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International Mobile Roaming Charging in the OECD Area

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Working Party on Communication Infrastructures and Services Policy

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FOREWORD

The Working Party on Communication Infrastructures and Services Policy discussed this paper at its meeting in June 2009. The Working Party agreed to recommend the paper for declassification to the Committee for Information, Computer and Communications Policy (ICCP). The ICCP Committee agreed to the declassification of the paper in October 2009.

The paper was drafted by Mr. Sam Paltridge, Mr. Yasuhiro Otsuka and Mr. Agustín Díaz-Pinés, of the OECD's Directorate for Science, Technology and Industry. It is published under the responsibility of the Secretary-General of the OECD.

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Main Points

The aim of this report is to provide information and analysis on market developments and pricing in international mobile roaming service (IMRS). While the wireless industry has witnessed spectacular developments in recent years, and is considered competitive in domestic markets, there is a widespread perception among many stakeholders, including some within the industry itself, that IMRS prices are unreasonably and inefficiently high.

This report provides comparative information on IMRS retail and, where available, wholesale prices. It also sets out the nature of the perceived problem together with analysis on why IMRS pricing takes the form it does. The report does not make recommendations to OECD governments as any such options are work in progress.

Some of the findings on pricing, in February 2009, are that:

A three minute call made by a roamer back to their home country, while roaming across the OECD area, costs, on average, USD 7.79. Remarkably the averages of prices for such a call ranged from USD 3.75 to USD 13.20.

The difference between the cost of sending an SMS, while roaming, in the least expensive and most expensive countries, varied by a factor of five.

Roaming pricing on bi-lateral routes (*i.e.* the cost of the same service for users visiting each other's country and calling home) can vary by a multiple of more than eight.

It can be up to 20 times more expensive for an international roamer to make a call home than for a local mobile user, in that country, to make an international call to the roamer's home country.

While the available data on wholesale rates is limited to a small number of countries, where information is on the public record, it would appear from these data and anecdotal corroboration, that the major contributor to high retail charges is the wholesale rates charged by foreign operators. Where information is available the wholesale rate makes up around three quarters of the retail rate. Wholesale roaming charges are frequently in excess of USD 2 to USD 3 per minute and sometimes are more than USD 4 per minute. For one operator, whose experience is probably typical, the wholesale charges faced range from USD 0.79 to more than USD 5 per minute across the OECD area. There is an even greater range for these rates if countries outside the OECD area are considered.

International mobile roaming services are sold in a bundle which usually includes domestic mobile access, local calls, SMS, eventual handset subsidies, etc. This usually results in an inelastic demand for roaming services for a significant part of the customer base, as many customers do not consider roaming prices when choosing a mobile service provider. There are a number of reasons for this inelasticity: low

user awareness of roaming prices, due to the fact that the roaming share of customers' bills is intermittent and relative to the year's total bill is unlikely to be high; lack of timely and readily available information to enable cross-operator comparisons, etc. As a result, competition dynamics for the retail roaming market remain inefficient, since an eventual wholesale reduction does not necessarily lead to retail price reductions. Thus, mobile operators can maintain high roaming charges with a relatively low risk of losing a customer. The economic figures support this assessment since, as mentioned throughout the report, international roaming only generates a relatively small share of the mobile market's overall revenue, around 5% of the revenue to MNO's, according to some estimates.

Different views on the issue of inefficiency for retail and wholesale roaming prices exist. While consumers clearly find that retail prices are unreasonably high, other stakeholders, such as large telecommunications operators, consider that there are no inefficiencies.

The available evidence suggests the wholesale market for roaming services was wholly dysfunctional prior to 2003. Since that time there have been gradual signs of change but the pace, and breadth across different markets, has been far from optimal. This report primarily attributes this to limited contestability in the provision of wholesale services. That being said the report finds some positive signs of potential change in that:

The emergence of traffic directing technologies, from 2003 onwards, has introduced some degree of competition in setting wholesale rates. The effect of steering roamers toward particular networks, in foreign countries, has also been to reduce the benefits some operators receive from a system that perpetuates high wholesale rates. This is particularly so in the case of smaller operators or operators without an extensive network of foreign affiliates. In this paper, we discuss whether this increases the likelihood that, in future, they will look to bypass the system as a greater range of commercial and technological options emerge for them to do so.

The development of on-net pricing, since 2005, has significantly reduced prices for roamers in countries where they are applicable and this innovation has proven very popular with users. Further cross border integration of operators can be expected to increase that trend. The current availability, however, beyond a handful of operators and routes across the OECD, is limited. Indeed, developments in this respect appear to be taking place faster in developing countries than in the OECD area. This is seemingly because operators in markets with lower tele-densities are focused on growing, rather than protecting, some types of revenue streams. That is also heavily dependent on the regional market structure, *i.e.,* whether MNOs have the necessary footprint for on-net offers.

The development of alternative calling procedures for roaming, which to date have been assessed by most analysts as imperfect substitutes, are becoming increasingly seamless. The main barrier to these services is that brand recognition among consumers, in respect to the providers of these services, remains very low and some users are understandably reluctant to have two providers of wireless services. The fact that the use of roaming may be relatively infrequent for most users reduces the incentive for the customer to look for substitutes (even imperfect). On the other hand, frequent users (*e.g.* business users) might be in a better position to negotiate better deals, which also discourages the use of substitutes.

In conclusion, while this report does find that roaming rates are excessive when compared to the underlying wholesale costs of providing the roaming service or the retail price of a domestic mobile call plus an international call from the fixed network, and that current levels are inefficient, it also notes similarities with the fixed line market prior to the collapse of the accounting rate system. Competition can be expected to increase but the pace is challenging to forecast. It will be strongly influenced by decisions taken by regulatory authorities in respect to matters such as cross-border acquisitions and the contestability of the roaming market including its openness to alternative calling procedures, and MVNOs that are not

constrained in the services and pricing they can provide. Price sensitivity of consumers will also influence the development of the roaming market and the potential use of substitutes.

The report also makes the first assessment of the affect of taxation on the cost of roaming. It finds instances of probable double taxation, including authorities from some jurisdictions taxing the tax applied by authorities in foreign countries. The OECD's Committee on Fiscal Affairs has recognised that the application of consumption taxes to international telecommunications is an issue for its 2010 programme of work. In the light of the work carried out in the ICCP, the Working Party on Consumption Taxes of the Committee on Fiscal Affairs will commence work in 2009 with a view to establishing current approaches by member governments (and selected non-OECD economies). From this it will seek ways to bring greater consistency in order to avoid double taxation and unnecessary complexity. This work is likely to include not only roaming charges but also the relevant international settlements between service providers.

Introduction

This report examines why the wireless industry, which has been so successful in so many respects, finds itself at loggerheads with users, policy makers and within its own ranks on international mobile roaming charging (IMRC). The discord stems from the perception by many stakeholders, including some within the industry itself, that roaming prices are unreasonably high. It costs a user around USD 2.60 per minute, on average, to make a call home when roaming across the OECD area.[1]

This report concludes that relatively high retail charges are to a great extent attributable to the high level of wholesale roaming rates which mobile operators charge each other for network use (and the lack of convenient alternatives to these wholesale agreements), as well as to demand inelasticity of a large share of the customer base. The report notes, however, that technological change and related commercial developments are opening possibilities for increasing competition in that market segment. For GSM networks, wholesale roaming charges are based on the so–called Inter Operator Tariffs or IOTs, which define a non-discriminatory tariff (known in advance by all GSMA members) that is the starting point for negotiating the wholesale rates. Thus, any GSMA member has the right to obtain without negotiation wholesale roaming services from any other member priced at the IOT level, and the final outcome of the negotiation will be determined through a number of factors: volume discounts, traffic balance, negotiating power, etc. Alternatively, the IOT system may be bypassed through integrated cross border ownership or alternative market access arrangements. In that case, roaming pricing tends to mirror domestic pricing, depending on the availability and take-up of such alternatives, the extent to which they are substitutes, and the price sensitivity of roaming consumers.

It is interesting to consider whether these trends in the mobile industry mirror to some extent an earlier stage of development in the fixed line market. In the final decade of the 20th century, regulatory, commercial and technological developments swept aside the traditional settlements system across the OECD area. Liberalisation allowed third party providers without an incentive to maintain high wholesale payments under the accounting rate system to connect to the far end using their own facilities or resale. Faced with a choice of high cost termination through the accounting rate system or low cost local termination, through direct access to domestic wholesale prices, the balance of traffic quickly swung toward a combination of local termination and end-to-end provision of international services. An important difference is that, contrary to what happened under the accounting rate system, in general under the IOT system MNOs have the possibility to negotiate roaming agreements with multiple operators in each country, who in principle have incentives to compete with each other, which allows the wholesale tariffs to be finally established below the IOT level.

However, IOT levels are far higher than the wholesale rates paid by local MVNOs, as may be the negotiated tariffs if the competitive incentives are not strong enough. While these differences remain it could be argued that the same forces that went to work in the market for fixed network international services, could become increasingly evident in the mobile market for international roaming. Over time that would drive the IOT system towards more competitive levels or simply see them replaced by local wholesale rates. Whether this can occur in practice depends on a number of factors relating to the characteristics of roaming services. Internalisation of mobile roaming traffic by MNOs with a large footprint may be compared to the emergence of end-to-end connectivity for fixed international calls. But where undermining the IOT system depends on third party providers, their take-up and market impact will depend on whether consumers are sufficiently price sensitive and there is price elasticity in roaming services. International fixed calls proved very price elastic, especially for business users who bought significant quantities of international minutes separately from domestic minutes and on the basis of price. As price–sensitive consumers then moved to third party providers, this eventually exerted pressure on

mainstream telecoms providers to lower their prices, although they are still not necessarily as low as third party providers given that customers who buy both domestic and international services from a mainstream provider are considered less price sensitive. For smaller MNOs the decision to break away from the IOT system and sell to third party providers is a complex one, involving an evaluation of whether the MNO benefits *overall* from the system, even though it may have more outbound traffic on certain routes.

There are several key factors which, in theory, have the potential to place pressure on wholesale rates for roaming services and over time reduce the influence of the IOT system. One trend could be termed "internalisation" and the other "localisation". If these factors became sufficiently widespread, they could drive retail prices to a lower level than at present. They will do this by minimising or eliminating exposure to the IOT system.

Internalisation: Prior to 2003 only those mobile network operators (MNOs) with integrated ownership could endeavour, though not always effectively, to steer roamers towards their local affiliates. The development of network-based steering of roaming systems enabled MNOs to exert greater control over the apportionment of outbound traffic. This was potentially a "game changing development" because it meant MNOs could much more effectively steer traffic toward partners or preferred networks. In contrast to the previous environment, where greater randomness in network selection accorded roughly equal benefit from inbound traffic to all players, the incentive was now to direct off-net roamers toward the network with the lowest wholesale rate. One of the first consequences was the formation of alliances among mobile operators through which members hoped to negotiate volume discounts with partners and, thereby, compete with MNOs with the greatest network reach. The competitive response, from the player with wholly owned networks in the most markets, came soon thereafter with the launch of the first 'on-net tariff' (*i.e.* retail tariffs for roaming oriented toward regular prices). MNOs that continue to pay high IOTs and are excluded from the bulk of inbound traffic, which now takes place through partner networks, will increasingly have an incentive to look outside the IOT system.

Localisation: "Foreign" service providers can be treated in the same way as virtual mobile network operators (MVNOs). In these cases they pay domestic wholesale rates rather than wholesale roaming rates. This enables local pricing for roaming services (*i.e.* retail tariffs for roaming that are oriented towards regular domestic prices). While the model is little used by MNOs and MVNOs it is used by, what this report terms a "global-MVNOs". The global-MVNOs could not operate without the co-operation of an MNO, MVNO or regulatory authority, in one or more markets, to give them access to global networks on local terms and conditions (including resources such as numbers). A global MVNO has access to networks in different countries on local terms and conditions, *e.g.* via domestic wholesale agreements or MVNO regulations, and then uses its own infrastructure or means to interconnect those different customers, thus bypassing the IOT framework. This potentially enables them to offer much more competitive rates, since they are not constrained by roaming agreements. It is also possible that some of the 'roaming hubs', that are now being established as places for commercial roaming exchange agreements to take place, will evolve with a mixture of localised network wholesale access and IOTs. One example of localisation are the offers from global-MVNOs that enable free inbound calls for roamers in the United States and outbound calls below the Eurotariff rate to European destinations. Such services are possible because the roamer is treated in the same manner as a local user by the home network in terms of wholesale arrangements. In other words the service most likely bypasses the IOT system.

The differences between the market players so far engaging in internalisation and localisation are extensive just as they were for fixed networks. On the one hand, there are relatively large MNOs with facilities in multiple markets. Their aim is to keep the majority of traffic within their own network and those of partner networks. On the other hand, there is a new type of service provided that this report calls a global-MVNO. The latter entities may or may not have a local presence in countries in which they offer service. In between, and likely to be increasingly squeezed, are MNOs that are smaller or those that have

limited international on-net presence as well as traditional MVNOs. It could be argued that this middle group of actors will sustain the IOT system only until they decide they are no longer net beneficiaries from its existence and use. If consumers are price sensitive regarding roaming services, their margins would be steadily eroded for the provision of roaming services. To better understand the pressures that will be exerted on the IOT system it is necessary to consider both internalisation and localisation.

Internalisation, localisation and "shaking apple-carts"

From 2003 onwards the effectiveness of techniques used by MNOs to steer roamers toward preferred networks began to substantially improve.[2] Prior to that time there was a greater degree of randomness in network selection. MNOs reacted to this development in several ways. One was to form alliances, such as "FreeMove", "Starmap" and the "Bridge Alliance", with a goal of facilitating volume discounts on IOTs to partnership members and directing traffic towards the network partners with the lowest wholesale charge.[3] The alliances were also aimed at offsetting the potential advantage held by MNOs with a greater direct network presence in multiple foreign markets. Begun in 2003, the FreeMove alliance members' footprint includes 32 countries across Europe, the United States and Brazil. Prominent members include Orange, Telecom Italia Mobile, T-Mobile and TeliaSonera. Starmap, which existed between 2004 and 2007, was also comprised of a number of European operators.[4] The Bridge Alliance, established in November 2004, is composed of a group of mobile operators in the Asia Pacific region.[5]

For the MNOs with the largest reach a more disruptive option was also available. In 2005 Vodafone launched the first widespread on-net tariff (*i.e*. Vodafone Passport). The novelty of this tariff was that, for a relatively small fixed fee per call, users paid regular prices while roaming on a Vodafone owned network. The option proved tremendously popular with Vodafone's customers. Between January 2007 and June 2009 this strategy, for a variety of reasons, was also adopted by Hutchison 3 (i.e. "3 Like Home"). This service enabled users to roam on Hutchison 3's shared ownership networks at regular rates. Although "3 Like Home" was available in fewer countries than Passport it was also tremendously popular with Hutchison 3's customers. The major difference between Passport and "3 Like Home" was that Hutchison customers did not pay a fixed fee per call though Vodafone waived the fixed fee between June and August 2009. [6] . There is no separate off-net charge within the applicable countries, while there was an off-net charge within 3 Like Home countries, if the user fell out of the 3 network. In May 2009 Hutchison 3 announced that the "3 Like Home" service would be withdrawn from the market.[7]

The relevant question for policy makers is why on-net tariffs had not previously been available and why, given their popularity with customers, more are not available. Certainly, networks with integrated ownership could have offered on-net tariffs prior to 2005. Shared ownership meant MNOs could record preferred networks on SIM cards or encourage their users to manually select networks through their direct customer relationship. The fact that they did not leverage this ability into the creation of on-net offers, suggests they were net beneficiaries of the IOT system. In other words while they undoubtedly made efforts to keep traffic on-net they were also beneficiaries of the randomness of network selection in terms of inbound roamers. Once other MNOs began to reduce this traffic stream there was little reason, for the MNO with the broadest international reach (*i.e.* Vodafone) to hold back from an on-net offer. Internalisation can be said, to use a colloquial metaphor, to have "shaken the apple-cart" though not yet overturned it.

In contrast to Vodafone most MNOs across the OECD have resisted offering an on-net roaming pricing option for users. Some do, of course, offer discount plans based on the reduced price they bilaterally negotiate on wholesale rates or IOTs. Many MNOs, however, do not offer any form of discount plan suggesting that substantive discounts are not available through the IOTs system to them or, based on their assessment of consumer behaviour, that some MNOs feel they do not need to compete vigorously in that market segment (*e.g.* the customer does not consider the price of roaming in selecting a service

provider so lowering the price will not lead to an increase in volumes). This position would become less tenable if there was the added competitive pressure from localisation, but that also depends on consumer price sensitivity and roaming price elasticity.

MNOs may react when and where their market shares are threatened, or as a result of better wholesale deals. Take, for example, high volume roaming routes such as between Japan (DoCoMo) and Korea (KTF) or Spain (Movistar) and Morocco (Movistar). In both of the examples the leading MNOs now offer customers the option of having two numbers (*i.e.* one for each country) enabling them to roam at discounted prices with a relatively seamless service. In the case of a Japanese user roaming in Korea, by manually selecting KTF's network after arriving in Korea, they will be able to place calls for lower charges compared to using DoCoMo's conventional international roaming service. In addition, there is no charge to receive calls terminating on local numbers. This service is not as seamless as Vodafone's Passport or the Kuwaiti based Zain's One Network. This may reflect that DoCoMo is a minority shareholder in KTF rather than having full ownership of a shared network as is the case for Vodafone and Zain. In that sense it is more a "localisation play" because it uses local network resources (*i.e.* local numbers), terms and conditions.

When there are ownership changes that result in less cross-border integration this can have negative consequences for users. This was exemplified in May 2009 when Vodafone announced it was increasing the number of countries in which its customers could use Passport from 31 to 45. At the same time, Japan which had been one of the countries previously included in the Passport plan was excluded from this offer.[8] The most likely reason for this change was that the sale of Vodafone's Japanese MNO, in 2006, subsequently brought about changes to the wholesale arrangements which are not compatible with Passport.

Customers would obviously prefer a seamless service rather than solutions that involve two numbers and so forth. Without integrated cross-border ownership or some other means to bypass high wholesale rates some types of discount options, even on the busiest roaming routes, may not be sustainable. In 2004, for example, Verizon launched a tariff plan entitled "North America's Choice".[9] This service enabled users from the United States to pay domestic rates while in Canada, Mexico and Puerto Rico. In 2007 Verizon completed the sale of interests in network facility providers in a number of countries in the Latin American region including Puerto Rico.[10] In the same year the company discontinued the "North America's Choice" option for its customers.[11] Both Verizon and Vodafone had sold their interest in Iusacell, a Mexican MNO, in 2003.[12]

It has been suggested that Verizon ended the attractive roaming plan, as had AT&T (formerly Cingular) in 2005, due to increases in the wholesale rates charged by foreign carriers.[13] Once the company had sold its mobile operator in Puerto Rico, for example, it could no longer leverage integrated ownership in the pricing of roaming services to that country.

In 2009 Verizon does offer two plans with more limited attractiveness for roamers than North America's Choices. Verizon's "Nationwide Plus Canada" makes available an offer similar to North America's Choices but with coverage limited to Canada.[14] This suggests the United States–based carrier has been able to negotiate a sustainable wholesale model for this tariff plan. In contrast Verizon's "Nationwide plus Mexico" [15], introduced in May 2009, stipulates that if less than half of the calls made are from outside the nationwide coverage area the service may be terminated. This may be to stop people making the service substitutable for users who are permanent residents in Mexico as this would be unlikely to be sustainable given international wholesale pricing.

The question can be raised as to why Verizon's offers, while being among the best available, are less attractive today than in the past. Certainly it is not because there is less competition at the domestic level in the United States than when they launched "North America's Choices". In the United States the level of

competition for users, including through the use of pre-paid cards, has increased significantly in recent years. In 2008, for example, large carriers began to offer plans with unlimited domestic minutes for USD 100. By 2009 smaller operators were offering similar deals for USD 50 per month including nationwide roaming.[16] Some of these offers include heavily discounted or unlimited international calls to neighbouring countries, such as Canada and Mexico, for an additional fee.[17]

The smaller United States operators (*e.g.* Cricket, Boost, MetroPCS) sometimes do not offer international roaming or have plans that charge additional fees for domestic roaming outside the user's local area. Some do offer international roaming to a limited number of destinations. Cricket, for example, offers international roaming in certain areas of Canada at the regular Nationwide Roaming per minute rate.[18] A user on a USD 60 Cricket plan could roam, in those parts of Canada served, for the equivalent of USD 0.30 per minute.[19] Boost also offers a "Walkie-Talkie" service that can be used while roaming in Canada.[20]

Service providers such as Boost or Cricket aim their service pricing at some of the most price sensitive users in the market (*e.g.* using the Walkie-Talkie feature to bypass steeper international call charges). Some of these users do not require international roaming, while others – including from some low income groups – are looking for this feature. Beneficial roaming tariffs is one area to which Verizon can seek to differentiate its services from some of its smaller rivals perhaps suggesting that it is domestic competition, rather than directly from the roaming market itself, that provides the driver for Verizon to offer "Nationwide plus Mexico" and "Nationwide plus Canada". If it assumed that wholesale rates are reciprocal between North American providers, the more competitive domestic market in the United States may be why there are more attractive roaming offers than in neighbouring countries. The limited amount of cross border integration between MNOs across North America is the most likely reason that "on-net tariffs" have not developed throughout the continent. Verizon's "North America's Choices" filled this void for a short time but seemingly proved unsustainable when it sold its interests in various countries, reducing the potential for internalising wholesale costs.

MNOs have for the most part not used localisation, except where they enjoy an element of shared ownership, because it would overturn the "apple-cart".[21] This is because, for many MNOs, the balance of benefits is still in favour of the IOT system for off-net traffic. One reason for this is that roaming steering techniques are not perfect. Partner networks have different strengths in terms of coverage, customers sometimes manually select networks and even the largest MNOs have a limited direct presence around the world. Vodafone, the world's largest MNO, offers Passport in 45 countries although it has a presence, through partner networks, in 65 countries.[22] Like other MNOs, when a Vodafone customer goes beyond the reach of its networks, retail pricing is dependent on IOTs. This means, however, that IOTs are also a potential profit centre for MNOs as well as a cost. This point is significant because some have argued that less than perfect traffic retention encourages operators to set higher wholesale rates than would otherwise be the case.[23]

The outcome for smaller MNOs, and MNOs without direct presence in multiple markets, is that while larger players and their partners can internalise traffic, and minimise their reliance on the IOT system, they can also maintain high wholesale prices for other operators. Thus, even though some MNOs may be net beneficiaries of IOTs at present, this may not continue. Moreover MNOs that can successfully internalise the bulk of their traffic are going to be understandably reluctant to assist their competitors through lower wholesale rates. If global MVNOs were able to achieve significant take-up, they could exert pressure on MNOs and MVNOs that cannot offer on-net roaming, or attractive discount plans.

While MNOs have resisted localisation any market segments which generate abnormally high profits attract competitors (*i.e.* global-MVNOs). This will continue while substantial amounts of traffic need to be exchanged off-net and the price differential between IOTs and the wholesale rates paid by MVNOs

generate relatively high retail prices. In contrast to the situation for even the largest MNOs, global-MVNOs can offer cost-oriented pricing worldwide. They can do this because they have wholesale access to local networks and resources (*e.g.* numbering) on local terms and conditions. In addition they look for least-cost routing for those elements of roaming services that require international transit. MNOs, on the other hand, include their own mark-up, within the IOT, on international carriage and this is reflected in the wholesale prices paid by foreign service providers.

The entities that make local wholesale access available to global-MVNOs will be the MNOs and, where permissible, MVNOs that decide they are not net beneficiaries of the IOT system. Some MNOs and MVNOs seem to have decided that they can benefit from a more market based system. This is evident from the market access that global-MVNOs already have in many markets throughout the world. MNOs, and perhaps MVNOs, provide this third party access because they are being marginalised from the largest share of the lucrative roaming market which at the same time provides enormous competitive advantages for larger MNOs. They can do this simply because the market access arrangements are those that apply to any other mobile services. While the wholesale agreements between MNOs and MVNOs will likely constrain the ability of MVNOs to be disruptive for IMRS this may not necessarily be the case for local access. When a global-MVNO obtains market access it is simply getting local access rather than contravening the conventions associated with the IOT system.

It is possible that smaller MNOs will seek to be taken over by larger firms as an alternative to being disruptive. This may happen as a logical response to minimise the influence of IOTs. On the other hand roaming services may not drive the market. International roaming is only responsible for a relatively small share of the mobile market's overall revenue. One estimate mobile roaming contributes an average of 5% of revenue to MNOs.[24] In addition, the relatively high profitability which has typified this market segment to date, would be reduced if greater competition in the market evolved. A plausible case could therefore be made for smaller MNOs and MVNOs to engage in disruptive pricing through taking advantage of local wholesale arrangements rather than becoming take-over targets.

Greater use of alliances is also possible but this strategy did not prove to be very successful at the time of widespread liberalisation of fixed networks. As the market for fixed services evolved a clear preference for end-to-end service provision, through direct cross-border ownership of networks, proved to be the market's choice. At the same time, the Starmap alliance folded in 2007 after less than four years in operation. This followed the withdrawal of "O2", one of Starmap's founding members, after its purchase by Telefonica. Accordingly, it is unlikely that alliances will provide a sustainable future for the IOT system but are rather an interim stage in the market's evolution.

The major unknown for policy makers is whether, and if so to what extent and how quickly these developments will unfold. The success of the global-MVNOs, for example, would rely on consumer interest in and acceptance of their services. The development and take-up of alternative services, to date, has been hampered by them being relatively imperfect substitutes for international mobile roaming services (IMRS) with a resulting low level of consumer acceptance. In summary, there is a relationship between the degree to which roaming consumers are price sensitive and willing to seek and actually switch to alternative roaming services, the degree to which the alternatives are convenient substitutes and the degree of price differential to justify switching. This report argues that these services are becoming more seamless in terms of the user's experience. Depending on the remaining questions of price sensitivity and elasticity, if the balance tilted in their favour their greatest impact could be in placing pressure on mainstream players to break away from the IOT system. If firms with recognised brands decided to bypass the IOT system it could steadily decline in importance as did the accounting rate system for fixed networks.

