increases occurred in the second year of service in Greece and Poland.
57. Telmex views were reflected in an interview of CEO Jamie Chico Pardo by Mark Holmes in *Global Telecoms Business*, Number 40, July/August 1999. p 31
58. Information about PEGASO is available at: <http://www.leapwireless.com/site/opcom/index.html>
59. Fiona Ortiz, "Growing Pains Cramp Mexico Cellular Phone Companies", *Reuters*, 15 September, 1999.
60. Cofetel, "Traffic on the Cellular Network during May 1999 with CPP", Bulletin 22/99. 1 June 1999.
61. ART, "ART recommends reductions in the prices charged for calls to mobiles", Press Release, Paris, 29 June 1999. <http://www.art-telecom.fr/communiqués/pressrelease/23-99a.htm>
62. *Comision del Mercado de las Telecomunicaciones*, Annual Report, Madrid, 1998.
63. France Telecom, "France Telecom announces 20% rate cut for calls from fixed phones to France Telecom Itineris mobile phones as of July 1 1999", Press Release, Paris, June 29, 1999. <http://www.francetelecom.fr/vanglais/actualite/commdosp/actu290699.htm>
64. Oftel, "prices of calls to mobile phones - statement", March 1998. <http://www.oftel.gov.uk/pricing/ctm0398.htm>
65. ACCC, "Mobile long-distance services Drat Report", Press Release, 23 August 1999. <http://www.accc.gov.au/media/mr-152-99.htm>
66. Ben Potter, "Big Fall in cost of mobile phone calls", *Sydney Morning Herald*, 3 August 1999.
67. ART, "ART recommends reductions in the prices charged for calls to mobiles", Op.cit. <http://www.art-telecom.fr/communiqués/pressrelease/23-99a.htm>
68. *International Herald Tribune*, "2 Italian Mobile Phone Firms Fined in Price-Fixing Scheme", Paris, Saturday, October 2, 1999.
69. OPTA, "OPTA stimulates price-reduction for fixed-to-mobile calls," 29 June 1999 Press Release. <http://www.opta.nl/eng/pub/press.html>
70. Refer Telecom Supervision 1998 - Draft (June 1999) http://firewall.pts.se:80/infoeng/info_eng.htm
71. PriceWaterhouseCoopers, "The Swedish Telecommunications Market", 1998 An analysis conducted on behalf of the National Swedish Post & Telecom Agency, 4 June 1999. http://firewall.pts.se:80/infoeng/info_eng.htm
72. United Kingdom Competition Commission "Cellnet and Vodafone: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Cellnet and Vodafone for terminating calls from fixed-line networks", 21 January 1999. Refer <http://www.mmc.gov.uk/9798.htm#1999>

73. OFTEL, "Calls to mobile networks to be reduced by 25%", Press Release, 15 December 1999. <http://www.nds.coi.gov.uk/coi/coipress.nsf/d63cbd4e534a5b8b802567350058dced/655c1110d95cef8e802566db0034f6ff?OpenDocument> .
74. Information Society DG (DGXIII), Explanatory Note, Brussels, "Tariff principles for fixed to mobile calls originating on the fixed network of an operator notified as having significant market power", 10 September 1999.
75. James Amott "EU to Investigate Claims of Over-Charging by Mobile Companies", Bloomberg News at Totaltele, 27 September 1999.
76. For example: Squire, Sanders & Dempsey, "Consumer Demand for Telecommunications Services and the Implications of the Convergence of Fixed and Mobile Networks for the Regulatory Framework for a Liberalised EU Market." June 1999 Refer <http://www.ispo.cec.be/infosoc/telecompolicy/en/Study-en.htm>.
77. European Commission, "Commission closes mobile telecommunications cases after price cuts", IP/98/1036, Brussels, 26 November 1998.
78. European Commission, "Commission successfully closes investigation into mobile and fixed telephony prices following significant reductions throughout the EU", IP/99/298, Brussels, 4 May 1999.
79. OFTEL, "Prices of calls to Mobile Phones", 1997. Consultative document formerly available at: <http://www.oftel.gov.uk/call2mob.htm>
80. OFTEL, "British Telecommunications plc. A report on a reference under section 13 of the Telecommunications Act 1984 on the charges made by British Telecommunications plc for calls from its subscribers to phones connected to the networks of Cellnet and Vodafone," December 1998. <http://www.oftel.gov.uk/pricing/bmmc1298.htm>
81. ART, "ART recommends reductions in the prices charged for calls to mobiles", Paris, 29 June 1999. <http://www.art-telecom.fr/communiqués/pressrelease/23-99a.htm>
82. Public Networks Europe, "Time to Scramble the Swot Team?", June 1999. p 38.
83. Information on the genesis of pre-paid cards is available at: <http://home.swipnet.se/OsbyMikro/kontan2e.htm>
84. Alistair Harris, "European Outlook: Iberia's mobile marvel", *Communications International*, 1 September 1999.
85. Telecom Portugal, Annual Report, 1996 http://www.telecom.pt/uk/empresa/financeiras/relatorios/rel96/rel96_03.htm
86. TMN, Press Release, 2 February, 1998 http://www.telecom.pt/uk/empresa/noticias/artigo.asp?id_artigo=25.6
87. <http://www.sonera.fi/english/press/prepaid.html>
88. Jakob Dalskov, "Denmark's Sonofon Joins Trend for Mobile Prepaid Alternative", Bloomberg News, Totaltele, 5 January 1998. <http://www.totaltele.com/secure/view.asp?articleID=9493&Pub=TT&categoryid>