How did we get to here?

Over recent years the development of the mobile communication industry, and the services it provides, has been a spectacular success. At end 2008, by some estimates, the number of mobile users had surpassed 4 billion. Moreover users can roam with their service over virtually any part of the globe that has cellular wireless network coverage. Notwithstanding its tremendous accomplishments, in delivering global roaming, it is precisely this area of service in which the industry faces sustained and trenchant criticism.

A range of stakeholders share the perception that international roaming prices are far higher than might reasonably be justified by cost-oriented rates. The discontent this engenders is not restricted to consumers. Some mobile service providers point to the damage they believe roaming pricing do to their customer relationships and reputation. They argue the excessive pricing of wholesale services is the key determinant of the level of the total price and that there is insufficient competition through the IOT system. Where this consideration is absent, such as in international mobile roaming over networks with shared ownership, they highlight popular on-net pricing packages some operators have developed as a market response to consumer demand, or a strategy to seek to unlock consumer demand. This raises some key questions for policy makers. Why does the market appear to have been more effective in some segments than others and what forces might be at work to change current market dynamics?

Competition has been the key to success

The main factor in the success of the mobile sector has been the prevalence of competition. Whereas fixed networks were characterised by monopolies, for most of the 20th century, the mobile industry typically has three to five MNOs competing in the same markets with their own infrastructure. In some countries mobile virtual network operators (*i.e*. resellers leasing network capacity called MVNOs) have added to the level of competition. The higher level of competition has produced affordable and innovative services. It is competition, for example, that drove the development of prepaid cards which made it possible for many people to own a telephone for the first time.

But the market has high entry barriers to the development of competition in some segments

The mobile sector is not a perfectly contestable market in that there are relatively high barriers to entry and exit. The physical properties of the radio spectrum, upon which the provision of service fundamentally relies, make it a finite resource. The need to manage this resource, so as to preclude interference, has made the licensing of operators a necessary requirement. This imposes a barrier to market entry if, due to spectrum scarcity, additional licences are unavailable. A merger or take-over involving existing players in the same market, may further diminish the potential for competition because the merged entities will retain spectrum which has been respectively assigned to them.

The wireless industry is also characterised by high fixed costs in the establishment of network facilities – though this is also the case with any telecommunication network. Any player considering market entry (*i.e.* high entry costs) or exit (*i.e*. high sunk costs) will need to take this into account. In addition, governments have sometimes shown they are willing to financially support mobile operators that may otherwise have exited the market.[25] One of the primary reasons for this is that policy makers, like other stakeholders, highly value service continuity and stability. Policy makers may also judge that mobile operators will only make the required investment in developing network facilities, particularly in the case of new entrants, if further market entry is precluded. Taken together, these factors may reduce the competitive disciplines that apply to markets in other parts of the economy.

Why is contestability critical?

In markets with high barriers to entry and exit the existing players can largely discount the potential for disruptive pricing that might accompany a new entrant and regulation may prevent established players from exploiting a potential advantage they have in the provision of service. In the first instance, this is because rivals, who might be attracted by abnormally high profits for a particular product or service, face barriers to entering the market. At the same time, for a variety of reasons, regulatory authorities may act to prevent the development of pricing structures they believe will weaken the ability of smaller market players to compete with larger rivals.[26]

It can be argued that the development of MVNOs has increased the level of contestability. There is, for example, a lower level of investment in infrastructure required to be an MVNO. However, MVNOs may be limited in their potential to provide disruptive change if such approaches are curtailed by the wholesale agreements which enable their market entry, or if their pricing strategies offer little more than discounts on retail services with elastic demand, as opposed to wholesale reselling.[27] The real test of whether MVNOs offer an improvement in contestability is whether they change the dynamics of the market to an extent that "hit and run" entry and exit is possible, targeting areas where facilities–based operators might otherwise make abnormal profits. It may well be that technological developments that enable the localisation of roaming services create the conditions for it to occur. This raises the question of whether service continuity and stability are compatible with "hit and run" entry and exit. If not, a further question could be under what circumstances might change in this area be acceptable?

Could market contestability be about to radically change?

Many MVNOs price services which have relatively inelastic demand, such as international mobile roaming service (IMRS), little differently to facilities-based operators. In some cases they are more expensive for IMRS. There are signs, explored in this report, that this could begin to change based on the rapid development of technology. In fact, technological change is opening up a range of possibilities for the provision of competitive alternative IMRS. A relatively new category of MVNOs, neither modelling themselves on MNOs nor being licensed for any specific geographical territory in any country, is emerging. In this report they are called global-MVNOs. These entities use a variety of techniques, increasingly seamless to the user, to offer services in particular market segments sometimes in combination with the services provided by the consumer's regular provider.

It is now increasingly possible for consumers to enjoy a combination of a stable and continuous service, from their regular provider for every day communications, as well as to take advantage of disruptive market entrants for particular services such as international calls or international roaming. One example is the possibilities opened by dual-SIM card handsets which effectively enable users to have two service providers for different market segments. In such cases the second card provides a second source of relatively inexpensive global coverage (*e.g.* CallGSM). Another is software that integrates home services with a SIM card purchased locally in the country in which the user is roaming (*e.g.* MyCosmik). A third possibility is a single SIM card with multiple identities (MaxROAM, Truphone "Everywhere"). In all these cases, examined later in this report, the pricing of service is oriented toward those for locally offered services. This is because the services are provided through domestic access arrangements which are more contestable than for international roaming. Moreover, some of the most recent developments include a relatively seamless provision of service overcoming some of the initial drawbacks of dual-SIM card approaches such as foreign numbers or second numbers.

It needs to be acknowledged that even very recent analytical reports tend to be sceptical about the substitutability of alternative calling procedures (ACPs) for international roaming services.[28] One reason for this is that even the most seamless alternative procedure will face challenges in building awareness and,

without widely trusted brands, some services will likely be off-putting for many consumers. Even when consumers are aware of and trust the alternatives, there is the question of consumer inertia to actually change for roaming purposes, especially for consumers who do not travel frequently, *e.g.* families that take one foreign holiday a year. ACPs have, at least to date, been imperfect–enough substitutes which compound these factors, although this aspect may be improving. There is a need to critically reassess this position for certain types of roaming users. Namely, high volume users of international roaming do have an incentive to explore alternatives that can provide savings in the range of 70% to 90% on standard IMRC, particularly as they become more seamless and, in some cases, offer additional services. Of course, it is their roaming custom that is most valued and they may have the negotiating power to obtain lower roaming rates from their usual operator. This is particularly the case for large corporations and SMEs with bespoke business mobile telephony deals. Small companies with significant roaming needs relative to their telecoms expenditure, but without the overall negotiating power of larger spenders, and that use standard business or even residential packages, seem particularly likely to look to alternative providers. Nonetheless, depending on the sector they operate in, small companies may suffer from the same limitations of lack of awareness and/or inertia to switch as residential consumers. And business users of all sizes may have additional concerns about using an alternative provider, especially regarding resilience, quality of service and security.

Mobile operators are launching their own special roaming offers. This may be influenced by the development of new, especially more seamless, ACPs, as well as the political, media and regulatory pressure to lower roaming prices that can be seen in many regions. One example is the international on-net roaming services that enable users to roam on networks with shared ownership at domestic rates (*e.g.* Vodafone's Passport and Zain's One Network). A second example is MNOs themselves offering dual numbers to their users for their highest volume routes (*e.g.* Japan-Korea, Spain-Morocco). While such offers are to be welcomed, to date the most innovative pricing has mostly been limited to on-net provision because that enables operators to keep the underlying wholesale costs down, and when users roam off-net they often pay much higher prices.

This leads us to consider that the root cause of the problem with IMRC is not the retail margins applied by operators but excessively high wholesale rates. It could be argued that the increasingly seamless nature of ACPs could place competitive pressure on wholesale rates in several ways. The most common response to competitive pricing by network operators, is to seek to offer discounts to users with the most elastic demand. Take, for example, the pricing of fixed international calls in many countries, which has come under competitive pressure. In response, operators offer discount plans where, frequently for a small fixed fee, the average price per unit can be relatively inexpensive. If users do not elect a discount plan the per-unit price to make international calls can be exorbitant considering the underlying costs. The fact that operators are able to make such retail offers indicates that they have been able to negotiate lower wholesale rates with other operators or alternative providers, possibly linked to volume discounts. In the case of IMRS MNOs are limited in their ability to offer off-net discounts by the high level of wholesale rates. If they wish to compete for the custom of users with the most elastic demand, operators will increasingly place pressure on wholesale rates as, to offer sustainable discounts, MNOs will have to agree lower wholesale rates or look outside IOT arrangements. Smaller MNOs would be more limited offering discounts, due to the lack of a large enough footprint, and they would be able to a lesser extent to exert pressure on wholesale rates. If smaller MNOs find it commercially interesting to gain local access, they would seek to do it directly, or through alliances, or look for partnership with a global MVNO.

In the future MNOs may also increasingly face disruptive pricing at the retail level. Sometimes disruptive pricing comes from a new entrant's ability to offer a bundled package of services at more cost-oriented rates. This eventually takes away the abnormal profits that had previously accrued to incumbents for particular market segments. An example from fixed networks comes from France where broadband providers typically offer free international calls to fixed networks to much of the world, included in the

basic monthly price. It is not that these services do not have an incremental cost. International transit and termination rates on fixed networks are, however, relatively inexpensive enabling the broadband operator to cover these costs in their fixed monthly charge as well as earn revenue from the provision of additional services (*e.g.* premium IPTV channels, on–demand films). The disruption to the previous model, where relatively high rates per minute were charged for international calls, is clear, even taking into account the various discount plans on offer. The tariff plans, in effect, offer French users the possibility to make calls at similar prices to those for users located in the country they are calling.

The ability of the new generation of global MVNOs to target specific market segments in a relatively seamless manner and treat roamers as local users may increase pressure on MNOs to lower wholesale rates. Like other market segments operators would then differentiate tariff plans in ways that allow users to signal how price sensitive they are for IMRS. Many of the developments routinely witnessed in other markets would then be expected such as discounts for users with elastic demand, MNOs launching MVNOs under different brands with discounted service offers and so forth. As the global provision of ACPs becomes increasingly easy those MNOs that are already net-outpayers for wholesale IMRS will also have an incentive to offer these services to their customers. They can also resell their global roaming arrangements to global-MVNOs. If the latter option did not already occur it would not be possible for global-MVNOs to offer some types of ACP services already in the marketplace.

The unknown factor in the future of IMRS is whether ACPs will be taken up enough to a sufficient extent to exert pressure on the pricing options available for everyday users and if so how long this will take. Technological change and service possibilities will often run ahead of market acceptance. Without market acceptance mobile operators will face less competitive discipline to lower wholesale rates. Some of the global-MVNOs appreciate the challenge and will seek to offer their services as "white label" products which can be rebranded by better known entities. National Geographic, one of the largest non-profit scientific and educational institutions in the world, offers one such rebranded global roaming service.[29] There may also be a push-back from MNOs with appeals to regulators in some countries to limit the openness of the market to some types of ACPs, as well as appeals from MVNOs to ensure access at a reasonable price or mediation.

The challenge for policy makers, and other stakeholders looking for greater cost-orientation in IMRC, is to assess at what pace more robust competition will develop. If the key to addressing the perceived high level of prices for IMRS is how contestable this market segment is now, or in the future, several key areas need to be considered. The first is to briefly introduce how roaming prices are set. The second is whether the choice of air interface -- Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA) -- is a significant factor in the competitive forces emerging for IMRS. The third is whether the choice of pricing structure for mobile services – Calling Party Pays (CPP) or Mobile Party Pays (MPP) – influences outcomes in the provision of IMRS services.

Mobile markets and contestability

How are international roaming agreements and prices set?

Each MNO is responsible for setting the retail price for IMRS for its customers. To be able to offer international roaming services an operator needs to enter into an agreement with a foreign network operator. Once agreement is reached, between the two MNOs, the necessary technical arrangements and tests will be undertaken. In most cases operators will agree to roaming arrangements on a bilateral basis. In other words, even if a group of operators share common ownership, an operator wishing to enter into a roaming agreement, with one or more of those operators, will negotiate individually with each of them. Some operators also use their own roaming contracts to enable entities called 'roaming brokers' to resell those roaming relationships. This can allow roaming between two networks which have no direct

contractual relationship. Recently, some operator groups and intermediaries have set up roaming hubs.[30] The aim of these hubs is to enable participants to enter into multiple roaming arrangements, through a single standard agreement across different countries, and thereby reduce the time and cost of creating roaming agreements.

In concluding roaming agreements mobile operators will agree on a price for the exchange of roaming traffic. In the case of GSM operators, both parties will have consulted the Global System for Mobile Communications Association's "Infocentre" database, to view the other's Inter Operator Tariff or IOTs as they are known.[31] They will then negotiate whether discounts will be applicable based on factors such as the volume of traffic expected between their two networks. Once the wholesale roaming rates have been established both operators will apply their own margin to the services they offer to their customers, to create retail prices.

IOTs can be thought of as a starting point for negotiating wholesale rates. Under the binding rules set by the GSMA, the IOT is a non-discriminatory tariff shared among GSMA members. Any GSMA member has the right to obtain without negotiation wholesale roaming services from any other member priced at the IOT level. The IOT rate is accessible to all operator IOT administrators except those of national competitors. In other words, operators can view the headline IOTs of other operators for every country except the one in which they operate. However, the final rate paid will be determined by a number of factors: volume discounts, traffic balance, negotiating power, etc. MNOs usually sign one wholesale roaming agreement with one preferred network at a rate below the IOT level, to which most of the traffic will be routed by traffic steering techniques. That will usually be complemented with multiple roaming agreements at the IOT rate with the competitors of the preferred network to complement coverage and provide a route for overflow traffic. An operator that generates greater volumes of roaming traffic, from their customers roaming in foreign countries, can be considered a net buyer of minutes (or a net-outpayer). As a result, only a small fraction of the traffic is priced at IOT level, which is the rate that may be seen by other operators, while most of it is priced at a lower rate (the one resulting from the bilateral negotiation), which is not accessible to other operators.

Operators have a tremendous incentive to find a roaming partner in every market in which their users are likely to travel and in which their competitors have agreements. Not being able to offer service in one or more countries in which a competitor is active would be a clear competitive disadvantage. At the same time, by not having roaming agreements operators would forego the opportunity to make revenue from the customers of other operators roaming in their country of operation.

Placing the issue of pricing to one side, as a mechanism to assist in facilitating roaming agreements,the IOT system appears to be reasonably robust. The evidence lies this is in the thousands of such agreements in existence. In addition, the development of hubs may reduce the cost of facilitating such agreements. Nevertheless, on the other hand, any system may have potential drawbacks for market contestability.

The question can be raised, for example, as to whether IOTs can be seen as a system of administered prices. Administered prices are prices set by firms that do not vary in response to short-run fluctuations in demand and supply conditions.[32] They depend on the seller being able to exercise sufficient market power to maintain the system. Given that in some cases IOTs have been reported not to have changed over several years it can be said that they represent a system of administered prices.[33] However, IOTs are generally negotiated on a yearly basis and they often change from one year to the next. That being said, they could only be seen as a system of administered prices those pertinent to infrequently used routes, where offering a lower rate and re-negotiating between years is not a commercial priority. Nonetheless, IOTs only provide a starting point for negotiations on the actual wholesale rate and traffic steering has introduced a degree of competitive pressure on wholesale rates.

To publish or not to publish

It is worth asking whether the IOT rates that are shared among GSMA members (*i.e.* not the final rates negotiated) should be placed in the public domain so they are transparent to all stakeholders. One consideration could be whether the existing system effectively meets its goals by not publishing IOTs. The possibility of information on IOTs being shared among affiliates from different markets, who can access these data under the GSMA system, cannot be entirely dismissed, although these would not be the final, negotiated rates.[34] Certainly, there have been cases where mobile operators have been fined for the collusive sharing of confidential information and some mobile operators have in the past alleged collusive practices among rivals.[35]

If IOTs only provide a starting point for the negotiated wholesale rate, and are widely known by industry players, is there any reason to keep them confidential? Publication of IOTs could, of course, be argued to be potentially damaging to competition if it supported the ability of firms to fix prices at higher levels than otherwise would be the case. Some stakeholders also object to the publication of IOTs, since they find them likely to provide a "target" for prices and discourage discount deals. On the contrary, some economists and regulatory authorities regard the IOTs as being highly transparent, to players in the market, in a manner that could already support tacit collusion, although they are not the final negotiated rates.[36] This danger needs to be set against the value greater transparency may have in supporting benchmarking of IOTs and, for example, highlighting situations where operators raise IOTs in an unreasonable manner. Another option would be to give regulators the legal power to collect data on wholesale prices so that they can produce such a benchmark to inform their regulatory decisions. This is the case in the European Union, where aggregate national data is published but individual operator data is accessible only by the relevant national regulatory authority and the European Commission. Such a benchmark could be either published or internal.

IOT discounts are typically negotiated annually but there is no standard convention on the interval. If operators identify an opportunity to negotiate lower rates they may do so at any time. At the same time, some operators report that foreign operators unilaterally raise IOTs. In a submission to an Australian Parliamentary Inquiry into IMRS, one Australian operator reported a foreign operator had unilaterally increased its IOTs three times within the space of a year. The per-minute rate was increased by 236% over that period. The Australian operator said they had no choice but to accept this increase.[37] The same submission said that in the month prior to the inquiry one Australian operator had received 30 unilateral increases to IOTs by foreign operators.

What factors could bring wholesale rates closer to more competitive prices?

There is growing evidence that pressure from users can bring down the retail margin for on-net IMRS, where operators are able to access lower wholesale costs. The main factor that could bring down IMRS prices, more generally, is an incentive for operators to negotiate lower wholesale rates. This could happen in a number of ways, including consumer, political and regulatory pressure or action. As discussed in the section above, other possibilities are to publish IOTs, or to empower regulators to collect and benchmark negotiated wholesale rates to inform their regulatory decisions. If these rates were published, for example, this would allow benchmarking and potentially place greater pressure on operators to reduce wholesale rates towards the most competitive rates. In a negotiation operators could point to lower prices, in the same or other markets, to advocate decreases. They could, of course, do this now but the other party will not know the accuracy of this information, making it readily dismissible. Another option, as noted above, would be for regulators to keep these benchmarks internal.

During the early 1990s most countries refused to publish the accounting rates which provided the basis for the settlements system for international telecommunication traffic over fixed networks. But this

data was made available by the United States Federal Communications Commission, with the aim of providing a window for informed debate about what cost oriented prices may resemble and what reforms might be necessary to increase competition. As the momentum for international reform gathered pace New Zealand and the United Kingdom also published accounting rate information. In these markets multiple operators existed and the OECD is not aware of any evidence to suggest that competition was impaired by publication. In addition, the OECD started to obtain and publish average accounting rate prices for geographic regions, to also put pressure on prices. Nonetheless, it may also be said that it was the wider regulatory and commercial developments that swept aside the traditional settlements system. In particular, liberalisation allowed third party providers without an incentive to maintain high wholesale payments under the accounting rate system to connect to the far end using their own facilities or resale. Faced with a choice of high cost termination through the accounting rate system or low cost local termination through direct access to domestic wholesale prices, the balance of traffic quickly swung towards a combination of local termination and end-to-end provision of international services.

It could also be argued that publication of IOTs might enable users to exert downward pressure. Those arguing against this approach, as some did with accounting rates, suggest that the existence of such information may confuse users. Moreover, this approach relies on a significant proportion of users being sufficiently aware and motivated to access and act upon this information. A further argument against publication is that as there is no requirement for suppliers of other services to include such information, why should this be the case for IMRS?

The validity of the first criticism may depend on the form in which such information is published. If the information were not presented in a clear way it might confuse consumers. There is no evidence, however, that the separate publication of accounting rates by the FCC ever led to confusion on the part of users. That being said, this information was likely consulted much more by specialists in the field than by consumers. A more telling counter argument, on this point, is that some operators do publish their standard retail mark-up on IMRS, as a percent of the wholesale rate, in their customer terms of service. This means that if so wished, a user can know, the major element of cost causation when they are roaming for these operators.

Some industries routinely separate the cost of services. Take the example of using a travel agent to book an airline ticket. In some countries the agent will receive a commission from the airline which is built into the cost of a ticket. In other countries, where the airline does not pay a commission, the cost of the travel agent will be shown as a separate service fee. While purchasing an airline ticket or making a roaming call are obviously different services, the question can be raised as to whether an itemisation of both operator's charges in a customer's bill would be beneficial for the user. Publishing this information could, for example, remove one of the greatest frustrations for users, in that they are relatively powerless in attributing cost causation to their home operator or the foreign operator, although they would not be privy to the results of negotiated discounts, which are usually calculated at year's-end.

The argument that IOTs should not be published because there is no requirement on firms in other markets to publish wholesale rates is only relevant if those sectors also face high barriers to market entry and exist. If a market with regulated entry exhibits a high degree of market power the case for wholesale rates to be public is much stronger than would otherwise be the case.

Roaming agreements and contestability

A further potential weakness, in terms of market contestability, may be where an operator refuses to reach a roaming agreement or, more likely, stalls or delays its introduction. The most obvious example is that Company A, with subsidiary operators in multiple markets, refuses or delays reaching an agreement with Company B because it operates in one or more of those same markets. The players most likely to be

affected by this phenomenon are new entrants. It potentially makes the IMRS less contestable than it might otherwise be.

The foregoing does not mean that operators should be compelled to reach agreements though the argument for this is much greater than in markets where there are lower barriers to entry (*e.g.* Internet peering). Such agreements do carry a cost and that amount may be greater than is warranted by some roaming relationships. That being said new entrants, including those with the scale to make reaching such arrangements economic, sometimes point to the difficulty in concluding agreements, including between OECD countries, and this needs to be taken into account in assessing market contestability.

A further problem for new entrants is that they may be unable to reach agreements on wholesale prices that are as attractive as those of the established players. In addition, they may be subject to a margin squeeze whereby operators, with an established relationship, offer each other wholesale rates that are low enough to enable them to set retails rates that are lower than the wholesale rates charged to the new entrant. Once again, this does not imply that regulation should be applied especially if the market is competitive. The competitive response from smaller operators, for example, could be to form their own alliances. However, it would be of concern if the number of potential partners is limited due to licence availability or there being a limited number of operators with compatible network standards (see following section).

In the future it will be important to see if roaming hubs increase the contestability of IMRS markets. In theory, if they reduce the cost of reaching agreements this should enable smaller facility–based operators to reach roaming agreements more quickly around the world. One of the barriers in the past has been the cost and length of time it takes to reach agreements. It will also be worth observing if roaming hubs are receptive to operators or their partners with disruptive business models.

Mobile technical standards and market contestability

In some parts of the world the choice of standards may influence how contestable a particular mobile market is for IMRS. Mobile networks predominantly use GSM or CDMA based systems. The GSMA say that their technology is used in 219 countries and territories serving more than 3.5 billion users. The CDMA Development Group (CDG) says CDMA2000 is being used by 276 operators, in 102 countries and territories, serving more than 463 million users.[38] The different standards have influenced IMRS in several respects.

GSM customers have the option of purchasing additional SIM cards in order to bypass international roaming charges. In other words a user with a GSM handset, roaming in a foreign country with a GSM network, can purchase a local SIM card to make and receive calls. They can do this using a dual SIM card handset or, as a more imperfect substitute, replace their home network SIM card with the one purchased in the country where they are roaming. Until relatively recently this has not been an option for CDMA users where the handset is tied to a particular network identity. CDMA does have an equivalent to a SIM card, the R-UIM (Re-Useable Identification Module), but it has been less widely supported by manufacturers and by mobile operators.[39]

As a result of the different standards, a GSM user roaming in a wholly or predominantly 'CDMA-country', or vice versa, a CDMA user roaming in a wholly or predominantly 'GSM-country' may face limitations on their ability to bypass IMRS prices with their regular handset. On the other hand, dual SIM card handsets capable of using both GSM and CDMA cards are now available in some countries. That being said, few consumers may be aware of this possibility or be able to predict this as being a useful feature at the time they purchase a handset. Sometimes the success of particular features, in respect to IMRS, depends on the incentives operators have for their facilitation. A good example was the incentive GSM 1800 operators had to sell dual band handsets (*i.e.* GSM 900 and 1800) not only to open

opportunities for their own customers but also to make themselves more attractive roaming partners to GSM 900 operators.[40]

Differences in the choice of air interface may also have a further affect on IMRS pricing. Take, for example, the situation where a country uses both CDMA and GSM based networks but does not have multiple operators using the standard deployed in another country. If a country has four CDMA operators, and only one of them offers GSM, the GSM mobile operator may be in a stronger bargaining position to extract higher wholesale rates from foreign GSM networks. In effect it has a "GSM monopoly". In other words, an assessment of how contestable particular markets are needs to take into account not only the number of operators but the degree to which roaming is possible on their networks by competitors and the level of wholesale price they pay.

Mobile pricing structures and market contestability

The contestability for some types of mobile services can be influenced by the choice of pricing structure. Mobile markets are characterised by two types of pricing structure: Calling Party Pays (CPP) and Mobile Party Pays (MPP). In a CPP market the user initiating the call pays the entire cost of the call (*i.e.* the costs incurred by the originating network and the terminating network). In an MPP market these costs are shared such that, for a call across different networks, both parties incur a charge from their respective service provider. In practice, this means that operators in MPP markets compete to attract customers, with cost-oriented prices, for both making and receiving calls. By way of contrast, operators in CPP markets compete to attract users based on the prices they charge for originating calls as, by definition, the cost of receiving calls is not met directly by the customers they are seeking to attract.

The characteristics of MPP and CPP markets lead to different levels of transparency for the pricing of call termination. An MPP operator sells making calls (originating) and receiving calls (termination) directly to its customers in competition with its rivals. The customer, at the point of sale, takes into account both the cost to make and receive calls from joining a particular network. In contrast, a CPP operator offers its own customers free reception of calls and charges rivals for call completion. The other operators, in turn, pass those costs to their customers responsible for initiating the call. As receiving calls is free, to the user selecting the service provider, the cost for others to call them, if considered, is secondary.

Users will mostly make decisions about which network they join based on the prices they will be charged rather than those borne by others. Some users will of course join the same network to take advantage of on-net offers, but this places little competitive discipline on the termination rates set for the customers of other networks to call them. Indeed, on-net pricing may increase the cost of termination, if operators seek to recover costs of inexpensive or free on-net calls, through higher termination rates.

That there is perceived to be greater discipline on termination prices in MPP than CPP markets is evident from the fact that regulation has been applied in the majority of CPP markets to limit termination prices. This stems from a concern that mobile operators in CPP markets can leverage their monopoly power, over call termination, into higher prices to be paid by the customers of other networks.

A further area of concern, and the subject of this report, stems from the perception that IMRS prices are very high relative to other types of calls on fixed and wireless networks. This may seem paradoxical as international roaming services use MPP. In other words, users generally pay to both make and receive calls while they are roaming. This raises an important question. Given that the mobile user pays directly for making or receiving a call shouldn't the same competitive disciplines, evident in domestic markets with MPP, be at work for international roaming? The answer to this question is twofold.

While there is undoubtedly some discipline applied to the prices of the home network (*i.e*. the margin they add for roaming services), through their direct relationship to the customer, there is much less competition at the wholesale level. This is primarily due to the low level of contestability for this service more akin to the problem identified by regulators for domestic termination in CPP markets. Accordingly, while the MPP element of pricing has brought forth some developments in mobile pricing in recent years (*e.g.* on-net discounts for IMRS on networks with common ownership) wholesale prices have remained high relative to the provision of similar services. The following section examines this in more detail and argues that the primary factor in the cost of IMRS is the level of wholesale rates.

MPP and International Mobile Roaming Services

When users are roaming they are generally charged to both make and receive calls. There is, however, an important distinction between MPP in domestic and international markets. Whereas, at the domestic level, users unhappy with the prices they are paying for making and receiving calls using MPP can change their service provider, this may have a limited effect on the prices they pay at the international level.

Users may, of course, baulk at prices they perceive as unreasonable for international roaming and simply not use the service or substitute other services. Notwithstanding these options the pricing of IMRS has been the source of ongoing dissatisfaction among users frustrated that the high level of competition they experience in domestic markets is not as evident at the international level. Complaints to their own service supplier, however, will frequently be met by the response that the prices charged reflect the wholesale prices charged by the foreign network operator. Questions to the foreign operator are met by the response that service is charged at the rates the consumer's home operator applies. The net result is that while users may be able to exert some degree of competitive pressure on their 'home' network provider, there is little they, and perhaps even their home network, can do to influence foreign networks. However, the fact that roaming services are sold in a bundle, and consumers do not usually pay attention to the roaming component within that bundle, makes them unlikely to switch domestic provider. When a domestic operator has to negotiate roaming agreements with a MNO in a foreign country, it has little incentive to bring down rates, since it would not lose many customers due to high roaming prices. When it comes to the choice of visited network, most countries in the OECD area have three or more MNO networks with wide coverage.

Consumer behaviour

Consumers themselves bear some responsibility for the lack of competition in the provision of IMRS. The available evidence suggests that most users do not take the cost of international roaming into account when selecting a service provider. One survey in Finland, for example, found that only 4% of consumers paid attention to roaming prices when they selected their service provider.[41] Nor does the evidence suggest that most users are aware of the prices for services when they are roaming. In Norway only one in ten users, surveyed in 2005, said they checked roaming prices prior to each departure.[42] The same surveys revealed that only 10% of Finnish and 20% of Norwegian users knew the price of service when they were roaming.

If users did pay more attention to roaming prices, the argument runs, mobile operators would have a greater incentive to strike better deals with correspondent networks or simply reduce prices on networks which share common ownership. Mobile operators that are net out-payers for IMRS already have an incentive to reduce negotiated wholesale rates but the effect is limited if the other operator disproportionately benefits from these out-payments. Moreover the customers of the operator benefiting from the larger out-payments may pay lower prices, at the domestic level, and as a result be unconcerned about IMRS prices for foreign users.

There may be several reasons why many users are unaware of IMRS pricing when they are making purchasing decisions. For some it may be because they do not travel abroad or are infrequent travellers. It could also be because the roaming component of their bills, while having a high unit price, may not be a large part of their overall consumption. Moreover customers may not know their international roaming requirements at the time they initially purchase their service. A further factor, suggested by many experts, is that the information is not readily available to them in a simple, understandable and transparent manner that would enable comparisons across operators.

Who roams?

The GSMA has made available the proportion of users that roam internationally, with their mobile service (Table 1). In Latin America only 3% of users roam with their mobile service. In regions with OECD countries the rate is higher. In North America, for example, nearly one in every five subscribers utilise international mobile roaming. Europeans make the greatest use of roaming services but they still only number one in three users. These data assist, to some extent, in helping to explain why the price of roaming is not more prominent in the purchasing decisions of users. Clearly many mobile users do not seek out information on IMRS, at the time of purchase, because many do not travel abroad. However, the data show there still is a substantial global market for roaming of more than 500 million users. In addition, while the proportion of roamers may be a minority in terms of overall subscribership, these and other data suggest that the majority of travellers from OECD countries crossing boarders do use IMRS.

Some destinations will, of course, be more common than others for OECD countries including near neighbours. By way of example Mexico's international roaming traffic is 94% with the United States, 1% with Canada, 3% with Europe and 2% for other countries. In Norway, Scandinavian users visiting that country account for nearly 50% of roaming traffic.[43] This is raised to 75% with the addition of foreign roamers from Germany, the Netherlands and the United Kingdom. The available evidence suggests the most common type of call made by users when roaming is one to their home country. NPT, the Norwegian regulatory authority, says some 80% of calls made by Norwegians abroad are back to Norway. Overall Norwegians roaming abroad generate more traffic than foreign roamers visiting Norway. NPT says that in 2005 the ratio of traffic generated by Norwegians abroad (outbound roaming) and traffic generated by foreigners in Norway (inbound roaming) was about 80/20 based on revenue.

Table 1: Percentage of mobile subscribers roaming internationally at least once a year

	as % of total mobile subscribers
Asia Pacific	8
Europe	33
Latin America	3
Middle East and Africa	10
North America	17

Source: GSMA (Based on Informa Global Roaming Feb 2007, Convergencia Operator Survey).

Can better customer information address the perceived problem?

While frequent travellers abroad do have an incentive to be mindful of IMRS prices the available evidence suggest this will only place competitive discipline on the margins added by their own service supplier. Operators in more competitive markets will provide discounts and simplified tariff plans on those elements of pricing they control (*i.e.* their own margins for on-net roaming). This is why some consumers and business users can extract discounts from their mobile providers and better awareness of IMRC is an

element in this process. Domestic operators also control the retail margin for off-net roaming but, since most users are not likely to pay much attention to this component of the domestic mobile services bundle, they may not always represent a reasonable contribution to common costs and a reasonable profit, as would be the case in a stand-alone, competitive market.

Notable examples of IMRS discount plans are Vodafone's "Passport" service and Zain's "One Network" service that operates through much of Africa and the Middle East. These offers basically apply regular prices, which are the outcomes of competitive national markets, to IMRS. They are also relatively simple for consumers to understand. The main limitation is that they are generally only applicable in countries where networks enjoy common ownership. If the user roams across another network, as they have to do if territorial coverage is unavailable (even in countries covered by such intra-operator agreements), they will pay prices that are much higher than under on-net tariff plans. In addition, such plans have arguably not yet had a widespread impact on the tariff structures of other operators in OECD countries – many of whom do not offer such discount plans particularly if they do not have foreign network partners.

There is less evidence that consumers, when well informed on the prices of their own operator, are able to apply significant pressure on the wholesale rates of foreign operators. In the European Union area, the perceived deficit of transparent information for consumers has led to several initiatives to make comparative data available. These include the respective websites, with intra-European roaming prices, of the European Commission and the GSMA.[44] Both offer a convenient and relatively simple way to compare a sample of prices across different European countries. On the other hand, there is high degree of uniformity in the prices displayed for some operators, services and routes.

It would be expected that with five operators, prices in the United Kingdom would be amongst the most competitive markets in the European Union area for both inbound and outbound roaming. A user from the United Kingdom, consulting the European Commission website, with September 2008 prices, would find that roaming in France, Italy, Malta, Portugal, Slovenia and Spain was substantially less expensive using one particular operator, from the United Kingdom, than the other four.[45] The GSMA site also reflected substantial differences when checked for prices for a user from the United Kingdom roaming in France and Germany, in terms of their selection of home operator. In that case two of the five operators were significantly less expensive for calls home to the United Kingdom.

Both websites, therefore, potentially empower users in their selection of home network operators. However, both sites showed the same prices for roaming on different networks in the countries visited. In other words the data suggest it made no difference to the price charged by their home network, if users manually selected one or another of the networks in the foreign country.

The GSMA site was also examined for the prices French and German users pay when they roam in the United Kingdom. Once again there were differences in the prices charged by home networks but it made no difference to the retail price in respect to which network the user roamed on in the United Kingdom. This suggests that each corresponding network charges close to the maximum amount permissible, together with home networks applying exactly the same margin to each foreign network, and many operators setting uniform prices for roaming in countries or regions irrespective of which network the user selects abroad. In this respect, it would be interesting to consider the effect of the EU Regulation, applicable in the European Economic Area (EEA), which places an average price cap on the wholesale rate between each pair of operators and a maximum cap on the retail price charged to consumers in the EEA. Providers may offer other retail rates alongside the regulated tariff.

While the standardisation of rates for a particular country, region or zone may make presentation simpler for a consumer, it may also have an anti-competitive effect. How in these instances, for example,

can a user select the least expensive network while roaming and perhaps place some competitive discipline on foreign networks to negotiate lower wholesale roaming rates? Why should a country which may have relatively inexpensive wholesale rates be bundled in a zone with those countries with higher rates simply because they share a geographical region?

A counter argument is that by providing customers with a blended price (*i.e*. the same price for whichever network a customer roams on) the home network operator can also benefit customers who might otherwise be logged onto a more expensive roaming partner. The home network may also steer customers towards the foreign network with the lowest wholesale price making it possible for them to offer a lower average price than otherwise. This also simplifies billing in that the issue of which network a user was roaming on when they incurred charges will not arise as a point of dispute.

It is instructive to examine the prices of those operators which do not share common ownership, that do differentiate rates depending on which network a customer roams. Take, for example, a Telstra customer user roaming in Austria wishing to make a call back to Australia. In February 2009, the difference in Telstra's price between the least expensive and most expensive Austrian networks was 55%. The same difference in Bangladesh, for the Telstra user roaming in that country, was 334%. As Telstra applies the same retail margin to all but 16 countries the pricing differences reflect differences in the underlying wholesale rate. This issue is taken up later in this report.

One conclusion that can be drawn from these data is that a well informed consumer can sometimes use comparisons to their advantage when selecting their home network provider. On the other hand, if a user's operator standardises rates, for a country, region or zone, the effectiveness of such comparison is limited because the consumer is not empowered to select the least expensive network on which to roam. In short, an informed consumer may profit from selecting the least expensive network, as long as the home provider does not offer a blended or standardised price, which would make any network choice irrelevant in terms of consumer savings.

International roaming pricing and demand elasticity

Economic theory can assist in clarifying the aims of mobile operators in structuring pricing. A key factor operators will take into account, when setting prices, is the elasticity of demand for a particular service. Like all for-profit firms mobile operators can be said to be profit maximisers. Accordingly, the prices they charge, beyond cost recovery, will reflect demand for that service. In a competitive market, prices will be cost-oriented because alternative suppliers can also meet that demand. In a market where monopoly power exists higher rents will be extracted, particularly if there is inelastic demand for particular goods and services. Such a development, however, is not necessarily inefficient from an economic perspective.

Competition does not always result in rates that equal marginal costs when significant fixed costs are present – as they are for mobile networks. In such cases, some rates need to be marked up over marginal costs so that the firm can recoup its total costs. Thus, the mere existence of mark-ups, for a particular market segment, does not prove a competitive problem exists. Rather, useful questions to pose include: What is the evidence to support the position that the current mark-ups in international roaming are inefficiently high? What is the elasticity of demand for international roaming services? And what might efficient roaming mark-ups be, given demand elasticity?

Mark-ups in international roaming

An example from the provision of mobile service not related to IMRS can serve as an example of pricing a service in relation to demand elasticity. Unless a user has a highly attractive discount plan, the

price to make an international call from a mobile phone is generally much more expensive than a fixed phone. A cost-oriented call price, for such a service, would likely resemble the price of a domestic mobile call plus the price of an international call from a fixed network. International calls made from mobiles, however, frequently cost several times that amount. Such differences cannot be explained by pricing at marginal cost but rather they reflect the elasticity of demand from customers.

As inexpensive substitutes are readily available, those users making international calls on mobile phones can be said to have inelastic demand. Rather than try to compete with lower prices, to increase their volume of calls, many operators have concluded they can make higher returns from users with inelastic demand. In other words, users are willing to pay a premium for the convenience of mobile phones or signalling that the higher unit price is not an issue for them. On the other hand, where there is greater competition in the mobile retail market one or more operators may break from the traditional approach. In the United Kingdom Hutchison 3, the fifth market entrant, offers users up to 3 000 minutes per month to 31 countries for USD 21.64 per month (*i.e.* USD 0.01 per minute).[46] This includes calls to mobile services in countries such as Canada and the United States (*i.e.* markets that have MPP) as well as fixed lines in all 31 countries.

Turning to the issue of whether IMRS rates are inefficiently high several points can be noted. First is that there are two mark-ups to be considered. Both the home network and the foreign network add mark-ups. This paper has argued that some of the routine competitive discipline that applies to domestic pricing comes into play in respect to the mark-up of the home network provider. Thus while this mark-up taking demand elasticity into account is likely to be above marginal cost pricing this may not be inefficient.

At the same time, this paper argues that wholesale rates for international roaming are not subject to the same degree of competitive discipline. Accordingly, the pricing of services for which there is inelastic demand, in this situation, may go well beyond what is efficient as the operator seeks to maximise profits. This issue is taken up, later in the report, where evidence is presented that the level of wholesale rates for IMRS are inefficiently high. The following section examines wholesale IMRS rates in relation to demand elasticity and, given that demand for the service is widely considered to be relatively inelastic, what factors may emerge to drive prices closer to what efficient mark-ups might resemble.

There is another factor that influences the ability of operators to set high mark-ups for roaming services. It is the fact that roaming services are sold in a bundle, including domestic calls, SMS, etc. The roaming component of this bundle is not considered by most consumers when choosing a provider or deciding whether to switch operator. This is one of the reasons why, in addition to other issues pointed out through the paper, consumers are not able to exert pressure on retail prices as would be the case if roaming services were purchased independently.

Although the economic theory of "Ramsey-pricing" supports the fact that operators set higher mark-ups on products or services with lower price elasticity within a package or bundle, which may the case for roaming services, this reports finds that IMRC are excessive and pose problems for international trade and travel, consumer protection and transnational markets. Making consumers more aware of IMRC and allowing for a better market contestability for roaming services may help make roaming charges more reasonable although, being a part of a mobile services bundle, it does not necessarily mean that they are brought down to cost-oriented rates.

Wholesale IMRS prices and demand elasticity

The pricing of IMRS at both the retail and wholesale levels is contingent on an operator's view of the elasticity of demand for their service. Mobile operators know that there are many substitutes, albeit mostly imperfect, to what they offer. They know that the most price sensitive consumers will seek out these

alternatives such that, even if they dramatically cut their rates, they still may not be competitive. Accordingly, prices from these operators are set for those users that have relatively inelastic demand, due to the imperfect nature of potential substitutes, with the aim of profit maximisation. This means that some operators, especially large MNOs, have little economic incentive to reduce their charges, since high revenues generated by non-price sensitive consumers, allowing for lost custom to price-sensitive users, outweigh potential revenues from offering lower prices to all users.

In a market with low barriers to entry or healthy levels of competition, the charging of higher prices to users with inelastic demand would be of little concern because other firms would soon act to lower prices that were not reasonably oriented towards costs. There is some evidence that this happens at the retail level for IMRS but, as noted, mobile markets are not perfectly contestable in respect to wholesale markets. Retail pricing of IMRS is, in fact, highly constrained by wholesale pricing for any off-net traffic as readily becomes apparent when these data are in the public domain.

Where operators are not constrained by wholesale rates they are free to explore elasticities. The first on-net tariff introduced by Vodafone in part reflected a belief that there were greater demand elasticities than had previously been thought. The company's market research showed that while consumers were willing to pay a higher price for roaming they also wanted cost oriented prices and a readily understandable pricing structure. Vodafone's solution was to introduce Passport which they believe has assisted them to win new customers from other operators. Hutchison 3's range of on-net services for roamers won new business for the company and, they argued, attracted users with higher ARPU (*i.e.* average revenue per user). These initiatives are, however, on the retail side of the roaming equation.

Operators will likely set wholesale rates in the belief that demand for roaming from users is relatively inelastic or that, for a variety of reasons, such users may not be effective in exercising choice when it is available to them. There may be language barriers, for example, to utilising substitutes such as purchasing a local SIM card or using a payphone. Some users may be unaware that they can manually select the network on which they roam or they may not have learned how to make this change. Others may not be aware that they will be charged for using voice mail when roaming and so on.

In response to surveys undertaken in Finland and Norway, some 90% of users say they utilise the network which first appears on their screen when roaming.[47] Thus, even if they are aware that an alternative operator corresponds to a lower roaming price from their home network provider, they may not be proficient in or sufficiently motivated to manually select that network. This reinforces the incentive for the foreign operator to set wholesale pricing for users with inelastic demand rather than lower prices.

It is in general difficult to assess demand elasticity for roaming services, and there are a number of different views and empirical results on the subject. The European Parliament commissioned a study to assess the revision of the EU roaming regulation that estimated demand elasticity for roaming calls made to be between -0.35 and -0.44, whereas the European Commission considered a range between -0.5 and –1.2 in its Impact Assessment. After evaluating volumes and prices for roaming calls made in the EU after the enforcement of the EU roaming regulation, the ERG benchmark data report[48] for April to September 2008 found no evidence of high elasticity values. GSMA also estimates low elasticity values (around -0.25).

No matter what the elasticity value for the average customer is, it is clear that different customer profiles must have different results, in that heavy roamers should have high demand elasticities, while light roamers or customers that hardly ever use roaming services would experience a much lower demand increase in response to a price reduction. In this regard, any analysis pursuing an assessment of possible regulation or impacts should break down the customer base into a number of customer profiles. Thus, a possible price regulation that would bring prices down, such as the EU regulation has done, would have a

big impact on users with highly elastic demand but little or no impact on low elasticity customers or on those who do not use roaming services.

Another controversial issue is the existence of waterbed effects, meaning that operators would increase the price of other components of the mobile services bundle if they see their revenues decrease by price regulation. The more competitive the mobile markets are, the more waterbed effect there would be, according to existing literature,[49] since operators would seek to recover their revenues lost by regulatory intervention to remain at the level they were before the prices were regulated (in a competitive market, excess economic profits – once capital return has been counted – are zero). However, since roaming only represents a small part of mobile revenues, although a highly profitable one, any possible waterbed effect would have a limited impact. This impact is also difficult to assess for a number of reasons: it is hard to know what the "competitive" price level is, markets experience different degrees of competition, prices of domestic services might have decreased or further decreased if these had not been any waterbed effect, etc. It is also hard to find empirical evidence on the issue. If such effects do exist, any potential price regulation on roaming prices would have a negative effect on most consumers (those who do not use or make little use of roaming services, who would see domestic calls and SMS price increase), but a positive effect on heavy-roaming users (who would benefit from any price reductions).

If the home network charges the same retail price irrespective of which foreign network their customer roams on, there may be also less incentive for the foreign network to lower its wholesale prices to preclude losing business to competitors. Whatever pressure the home network can apply to negotiate a lower wholesale rate, is more likely to be related to how much traffic they can direct towards or away from a particular foreign operator. Additionally, there is the issue of the incentive to keep wholesale roaming prices high when visited networks are also competitors to the home network in the home country.

According to the European Commission in 2006, approximately 80% of all traffic in the European Union area was directed to specific networks.[50] This can be convenient for users and particularly so for those users who have elected to benefit from on-net discount plans. Indeed, users would be quick to complain, on receiving their bill, if they were logged onto another network but had an expectation of paying on-net rates.

On the other hand, if smaller networks know they are unlikely to attract customers based on lowering their wholesale charges they may have little incentive to orient those rates toward costs. If larger networks can direct the majority of users to on-net partners they may also have little incentive to lower wholesale rates for the customers of other operators. In that sense they are being responsive to demand from their own customers (*i.e.* on-net discounts) but the customers of other networks have little influence on their own wholesale rates.

Are IMRS prices inefficiently high?

The answer to whether prices are inefficiently high will depend on a respondent's perspective. Some mobile operators believe that current pricing structures allow them to maximise profits, as well as recover joint and common costs, from voice services that are demand inelastic. In other words because some users are willing to pay for IMRS they value the service at those prices producing an efficient allocation of resources. Other mobile operators, particularly those that are net out-payers, would like to see lower wholesale prices so that they have more flexibility in pricing retail services including relatively new services such as data roaming. For these operators current wholesale pricing is inefficiently high.

Forecasting of demand elasticity in response to pricing changes can be an inexact science. This can make it challenging to determine whether pricing is efficient in creating an environment conducive to

innovation. This is particularly so in an industry typified by rapid technological change as is mobile communication. Ithiel de Sola Pool once noted,

> "A study of the price elasticity of telegrams done before the low cost long distance telephone call came onto the scene would have shown some sensitivity of usage to price, but it would have given no clue to the drastic change that occurred once it became cheaper to send long distance messages by phone than by telegram."[51]

If pricing decisions, particularly in respect to wholesale prices, are being taken by firms less receptive to innovation, than others, it potentially holds back the development of new services. Demand elasticity for voice services, for example, may be similar to telegrams before affordable long distance telephony. Usage may be sensitive to price but increases may not compensate for lower prices. Voice services may not be where future innovation predominantly occurs. A contestable market will adapt quickly to determine optimal pricing levels whereas a market where participants can exercise monopoly power will be slower to develop new services.

Clearly, some users view IMRS prices as being too high. In 2006, a Eurobarometer survey found that 70% of respondents supported the need for intervention to lower roaming costs across the European Union Area.[52] The survey of 24,565 people from across the European Union's 25 Member States, reported that while travelling abroad:

15% of mobile users surveyed either choose not to take their phones on holiday at all or to switch them off completely.

21% use only text messages (SMS) while abroad.[53]

59% say they would use their phones more when abroad if charges were lower, a view which is widespread in *e.g.* Finland (60%), France (61%), Denmark (63%), the United Kingdom (64%), Belgium (66%), Poland (72%), Greece (74%), Luxembourg (75%).

63% declared that they use their mobile phone far less often when abroad than at home. At the European level, only 24% declared that they used their phone as often as at home.However, 3% of users declared that they use their mobile phone more often when travelling abroad.

Drawing on these results and other work undertaken by the European Commission, the Commissioner for Information Society and Media, concluded: "Excessively high prices restrict mobile usage while abroad. This hurts consumers, it hurts European industry, and it hurts Europe."[54] From an economic perspective any curtailment of routine use may be seen as a deadweight welfare loss [55] (although we acknowledge that, for some users, travel will represent a change of routine and therefore create a non-routine need to make calls). In other words, if users are not purchasing a service, even though their marginal benefit would have exceeded their margin cost, this can lead to an allocative inefficiency for an economy. It is difficult to find conclusive evidence in this area. A January 2009 Benchmark Data Report on International Roaming prices and volumes by the European Regulators Group found that, from Q2 2007 – Q3 2008, with a few minor exceptions, volumes of retail roaming services increased every year in all countries, regardless of whether the service was subject to price regulation. For example, the volumes of regulated voice services and unregulated SMS services (for which prices had remained static) followed a very similar trend. ERG said that it was not clear how to interpret this; it could imply that an assumption that price reductions would stimulate large increases in volumes could not be supported; or the rise in SMS roaming volumes could be seen as a natural consequence of the still increasing domestic SMS volumes in many EU Member States.[56]

In terms of the value of networks for participants it may also be said that the network effect is diminished if users don't take their mobile phones with them or switch them off while abroad. It might be argued that voice mail mitigates this effect although this would not be the case for time sensitive information or emergencies. Some users will, of course, substitute alternative services if they do not travel with their mobile phones. In 2007, even with the introduction of the Eurotariff, the German regulator noted an upswing in the use of payphones by travellers including from within the European Union area.[57]

It might also be argued that there is a deadweight welfare loss, for some users, when they receive their bill for IMRS. In other words, users judge in retrospect that their marginal cost from using a service exceeded their marginal benefit. Such cases may be related to the phenomenon of "bill shock" where users, unaware or unfamiliar with IMRS pricing, run up what they assess to be an excessive amount for use of a service.

In a competitive market whether prices are set at an efficient level can be best determined by producers and consumers. In a market that has relatively high barriers to entry assessments can involve value judgements. Business users, in particular, argue that the lower level of competition, evident in the IMRS market compared to domestic services, is inefficient because it reflects firms setting prices at higher levels than would be the case in a more competitive market.