89. Telia, "Swedish youth calls mobile!", Press Release, 23 July 1999. <http://han16ns.telia.se/Telia/Thk/ThkPre70.nsf/vNyhetEfocusEng/224D68150CD85FF4412567B7004A7245?OpenDocument>
90. Telenor press release at <http://www.telenor.com/display.cfm?m=5&s1=1&file=PressDetail.cfm&id=44>
91. Airtouch press release <http://news.excite.com/news/bw/990823/ca-airtouch-cellular>
92. Canadian Wireless Telecommunications Association at <http://www.cwta.ca/indguide/facts.htm>
93. James Careless, "Canadian Prepaid Sales Boffo, with Bonzo", 27 September 1999. <http://www.wirelessweek.com/news/sept99/ffive927.htm>
94. Ibid.
95. Isak Abramowicz *et al.* "The Swedish Telecommunications market, 1998". An analysis conducted on behalf of the National Swedish Post and Telecom Agency, Price Waterhouse Coopers, 4 June, 1999.
96. Chris Ayres, "Cellnet Launches Internet Shop", *The Times*, 1 October 1999. <http://www.the-times.co.uk/news/pages/tim/99/10/01/timbizbiz02028.html?999>
97. Data reported by the Australian Government at: http://www.dca.gov.au/nsapi-text/?Mival=dca_dispdoc&pathid=%2fpolicy%2ftelcombriefs%2fbrief7%2html
98. Refer to Panafon Website at: <http://www.panafon.gr/en/news/junior.htm>
99. Telia, "Swedish youth calls mobile!", Press Release, 23 July 1999. <http://han16ns.telia.se/Telia/Thk/ThkPre70.nsf/vNyhetEfocusEng/224D68150CD85FF4412567B7004A7245?OpenDocument>
100. Airtouch press release, 23 August 1999 at <http://news.excite.com/news/bw/990823/ca-airtouch-cellular>
101. "A SIM Lock", <http://home.swipnet.se/OsbyMikro/sim-locke.htm>
102. Ibid.
103. David Molony, "EC Dispute over lock-in costs", *CommunicationsWeek International*, 9 September 1996.
104. Alex O'Connell, "Mobiles left on the shelf", *The Times*, 28 September 1999.
105. Details are at: <http://mobicarte.itineris.tm.fr/vanglais/html/offre/prix/prix.htm>
106. Molony, "EC Dispute over lock-in costs", *Op.cit.*
107. Offer available at http://www.bam.com/wash_balt/dig_choice.htm
108. Simon Buckingham, "An Introduction to SMS", Mobile Lifestreams Ltd., 22 June 1999. http://www.gsm.org/gsmdata/sms_02.htm
109. BC Tel's SMS enabled Website is at <http://www.bctm.com/digital/short.htm>
110. <http://www.omnipoint.com/common/center/main.html>
111. <http://sms-tng.skynet.be>

112. Some of Sonera's applications are described at: <http://www.sonera.fi/smarttrust/ss.html>
113. Buckingham, Op.cit.
114. Buckingham, Op.cit.
115. Buckingham, Op.cit.
116. Gary Krakow, "Free Wireless Internet, now!", MSNBC, 1 October 1999. <http://www.msnbc.com/news/318283.asp?cp1=1>
117. Refer to <http://www.hz.com>
118. Buckingham, Op.cit.
119. One limitation is that to receive an SMS a mobile handset must be switched on. To retrieve messages, sent when their handsets are not actively connected to a network, a user must programme the number of their mobile operator's short message service centre (SMSC). Depending on the network concerned the sender may or may not receive confirmation that their message has been received.
120. Some value added service providers, without networks, charge users for sending messages from their Website to mobile operators, such as Redrock in Australia. Refer: http://www.redrock.com.au/messagenet/gateway/index_message.html
121. The MTS Website is at: <http://www.mtnsms.com>
122. Joanne Taaffe, "Operators face mobile data billing conundrum as GPRS looms", *CommunicationsWeek International*, 20 September 1999.
123. Refer to <http://www.branchenbuch.ch/sms>
124. "Swisscom Clips Competitors' Messages", 6 September 1999. Abstracted from *Neue Zuercher Zeitung* by RDSL for Totaltele. <http://www.totaltele.com>
125. Decision No 128/1999/EC of the European Parliament and of the Council of 14 December 1998 on the coordinated introduction of a third-generation mobile and wireless communications system (UMTS) in the Community.
126. RDSL "South Korean Companies Rush To Bid For 3G Licences", Abstracted from FT Asia-Pacific Telecoms Analyst by RDSL for Totaltele, 13 September 1999.