The phenomenon of double marginalisation may also exist in the provision of IMRS. This occurs where two firms in a value chain have monopoly power and use that leverage to apply higher mark-ups than otherwise would be the case. Typically this analysis is applied to upstream and downstream firms in a value chain. This paper has argued that the provision of retail services (*i.e.* downstream) in mobile markets is subject to routine competitive disciplines. In such a case it might be thought that the problem of double marginalisation would not exist. On the other hand, if the value chain is considered to include the reciprocal provision of wholesale access through the IOT system then a case can be made that double marginalisation may lead to an overall welfare loss. Certainly one of the suggested remedies for double marginalisation -- vertical integration – can be argued to have brought forth on-net roaming prices such as "Passport" and Zain's "One Network".

Mobile operators contend that they operate in a competitive market and that any judgement on prices should take into account all prices rather than a particular market segment such as IMRS. If prices are set higher for some services, they say, it reflects demand elasticities that they need to take into account in pricing their overall package for users. Notwithstanding this, critics and some operators believe prices are inefficiently high due to the high level of wholesale prices for IMRS and this may be detrimental to service innovation and efficient levels of use.

What about substitutes?

Given that many substitutes for IMRS exist, albeit imperfect, operators know that when users roam they do so because their demand is inelastic. Rather than setting wholesale rates that would enable retail pricing to attract users with elastic demand, operators adopt a strategy of pricing for those users with inelastic demand. In other words, mobile operators judge that they can make greater returns from charging higher prices to a potentially smaller number of users than they could with lower prices to a potentially larger number of users and greater volumes (*i.e.* business customers compared to residential customers).

The wholesale rates charged by foreign networks essentially mean a mobile operator can almost never compete for the most cost conscious of users. Take for example an imperfect substitute such as using Skype or JAJAH from a free Wi-Fi hotspot. Remember that use of such a service, as an alternative to IMRS, means a user is both price sensitive and has elastic demand. The VoIP call may be free or cost very little per minute. The equivalent wholesale component of the mobile call may cost more than 100 times

that amount. Thus, even if they wanted to compete the user's home network they would be hard pressed to do so based on price. Alternatively, a VoIP call may be directly made over a VoIP-enabled handset, being then a better substitute, but it would then be subject to data roaming charges.

The potential exception is on-net roaming or other instances where the user has already paid for their airtime and can consume those minutes at domestic prices. To adopt this pricing structure the roamer must be on the operator's own network or that of a partner offering a wholesale model which can sustain that pricing structure. Vodafone's Passport service, for example, charges a call set-up fee (USD 1.06) and then enables customers to use the airtime included in their regular tariff plan. For a Vodafone user calling home to the United Kingdom from Australia or France the additional cost of a 10 minute call, over and above what they have already paid for their airtime, is USD 1.06.[58] While this is still several times the price of a Skype-Out call it may be much less expensive than some other types of substitutes (*e.g.* a hotel phone). Such a pricing strategy, however, would not be available to Vodafone, and other mobile operators, for the pricing of off-net roaming without significant reductions in the wholesale rates.

While there is evidence of operators reducing retail rates through schemes such as "Passport", "Like-Home" and "One Network", for their own on-net customers, there is little evidence that this has affected either wholesale rates or standard retail rates. If such plans were more widespread, had greater global reach, and had a stronger influence on related pricing there would undoubtedly be less concern about the level of roaming prices. That many operators have not felt the need to compete, or are restricted from doing so by high wholesale rates where they do not have partner networks, remains a concern for many stakeholders. The question that needs to be addressed by policy makers and regulators is the following. What are the incentives for mobile operators to reduce wholesale roaming rates towards cost-oriented prices?

Technological change and new possibilities for contestability

Notwithstanding the potential benefits of having a more transparent pricing structure, the market may provide a much more effective solution if technological change makes IMRS more contestable. The final sections of this report discuss potential substitutes for IMRS services. By their nature virtually all alternatives to IMRS are imperfect substitutes. Some of these alternatives have, however, a greater potential than others to affect the elasticity of demand for IMRS. The closer they are to being substitutable the more likely facilities based operators will react by reducing wholesale rates so they can compete more effectively with alternative suppliers at the retail level.

Before discussing the technological and service developments most likely to impact on IMRS, it is necessary to note that even the closest substitutes sometimes involve users having two suppliers. For some users this may always be a drawback, such as paying two bills or finding a second trusted provider, but it may also have advantages. As noted earlier, a traditional barrier to the competitive provision of service in mobile markets has been contestability. The idea of 'hit and run' operators seems almost antithetical to how communication markets have worked in the past. Users naturally prefer a stable and continuous service that maximises the network effect. This is one reason that portability of telephone numbers, for example, has led to the development of more effective competition.

A question worth considering is what characteristics would be exhibited by a close or effective substitute to traditional IMRS. Placing the issue of price to one side an effective substitute would have to be convenient, stable and always-on. To date, one or another of these factors has impeded the development of various potential substitutes for users with inelastic demand. A VoIP over Wi-Fi call could, for example, be an effective substitute for a user with convenient access to a hotspot and an appropriately enabled phone. The service is, however, not a perfect substitute because it is not always-on, may have limitations on the reception of incoming calls and a hot-spot may not always be convenient or available. Nor have the initial services offering alternative SIM cards been a perfect substitute to IMRS, because they involved the user

receiving a foreign telephone number and utilising call-back. In addition, historically, if a user installed an alternative SIM card they could not use this concurrently with their existing service and had to initiate call forwarding to ensure they could receive calls (and meet the cost of international forwarding).

There are signs that the rapid development of technology is starting to overcome some of the previous deficiencies to alternative calling procedures for IMRS. Perhaps one of the most promising is appropriately enabled dual SIM card handsets. The major advantage of this approach, over alternatives such as VoIP over Wi-Fi, is that the user has access to the extensive coverage of cellular wireless networks. The first development was for users to purchase a local SIM card, in the country in which they were roaming, and utilise whichever service was least expensive (*i.e.* their own card from their home network or the local SIM Card). While being more economical such approaches had obvious disadvantages for users. Combining the use of the user's home SIM and the local SIM was not seamless and, if the phone did not enable concurrent use, could not provide perfect substitutability. More recent services have largely overcome such deficiencies.

A number of SIM card based operators (*i.e.* global-MVNOs) have emerged to provide seamless always-on roaming. From the perspective of the user the only drawback is that they have two service providers. The first SIM card is provided by their every day service provider which they would use for all domestic services. This service provides the convenience, continuity and stability they expect from a cellular operator. The second service provider provides an additional SIM card which provides two key features:

Software which reroutes international calls made by the user while they are still in their home country to the alternative provider's own network point of presence (POP). From the POP, the alternative provider uses least cost routing to complete the call. The service known as 'call around' doesn't affect IMRS. Rather it is aimed at bypassing relatively high prices for international calls made from mobile networks.

The more significant feature for IMRS is to provide an additional and local network identity for the user when they are roaming abroad. This means that when a user is travelling they will be logged onto the network with a local identity rather than the one provided by their home network. Accordingly, the local network treats them in the same manner as a local customer and calls back to their home country, are routed to the alternative provider's POP. Unlike other alternatives the features of this approach include a relatively seamless service as calls can be made and received without any special action on the part of the user. This includes seamlessly receiving calls on the number provided by their home network. In addition, such services claim to be able to provide additional services to roamers, via short codes, such as account information and voicemail not offered by other services.

The forgoing service probably comes as close to a product with perfect substitutability as will be possible for cellular wireless communications. This is essentially because it uses the cellular network and the cost-oriented pricing typical to local communication. The major advantages for the user include: using cellular wireless networks (*e.g.* no need to find a hotspot or Internet café); lower prices with routine cellular connectivity (they don't rely on uneconomic bypass which may not reduce costs such as using VoIP over mobile roaming data services); and service continuity (users keep their home operators, existing numbers etc).

While there are undoubtedly some barriers to the development of services it is difficult to envisage that they will not affect the IMRS market to some degree. From the perspective of the providers of such services, there is an enticing arbitrage opportunity at least until MNOs and MVNOs feel compelled to compete. This may happen quickly for some market segments such as high volume users. These users have the highest incentive to adopt a dual-SIM service.However, today's dual-SIM providers do not have well known brands so that most are looking for partners, with trusted brands, to resell their services.

It is possible that the market may move apace. Historically the companies that have benefited most from IMRS are those with the greatest amount of international and local on-net roaming traffic. Prior to the development of technologies which enabled operators to direct customers to their own or alliance networks there was more of a random nature to roaming. This meant that smaller networks stood a better chance of winning a higher proportion of traffic in the past than is the case today.

There is an increasing likelihood that smaller facilities based operators or MVNOs will partner with dual-SIM providers (*i.e.* one type of global-MVNOs). That such providers are already operating in the market suggests that some existing players have already 'broken ranks'. Certainly the proponents of dual SIM cards believe they have every incentive to step up competition in the roaming market, as is evident from the following claims made by one global-MVNO for its service:

"The platform will create a suitable collection of MNOs and MVNOs, none of which need be tier-1 carriers, which will be transformed into a truly global MVNO that will have a singular network with global reach which will far surpass the current global operators … who actually are fragmented geographically and do not have this degree of commercial or technical integration and coordination The tables have been turned on the incumbent Global Mobile Operators! … Up until the creation of the Unify Mobile GSM platform …the key Mobile players acted like an impenetrable walled city. Their semi-monopoly situation, in many parts of the world, is generally considered to be the last 'fat' margin available in the voice telecommunications marketplace. Despite the recent changes in the European market, typical mobile roaming charges are still up to 10 times higher than international fixed line calling. Outside Europe, roaming charges are still very expensive and complex. Basic functions such as voicemail and short code use are difficult if not impossible"[59]

The only way large operators may be able to compete with such developments, using their own branded services, is to negotiate lower wholesale rates for off-net roaming in those countries where they do not own a network. Failing that they will always be uncompetitive on pricing. At the same time, smaller operators or MVNOs have a growing incentive to co-operate with dual-SIM card system operators. This is because the revenue they receive from enabling their own customers to roam, at cost-oriented rates, together with their share of inbound roaming revenue from services at cost-oriented rates, is likely to be larger than their existing roaming market revenue. They are currently less than competitive due to either having few partner networks or larger players directing traffic to partners.

To better understand the position of stakeholders on IMRC, including differences between mobile operators, a brief description of their positionsfollows.

What different stakeholders are saying

Large market players

While there is no uniform view of the development of IMRS the larger mobile operators (and some smaller operators) typically make some of the following points:

- Market effectiveness: Mobile service providers say they operate in a highly competitive market place and their overall return on investment is not excessive when compared to other industries.[60]

- Pricing: Mobile operators point to decreases in IMRS prices and to the increasing prevalence of discount plans for IMRS.

- Waterbed effect: Some operators argue that if regulation aimed at decreasing wholesale or retail rates is applied in a particular market segment, such as IMRS, it will force them to raises prices in

another market segment (*e.g.* domestic services). Internationally, some say, regulation aimed at lowering wholesale rates in one market or region may lead to higher wholesale prices for another region.

- Network effects and inclusiveness: The value of any network increases with the number of opportunities it enables for communication (*i.e.* the network effect). Sometimes the claim is made higher IMRS prices enable operators to offer lower prices for domestic services, including for low income users whose demand may be more elastic than middle or high income users. An example of this argument is one that says "price differentiation can benefit disadvantaged social groups. This is because companies set higher mark-ups for the least price sensitive consumers, who are likely to be more affluent (or are travelling on business and are able to pass on their expenses to others), while setting lower mark-ups for the most price–sensitive consumers. The benefits of voice roaming regulation have been strongest for businesses that involve considerable international travel, such as consultancy or investment banking."[61]

- Willingness to pay/Ramsey pricing: Some operators argue that recovering joint and common costs, found in any network, is best achieved by a form of Ramsey pricing (*i.e.* charge higher prices where demand is most inelastic to recover fixed costs leading to the least reduction in overall demand). They argue that looking at the incremental or stand-alone costs generated by roaming is insufficient to understanding their overall cost base and the pricing for a range of services that customers purchase.

- Investment: Some operators argue that regulation aimed at lowering IMRS may reduce their ability to invest in network development including facilities supporting increases in broadband access. In short some operators argue they "…will have little incentive to continue risky investments in new services and infrastructure if regulators intervene to stifle profitability on the occasions when these investments succeed".[62] They note that access to capital for network investment may be constrained by the financial crisis.

- Taxation: Mobile operators point to some instances of double taxation on IMRS particularly, but not exclusively, outside the OECD area. This has the effect of increasing the cost of IMRS to the consumer and in some cases users may be paying tax in their home country on the taxation levied in foreign countries.

Each of the above points has supporters, and sometimes critics, within the community of mobile operators and other stakeholders. Some additional considerations can be:

- Market effectiveness: While the provision of mobile services in domestic markets can be highly competitive critics point to market imperfections in relation to IMRS particularly in respect to the level of wholesale rates. In addition smaller operators claim that larger players or those with greater international reach engage in anti-competitive practices (see following section). It can be noted that market segments with abnormally high profits, and low barriers to entry and exit, will attract competitors. There is evidence that technological change is opening up new possibilities to increase the contestability of IMRS provision.

- Pricing: While it is true that IMRS prices have declined in some markets over recent years, critics argue this was from a relatively high level and that prices remain higher than they believe would be the case in a more competitive market. Critics also say that price reductions sometimes reflect regulatory intervention, or the threat of regulatory intervention, rather than market based outcomes. They note that discount plans are generally limited to on-net IMRS and that off-net prices are much higher reflecting a problem at the wholesale level.

- Waterbed effect: Critics of the existence or significance of this effect would contend that the price of any service will be cost-oriented in a competitive market. As the provision of domestic service is more competitive than for IMRS in OECD countries, it does not necessarily imply that domestic prices will increase. On the other hand, it is conceivable that a reduction in IMRS prices in one market may affect IMRS prices in another market. Some operators, for example, have argued that price reductions for EU customers using IMRS in the European Union area may generate prices increases for EU customers using IMRS in the rest of the OECD area. If it is accepted that the setting of wholesale rates is less susceptible to routine market disciplines operators may seek to maintain margins through this strategy. Some regulators in OECD countries are monitoring developments in this area but for the retail rates paid by their national consumers as opposed to any potential impact on their domestic wholesale rates.[63]

- Network effects and inclusiveness: The price of mobile services in any country primarily reflects the competitiveness of its market. Network operators, like any business, will endeavour to charge consumers the maximum amount they can for any good or service. Consumers have, of course, different propensities to pay. Pre-paid cards introduced a means for low income consumers to signal how price sensitive they were to paying for telephone services and to always pay an amount which they assess exceeds their private benefit. A rational operator may try to maintain higher levels of profitability from users that are less price sensitive but it would not be expected that changes to IMRC would make the overall market less inclusive in terms of the network effect. The contention that businesses are the greatest relative beneficiaries of roaming regulation, particularly those with the highest volumes, can also be questioned. High volume users may receive discounts that are not available to low volume users. It may also be worth distinguishing large businesses from SMEs, which may not have bespoke deals, depending on the volume of traffic they generate.

- Willingness to pay/Ramsey pricing: Ramsey pricing may be welcomed by regulators in markets where a monopoly operator seeks to maximise welfare and it can be economically efficient under some circumstances.[64] If the pricing covers more than incremental cost as a contribution toward recovering overall fixed costs, reflects a general consumer assessment of receiving greater private benefit than cost, leads to the least reduction in demand and provides lower prices for services with elastic demand it can be beneficial. An important stipulation, however, is that markets should be equally competitive or monopolistic. This is not the case in the provision of mobile services where retail domestic services may be highly competitive and wholesale IMRS markets exhibit a high degree of market power by some players. Pricing principles that may be efficient at the retail level, and subject to routine commercial disciplines, may not be applicable at the wholesale level particularly where there is market power.

- Investment: Operators will take a number of factors into consideration in determining their level of investment including, of course, the likely return on that investment. The IMRS market while significant and highly profitable represents a relatively small part of the overall communication market for any firm considering network investment. The development of profitable services which rewards investment and risk taking is welcome but investment decisions should not be overly dependent on the provision of wholesale services to foreign users. In addition, there is no guarantee that abnormal profitability in one market segment will lead to significantly greater network investment than otherwise would have been the case as opposed to being returned to shareholders.

- Taxation: OECD governments need to take into account that double taxation can significantly raise the price of IMRS. The current treatment of IMRS varies extensively across the OECD area.

What the new entrant or mobile operators with smaller market shares say

New entrants and smaller mobile operators, while agreeing with their larger rivals in many respects, take a number of alternative positions in respect to IMRS. In Europe, for example, the "third or fourth mobile operators" have formed a group to represent their positions in policy and regulatory debates. The so called Mobile Challengers Group argues that:

> "Alliances like the Freemove Alliance (Orange, TIM, T-Mobile, Teliasonera), the Starmap Alliance (One, Sonofon, Eurotel, Pannon, Wind, Telenor, Amena, Sunrise, O2), or the Vodafone alliance divert the roaming traffic to the host networks that are members of these alliances. However, the Vodafone and Free move alliances have anti-competitive effects. Exclusivity agreements combined with reciprocity agreements enable alliances members to: Block the market by retaining all of the traffic; and Refrain other operators from offering lower prices by steering all traffic onto their network. As a result Challengers suffer not only from the exclusionary effect of such practices but also from high wholesale prices that are no longer significant to alliances members."[65]

In relation to the Eurotariff regulation, the Mobile Challengers Group says it:

> "…is insufficient to establish long-term sustainable competition in the roaming market as international alliances will still be able to negotiate cheaper and better rates among themselves. With little or no opportunity for commercial negotiation with these alliances, Challengers will not be able to play their natural role in bringing retail roaming prices down. Unless steps are taken to tackle the anti-competitive practices implemented by the different alliances, true competition will not take place."[66]

Consistent with the position taken by this paper the Mobile Challengers Group is right to point toward high wholesale prices for off-net traffic. That being said this paper has also pointed out the potential benefits of traffic steering and on-net pricing plans while recognising that some anti-competitive actions are possible in areas such as the establishment of roaming agreements and wholesale pricing. Nevertheless careful consideration needs to be given to the market responses available to challengers. These include forming their own alliances, offering attractive on-net pricing and additional services over their own networks as well as the potential to be disruptive (*e.g.* Hutchison 3's Skype service). In addition rapid technological change may open possibilities for the Mobile Challengers to take a disruptive approach to the IMRS market in that it is no longer clear that alliances are the only way to offer inexpensive roaming services and avoid high wholesale charges.

What others are saying

In recent years a number of OECD governments have commissioned independent research or held inquiries to examine the IMRS pricing. These include:

- In 2006 a report by Copenhagen Economics for the State Secretariat for Economic Affairs in Switzerland, investigating whether or not Swiss end-users pay excessive international roaming prices. The report found clear evidence of high international roaming prices for Swiss end-users compared to costs.[67]

- In 2006 a report by Copenhagen Economics for the Policy Department: Economic and Scientific Policy, of the European Parliament in response to the European Commission's proposals to introduce price caps on IMRS.[68] The report made recommendations on the appropriateness of the level of price caps on retail and wholesale services and their calculation.

- In 2006 the Norwegian Post and Telecommunications Authority (NPT) undertook a study of wholesale rates for international mobile roaming.[69] The study compared Telenor's and Netcom's wholesale rates for international roaming with wholesale rates for national resale and concluded that the underlying costs could not explain the very large difference. The NPT concluded this indicated very high profitability from providing wholesale roaming. The NPT also noted that the IOTs, for Telenor and Netcom (TeliaSonera), had not changed between 2000 and 2006. They concluded this may indicate a low competitive intensity and that this was little different to other European markets as corresponding wholesale rates appeared to be at the same level. They suggested discounts on IOTs may increase due to traffic steering but that this had yet to affect retail prices (that had remained constant over the three previous years). Overall they concluded wholesale prices were excessive which would not be the case in a market with effective competition.

- In 2008 a report undertaken by KPMG for the Australian Government, examining the prices paid for IMRS by Australian users.[70] The study concluded from a literature review and its own data collection that the prices for IMRS were excessively high in relation to costs.

The state of IMRC has also been the subject of a number of Parliamentary enquires in OECD countries including:

- In 2006-2007 the United Kingdom House of Lords conducted an enquiry into the European Commission's proposals to introduce price caps on IMRS. The report entitled "Mobile Phone Charges in the EU: Curbing the Excesses" concluded that there was strong, albeit circumstantial, evidence of market failure in roaming and that regulation was justified at the wholesale level.[71]

- The Australian House of Representatives Standing Committee on Communications undertook an inquiry in 2008-2009 culminating in the release of a report entitled "Phoning Home: Inquiry into International Mobile roaming".[72] The report concluded that there was a higher cost attributable to roaming and that Australian providers did not appear to have the customer base to negotiate competitive wholesale prices from foreign operators. The Committee made a number of recommendations to overcome what it perceived to be deficiencies in the current market including "…a policy of regulating the framework for the wholesale cost of roaming through bilateral and multilateral negotiations with other countries."[73] The Committee also recommended temporary number portability (to enable customers to switch to the least expensive Australian operator for their destination country) as well as the provision of information on alternatives to roaming by the Australian Government for travellers. On 9 September 2009, the Government tabled its response to the Parliamentary enquiry report. It agreed to three of the recommendations, noted a fourth recommendation (on introducing reporting requirements for IMRS on Australian providers) and did not agree with a fifth recommendation concerning number portability[74], on the grounds that there are significant technical barriers and operational complexities that prevent the implementation of temporary number portability.

Outside the OECD area developments include:

- In October the Singapore and Malaysian Governments have announced a mutual agreement to bring down the cost of roaming between their two countries.[75]

- In April 2008 the Arab Regulators Network (AREGNET) agreed on a set of recommendations which they say will result in reduced international mobile roaming charges.[76] AREGNET say roaming charges will be lowered over a three year period leading to a decrease of 36% in average

roaming rates for consumers in the third year of regulation. The Arab Regulators Network covers 21countries in North Africa and the Middle East.

Consumer and users groups have also undertaken a number of studies or commissioned research:

- In 2007 a study was undertaken for *UFC-Que Choisir* and the European Consumers organisation (BEUC) on the European Commission's proposals to introduce price caps on IMRS.[77] The study concluded that wholesale prices were significantly above cost and that there was a lack of independent statistical monitoring to inform stakeholders of basic indicators such as the volume of traffic.

- The International Telecommunications User Group (INTUG) has been a vigorous and consistent critic of roaming charges in regulatory and policy fora around the world.[78] INTUG has made numerous submissions over many years arguing that IMRS prices are excessive with a considerable amount of empirical evidence.

Indicators, trade flows and international roaming

Regulatory authorities in several OECD countries report a number of indicators on roaming traffic and revenue. Generally, the data in the public domain are aggregates for inbound and outbound roaming by volume (*e.g.* number of calls, minutes of traffic or SMS messages) and in some cases the revenues attached with providing these services. In Europe, France (ARCEP), Spain (CMT), Portugal (ANACOM) and the United Kingdom (OFCOM) all provide data on the volume of traffic. ARCEP and CMT also provide data on the revenue received by operators for inbound and outbound roaming. The European Regulators Group (ERG) also publishes data on international roaming prices and volumes predominantly for the countries within its membership to monitor compliance with the EU Regulation on Roaming ((EC) No 544/209 amending (EC) No 717/2007), and to inform the European Commission's consideration of the functioning of the Regulation and the need to extend it in duration or scope. The ERGs indicators include average prices for retail voice calls made and received in the rest of the world. Outside Europe the Australian Competition and Consumer Commission has also published data on an *ad hoc* basis.

France

In France data are available for both the volume of roaming traffic and the revenue attached to the services (Table 2). Both inbound and outbound roaming has grown considerably over the past decade. In 2007 French operators charged their customers USD 1.5 billion for outbound roaming from which they would have paid foreign operators for their wholesale services. For the same year, French operators charged foreign operators just under USD 1 billion in wholesale charges. Given that France generates significantly more inbound than outbound traffic it is likely that overall French operators receive more in roaming payments for wholesale charges than they pay out.

The average revenue per minute for both inbound and outbound traffic, for French operators, has fallen significantly in recent years. The influence of European Union regulation, which only came into force in Q4 2007, on the wholesale rates for both France and its likely largest roaming partners, would be the largest factor for the most recent years. In 2007 the maximum Inter Operator Tariff in the European Union area was USD 0.38 per minute compared with average revenue for all countries of USD 0.58 per minute.[79] This suggests, as would be expected, that European roaming is responsible for the bulk of inbound and outbound traffic in France. If these inbound data were disaggregated, between the EEA countries and the rest of the world, it could inform the question of whether the so called "waterbed effect" was occurring in respect to wholesale rates.

Table 2: Inbound and outbound roaming traffic and revenue: France

Outbound roaming

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Minutes (millions)	na	318	385	509	655	985	1093	1180	1328	
Revenue (USD millions)	219	536	669	612	1013	1198	1378	1417	1496	
Average revenue per minute (USD)	na	1.69	1.74	1.20	1.55	1.22	1.26	1.20	1.13	

Inbound roaming

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Minutes (millions)	266	800	858	1191	1294	1350	1393	1521	1656	
Revenue (USD millions)	533	759	1070	1023	1055	1189	1141	1087	955	
Average revenue per minute (USD)	2.00	0.95	1.25	0.86	0.82	0.88	0.82	0.71	0.58	

Note: The outbound volumes are voice, minutes, consumed from abroad by customers of the French operators. Outbound revenues are the amounts charged by French operators to their final customers (excluding tax) for communications sent and received. They therefore cover both the costs, including wholesale costs, and the margin of the operators. The March 2009 exchange rate was used to convert Euros to USD.

Source: ARCEP.

Spain

The Spanish communications authority CMT reports some of the most detailed statistics on international roaming (Table 3). Indicators include: switching exchanges and registers of roaming subscribers; revenue for international roaming by contract type (*i.e.* prepaid and post paid roaming revenue); revenue from SMS roaming; revenue from data traffic roaming; volume of minutes generated by roaming; number of SMS roaming messages as well as derived indicators such as revenue per minute for roaming minutes or per SMS message. CMT also publishes data on the wholesale revenues received by Spanish operators for Voice, Data and SMS as well as data on traffic levels.

In 2007 Spanish operators recorded total revenue of just under USD 1.2 Billion from outbound roaming from which they would have paid foreign operators for their wholesale services. During the same year wholesale revenue was USD 772 million. Between 2006 and 2007 outbound roaming traffic increased by 40% in 2007 and average revenue per minute decreased by 21%. SMS traffic increased by 115% and average revenue per SMS decreased only by 5.4%. While outbound voice roaming traffic was affected by the EU Roaming Regulation, which entered into force in October 2007, SMS retail prices were not affected by it.

A number of factors might be involved in the 2006-2007 outbound roaming traffic increase, including the rate reduction enforced by the EU regulation in Q4 2007, overall economic development or growth and the increase of the use of mobile services as a whole. It is noteworthy that SMS traffic, whose rates were not regulated, increased more even though its associated average revenue decreased only 5.4%, and not by 21% as voice average revenue did.

An internal study carried out in Spain by CMT for 2007-2008, when the regulation began to be applied, shows voice roaming services as having a rather inelastic behaviour (price elasticity is -0.36). The

study "Review for roaming regulation"[80], commissioned by the Committee on Internal Market and Consumer Protection (IMCO) of the European Parliament, shows similar results (elasticity between -0.35 and -0.44).

The ERG benchmark data report[81] for April to September 2008, published in January 2009 shows similar results for the EU/EEA area: *"A direct comparison of the developments in the volumes of regulated voice services and unregulated SMS services (for which prices have remained static) reveals a very similar trend. It is not clear how to interpret this and ERG is reluctant to draw definitive conclusions at this stage. It could imply that the assumption that some had made that price reductions would stimulate large increases in volumes does not hold water. On the other hand, the rise in SMS roaming volumes could also be seen as a natural consequence of the still increasing domestic SMS volumes in many member states"*. A graph showing trends in volumes for regulated retail voice calls and unregulated SMS shows a similar growth for voice and SMS, with SMS showing larger growth in some periods.

In 2007 it is noteworthy that Spanish users roaming abroad generated greater traffic than inbound roamers for the first time. If it is assumed that inter-operator tariffs are largely reciprocal it is likely that Spain shifted from being a net recipient of wholesale payments to being a net outpayer for voice traffic. On the other hand, Spanish roamers abroad generated significantly less SMS than inbound roamers. This may suggest that inbound roamers are substituting SMS for voice services but it also means that Spanish operators would have received more money for wholesale SMS than they paid out to foreign operators. Nonetheless, changes in the number of Spanish travellers abroad and foreign tourists in Spain should be taken into account when drawing conclusions on being a net recipient or a net out-payer for voice traffic.

Table 3: Inbound and outbound roaming traffic and revenue: Spain

Outbound roaming

		2003	2004	2005	2006	2007	2008
Total roaming revenue (USD millions)				768	990	1195	
Voice	Prepaid			55	79	67	
	Post-paid			710	803	949	
	Total Voice			716	883	1016	
SMS	Prepaid			0.6	8.9	12.5	
	Post-paid			42.3	48.5	59.4	
	Total			42.9	57.4	71.8	
Data	Prepaid			0.1	0.8	0.6	
	Post-paid			8.5	49.8	106.4	
	Total			8.6	50.6	107.0	
Voice revenue per minute (USD)				1.40	1.30	1.07	
Traffic							
Voice Minutes (millions)		432	489	547	679	952	
SMS (millions)				33	45	97	

Inbound roaming

	2003	2004	2005	2006	2007	2008
Total wholesale revenue (USD millions)	806	805	865	912	772	
Voice	806	805	693	710	556	
SMS			34	50	54	
Data			139	152	162	

Voice revenue per minute (USD)		1.07	1.04	0.95	0.66	
Revenue per SMS (USD)			0.37	0.34	0.29	
Traffic						
Voice Minutes (millions)		750	667	745	844	
SMS (millions)			337	442	554	

Note: March 2009 exchange rate used to convert Euros to USD.

Source: CMT.

Portugal

The Portuguese communication regulator ANACOM published data on outbound and inbound roaming traffic (Table 4). These data also include the number of individual calls as well as SMS. In 2007 Portuguese roamers made some 99 million calls while abroad. The average length of each call was 150 seconds. As in the case of France, Portugal receives more inbound roaming traffic than it generates. While data are not available on revenue it is likely that Portugal, like France, receives more revenue from roaming than it pays out.

Table 4: Inbound and outbound roaming traffic and revenue: Portugal

Outbound roaming

	2003	2004	2005	2006	2007	2008
Calls (millions)	72	75	78	88	99	
Minutes (millions)	138	143	155	204	249	
Average call duration (Seconds)	114	114	118	138	150	
SMS (millions)	59	75	118	140	193	

Inbound roaming

	2003	2004	2005	2006	2007	2008
Calls (million)	120	111	110	126	138	
Minutes (millions)	185	217	217	248	282	
Average call duration (Seconds)	93	117	118	118	123	
SMS (millions)		139	154	192	241	

Source: ANACOM

United Kingdom

In the United Kingdom OFCOM publishes data on a quarterly basis, for four of the five facilities based operators, (Table 5). In respect to roaming, the indicator published is the volume of outbound minutes. OFCOM data demonstrate the high seasonal variations that occur in the level of roaming.

Table 5: Outbound roaming traffic: United Kingdom (millions of minutes)

	2006			2007				2008			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Vodafone	170	193	151	161	184	211	164	163	184	202	
O2	123	158	107	115	143	183	132	138	173	213	
T-Mobile	33	43	29	33	41	52	36	36	44	56	
Orange	88	103	70	85	102	90	89	88	105	125	
Total of above	414	497	357	394	470	536	421	425	506	596	
Increase over equivalent quarter for previous year	14%	10%	10%	15%	14%	8%	18%	8%	8%	11%	

Source: OFCOM.

Australia

Australia is the country with the most detailed breakdown of traffic and revenue flows between its operators and foreign operators (Table 6). These data, collected by the Australian Competition and Consumer Commission (ACCC), provide a unique window through which Australian authorities can assess that country's largest roaming partners as well as the financial value attached to the trade in roaming services with these countries. It needs to be noted that the data do have some limitations beyond the top four countries – as measured by volume for inbound and outbound roaming. This is because the ACCC collected the top 10 countries for each operator and aggregated the data. While the top four countries are the same for each operator, the remaining six countries may be different for each operator. Take the example of Canada. Australian roaming in Canada generated the 10th largest volume of outbound traffic. If Canada is only in the top 10 for two of the four Australian operators only traffic for those operators are included.

In the period June 2007 to July 2008 the total value of outbound roaming revenue between Australia and the top ten destination countries, was at least USD 143 million. The countries in which Australians generated the most revenue for mobile operators, while roaming, were the United States, New Zealand, the United Kingdom and China. The countries from which Australians generated the most minutes, while roaming, were the United States, New Zealand, the United Kingdom and Singapore.

For inbound roaming data are available for the 19 countries generating the most traffic. In terms of this service, foreign SIM card holders through their home service providers, paid USD 77 million to Australian mobile network operators. Roamers from the United Kingdom generated the most revenue followed by the United States, Singapore and New Zealand.

One significant factor to bear in mind in examining the ACCC data, is that the four Australian based operators all have one or more overseas operators, through which they partner for roaming services, with shared ownership. Telstra the largest Australian mobile provider owns a network in Hong Kong, China. The other three providers (Vodafone, Optus and Hutchison 3) all have a far more extensive network of foreign partners with shared ownership. Why this is significant is that it could influence indicators such as the average revenue from inbound roaming. Take the case of Italy where both Vodafone and Hutchison 3 have partner networks. In that instance the average revenue per minute for inbound roaming across all the Australian operators was USD 0.33 per minute and the calls some of the longest in duration. This may be because the customers of partner networks are making on-net calls to an extent that significantly lowers (*i.e.* decreases average revenue from wholesale rates) or raises (*i.e.* lower price increases call duration) the particular indicator. That may be also the case for some countries where most of the traffic remains on-net.

The influence of partner networks could explain why the average revenue from inbound and outbound roamers between Australia and Singapore is also lower than for most countries. As for the Italian case this suggests that while operators without partner networks may pay relatively high wholesale rates, the figures for those with partners significantly lowers the average. The influence of technical standards may also be at work. While Canada is a popular destination with Australia's outbound roamers, users from that country are not among the top 19 inbound roamers for Australia. This is likely due to Canada's mostly CDMA users using alternatives when they visit Australia, whereas Australians can roam on Canada's single national GSM network. This may also be a factor in the volume of roamers between Australia and other countries which use CDMA such as Japan, Korea and the United States, though the increasing use of UMTS (*i.e.* 3G) will offset this factor. In Japan, during FY2006, only about 35% of NTT DoCoMo's roamers used their own handsets with the remainder using rented handsets. By the third quarter of FY2008 more than 90% of NTT DoCoMo's roamers used their own handsets when abroad.[82]

Table 6: Australian inbound and outbound roaming July 2007- June 2008

Outbound: Australian users in:	Minutes	Revenue (USD)	Average revenue per minute (USD)	Revenue per call (USD)	Average time per call (1)
United States	20 213 088	30 290 718	1.50	3.31	132
New Zealand	19 720 645	29 111 123	1.48	3.29	134
United Kingdom	14 353 929	19 847 101	1.38	2.80	121
Singapore	9 715 563	5 886 134	0.61	1.30	129
Thailand	8 928 486	9 094 270	1.02	2.81	166
China	6 723 610	16 147 293	2.40	5.83	146
Hong Kong, China	6 713 886	8 489 956	1.26	2.96	141
France	5 999 122	9 441 270	1.57	4.59	175
Italy	4 417 946	10 485 094	2.37	4.09	103
Malaysia	1 697 053	1 475 774	0.87	2.49	172
South Africa	849 181	1 179 640	1.39	2.78	120
Germany	545 410	1 443 155	2.65	5.29	120
Canada	242 915	341 271	1.40	5.51	235
Total/Average	100 120 834	143 232 800	1.43	3.62	146

Inbound: Foreign users in Australia from:	Minutes	Revenue (USD)	Average revenue per minute (USD)	Revenue per call (USD)	Average time per call (1)
United Kingdom	22 279 686	26 378 597	1.18	1.69	86
United States	12 422 557	10 451 388	0.84	2.32	165
Singapore	10 104 295	6 919 362	0.68	2.02	177
New Zealand	8 432 756	7 841 209	0.93	2.36	152
China	4 928 554	4 696 117	0.95	1.68	106
Hong Kong, China	4 340 193	4 325 429	1.00	1.59	96
Japan	4 370 494	2 982 291	0.68	2.78	244
Germany	3 328 927	3 073 997	0.92	2.16	140
Italy	2 269 592	759 117	0.33	2.38	426
Malaysia	2 461 992	2 613 028	1.06	1.58	89
Switzerland	1 669 782	804 401	0.48	1.65	206
Indonesia	1 249 159	1 261 903	1.01	3.29	196
Thailand	1 158 157	1 161 913	1.00	2.77	166
India	954 511	902 825	0.95	2.19	139
France	750 029	1 732 860	2.31	2.66	69
Ireland	366 775	1 000 216	2.73	1.19	26
Korea	84 934	52 233	0.61	2.55	248
UAE	49 838	38 041	0.76	4.24	333
Chinese Taipei	38 755	24 670	0.64	2.28	215
	81 260 986	77 019 596	0.95	2.28	173

Notes: (1) The figure for time (in seconds) is an estimate only and is derived by dividing the call cost by the revenue per minute and multiplying by 60. Some Australian carriers only provided estimates of call duration to the ACCC. (2) Roaming data not provided for full 12 months in some instances are aggregate only. (3) The data does not include all roaming data as each Australian operator has a different top ten countries in terms of volume, however, the top four countries (United States, New Zealand, United Kingdom and Singapore) are the same for all operators.

Source: Australian Competition and Consumer Commission.

Tax treatment of roaming

Before examining IMRS prices in detail, the treatment of roaming by taxation authorities needs to be noted. One reason for doing this is to be clear about the methodology used for comparisons of IMRC. A second is to better understand the different approaches and treatment of the application of taxes to roaming services. In terms of taxation, roamers can be considered under two categories: outbound (*e.g.* holders of SIM cards from the tax authority's home country roaming abroad) or inbound (*e.g.* holders of SIM cards from foreign countries roaming in the tax authority's home country).

Methodological issues for comparisons

In undertaking comparisons of the price of telecommunication services the OECD's approach is to either include or exclude VAT for all countries. In the past, when this benchmarking was primarily undertaken to assess the performance of incumbent monopolists it seemed reasonable to exclude tax for all operators to better understand underlying performance. On the other hand, if taxes (*e.g.* VAT or local sales tax) were considered they were included for all countries. This was to ensure a harmonised approach for comparisons. In the case of international roaming, the practices are so variable that the fairest and most revealing comparisons are those that include all applicable taxes even though some countries have different tax treatment. This is in part because the report is an examination of the roaming prices actually paid by users rather than the efficiency of operators. It is also the case that reverse engineering data, to exclude the VAT actually paid, would be a highly complex matter and may not be available if the operator includes any applicable local tax in the wholesale charge.

When and where does tax apply to roaming?

The following application of valued added tax (*i.e.* VAT here including for simplicity Goods and Services Tax or Sales Tax or Taxes specific to communications – Table 7) occurs in the OECD area and selected additional countries:

- Some countries do not apply VAT to either outbound or inbound roamers (*e.g.* Australia).
- Some countries apply VAT only to outbound roamers but not to inbound roamers. (*e.g.* the Netherlands, Norway, Spain).
- Some countries apply VAT to both outbound and inbound roamers (*e.g.* Chile, India).
- Some countries apply VAT only to some types of outbound roaming (*e.g.* VAT is applied to receiving a call from their home country but not to calls they make back to their home country or to third countries – for example Israel) Some European Union countries apply taxes to outbound roamers in the European Union area but do not tax users roaming outside the European Union area (*e.g.* the United Kingdom).
- Some countries apply federal and state taxes only to some types of outbound roaming related to the user's home state or province (*e.g.* VAT is applied to making a call to their home state or province but not to calls they receive from their home country – for example Canada).
- In some countries state or provincial taxes, where applicable, are added to inbound and outbound roamers (*e.g.* the United States). The United States Federal universal service charge is also applicable to outbound roamers.

- Some countries apply VAT only to some types of inbound roaming (*e.g.* VAT is applied to making a local call while roaming in that country but not to calls back to the roamer's home country – for example Canada, Japan[83]).

- Some European Union countries apply taxes to outbound roamers in the European Union area as well as roaming outside the European Union area (*e.g.* Ireland, Spain).

- Some European Union countries do not apply taxes to inbound roamers from the European Union area but do tax roamers from outside the European Union area (*e.g.* Austria, Slovenia). In some cases the Austrian taxes charged but are redeemable and may not be applied if the other country has a comparable taxation system (*i.e.* VAT) to Austria.

- Some countries, such as Turkey, apply VAT only to the inbound roamers if the home country of those users applies taxes to Turkish roamers.

- Some countries apply additional taxes, other than VAT, to roaming services such as local taxes or applicable communication taxes (*e.g.* Brazil, Chile and, subject to the above, Turkey).

- Finally, most countries when they apply taxes to inbound or outbound roaming, tax the total charge incurred by the roamer (*i.e.* wholesale and retail). In contrast at least one country (Turkey) only applies tax to the retail margin of their home operators.

Table 7: Taxes on mobile roaming

	Tax rate (%)	Outbound SIM card holders	Inbound SIM card holders
OECD countries			
Australia	10	No	No
Austria	20	Yes	Yes for non European Union Countries
Belgium	21	Yes	No
Canada	0 to 15.5	Yes for making calls to home province but not for receiving calls	Only local/national calls within Canada. International calls are not taxed.
Czech Republic	19	Yes	No
Denmark	25	Yes	No
Finland	22	Yes	No
France	19.6	Yes	No
Germany	19	Yes	No
Greece	19	Yes	No
Hungary	20	Yes	No
Iceland	24.5	Yes	No
Ireland	24.5	Yes	No
Italy	21	Yes	No
Japan	5	No	Only local/national calls within Japan. International calls are not taxed.
Korea	10	Yes	No
Luxembourg	15	Yes	No
Mexico	15	Yes	No
Netherlands	19	Yes	No
New Zealand	12.5	Yes	No
Norway	25	Yes	No
Poland	22	Yes	No
Portugal	20	Yes	No
Slovak Republic	19	Yes	No
Spain	16	Yes	No
Sweden	25	Yes	No
Switzerland	7.6	Yes	No
Turkey	43	Yes to the margin of the Turkish operator	No unless the foreign country applies tax to Turkish roamers.
United Kingdom	15.0[1]	Yes for EU area and No for rest of World	No
United States	0-36	Yes for calls originating or termination in the US. No for local roaming calls made in foreign countries.	Yes depending on the State in which the user is roaming.
Accession candidate countries			
Chile	19	Yes	Yes
Estonia	18	Yes	No

[1] UK VAT rate for 1 December 2008 to 31 December 2009

Israel	15.5	Yes for calls received but not for making calls	Yes
Russia	18	Yes	Yes
Slovenia	20	Yes	Yes. The rate applies to roamers from outside the EU area and to calls made to non-EU countries.
Enhanced engagement countries			
Brazil	Up to 44.2	Yes	No
China	na	na	No
India	10.3	Yes	Yes
Indonesia	10	Yes	Yes
South Africa	14	Yes	No

Notes:

1. These data were collected from a number of sources including, in terms of inbound taxes, the actual rates paid by two foreign operators (one from inside and one from outside the EU area). It is possible that mutual agreements between countries, that do not include these countries, may vary outcomes.

2. While tax is not applicable to inbound roamers in the United Kingdom it does apply in some Crown dependencies such as the Isle of Mann (25%). Swiss operators do not apply inbound taxes unless the user is roaming in Liechtenstein (7.6%).

3. The Federal tax paid for Mexican consumers is VAT at the rate of 15%, except for border cities with the United States, Guatemala and Belize that is 10%. These taxes apply for international roaming services.

It is possible to broadly categorise the treatment of taxation into three categories:

- Countries not taxing inbound or outbound roaming
- Countries taxing outbound and not inbound roaming
- Countries taxing outbound and inbound roaming

One category of countries, which taxes neither inbound or outbound roamers, includes Australia and Japan. In other words an Australian roaming in Spain will not pay VAT to the Australian authorities and the Australian Government will not tax the Spanish roamer in Australia. Japan can also be considered in this category with the exception of local or national calls made by foreign roamers in Japan.

A second group of countries, which is probably the most common, only taxes their outbound roamers. In other words a Spanish roamer in Australia will pay tax to the Spanish authorities but the Spanish government does not collect VAT on an Australian roamer. There are variations within this category such as the United Kingdom which would not tax an inbound roamer from Australia or an outbound roamer to Australia. The United Kingdom would tax an outbound roamer to Spain because they are roaming inside the European area.

A third group of countries applies VAT to both inbound and outbound roamers. India, for example, applies VAT to Indians roaming abroad and to foreign SIM card holders roaming in India. This tends to be the case more outside the OECD area.[84] It can also be the case in Canada and the United States where Provincial, State and sometimes Municipal taxes can apply. As in other categories taxes are sometimes applied to some types of roaming calls and not to others, such as in Israel.

In some cases tax may not be applied to inbound roamers by mutual agreement between two countries. Turkey has a "Special Communications Tax" (25%) as well as VAT (18%) but these taxes are applicable to inbound roamers only if their country of origin applies taxes to Turkish roamers. The Austrian application of tax, to users from outside the European Union Area, is also contingent on their home country taxation system being comparable with that in Austria.

Inconsistent tax treatment of roaming

The various approaches raise questions on why roaming is treated so differently around the world. In formulating their policy the Australian Government cited two factors. In the case of outbound roamers, Australia does not tax the supply by an Australian carrier to a customer roaming overseas, because the customer uses or enjoys that supply outside Australia. The supply of use of the overseas network made by the non-resident telecommunication carrier to the Australian carrier is also not taxed because the service is not connected with Australia.

Australia also does not apply VAT to inbound roamers though under the general application of its taxation law this would be expected.[85] The reason for this is that the Australian Government considers the taxation of inbound roamers to be inconsistent with Australia's treaty obligations under the International Telecommunication Regulations (ITRs). Therefore the Australian Government intends to amend the law to ensure that these supplies continue to not be subject to tax.[86] The Australian Tax Office is not seeking to enforce compliance with the existing law subject to the outcome of the proposed measure.

In contrast to Australia some countries tax both inbound and outbound roamers. In 2007 India, for example, changed its law to place taxes on foreign SIM card holders roaming in India. In levying the tax on inbound roamers the Indian authorities said it was applicable because the service was enjoyed in India and utilised the networks of local providers. This also appears to be a common practice in Latin America in countries such as Chile.

The most common treatment of IMRS is to tax outbound roamers but not inbound roamers. This position, however, can be contrasted to the one taken by Australia and Japan that outbound roamers should not be taxed because they do not enjoy the service within those countries. It can also be contrasted to those countries that tax both inbound and outbound roaming.

In the European Union area there is a "use and enjoyment" option available to Member States in deciding whether to apply VAT. The Directive does not, however, define such use and enjoyment and Member States take differing approaches. For instance in France "use and enjoyment" is defined by residence. A French resident's calls will be subject to French VAT wherever they use their French SIM card. The United Kingdom takes a different approach by applying a "pure" use and enjoyment test. That is why a United Kingdom resident using their SIM card outside the European Union area will not pay United Kingdom VAT.

Here it is worth considering the treatment of comparable services to see if the telecommunication sector is being treated differently. To be sure if a European Union citizen purchases a chocolate bar and travels outside the European Union area, before consuming that product, they will have paid tax at the relevant rate for their country. Consider, however, that if a European travel agent has sold that person a travel package, with elements such as local hotel accommodation or travel included, the sale would be exempt from VAT at the rate applicable for that European country.[87] This raises the question of whether IMRS is more like the chocolate bar or a foreign hotel?

Some may conclude, as Australia and Japan have, that the main inputs into the roaming service are provided by the foreign network and the service is enjoyed abroad so they are not taxable. The 'home' network is contacted to authenticate the customer's SIM card identity and for the necessary credit authorisation and undertakes final billing but, arguably, the main components of the service are provided and enjoyed abroad.

In the United States the general rule is that if any part of the service is provided in the United States (one end of the call is there) then it is taxable. Tax is applied to any roaming charge that appears on a

user's bill for making a call back to the United States or receiving a call from the United States. If, however, the user makes a local call in the country in which they are roaming (*i.e.* both ends of the call are outside the United States) they will likely not incur a roaming charge as it is nearly always not considered to be taxable by states or municipalities.

In the United States the basic legislation dealing with state taxation of mobile service is the Mobile Telecoms Sourcing Act of 2002. It designates the state (and/or subset thereof, such as a county or municipality) as the "taxing jurisdiction" if one end of the call is in the United States. The language of the state statute that created the tax in question must set the terms of how it applies. In other words it has to be clear that it applies to international calls. Thus, there could be a state telecom tax that would not apply – for example if the state law refers only to intrastate calls. Mobile operators in the United States generally assume that federal taxes could apply if one end were in the United States, although the federal excise tax on telecoms is being phased out, so that is not a practical issue at present.

The view of the Austrian courts is similar to that of the Australian Government though not the Austrian taxation authorities. According, to PriceWaterhouseCoopers Austrian courts have also consistently ruled that Austrian VAT does not have to be charged on services supplied outside the European Union area:

> "In the past, non-EU telecom providers could in practice not obtain a refund of Austrian VAT incurred on roaming and similar charges. Based on the use and enjoyment rules implemented in Austria, the tax authorities claimed that the supplies of the non-EU telecom providers to its customers were subject to Austrian VAT. Thus, any input VAT claimed would be offset by output VAT due on the supplies by the non-EU telecom providers to its customers and 13th EC VAT Directive refund claims were rejected. However, in a couple of cases Austrian courts ruled in the last year that this interpretation of the use and enjoyment rules is not in line with EU VAT Law. Following these court decisions the Austrian tax authorities have issued a new Decree which will enable a refund of Austrian VAT incurred in the past (under some conditions)."[88]

It is also interesting to highlight the intra-European taxation framework for the application of VAT in respect to travel agents. In the European Union area:

> "…under the special 'margin' scheme all transactions performed by the travel agent in respect of a single travel package are treated as a single supply of services for VAT purposes, taxable in his own Member State . He has no right to deduct VAT on supplies made to him, but on the other hand he is only taxed on the profit margin realised on the supply of the travel package."[89]

This raises an option for the treatment of IMRS which could be that authorities only apply tax to the component of IMRS levied by the resident telecommunication carrier but not the foreign carrier. This is the approach taken by Turkish authorities who only tax the margins of the Turkish provider and not the wholesale inputs provided by the foreign operator for outbound roaming. Such an approach would seem more consistent with the ITRs which, although written without international mobile roaming services in mind, state:

> " 6.1.3 Where, in accordance with the national law of a country, a fiscal tax is levied on collection charges for international telecommunication services, this tax shall normally be collected only in respect of inter-national services billed to customers in that country, unless other arrangements are made to meet special circumstances.

and in Appendix 1 of the ITRs:

> " 1.6 Where an administration* has a duty or fiscal tax levied on its accounting rate shares or other remunerations, it shall not in turn impose any such duty or fiscal tax on other administrations*. [* administration or recognized private operating agency(ies))".

The intent of the ITRs, or "The Melbourne Agreement" as it is sometimes termed, was that no taxation should be imposed by one country's operator(s) in relation to wholesale supplies of cross border voice and data services.[90] Tax experts say, however, it has either been inconsistently applied across different countries or, subject to the reservations various countries made, interpreted as being narrowly applied to only some operators or services or as incompatible with their national laws.[91]

Potential for double taxation

Double taxation occurs when two different governments tax the same income. The OECD's Model Tax Convention has as one element articles designed to eliminate double taxation.[92] According to the United Kingdom's HM Revenue and Customs there are more than 1 300 double taxation treaties worldwide designed to protect against the risk of an individual or a corporate entity being taxed twice for the same taxable income.[93] There are two types of double taxation. One is economic double taxation (where two different legal persons are taxed on the same income or other taxable item by more than one State) and the other juridical double taxation (the situation wherein a person, being either an individual or a company, is determined "resident" under the domestic tax laws of both the States having concluded a tax treaty). Although this terminology was developed for income taxes the double taxation on a consumer by two countries in respect of the same transaction can be classified as "juridical" in nature.

The GSMA has pointed to instances of double taxation in Latin America which they say can double the cost of an international mobile roaming call.[94] In the OECD area this may be less of a problem but clearly in those instances where taxes are applied to both inbound and outbound roamers for the same communication (*e.g.* a call or SMS) there is potential for double taxation. In addition, it may be the case that in applying tax to the total bill many OECD countries are taxing the taxes applied in foreign countries through the wholesale rates charged to roamers.

The OECD's Committee on Fiscal Affairs has recognised that the application of consumption taxes to international telecommunications is an issue for its 2010 programme of work. In the light of the work carried out in ICCP, the Fiscal Affairs Committee's Working Party on Consumption Taxes will commence work in 2009 with a view to establishing current approaches by member governments (and selected non-OECD economies). From this it will seek ways to bring greater consistency in order to avoid double taxation and unnecessary complexity. This work is likely to include not only roaming charges but also the relevant international settlements between service providers.

Roaming prices across the OECD area

This report considers roaming prices for voice services and SMS. The methodology used for these comparisons are to be found in Annexes 1 and 2. The data are for roaming relationships between all OECD countries but excluding the intra-EEA area. In other words an Austrian user roaming in Australia is included but not an Austrian in Belgium. The prices are for the firm with the largest market share as measured by subscribers and do not include any applicable discount plans. The commentary considers retail prices in the context of likely underlying costs of providing the service. Therefore they should be seen in light of the preceding discussion in this paper. For example, it should be borne in mind that the average includes prices for frequently used routes and infrequently used routes, *i.e.* where there may be different levels of consumer price sensitivity, price elasticity and competition between providers. Differences in retail prices for the same route depending on the direction of travel may be due to asymmetrical wholesale rates where there is more competition on one end of the route than the other, *e.g.*

where there is more than one operator in the visited country offering network coverage in areas where the home provider wishes to offer roaming services, compared to a country where there is an operator with monopoly power over an area.

Telephony

Three types of calls made or received while a user is roaming abroad are considered here:

- **The price to make a local call in the country in which the user is roaming** from the vantage point of the roamer as well as the average price for that country across all roaming relationships (Category 1).

- **The price to make a call to their home country** from the vantage point of the roamer as well as the average price for that country across all roaming relationships (Category 2).

- **The price to receive a call** from the vantage point of the roamer as well as the average price for that country across all roaming relationships (Category 3).

Category 1: Making a local call

In February 2009 the average retail price for making a local call while roaming, across the OECD area, was USD 6.76 per three minutes (Table 8). The column on the left in Table 8 shows the average price by country of origin. For example, the average price for a Korean user, roaming in 30 countries and making a local call in each, is USD 1.56 per three minutes. The five countries with the lowest charges were Korea, Japan, Switzerland, Australia and Norway. In contrast users from the Slovak Republic, Luxembourg, Austria, Italy and Belgium paid the highest prices in this category.

In each category considered in this section of this report, roaming routes inside the European Economic Area (EEA) are excluded. In other words, while France to the United States is included the route between France and Germany is excluded. It is also possible to calculate an average for making a local roaming call in the 10 countries considered here that are not in the EEA. Using this approach the data for EEA countries does not change. The figures for the countries that are not part of the EEA do change and display the average for the 9 possible destinations (*i.e.* excluding the home country). For example, a Korean user pays an average of USD 1.94 to make a local call while roaming in the nine non-EEA countries instead of USD 1.56 for all 30 countries considered here. The average charges determined using this methodology are higher than using all 31 destinations except in the case of Mexico. The average across all countries was USD 6.96 per three minute local call. Notwithstanding the change, the same non-EEA countries, Korea, Japan, Australia and Switzerland, are among the least expensive countries by origin.

Table 8: Retail charges for making 3 minute local calls while roaming (average by country of origin) (USD)

Average for roaming in 31 countries (excluding intra EEA routes)		Average for roaming in the 10 non-EEA countries	
Korea	1.56	Korea	1.94
Japan	2.65	Japan	2.80
Switzerland	2.69	Norway	3.17
Australia	2.90	Australia	3.39
Norway	3.17	Sweden	3.46
Sweden	3.46	Switzerland	3.84
New Zealand	3.59	Israel	4.24
Canada	3.69	New Zealand	4.49
Israel	3.71	Canada	4.54
Greece	4.57	Greece	4.57
Denmark	4.60	Denmark	4.60
United States	5.16	Poland	5.63
Poland	5.63	United States	6.02
United Kingdom	6.12	United Kingdom	6.12
Czech Republic	6.73	Czech Republic	6.73
Netherlands	6.77	Netherlands	6.77
Hungary	6.92	Hungary	6.92
Turkey	6.96	Mexico	7.90
Finland	8.05	Finland	8.05
Ireland	8.55	Turkey	8.39
Mexico	8.65	Ireland	8.55
Iceland	8.75	Iceland	8.75
Portugal	9.13	Portugal	9.13
France	9.16	France	9.16
Germany	9.18	Germany	9.18
Spain	9.97	Spain	9.97
Belgium	10.09	Belgium	10.09
Italy	10.76	Italy	10.76
Austria	11.57	Austria	11.57
Luxembourg	11.75	Luxembourg	11.75
Slovak Republic	13.20	Slovak Republic	13.20
Average	6.76	Average	6.96

It is possible to calculate the average price of making a 3 minute local call, while roaming, by the country of destination (Table 9). Table 9 contains the average of the same data used in Table 8 -- retail charges for making local calls while roaming – but by country of destination instead of by origin. For example, the average charge for users making calls in Iceland is USD 3.28. Table 9 also contains an average calculated for 31 countries (excluding intra-EEA relations) on the left and for roaming in the 10 non-EEA countries on the right. The average is USD 4.91 and 4.16 respectively.[95] Here Iceland, Ireland, Hungary, Finland and Denmark were the least expensive destinations. In contrast, non-EEA countries, United States, Israel, Japan and Turkey, appear to be among the most expensive destinations.

Table 9: Retail charges for making 3 minute local calls while roaming (average by country of destination) (USD)

Average for roaming from 31 countries (excluding intra EEA routes)		Average for roaming from the 10 non-EEA countries	
Iceland	3.28	Iceland	3.28
Ireland	3.31	Ireland	3.31
Hungary	3.51	Hungary	3.51
Finland	3.54	Finland	3.54
Denmark	3.67	Denmark	3.67
Norway	3.80	Norway	3.80
Germany	3.83	Germany	3.83
Sweden	3.84	Sweden	3.84
Luxembourg	3.87	Luxembourg	3.87
Poland	3.88	Poland	3.88
Spain	3.88	Spain	3.88
Slovak Republic	3.90	Slovak Republic	3.90
Greece	3.93	Greece	3.93
Netherlands	3.97	Netherlands	3.97
Belgium	3.99	Belgium	3.99
Portugal	4.10	Portugal	4.10
United Kingdom	4.11	United Kingdom	4.11
France	4.13	France	4.13
Austria	4.31	Switzerland	4.21
Switzerland	4.39	Mexico	4.28
Italy	4.48	Austria	4.31
Czech Republic	4.56	Australia	4.37
Turkey	5.50	Canada	4.40
Canada	6.29	Italy	4.48
United States	6.34	Korea	4.53
Australia	7.28	Czech Republic	4.56
New Zealand	7.73	New Zealand	4.72
Korea	7.86	Turkey	4.75
Japan	8.10	Japan	4.87
Israel	8.34	Israel	5.39
Mexico	8.48	United States	5.49
Average	4.91	Average	4.16

Category 2: Making a call to the user's home country

In February 2009 the average cost of making a call back to a user's home country, while roaming, across the OECD area was USD 7.79 per three minutes (Table 10). The countries with the least expensive calls home were Switzerland, Mexico, Belgium, the United States and Korea. In contrast users from the Slovak Republic, Greece, Austria, Israel and New Zealand faced the highest prices to call home. If data are limited to an average for the 11 non-EEA destinations, the price was USD 8.16 per three minutes.

Table 10: Retail charges for making 3 minute call to the user's home country while roaming (average by country of origin) (USD)

Average for roaming in 31 countries (excluding intra EEA routes)		Average for roaming in the 10 non-EEA countries	
Switzerland	3.75	Mexico	3.89
Mexico	4.32	Belgium	4.76
Belgium	4.76	United Kingdom	5.60
United States	5.16	Poland	5.63
Korea	5.41	Ireland	5.74
United Kingdom	5.60	Korea	5.98
Poland	5.63	United States	6.02
Ireland	5.74	Sweden	6.50
Canada	6.08	Czech Republic	6.73
Japan	6.10	Japan	6.77
Sweden	6.50	Netherlands	6.83
Czech Republic	6.73	Canada	6.89
Netherlands	6.83	Hungary	6.92
Hungary	6.92	Norway	7.19
Turkey	6.96	Switzerland	7.40
Australia	7.16	Denmark	7.44
Norway	7.19	Australia	7.68
Denmark	7.44	Finland	8.05
Finland	8.05	Luxembourg	8.32
Luxembourg	8.32	Turkey	8.39
Iceland	8.75	Iceland	8.75
Portugal	9.13	Portugal	9.13
France	9.16	France	9.16
Germany	9.18	Germany	9.18
Spain	9.97	Spain	9.97
Italy	10.76	Italy	10.76
New Zealand	11.14	Austria	11.57
Israel	11.23	New Zealand	12.51
Austria	11.57	Greece	12.71
Greece	12.71	Israel	13.18
Slovak Republic	13.20	Slovak Republic	13.20
Average	7.79	Average	8.16

In contrast to the previous table, averages by destination show that Norway, Luxembourg, Iceland and Switzerland were the least expensive destinations for foreign roamers to make calls back to their home country (Table 11). Meanwhile, Mexico, Israel, Japan and Korea are among those destinations with the highest charges.

Mobile operators in 14 countries set the same charges for a user making a local call and a call back to their home country while roaming. Operators in 12 countries charge more for making a call back to the user's home country (up to 245.7% more than a domestic call), and operators in five countries charge less for this type of call (up to 52.8% less than a domestic call).

Table 11: Retail charges for making 3 minute calls to the user's home country while roaming (average by country of destination) (USD)

Average for roaming from 31 countries (excluding intra EEA routes)		Average for roaming from the 10 non-EEA countries	
Norway	4.47	Norway	4.47
Luxembourg	4.74	Luxembourg	4.74
Iceland	4.83	Iceland	4.83
Switzerland	5.01	Finland	5.08
Finland	5.08	United Kingdom	5.49
United Kingdom	5.49	Sweden	5.52
Sweden	5.52	Netherlands	5.59
Netherlands	5.59	Ireland	5.64
Ireland	5.64	Germany	5.94
Germany	5.94	Denmark	6.04
Denmark	6.04	Hungary	6.15
Hungary	6.15	Austria	6.23
Austria	6.23	Switzerland	6.42
Slovak Republic	6.48	Slovak Republic	6.48
Turkey	6.51	Greece	6.60
Greece	6.60	United States	6.66
Spain	6.81	Spain	6.81
United States	6.82	Canada	7.01
Belgium	7.08	Belgium	7.08
Canada	7.13	New Zealand	7.08
Poland	7.26	Korea	7.09
Portugal	7.27	Poland	7.26
France	7.40	Portugal	7.27
Italy	7.72	France	7.40
Australia	8.17	Italy	7.72
New Zealand	8.77	Australia	7.99
Czech Republic	8.77	Japan	8.23
Korea	9.03	Turkey	8.35
Japan	9.38	Czech Republic	8.77
Israel	9.80	Israel	9.18
Mexico	11.04	Mexico	9.90
Average	6.86	Average	6.74

Category 3:Rreceiving a call

In February 2009 the average cost of receiving a call while roaming across the OECD area was USD 4.49 per three minutes (Table 12). The countries whose users were charged the lowest prices were Korea, New Zealand, Switzerland, Hungary and Australia. In contrast users from the Spain, Mexico, Italy, Denmark and Austria faced the highest prices to receive a call. If data are limited to an average for the ten non-EEA countries, the price was USD 4.65 per three minutes.

Table 12: Retail charges for receiving 3 minute calls while roaming (average by country of origin) (USD)

Average for roaming in 31 countries (excluding intra EEA routes)		Average for roaming in the 10 non-EEA countries	
Korea	1.36	New Zealand	1.74
New Zealand	1.74	Korea	1.78
Switzerland	1.96	Hungary	2.30
Hungary	2.30	Greece	2.70
Australia	2.45	Iceland	2.92
Greece	2.70	Israel	3.16
Israel	2.73	Australia	3.17
Iceland	2.92	Luxembourg	3.23
Luxembourg	3.23	Turkey	3.30
Turkey	3.30	Poland	3.30
Poland	3.30	Norway	3.58
Norway	3.58	Slovak Republic	3.62
Slovak Republic	3.62	Japan	4.02
Japan	3.70	Switzerland	4.13
Netherlands	4.21	Netherlands	4.21
Belgium	4.30	Belgium	4.30
France	4.40	France	4.40
Portugal	4.42	Portugal	4.42
Sweden	4.45	Sweden	4.45
United Kingdom	4.73	United Kingdom	4.73
Czech Republic	4.99	Czech Republic	4.99
United States	5.16	Ireland	5.47
Ireland	5.47	Germany	5.97
Germany	5.97	Finland	5.99
Finland	5.99	United States	6.02
Canada	6.04	Austria	6.61
Austria	6.61	Canada	6.75
Denmark	7.12	Denmark	7.12
Italy	7.93	Mexico	7.90
Mexico	8.65	Italy	7.93
Spain	9.97	Spain	9.97
Average	4.49	Average	4.65

The average prices by destination show that Switzerland, the United Kingdom, Germany, Italy and France were, on average, the least expensive countries for foreign roamers to make calls back to their home country (Table 13). Meanwhile, Mexico, Israel, Korea and Japan were among those destinations with the highest charges.

Table 13: Retail charges for receiving 3 minute calls while roaming (average by country of destination) (USD)

Average for roaming from 31 countries (excluding intra EEA routes)		Average for roaming from the 10 non-EEA countries	
Switzerland	2.68	United Kingdom	3.16
United Kingdom	3.16	Germany	3.19
Germany	3.19	Italy	3.19
Italy	3.19	France	3.20
France	3.20	Netherlands	3.22
Netherlands	3.22	Spain	3.26
Spain	3.26	Belgium	3.32
Belgium	3.32	Iceland	3.32
Iceland	3.32	Greece	3.38
Turkey	3.35	Ireland	3.43
Greece	3.38	Switzerland	3.45
Ireland	3.43	Hungary	3.48
Hungary	3.48	Luxembourg	3.50
Luxembourg	3.50	Sweden	3.50
Sweden	3.50	Denmark	3.51
Denmark	3.51	Finland	3.57
Finland	3.57	Norway	3.57
Norway	3.57	Austria	3.67
Austria	3.67	Australia	3.69
Portugal	3.91	New Zealand	3.69
Slovak Republic	3.92	Portugal	3.91
Czech Republic	4.02	Slovak Republic	3.92
Poland	4.18	Canada	3.96
Canada	4.32	Japan	3.99
United States	4.48	United States	4.02
Australia	4.56	Czech Republic	4.02
New Zealand	5.04	Poland	4.18
Japan	5.09	Turkey	4.42
Korea	5.48	Israel	4.66
Israel	5.53	Korea	4.67
Mexico	6.14	Mexico	5.02
Average	3.88	Average	3.71

Are the prices for voice service high?

It can be reasonably said that the standard IMRS prices, for the voice services considered, are significantly higher than for domestic wireless services. This finding will be of little surprise to any stakeholder. What is surprising is the huge range of prices for *Category 1* (USD 1.56 to USD 13.20), *Category 2* (USD 3.75 to 13.20), and *Category 3* (USD 1.36 to USD 9.97). Such differences cannot be explained by cost-oriented prices.

SMS

The average price for sending an SMS across the OECD is USD 0.55 (Table 14). The least expensive country is Korea at just USD 0.21 per SMS followed by Switzerland, France, Finland and Ireland. Spanish users pay the most expensive rate for sending an SMS at USD 1.11 per SMS followed by Japan, Italy, Greece and the Netherlands.

Table 14: Retail charges for sending SMS while roaming (average by country of origin) (USD)

Average for roaming in 31 countries (excluding intra EEA routes)		Average for roaming in the 10 non-EEA countries	
Korea	0.21	Korea	0.18
Switzerland	0.34	Switzerland	0.34
France	0.36	France	0.36
Finland	0.37	Finland	0.37
Ireland	0.37	Ireland	0.37
Turkey	0.38	Turkey	0.38
Australia	0.41	Poland	0.41
Poland	0.41	Denmark	0.43
Denmark	0.43	Israel	0.45
Israel	0.45	Sweden	0.46
Sweden	0.46	Australia	0.46
New Zealand	0.46	New Zealand	0.46
United Kingdom	0.47	United Kingdom	0.47
Czech Republic	0.47	Czech Republic	0.47
Canada	0.48	Canada	0.48
Germany	0.50	Germany	0.50
Austria	0.51	Austria	0.51
Hungary	0.52	Hungary	0.52
United States	0.55	Mexico	0.53
Slovak Republic	0.58	United States	0.55
Norway	0.58	Slovak Republic	0.58
Luxembourg	0.60	Norway	0.58
Mexico	0.60	Luxembourg	0.60
Portugal	0.61	Portugal	0.61
Belgium	0.64	Belgium	0.64
Iceland	0.65	Iceland	0.65
Netherlands	0.70	Netherlands	0.70
Greece	0.80	Greece	0.80
Italy	0.91	Italy	0.91
Japan	1.08	Japan	1.08
Spain	1.11	Spain	1.11
Average	0.55	Average	0.55

The countries from which it is the least expensive, on average, to send an SMS are Luxembourg, Poland, the United Kingdom and Hungary (Table 15). Meanwhile, Mexico, Korea, Israel and New Zealand are among those destinations with the highest charges.

Table 15: Retail charges for sending SMS while roaming (average by country of destination) (USD)

Average for roaming from 31 countries (excluding intra EEA routes)		Average for roaming from the 10 non-EEA countries	
Luxembourg	0.49	Japan	0.40
Poland	0.49	New Zealand	0.46
United Kingdom	0.49	Canada	0.47
Hungary	0.49	United States	0.47
Ireland	0.49	Mexico	0.49
Slovak Republic	0.49	Luxembourg	0.49
Finland	0.49	Poland	0.49
Norway	0.49	United Kingdom	0.49
Germany	0.50	Hungary	0.49
Belgium	0.50	Ireland	0.49
Iceland	0.50	Slovak Republic	0.49
Switzerland	0.50	Finland	0.49
Greece	0.50	Norway	0.49
Netherlands	0.50	Germany	0.50
Czech Republic	0.50	Belgium	0.50
France	0.50	Iceland	0.50
Italy	0.50	Greece	0.50
Turkey	0.51	Netherlands	0.50
Sweden	0.51	Czech Republic	0.50
Denmark	0.51	France	0.50
Portugal	0.51	Italy	0.50
Austria	0.51	Sweden	0.51
United States	0.52	Turkey	0.51
Spain	0.52	Korea	0.51
Canada	0.52	Denmark	0.51
Japan	0.54	Portugal	0.51
Australia	0.55	Australia	0.51
New Zealand	0.56	Austria	0.51
Israel	0.59	Spain	0.52
Korea	0.61	Switzerland	0.52
Mexico	0.61	Israel	0.55
Average	0.52	Average	0.50

Are the prices for SMS service high?

It can be reasonably said that the standard IMRS prices considered, for sending text messages are relatively high compared to domestic wireless services. As with voice services there are large differences across the OECD which cannot be explained by cost-oriented pricing.

Comparing call pairs

It is possible to compare the price of a three minute roaming call between any two countries. Here the cost of Category 2 calls can be considered (Table 16). In other words the price for a Australian user roaming in Denmark, and making a call home, can be compared to the same price for a user from Denmark

roaming in Australia. In this example the price was coincidentally almost the same for both users during February 2009. By way of contrast there are very large differences for many other countries. For example it is more than eight times more expensive for a user from Greece to roam in Korea than for a Korean to roam in Greece. Such differences, even with differences in termination charges and any applicable taxes taken into consideration, cannot be explained by cost-oriented prices. One explanation may be asymmetrical wholesale rates due to monopoly power over a certain geographic area in one country, compared to competition in all areas of the other country. Another factor may be an imbalance in inbound and outbound roaming traffic volumes, which would give greater negotiating power to one side, and wholesale rates usually involve volume-based discounts.

Table 16: Comparison of charges for roaming calls to home countries compared back to the same calls in the opposite direction (%)

Origin \ Destination	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States
Australia		67	179	114	188	101	84	49	66	61	191	40	109	58	79	149	101	48	241	124	56	80	113	89	43	80	82	90	111	145	108
Austria	149			153										124		291	410		376		87							210	139		190
Belgium	56			88										33		79	79		171		31							193	67		99
Canada	88	65	114		116	97	75	106	84	60	93	64	78	89	63	160	125	82	485	109	42	74	168	77	40	60	114	85	112	81	157
Czech Republic	53			86										51		125	85		161		44							213	74		96
Denmark	99			103										131		106	204		275		65							101	65		145
Finland	119			134										172		122	194		252		132							149	157		190
France	203			94										76		192	221		248		54							508	71		107
Germany	153			119										113		198	250		255		125							261	90		134
Greece	165			167										74		314	839		406		123							313	108		236
Hungary	52			108										85		190	111		246		79							222	57		153
Iceland	249			155										210		129	186		272		217							101	99		176
Ireland	92			127										131		119	96		137		79							98	54		126
Israel	172	81	300	113	197	76	58	132	88	136	118	48	76		160	123	137	33	308	162	119	37	205	115	54	133	94	117	121	121	174
Italy	127			159										62		198	168		512		77							175	121		181
Japan	67	34	126	63	80	94	82	52	51	32	53	78	84	81	50		147	53	273	76	58	58	88	54	39	52	75	61	67	79	60
Korea	99	24	127	80	117	49	52	45	40	12	90	54	104	73	60	68		25	214	36	102	37	97	65	44	47	55	59	58	83	67
Luxembourg	208			122										305		189	400		245		137							91	31		207
Mexico	41	27	59	21	62	36	40	40	39	25	41	37	73	32	20	37	47	41		30	36	60	68	42	30	40	52	47	52	61	53
Netherlands	81			92										62		132	279		336		87							202	70		135
New Zealand	178	114	323	238	227	153	76	187	80	81	126	46	126	84	129	172	98	73	279	116		49	174	137	82	98	93	179	194	182	130
Norway	126			135										271		173	271		166		203							139	48		164
Poland	88			59										49		114	103		147		57							185	64		57
Portugal	113			130										87		186	155		241		73							263	124		119
Slovak Republic	233			249										187		258	230		334		122							270	165		159
Spain	125			168										75		193	213		249		102							369	128		190
Sweden	122			88										107		133	182		191		107							87	67		124
Switzerland	111	48	52	118	47	99	67	20	38	32	45	99	102	86	57	164	170	110	212	50	56	72	54	38	37	27	115		89	145	133
Turkey	90	72	150	90	136	154	64	140	111	92	175	101	186	83	83	149	171	319	192	144	51	208	157	81	61	78	150	112		107	114
United Kingdom	69			123										83		126	121		163		55							69	93		139
United States	93	53	101	64	104	69	53	94	74	42	66	57	79	57	55	167	150	48	188	74	77	61	176	84	63	53	81	75	87	72	

Comparing the price of roaming with international mobile calls

It is possible to compare the price paid by a roamer to make a call to their home country against the price of a national mobile user making an international call to that country. This approach was used by Copenhagen Economics in their study for the Swiss Government. In that study they compared prices between a Swiss roamer and a French mobile user both calling to Switzerland from France. In 2006 they found the difference in price was roughly twice as high for the Swiss user.

Here the cost of calling home, for a roamer, is compared to the cost of making an international call to that country for a national mobile user (Table 17). For example, a user from New Zealand roaming in Australia will pay 2 072% more to call home than would a local Australian mobile user calling to a New Zealand mobile user. An Israeli user roaming in Australia would pay 1 623% more to call home than would a local Australian mobile user to make an international call to an Israeli mobile user. Such differences across the OECD cannot be explained by cost-orientated pricing. Possible underlying factors are the amount of demand, the degree of consumer price sensitivity and price elasticity, and the extent of wholesale and retail competition for mobile international calls compared to mobile roaming calls.

Table 17. Comparison of charges for calling back to home country while roaming and making an international call to the country (%)

Origin \ Destination	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States
Australia		293	155	355	292	148	380	102	90	269	491	749	655	446	673	197	484	441	313	114	921	229	372	341	411	248	106	248	1516	127	55
Austria	682			308										813		242	1251		553		375							298	1393		160
Belgium	253			130										215		66	341		252		214							205	666		83
Canada	562	285	115		181	316	1046	228	91	266	577	735	837	425	359	329	487	1255	438	279	1113	554	359	519	477	145	190	312	1520	115	471
Czech Republic	379			252										289		104	391		237		337							151	736		97
Denmark	489			259										599		89	916		405		288							107	650		125
Finland	526			338										537		102	526		371		330							158	1575		168
France	1060			244										516		160	1330		365		518							720	715		93
Germany	1093			339										511		165	1371		376		534							370	902		115
Greece	956			304										458		262	1353		598		850							333	1083		135
Hungary	255			272										265		158	384		362		331							157	573		88
Iceland	519			287										558		107	554		401		570							107	993		149
Ireland	786			248										323		99	512		201		912							104	539		108
Israel	1623	493	331	590	306	127	210	273	121	607	404	554	432		240	158	483	188	401	226	694	200	215	244	513	413	138	360	1651	140	302
Italy	1194			221										503		165	1375		755		536							248	1211		154
Japan	553	275	109	241	125	105	297	108	69	143	307	886	505	578	76		505	303	355	121	270	296	92	114	371	161	97	188	917	139	41
Korea	311	98	65	177	84	91	116	94	55	53	208	305	627	297	90	75		72	278	57	384	105	102	137	181	146	71	182	795	96	47
Luxembourg	461			276										485		158	814		360		409							96	313		177
Mexico	191	163	50	29	47	67	148	84	54	177	145	311	390	174	59	63	226	118		94	209	86	71	88	125	124	57	87	382	71	89
Netherlands	349			226										339		110	706		494		357							214	697		115
New Zealand	2072	437	278	758	173	154	343	387	110	657	290	538	755	571	194	228	735	335	362	185		233	182	292	788	303	121	493	1426	160	87
Norway	390			351										584		144	551		244		402							148	481		137
Poland	346			196										253		95	357		216		307							131	638		57
Portugal	332			313										465		155	802		355		504							279	1236		156
Slovak Republic	921			507										597		215	812		492		699							191	1651		141
Spain	737			194										496		161	1031		367		522							392	1276		164
Sweden	736			249										449		111	711		282		360							92	665		108
Switzerland	540	133	59	259	72	75	139	119	58	98	116	185	190	430	228	137	877	380	312	64	264	107	140	167	174	66	113		895	57	111
Turkey	504	229	152	287	158	226	271	300	120	282	335	482	550	315	472	124	640	330	283	132	402	310	337	125	404	191	144	205		160	119
United Kingdom	504			390										367		105	708		240		484							98	933		117
United States	928	201	102	309	162	223	739	201	80	188	408	649	739	700	317	344	2323	739	199	246	997	391	375	566	520	128	134	275	1191	102	

Surprisingly roaming is not always more expensive than making international calls from mobile phones. This report argues that this is because MNOs and MVNOs believe that users making international calls from their mobile phones have inelastic demand. This means, on some routes, it can sometimes be less expensive for users from Japan, Korea, Mexico and Switzerland to make calls home when roaming than it is for nationals of countries in which they are roaming to make international calls to these countries. Mexico is the country with the most instances of this phenomenon. Such differences across the OECD cannot be explained by cost-orientated pricing for roaming or international mobile calls.

Wholesale roaming rates

Inter-operator tariff structure and billing

Until 1998 international wholesale roaming charges were calculated on the basis of the so-called "Normal Network Tariff" (NNT) of the visited MNO.[96] The NNT took as its starting point the standard retail price for a service (*e.g.* a call back to the roamer's home country) paid by a national user and added 15%. The additional charge was aimed at recovering the contribution to the cost of the call that would otherwise have been made by a monthly subscription fee from a subscriber. Leading up to that era mobile pricing packages had commonly included a fixed monthly fee and per call usage charges similar to the traditional pricing model for fixed networks. Increasingly, however, competition was starting to change or eliminate the traditional pricing models (*e.g.* prepaid cards, monthly subscriptions with bundled minutes etc).[97] In recognition of the shift away from standard pricing models the GSMA introduced the Inter-Operator tariff system with the aim of improving the ability of MNOs to form roaming agreements.

The arrangements underpinning the exchange of SMS traffic have also changed over the years. SMS was not planned as a commercial service.[98] The original purpose was for operators to share information with customers as well as staff. As such billing systems and the ability to send SMS off-net were largely not in place. As operators began to make possible the delivery of SMS between different networks the most widely used system was sender-keeps-all ("bill and keep").[99] Over time this model gave way to a paid termination model. In respect to roaming, SMS is now treated in the same way as voice traffic. The roamer's home network operator pays the wholesale charge for using the visited network which they incorporate into the retail charge paid by the user. Other costs include handling and routing the roaming SMS back to the home network, costs for sending the SMS to the receiver's network, data clearing house fees, signalling fees between the networks and other costs (*e.g.* commercial costs, IT costs, prepay cheques), the home operator's retail costs and taxes, such as VAT.[100] In general mobile operators do not charge for incoming SMS received by users when they are roaming.

What these changes have meant

Views on the change from NNT to IOT are mixed. Some believe the disassociation of the wholesale tariff from the retail tariff removed a link to the competitive conditions that apply at the retail level.[101] Others note that it was competition leading to "subsidies and bundled services" at the national level that made the NNT system less workable.[102] Observers have also pointed out that the link to retail competition was relatively weak in that the home network operator could select which 'standard tariff" to apply,generally choosing an expensive option.[103] A further drawback of the NNT system was that roamers could not be expected to know the structure of foreign tariffs (*e.g.* periods of peak and off-peak tariffs, different units – seconds or minutes).[104]

In contrast to the NNT system, the IOT model for voice services held potential for the roamer's own service provider to be able to structure retail tariffs and, as a consequence, make them simple and more transparent to users. In practice this has proven harder to accomplish. One reason for this is that the complexity evident at the retail level can also be reflected in IOTs. One commentator has noted:

> "For mobile originated calls, IOT dimensions are usually destination (domestic or international), time of day (peak or off-peak), time unit (10 seconds/30 seconds/1 minute or other), type of terminating network, (fixed or mobile terminated) and/or may include a set-up fee for each call."[105]

As a result of the different types of IOT agreements roaming charging structures may differ from how national services are charged (Table 18). Whereas some operators charge by the second, at the national level, this can differ at the level of international roaming. One reason for this is that operators need to recover their costs. If, for example, the IOT has a per minute basis and a user makes a 30 second call back to their home country their home service provider will be charged for a full minute. This is, however, not always the case. In Spain and the United Kingdom, Telefonica's MNOs charge by the second for both national services and roaming services. This suggests the company may have negotiated IOTs based on per second charging. Finland's Sonera also differs from the norm with per minute charging for national services but 30 second units for international roaming.

Some MNOs apply the same charging structure across all roaming destinations. Others base the structure directly on the agreed IOT arrangements. The latter group of MNOs say they are passing on the benefits of low units, such as per second billing, to their customers whenever reasonably possible and practical to do so. These MNOs are, however, in the hands of others in respect to those destinations where this is possible. If the corresponding operator insists on per minute billing that will be reflected in their retail charges.

The charging structure considered in the foregoing is for post-paid roaming. MNOs may apply different structures to pre-paid roaming. For example an MNO that applies per–second billing to post-paid roamers may apply 60 second units to pre-paid users. Applying an initial minimum billing period of 60 or for example 30 seconds may provide the customer with a better user experience. As pre-paid charging happens in real time once the user runs out of credit their usage is terminated. By charging an initial minimum period, an MNO ensures that calls will not terminate after just a few seconds because the user has to have at least sufficient credit remaining to allow for a reasonable length of conversation. However, this argument does not seem to justify billing in units greater than one second after the initial period. An initial charging period also allows the provider to recover the fixed costs of setting up the call. The average length of call may be different for post-pay and pre-pay customers, creating a different need to recover some fixed costs up front.

Even though some MNOs change the structure of their billing depending on the destination they usually publish per minute rates. This is understandable in that international roaming charges are complex and adding variations across this information would add to that complexity. They are likely to wish to pass on the benefits of lower units, when they can, to price sensitive customers. If operators were able to obtain lower wholesale billing increments from some operators, passed that on to the retail level by charging in different billing intervals depending on the foreign network the user connected to, and highlighted which foreign providers billed by lower incremental units, users would be empowered in selecting a foreign operator, presuming that they are sufficiently aware and motivated to access and act on this information. In addition the question can be raised as to why some MNOs that have per–second billing for national services have a uniform per minute charge for international roaming. Clearly they already have, or could negotiate with some foreign MNOs, per second IOTs. Instead they have chosen not to pass this benefit on to their customers. This may be linked to a lack of competition in roaming services, and the perceived level of price elasticity of roaming services.

In 2008, the European Regulators Group (ERG) estimated that consumers pay 19% and 24% more for calls received and calls made, respectively, as a result of roaming calls being in intervals greater than one second. They argued that regulatory action was required to address what they called a 'hidden charge'.

Accordingly, the amended EU Roaming Regulation (EC) No 544/2009 established per second billing for the regulated wholesale and retail tariffs across the EU, with up to a 30 second minimum charge for regulated wholesale calls and retail calls made. Some EU Member States have also taken national measures in this area at the retail level (*e.g.* France, Spain, Portugal and Lithuania).

For the European Union setting a minimum billing period at a level of 30 seconds serves two purposes. First, it allows operators to recover the fixed set-up costs which regulatory authorities asses to be much lower than the 30 seconds at the regulated wholesale and retail rates. This regulation does not, however, preclude operators from differentiating their services by offering shorter minimum charging periods or even full per second billing. Nor does it affect the negotiation of IOTs outside the EU area.

Table 18: Charging structure for Mobile Services

Country	Operator	Set-up fee	International Roaming Charging Structure	National Service Charging Structure
Australia	Telstra	Yes only for receiving calls (USD 0.26)	Making calls: vary based on where to roam in (60-60, 30-30, 1-1 etc.) Receiving calls: 1-1 (except airtime charges)	Varies based on subscription
Austria	Mobilkom	No	60-60	Varies based on subscription
Belgium	Proximus	No	60-1	60-1
Canada	Rogers Wireless	No	60-60	60-60
Czech Republic	T-Mobile	No	Varies based on where to roam in (60-60, 30-30 etc.)	Varies based on subscription
Denmark	TDC Mobil	No	Varies based on where to roam in (60-60, 30-30, 60-1 etc.)	Varies based on subscription
Finland	Sonera	No	30-30	60-60
France	Orange	No	60-1	1-1
Germany	T-Mobile	No	60-60	60-1
Greece	Cosmote	No	60-60	30-1
Hungary	T-Mobile	No	60-60	60-60
Iceland	Siminn	No	60-60	60-10
Ireland	Vodafone	No	60-30	1-1
Italy	TIM	Yes only for receiving calls (USD 0.20)	60-60	Varies based on subscription
Japan	NTT DoCoMo	No	60-60	30-30
Korea	SK Telekom	No	60-60	10-10
Luxembourg	LUXGSM	No	60-15	Varies based on subscription
Mexico	Telcel	No	60-60	1-1
Netherlands	KPN Mobile	No	Making calls: 60-30 Receiving calls: 60-60	Varies based on subscription
New Zealand	Vodafone	No	60-60	Varies based on subscription
Norway	Telenor Mobil	Yes only for receiving calls while roaming in some countries (USD 0.11)	Varies based on where to roam in (60-60, 30-30, 60-1 etc.)	1-1
Poland	PTK Centertel	No	60-60	1-1
Portugal	TMN	No	60-60	Varies based on subscription
Slovak Republic	Orange	No	60-60	1-1

Country	Operator	Set-up fee	International Roaming Charging Structure	National Service Charging Structure
Spain	Telefonica Moviles	Yes for making calls (charges vary)	1-1	1-1
Sweden	Telia	Yes only for receiving calls while roaming in some countries (charges vary)	Making calls: 60-60 receiving calls: 30-30	Varies based on subscription
Switzerland	Swisscom	No	60-60	10-10
Turkey	Turkcell	No	60-60 for post-paid 6-6 for pre-paid	6-6
United Kingdom	O2	No	Making calls: 60-15 Receiving calls: 1-1	1-1
United States	AT&T	No	60-60	60-60
Israel	Cellcom	Yes only for making calls while roaming in some countries (charges vary)	Making calls: vary based on where to roam in (60-60, 30-30, 30-10 etc.) Receiving calls: 60-60	n/a

Note: In the charging structure for roaming services 60-60 means that billing increment is always 60 seconds, whereas 60-1 means that initial billing increment is 60 seconds then billed by second and so forth. The charging structure shown in this table is for post-paid users.

The level of inter-operator tariffs

The retail price paid by users for IMRS reflects several components. One part is IOT which covers the foreign operator's domestic and international costs as well as any applicable taxes applied to roaming services at the wholesale level. The other component is the margin added by the home network operator to cover their costs as well as any applicable taxes.

In the European Economic Area (EEA) wholesale roaming rates are capped by regulation for intra-European traffic. The wholesale rates in force between European Summer 2008 and European Summer 2009 are USD 0.35 per minute for an outbound call.[106] During the same period the maximum allowable surcharge, to cover the home network operator's costs, was USD 0.23 per minute. Operators are free, of course, to set lower wholesale or retail rates. For the EU, the amended Roaming Regulation (EC) No 544/2009 provides for further reductions over successive years up to July 2012.[107]

Due to regulation, Europe's maximum intra-European average wholesale rates are public record. In most other OECD countries, and for extra-European traffic, such rates are held by operators to be commercially confidential. Some operators do, however, publish the surcharge they add to the wholesale rate to form the retail price. In Australia, for example, Telstra applies a standard surcharge of 30% to the wholesale rates of all foreign operators except for 16 countries.[108] Telstra is to be commended for doing this in a way that does not confuse the customer but also makes transparent to Australian stakeholders where the major element of cost causation is to be found. In other words over 76% of the retail cost to roam outside Australia is made up of the wholesale rates set by the foreign operator.

In Table 19 the charges for IMRS are broken out by the wholesale charge, Telstra's surcharge and the total price to be paid by the user for a one minute call back to Australia.[109] The list of operators includes all Telstra's roaming partners in the selected countries. Among OECD countries it is most expensive for a Telstra customer to roam in Turkey, the Czech Republic, Poland, Spain and Mexico, albeit in Spain and the Czech Republic there is some latitude to roam on a less expensive network. Outside the OECD area it is most expensive to roam in Russia, though there are several more expensive countries not shown in the selected countries (Table 20). The reason for the high cost, in all these cases, is the level of the wholesale rate.

The data in Table 19 also reveal those countries with the lowest wholesale rates. In the OECD area the mobile operator with the lowest roaming rate was Åland Mobiltelefon, which operates in the Åland Islands, off the coast of Finland in the Baltic Sea. Somewhat surprisingly the wholesale rate for Åland Mobiltelefon, is less than for New Zealand Telecom the next least expensive network. Operators in Nordic countries, in the OECD area, make up six of the least ten expensive networks on which to roam for Telstra customers. These countries are not, however, the least expensive destinations for the Telstra roamer. The low wholesale rates in South Africa ensure that it is less expensive for a Telstra customer to roam than in any of the OECD countries for which data are available.

The most striking thing about the wholesale prices per minute is that they range from USD 0.65 (South Africa) to USD 7.32 (Russia). Even within the OECD area the difference between USD 0.79 per minute (Aland, Finland) and USD 5.07 per minute in Turkey is very large. These differences cannot be explained by cost-oriented pricing.

Precisely why the wholesale charges show such large variations is not readily explainable. There appears to be no correlation with distance from Australia with some near neighbours showing remarkable differences in wholesale prices. Nor does the volume of traffic appear to be the decisive factor (Nordic countries are not among the top destinations for Australian roamers). At the same time, mobile operators within the same ownership group have vastly different rates with Vodafone's Greek operator having a wholesale rate five times less than its Turkish operator. It is tempting to think that, at least in this example, volume is a factor, due to patterns of immigration. If volume based on travel between two countries was a factor in lowering rates, however, Vodafone's New Zealand rate should be among the lowest instead of being 73% higher than the Greek rate.

An examination of the data produces results that may sometimes seem surprising or counter intuitive. It would not be expected that it would be less expensive for a Telstra customer to roam in South Africa or Finland than New Zealand. Nor, without Telstra's publication of their retail mark-up, would it be clear where the major element of cost causation is for IMRS. While some have suggested that the publication of wholesale rates may confuse customers, and potentially it may do so if published together with retail prices, there is no evidence that separate publication of the surcharge applied to the wholesale charge, does anything else but add transparency for user groups, operators, regulators and policy makers.

Table 19: Foreign wholesale rates and Telstra's retail rates in the OECD area (February 2009)

Destination country	Destination operator	Calls made back to Australia		
		Wholesale price (USD)	Telstra margin (USD)	Total retail price (USD)
Turkey	Vodafone TUR	5.07	1.52	6.59
Turkey	Avea	5.06	1.52	6.58
Czech Republic	Telefonica O2 CZE	4.75	1.43	6.18
Poland	PTC-ERA	4.11	1.23	5.35
Spain	Orange ESP	4.08	1.22	5.30
Czech Republic	T-Mobile CZE	3.39	1.02	4.40
Mexico	Telefonica Mexico	2.93	0.88	3.81
Mexico	Telcel	2.69	0.81	3.50
Hungary	Pannon	2.62	0.79	3.40
Spain	Vodafone ESP	2.61	0.78	3.39
Belgium	Mobistar	2.58	0.77	3.35
Poland	P4	2.47	0.74	3.21
Austria	T-Mobile (MaxMobile)	2.39	0.72	3.11
Turkey	Turkcell	2.39	0.72	3.11
Hungary	T-Mobile HUN	2.31	0.69	3.01
Spain	Telefonica Moviles ESP	2.23	0.67	2.90
Poland	Polkomtel	2.21	0.66	2.87
Ireland	O2 IRL	2.16	0.65	2.80
Japan	NTT DoCoMo	2.15	0.64	2.79
Belgium	Belgacom/Proximus	2.05	0.62	2.67
Belgium	Base	1.92	0.58	2.50
Denmark	Hi3G DNK	1.92	0.58	2.50
Japan	Vodafone K.K. JPN	1.91	0.57	2.48
Ireland	Vodafone IRL	1.88	0.56	2.44
Poland	Orange POL	1.86	0.56	2.42
Austria	Hutchison 3G	1.85	0.55	2.40
Greece	Wind GRC	1.82	0.55	2.36
Ireland	Meteor	1.80	0.54	2.34
Ireland	Hutchison 3G IRL	1.80	0.54	2.34
Czech Republic	Vodafone CZE	1.78	0.54	2.32
Luxembourg	VoxMobile	1.74	0.52	2.27
New Zealand	Vodafone NZ	1.73	0.52	2.26
Korea	KTF Korea	1.73	0.52	2.25
Iceland	IMC Viking Wireless	1.63	0.49	2.12
Austria	Telering	1.57	0.47	2.04
Denmark	TeleDenmark (TDC)	1.56	0.47	2.02
Austria	Mobilkom	1.54	0.46	2.00
Austria	Orange (Connect ONE)	1.54	0.46	2.00
Iceland	Vodafone Og Fjarskipti	1.54	0.46	2.00
Greece	Cosmote GRC	1.52	0.46	1.97
Finland	TeleiaSonera FIN	1.49	0.45	1.93
Canada	Rogers	1.36	0.41	1.77

Destination country	Destination operator	Calls made back to Australia		
		Wholesale price (USD)	Telstra margin (USD)	Total retail price (USD)
Korea	SK Telecom	1.32	0.40	1.72
Hungary	Vodafone HUN	1.27	0.38	1.66
Finland	DNA	1.27	0.38	1.65
Luxembourg	Tango	1.25	0.37	1.62
Iceland	SIMINN Iceland telecom	1.22	0.37	1.59
Luxembourg	P&T Luxembourg	1.05	0.32	1.37
Norway	Telenor Mobil	1.04	0.31	1.35
Greece	Vodafone GRC	1.00	0.30	1.30
Denmark	Sonofon	0.99	0.30	1.29
Norway	NetCom	0.98	0.29	1.27
New Zealand	New Zealand Telecom	0.84	0.25	1.09
Finland	Alands Mobiltelefon	0.79	0.24	1.03
Average of above		2.05	0.62	2.67

Note: Data are derived based on Telstra Terms of Customer Pricing and published retail prices. The OECD countries for which it is not possible to determine wholesale rates include: France, Germany, Italy, Netherlands, Portugal, Sweden, Switzerland, the United Kingdom and the United States. The Australian Government does not levy tax on roaming.

Table 20: Foreign wholesale rates and Telstra's retail rates for selected operators outside the OECD area (February 2009)

Destination country	Destination operator	Calls made back to Australia		
		Wholesale price USD per minute	Telstra margin USD per minute	Total retail price USD per minute
Russia	Megafon	7.32	2.20	9.52
Russia	Uralsvyazinform	6.49	1.95	8.44
Russia	NCC	5.54	1.66	7.21
Russia	Tele2 Russia	5.49	1.65	7.13
Russia	Beeline (VimpelCom)	5.19	1.56	6.74
Russia	Mobile telesystems)	4.40	1.32	5.72
Russia	NTC	4.05	1.21	5.26
Russia	Baykalwestcom	3.95	1.18	5.13
Russia	Zao Smarts	3.62	1.09	4.71
Russia	Yeniseytelecom	3.62	1.09	4.71
Israel	Partner Comms - Orange	3.26	0.98	4.23
Brazil	Oi (TNL PCS)	2.98	0.89	3.87
China	China Unicom	2.95	0.88	3.83
Egypt	MobNil	2.85	0.85	3.70
Egypt	Etisalat EGY	2.81	0.84	3.65
Egypt	Vodafone EGY	2.81	0.84	3.65
Israel	Cellcom	2.77	0.83	3.60
Brazil	Clarao BRA	2.65	0.79	3.44
Brazil	TIM Cellular S.A.	2.54	0.76	3.31
Estonia	Tele2 EST	2.36	0.71	3.07
Estonia	Elisa (Radiolinja)	2.30	0.69	2.99
India	All Indian operators	2.26	0.68	2.94
South Africa	Vodacom ZAF	1.02	0.31	1.33
Pakistan	Mobilink	0.78	0.23	1.01
South Africa	Cell C	0.75	0.23	0.98
Pakistan	Warid Telecom	0.70	0.21	0.91
South Africa	MTN ZAF	0.65	0.20	0.85
Ghana	ScanCom (MTN)	0.58	0.17	0.75
Average of above		3.10	0.93	4.02

Note: Data are derived based on Telstra Terms of Customer Pricing and published retail prices. Countries outside the OECD area for which it is not possible to determine wholesale rates include: Hong Kong, China; Indonesia; Macau China; Malaysia; Philippines;Singapore and Thailand. The Australian Government does not levy tax on roaming.

It is also possible to determine the wholesale charges paid by Turkcell to several regions of the world for various roaming services (Table 21). The wholesale charges are consistent with those paid by Telstra customers though Turkcell appears to get much lower rates for Russia. Turkcell's margin is similar to Telstra's. The conclusion that wholesale rates are responsible for roughly two thirds of the retail price is also consistent.

Table 21: Foreign wholesale rates and Turkish retail rates (February 2009)

Region	Foreign wholesale charge	Turkcell margin	Turkish government taxes applied to retail margin	Total retail
Making calls (per minute, USD)				
Europe	1.41	0.48	0.21	2.10
Russia and Ukraine	2.98	0.98	0.42	4.39
USA and Canada	1.94	0.65	0.28	2.86
Other	1.94	0.65	0.28	2.86
Sending SMS (USD, per message)				
All regions	0.26	0.08	0.04	0.38

The wholesale rate includes taxes as applicable. Numbers may not add due to rounding.

SMS

The wholesale rates for SMS, levied by foreign operators toward Telstra customers also display an enormous diversity. There is no obvious reason, in terms of the underlying costs, as to why wholesale rates for SMS should range from USD 0.13 in Germany to USD 0.76 in Israel for the operators shown in Table 22. In addition no obvious pattern is suggested by factors such as geography or volume of traffic.

While in no way being an "apples to apples" comparison, the cost of sending an SMS using Skype contains some of the same cost elements as the wholesale charge for SMS roaming (*e.g.* cost of termination on mobile network, international carriage). The elements of cost that are not included in Skype's prices, but would be factors in international roaming, cannot explain the very large differences between the two prices. The only plausible explanation is that there is insufficient competition in setting wholesale roaming rates.

Table 22: Foreign wholesale rates and Telstra's retail rates for selected operators (February 2009)

Destination country	Destination operator	Wholesale price USD per SMS	TelstramMargin USD per SMS	Total retail price USD per SMS	Skype price for SMS terminating in that country
Israel	Partner Comms - Orange	0.76	0.23	0.99	0.097
Israel	Cellcom	0.66	0.20	0.86	0.097
United States	Nextel	0.63	0.19	0.82	0.112
Iceland	IMC Viking Wireless	0.61	0.18	0.79	0.097
Austria	Hutchison 3G	0.46	0.14	0.60	0.146
Spain	Vodafone ESP	0.45	0.13	0.58	0.144
Spain	Telefonica Moviles ESP	0.45	0.13	0.58	0.144
Portugal	Optimus	0.41	0.12	0.54	0.130
Austria	T-Mobile (MaxMobile)	0.40	0.12	0.52	0.146
Austria	Mobilkom	0.38	0.11	0.50	0.146
Austria	Orange (Connect ONE)	0.38	0.11	0.50	0.146
Portugal	Vodafone	0.38	0.11	0.50	0.130
United States	Alltel	0.38	0.11	0.49	0.112
United States	AT&T	0.38	0.11	0.49	0.112
United States	Cincinatti Bell	0.38	0.11	0.49	0.112
Portugal	TMN	0.37	0.11	0.48	0.130

Destination country	Destination operator	Wholesale price USD per SMS	TelstramMargin USD per SMS	Total retail price USD per SMS	Skype price for SMS terminating in that country
Czech Republic	Telefonica O2 CZE	0.36	0.11	0.47	0.111
Mexico	Telefonica Mexico	0.35	0.11	0.46	0.312
Turkey	Vodafone TUR	0.35	0.10	0.45	0.127
Netherlands	O2	0.35	0.10	0.45	0.127
Netherlands	T-Mobile	0.35	0.10	0.45	0.127
Denmark	Sonofon	0.34	0.10	0.45	0.047
Denmark	TeleDenmark (TDC)	0.34	0.10	0.45	0.047
Japan	Vodafone K.K. JPN	0.34	0.10	0.44	0.066
Netherlands	Vodafone (Libertel)	0.33	0.10	0.43	0.127
Sweden	TeliaSonera	0.33	0.10	0.43	0.097
Turkey	Avea	0.33	0.10	0.43	0.127
Austria	Telering	0.32	0.10	0.42	0.146
Canada	Rogers	0.32	0.10	0.42	0.112
Ireland	Meteor	0.32	0.10	0.42	0.111
France	Orange	0.32	0.10	0.42	0.133
Italy	Wind ITA	0.32	0.10	0.42	0.127
Italy	Telecom Italia	0.32	0.10	0.42	0.127
Spain	Orange ESP	0.32	0.09	0.41	0.144
Switzerland	Sunrise	0.32	0.09	0.41	0.111
Switzerland	Swisscom	0.32	0.09	0.41	0.111
Greece	Wind GRC	0.31	0.09	0.40	0.119
Korea	KTF Korea	0.31	0.09	0.40	0.097
Korea	SK Telecom	0.31	0.09	0.40	0.097
New Zealand	Vodafone NZ	0.30	0.09	0.39	0.097
New Zealand	New Zealand Telecom	0.30	0.09	0.39	0.097
Czech Republic	T-Mobile CZE	0.30	0.09	0.38	0.111
Czech Republic	Vodafone CZE	0.30	0.09	0.38	0.111
Sweden	Tele2 Comviq	0.30	0.09	0.38	0.097
Mexico	Telcel	0.29	0.09	0.38	0.312
Netherlands	KPN	0.29	0.09	0.38	0.127
Greece	Cosmote GRC	0.29	0.09	0.37	0.119
Greece	Vodafone GRC	0.29	0.09	0.37	0.119
Japan	NTT DoCoMo	0.29	0.09	0.37	0.066
Iceland	SIMINN Iceland Telecom	0.28	0.08	0.37	0.097
Iceland	Vodafone Og Fjarskipti	0.28	0.08	0.37	0.097
Luxembourg	VoxMobile	0.28	0.08	0.37	0.097
Poland	Polkomtel	0.28	0.08	0.37	0.112
Belgium	Belgacom/Proximus	0.28	0.08	0.36	0.115
Switzerland	Orange	0.28	0.08	0.36	0.111
Sweden	Telenor	0.27	0.08	0.35	0.097
Norway	NetCom	0.27	0.08	0.35	0.107
Denmark	Hi3G DNK	0.26	0.08	0.33	0.047
Ireland	Hutchison 3G IRL	0.26	0.08	0.33	0.111
Germany	T-Mobile	0.26	0.08	0.33	0.127
Netherlands	Orange (Dutchtone)	0.26	0.08	0.33	0.127
Sweden	Hi3G	0.26	0.08	0.33	0.097

Destination country	Destination operator	Wholesale price USD per SMS	TelstramMargin USD per SMS	Total retail price USD per SMS	Skype price for SMS terminating in that country
Finland	TeleiaSonera FIN	0.25	0.08	0.33	0.097
Norway	Telenor Mobil	0.25	0.08	0.33	0.107
United States	T-Mobile	0.25	0.08	0.33	0.112
United States	SunCom Wireless	0.25	0.08	0.33	0.112
Hungary	Pannon	0.25	0.07	0.32	0.127
Turkey	Turkcell	0.25	0.07	0.32	0.127
Ireland	Vodafone IRL	0.24	0.07	0.32	0.111
France	Bouygues Telecom	0.24	0.07	0.32	0.133
Poland	PTC-ERA	0.24	0.07	0.31	0.112
Finland	Alands Mobiltelefon	0.23	0.07	0.30	0.097
Hungary	T-Mobile HUN	0.23	0.07	0.30	0.127
Italy	Vodafone Omnitel	0.23	0.07	0.30	0.127
Germany	E-Plus	0.23	0.07	0.30	0.127
United Kingdom	O2	0.23	0.07	0.30	0.099
United Kingdom	Orange	0.23	0.07	0.30	0.099
United Kingdom	T-Mobile	0.23	0.07	0.30	0.099
United Kingdom	Hi3G	0.23	0.07	0.30	0.099
Hungary	Vodafone HUN	0.22	0.07	0.29	0.127
Belgium	Mobistar	0.22	0.07	0.28	0.115
Finland	DNA	0.22	0.07	0.28	0.097
Germany	O2 DEU (Viag)	0.22	0.07	0.28	0.127
Poland	P4	0.21	0.06	0.27	0.112
Poland	Orange POL	0.20	0.06	0.26	0.112
Ireland	O2 IRL	0.19	0.06	0.25	0.111
Italy	Hi3G	0.19	0.06	0.25	0.127
Luxembourg	P&T Luxembourg	0.18	0.06	0.24	0.097
Luxembourg	Tango	0.18	0.05	0.23	0.097
United Kingdom	Vodafone	0.17	0.05	0.23	0.099
Belgium	Base	0.16	0.05	0.21	0.115
Germany	Vodafone	0.13	0.04	0.16	0.127

Note: All prices exclude tax. As specified in their customer terms and conditions Telstra charges the wholesale rate set by the foreign operator plus 30%. Unlike voice it is possible to apply the formula to all countries for SMS.

Operator roaming costs

The actors with the most accurate information on costs directly attributable to IMRS are the mobile operators. They are also in the best position to know the percentage of the mark-up made on IMRS that contribute toward meeting joint and common costs and to returns on investment. Such information is generally not in the public domain in a manner that would allow an independent assessment of these elements against the pricing of IMRS. There are, however, examples of this information being made available to regulatory authorities.

In the European Union, in order to assess profit margins related to IMRS, the European Commission requested data from the GSMA and 16 operators from the European Union area. [110] These operators were selected to provide a representative sample of networks with different sizes, volumes of traffic and membership of alliances. The European Commission also gathered information from national regulatory authorities and commissioned research from consultants. The overall conclusion of this work was that

IMRS costs were between 10% to 30% higher than national-only systems.[111] One estimate, taken from a study undertaken during this process, suggested the cost directly attributable to IMRS was USD 0.025 to USD 0.037 per minute for IMRS across the European Union area.[112] Analysis of pricing found IMRS prices to be more than 100% above directly attributable costs.[113]

Based on the findings of the European Commission, authorities agreed to a system to impose maximum prices on both the wholesale and retail prices of intra-European area roaming. The wholesale rates in force between European Summer 2008 and European Summer 2009 are USD 0.35 per minute for an outbound call (Table 23). The maximum allowable surcharge, to cover the home network operator's costs, is USD 0.23 per minute (*i.e.* USD 0.58 - USD 0.35 = USD 0.23).

Table 23: Intra-European IMRS maximum allowable prices 2007-2009

	Summer 2007 (USD)	Summer 2008 (USD)	Summer 2009 (USD)
Maximum limit for the Eurotariff for calls made abroad in EEA area	0.62	0.58	0.54
Maximum limit for the Eurotariff for calls received abroad in EEA area	0.30	0.28	0.24
Maximum average Inter-Operator tariff in EEA area	0.38	0.35	0.33

All tariffs per minute and without VAT

Source: European Commission.

A further reference point, for directly attributable costs caused by IMRS, is the prices of arbitragers. To take one example the price to call a fixed line, using the CallGSM service, when roaming in the European Union area is USD 0.37 per minute while a call to a mobile network is priced at USD 0.49 per minute.[114] The price to receive a call is USD 0.24 per minute. Outside the European Union area the prices are some times less than these rates. A Canadian or a Mexican roaming in Australia and calling Japan, or their home country, would pay USD 0.24 per minute to call a fixed line and USD 0.37 per minute to call a mobile. CallGSM's pricing includes additional surcharges when the user roams in Iceland, New Zealand and Switzerland (USD 0.29) or Canada, Mexico and the United States (USD 1.05). The surcharge is applied to both making and receiving calls while in these countries. The company says that in future receiving calls, while roaming in the United States, will not be charged. All CallGSM prices include tax as applicable and, as is sometimes applicable with prepaid cards, a user needs to make or receive at least one call every three months, to avoid paying a USD 12.52 for the provision of a telephone number.

As the cost of providing arbitrage services, such as CallGSM, are those for domestic service, plus those directly attributable to that entities provision of international service as well as their mark-up and any joint and common costs with other CallGSM services (*e.g.* billing system for international calls), it can be reasonably concluded that these prices exceed directly attributable costs for IMRS. That they are less than the Eurotariff prices suggests that prices set by European authorities cover all directly attributable costs and make some contribution to joint and common costs and exceed what would be charged in a highly contestable market with low entry barriers.

The foregoing discussion provides two reference points against which to compare the wholesale and retail prices charged to a Telstra user roaming abroad. The first reference point is the regulated wholesale and retail rates in the EU and the second is an arbitrager (CallGSM). Both reference points have obvious differences but provide an indication of prices in a regulated market (*i.e.* the EU) and a market segment that is becoming more contestable due to technological change (*i.e.* one with lower entry barriers than is usually the case with IMRS). In both cases it would be expected that there would be less opportunity for firms to charge mark-ups that are not reasonably cost-oriented.

The most obvious difference in comparing the Eurotariff for outbound calls with outbound roaming prices for Australia are the distances and volumes involved with some routes. There should, however, be some commonalties in that the costs directly attributable to roaming at the domestic level should be the same whether the user is from Paris or Perth. Where one might expect differences in cost causation to come into play are at the international level (*e.g.* transit costs between Australia and Europe being greater than, for example between France and Belgium or Portugal and Poland). In this context it can be noted that a wholesale agreement will include the cost of the international transit for traffic destined for the roamer's home network. That being said it is highly unlikely that the transit cost between OECD countries can justfy a 468% average mark-up on the EU regulated wholesale rate (Table 24). This becomes clear when the CallGSM tariffs are examined because unlike the wholesale or IOT arrangement, Telstra has with foreign networks, CallGSM is free to use its own least-cost routing arrangements for carrying traffic back to the roamer's home country (Table 25).

Table 24: Comparing wholesale and retail prices between regulated and unregulated markets

	Wholesale	Mark-up	Retail	Mark-up
EU regulated charges for outbound calls (USD per minute) (1)	0.35	0.23	0.58	66%
Average for calls to Australia (USD per minute) (2)	2.05	0.62	2.67	30%
Difference	486%	168%	360%	
Average for calls to Australia (USD per minute) (3)	2.41	0.72	3.13	30%
Difference	588%	214%	440%	

(1) The price for a European SIM card holder to call their home country from within the European Economic Area.

(2) Average for all OECD-Australia (Telstra) routes for which data are available.

(3) Average for all OECD-Australia (Telstra) routes for which data are available plus Brazil, China, Egypt, Estonia, Ghana, India, Israel, Russia, Pakistan and South Africa.

Source: OECD based on Telstra and European Commission.

In most cases the CallGSM retail prices are considerably lower than the average wholesale rate charged to Telstra by foreign operators. The differences between the Telstra prices and the CallGSM prices are highly illustrative of where mobile operators apply the highest margins. CallGSM's retail prices are a factor of the following inputs: wholesale domestic price for mobile service plus whatever CallGSM pays for international transit to Australia plus its overhead costs and a profit margin. The only exceptions are operators in those countries that charge an additional wholesale rate, over and above, that standard rate included in CallGSM's European retail rate. Telstra, on the other hand, is charged an international wholesale rate for roaming plus the foreign network's transit prices for carriage of traffic back to Australia before it applies its own margin.

The differences between the retail prices between the two systems are extremely large ranging as high as 2756%. These differences cannot be explained by directly attributable costs. Rather they are the outcome of foreign mobile operators deciding how much of their joint and common cost to recover from Telstra's customers, against their assessment of the elasticity of demand. In most cases this seems to be undertaken in the absence of competitive discipline. If this was not the case then differences between Telstra and CallGSM prices would not be as great as they are.

Table 25: Differences between Telstra retail prices and CallGSM retail prices generated by high IOTs

	Telstra User Calls back to Australia (USD)			CallGSM retail price for calls to Australia (USD)				
User roaming in this country	Foreign operator's wholesale charge	Telstra surcharge	Telstra Retail price	Additional wholesale surcharge not included in the Call GSM basic rate.*	CallGSM call to fixed network	CallGSM call to Mobile network	Difference with Telstra retail price %	Difference with Telstra retail price %
Russia	4.97	1.49	6.46	0.66	0.86	0.98	850	557
Turkey	4.17	1.25	5.43		0.24	0.37	2756	1385
Czech Republic	3.31	0.99	4.30		0.49	0.62	1003	597
Israel	3.01	0.90	3.92		0.24	0.37	1961	972
Spain	2.97	0.89	3.86		0.49	0.62	891	526
China	2.95	0.88	3.83	0.66	0.86	0.98	463	290
Egypt	2.82	0.85	3.67		0.24	0.37	1830	903
Mexico	2.81	0.84	3.65	1.05	1.23	1.36	273	169
Brazil	2.72	0.82	3.54		0.24	0.37	1762	868
Poland	2.66	0.80	3.46		0.49	0.62	788	461
Estonia	2.33	0.70	3.03		0.49	0.62	677	391
India	2.26	0.68	2.94	2.26	2.49	2.62	49	12
Belgium	2.19	0.66	2.84		0.49	0.62	629	360
Hungary	2.07	0.62	2.69		0.49	0.62	589	335
Japan	2.03	0.61	2.64		0.24	0.37	1288	622
Ireland	1.91	0.57	2.48		0.49	0.62	536	302
Austria	1.84	0.55	2.39		0.49	0.62	512	287
Korea	1.53	0.46	1.98		0.24	0.37	944	443
Denmark	1.49	0.45	1.94		0.49	0.62	396	214
Iceland	1.46	0.44	1.90	0.29	0.48	0.60	401	215
Greece	1.44	0.43	1.88		0.49	0.62	381	204
Canada	1.36	0.41	1.77	1.05	1.23	1.36	81	30
Luxembourg	1.35	0.40	1.75		0.49	0.62	349	184
New Zealand	1.29	0.39	1.67	0.29	0.48	0.60	340	177
Finland	1.18	0.36	1.54		0.49	0.62	295	149
Norway	1.01	0.30	1.31		0.24	0.37	591	259
South Africa	0.81	0.24	1.05		0.24	0.37	454	188
Ghana	0.58	0.17	0.75		na	na	na	na

Note: The prices for the countries shown are a simple average of Telstra rates for that country. In the cases of CallGSM's prices they are the actual rates, for a roamer, to call from that country to Australia. CallGSM did not have a roaming rate for Ghana. (*This price is included in CallGSMs retail price).

Source: OECD from Telstra and CallGSM.

While the foregoing analysis used the prices of CallGSM other arbitragers could be used. The price for the MyCosmik service, discussed later in this report, is based on the fee charged by the arbitrager plus the cost of purchasing a local SIM card. In other words the user meets the cost of roaming, within the country through the purchase of a local SIM card, with the additional fee charged by MyCosmik covering

any other directly attributable costs (*e.g.* international transit, billing etc). MyCosmik's fees for outbound calls typically range from USD 0.15 to USD 0.35 per minute for roaming in OECD countries.[115]

Market developments in international roaming

Retail price competition and discount plans

The range of discount plans for IMRS, available in OECD countries, increased appreciably between 2006 and 2009 (Table 26). This was particularly true for Pan-European plans or plans aimed at users roaming between two specific European countries. Several innovations occurred including time-limited discount plans aimed at users making short-stay trips abroad as well as 'on-net roaming'. MNOs say these tariff plans reflect an increasing competitive retail market in Europe and the decreasing influence of wholesale rates as larger players leveraged their ownership of networks in multiple countries. They note the emergence of traffic steering has improved the efficiency with which they can retain traffic "on-net" and therefore offer more attractive prices.

MNOs say recent developments in Europe are a natural evolution in the market that occurred earlier in the United States where industry consolidation and competition brought about unified national rates in that country (*e.g.* AT&T's Digital One Rate for domestic roaming introduced in 1998). Some European MNOs argue that continued cross border consolidation will further integrate the European market and that without the predominant influence of wholesale rates increasingly attractive offers can be expected.

Critics of IMRS pricing say the development of discount plans in Europe was a response to the actions taken by the European Union. They argue that without regulatory intervention the market would have moved at a much slower pace. They also say that the most attractive offers are frequently limited to European countries or rely on partner networks being available. They also point out that joint ownership has not necessarily led to lower prices outside the area covered by the Eurotariff. Certainly, shared ownership has led to lower on-net prices, outside the European area, but not always equal inclusion in other types of discount plans.

It may also be the case that while some European MNOs leverage ownership outside the European Union area for European users there has been less competition in the reverse direction except for on-net pricing. Take the example of T-Mobile which owns a network in the United States. T-Mobile UK charges USD 0.79 per minute, using the world traveller discount plan, for outbound roaming in the United States. Orange UK, which does not have shared ownership with a network in the United States, charges USD 1.36 per minute using the World Traveller discount plan. T-Mobile customers in the United States roaming in the United Kingdom pay USD 0.99 per minute – the same rate as AT&T and Verizon customers.

While it is unfair, to some extent, to compare a single price it does raise the question of why T-Mobile or Verizon, which is 45% owned by Vodafone, have not pressed home their advantage. One possibility is that it takes multiple networks with shared ownership to influence discount plans that don't involve company-wide on-net tariff plans (*e.g.* Passport, Like-Home). Without the higher level of competitive discipline, which comes from the retail pricing of company-wide on-net plans, operators may prefer to sacrifice a potential advantage in a foreign market so that they can continue to charge higher wholesale prices in other company markets. Meanwhile although the United States MNOs offer discounts of around 23% to 24% for larger OECD countries, they will be constrained in going beyond that level without steep reductions in wholesale rates or greater consolidation in international ownership.

It is likely that the most competitive roaming markets, in terms of MNO prices, will be those where there are multiple networks with multiple joint ownership and on-net pricing. This will bypass the barriers created by high wholesale rates. Those operators that don't have multiple foreign subsidiaries will likely be

at a competitive disadvantage for that market segment. The Australian market provides one example. Hutchison 3 and Vodafone, which are in the process or merging their Australian operations, both offer attractive on-net pricing to Australian users for the foreign destinations where they own networks. The largest player in the Australian market Telstra has more limited access to foreign networks through common ownership. Telstra owns an MNO in Hong Kong, China. Optus is owned by Singapore Telecom which does own MNOs in several nearby Asian countries. It is also a member of the Bridge Alliance. While Optus may choose to compete with an on-net pricing plan any decision on this would need to be company-wide for Singapore Telecom. In addition, Optus may feel less inclined to do that for competitive reasons if the option is not available to the largest player in the market (*i.e.* Telstra).

What factors may act to change the situation outside of Europe. One option open to MNOs such as AT&T and Telstra is to increase their ownership levels in foreign networks or seek partnership arrangements that provide more attractive wholesale rates. The impetus for this will depend on how well they can retain high volume customers that might otherwise transfer to competitors (*i.e.* are price sensitive) and how much traffic and revenues the high volume customers represent, to make them worth competing for instead of simply retaining high prices and getting revenues from less price–sensitive customers. Of course operators may choose to offer bespoke, lower roaming rates to high volume prices sensitive users and maintain standard higher roaming rates to all other users. In the event that they wish to compete for roaming users, smaller independent players may decide that being taken over by a larger operator is their best option. Alternatively, they may decide to co-operate with MVNOs and global-MVNOs in an endeavour to compete with international on-net pricing. If not they may be excluded from the bulk of the wholesale market and become increasingly less competitive in the retail market for IMRS. For their part the MNOs that have not launched on-net offers could decide to increase their prevalence as the number of markets in which they face multiple players with on-net offers increases. In some cases this pressure will also come from outside the OECD area.

Table 26: MNO International roaming discount plans

Type of plan	MNO and name ofpPlan	Comment
1) On-net use of inclusive minutes or local rates without additional "fixed fee" or separate inscription.	Zain "One World" (Middle East-Africa)	. Zain users pay local rates and can receive calls for free.
2) Combined domestic & roaming bundles: A bundle that can be used for roaming calls and calls made whilst in the home country.	SFR "Forfait ILLIMYTHICS PRO" (France)	SFR's customers can use inclusive minutes for roaming but at a higher unit price.
3) Conventional fixed roaming bundles: Fixed number of roaming minutes for a fixed fee	Orange "Pass Vacances" (France)	Users can call for 20 minutes (10 minutes outgoing calls + 10 minutes incoming calls) and send 10 SMS in zone Europe (1) for USD 8.13. Potential savings of up to 48%. For USD 12.19 the same service is available for roaming in Canada and the US.
	T-Mobile "Euro Travel Booster" (UK)	Users can call (up to 19 minutes of calls, receive up to 39 minutes of calls or send up to 30 SMS) for USD 7.25. Larger blocks of airtime available. Valid for 20 days ("use it or lose it"). Europe only.
	T-Mobile "World Class 100" (Austria)	For USD 39.31 additional fixed fee per month business customers get 100 minutes in 33 countries the majority of which are European
	AT&T "World Traveller", "AT&T Canada", "AT&T Mexico"	AT&T World Traveler USD 5.99 per month for discounts in 85 countries. AT&T Canada or AT&T Mexico USD 4.99 with rate of USD 0.59 per minute while roaming in those countries.
4) Unlimited roaming bundles: Tariff plan with a fixed fee / one-off activation fee / recurring (*e.g.* monthly) subscription fee for unlimited number of roaming minutes	-O2 "Chosen Country – Spain"	For USD 7.25 per month, a user gets a flat rate of only USD 0.36 per minute for calls to the UK and other selected European countries. Free to receive calls.
5) Two-part tariff plans with a call setup fee and incremental reduced price per minute rate (some allow customers to use domestic "inclusive" minutes)	- Vodafone/SFR/Telenor "Passport"	Vodafone charges a call set-up fee (USD 1.06) and then enables customers to use the airtime included in their regular tariff plan.
	- T-Mobile "Cestovatel" (Czech Republic)	The Cestovatel roaming add-on can be used in all countries where T-Mobile has a network. For a USD 1.70 set up fee, users can make calls for USD 0.23 per minute. During the ski season, this option is also available for France, Italy and Switzerland.
6) Discounted prices for an activation fee/monthly subscription fee	- O2/ Telefonica "My Europe - High Roamer"	"My Europe" offers flat-rate voice roaming rates across the EU during the summer months, regardless of the mobile network. The high roamer option is available for a monthly fee of USD 13.56 and offers discounts up to 70%.
	- Vodafone "Eurocall"	For a monthly fee of USD 13.56 users get discounted roaming calls in European countries.
	- Orange "Pays Préféré" (France)	For USD 6.76 per month calls can be made at domestic rates for France. For USD 13.52 the discount is available for multiple European countries.
	-Orange World Traveller (UK)	For USD 2.84 a month, users get up to 50% off calls and texts while abroad. A call made from Australia to the UK would cost USD 0.87 per minute
	-Telecom Italia "Zero Confini"	For USD 6.77 users can make three minute calls in 30 European countries for USD 1.35.

7) Reduced roaming rates with free opt-in (no activa-tion fee/ monthly subscription fee)	- O2/Telefonica "My Europe"	See above
	- T-Mobile "World Class" (UK)	With this WorldClass tariff you can make calls for just USD 0.77 per minute in 18 countries. OECD countries included are Optus (Australia), and Turkcell (Turkey). Ireland (Meteor) is also included for USD 0.34 per minute.
8) Corporate non-published tariffs that provide a discount based on certain level of total revenues	- Offered by most operators	Rates are negotiated. Operators may offer a range of discounts such as for calls within the same firm as the customer.

Source: Based on GSMA, OECD

Cross-borderless roaming market developments

In March 2009 Orange announced an on-net offer with its nine subsidiary MNOs in African countries with the expectation that a tenth MNO would soon join.[116] The offer enables Orange's African clients to roam in France and call and be called at preferential rates across Orange's African MNOs. Some of the Orange MNOs in Africa had already enabled their users to roam across each other's networks at preferential rates, and receive incoming calls for free, but previously this had not included France.

The Orange offer comes on the heels of several MNOs, headquartered outside the OECD, pioneering cross borderless on-net roaming. The leader was Celltel which, in September 2006, launched the first cross border on-net roaming option in East Africa (Kenya, Uganda and Tanzania). Celltel was subsequently taken over by Zain a Kuwaiti based MNO. Zain extended the offer throughout its territory and, by early 2009, the "One Network" option was available in 17 of Zain's 21 countries throughout Africa and the Middle East. Moreover Zain is reported trialling admittance of other MNOs to its service.[117] The attractiveness of "One Network" was that for the first time it enabled users to cross borders without paying additional fees for roaming. Calls made using the service are at the rates applicable to the users of the country in which the user is roaming. In addition it is free to receive calls, there are no fixed charges and users can top up their airtime in whatever country they happen to be in. By early 2009, a quarter of a million people in East Africa were calling across the three original borders at no additional cost.[118]

Zain's (Celltel) innovation forced rivals to offer similar plans. Initially, that meant forming alliances to provide a similar service where networks did not necessarily share ownership (*e.g.*, Vodacom in Tanzania, Safaricom in Kenya and Uganda Telecom and MTN in Uganda).[119] As Zain expanded its cross–borderless roaming service so have its rivals such as MTN. In November 2008 the South African based MTN said it expected to introduce seamless roaming across its 21 operations in Africa and the Middle East in the first half of 2009.[120] The service, called "One World", enables users to pay local rates in whichever country they are roaming in as well receive free incoming calls.

Zain has also generated similar offers in the Middle East, that like Orange's African clients, enabled users from outside the OECD area to roam at preferential rates in OECD countries. In September 2008 Batelco introduced free incoming calls for all its roamers across 21 countries.[121] Saudi Arabia's Mobily allows both post and prepaid users to roam in 56 countries, spread over four continents, and receive calls without being charged for incoming calls.[122] The countries covered include a large number of operators in OECD countries such as Denmark, France, Iceland, Japan and Switzerland. The so called "Tejwaly Service", was introduced in February 2009.

The foregoing experience also shows that once a player breaks away from the "cartel-like" behaviour they can increase competition and become a market leader. They can also increase revenue and profitability. For the year 2008, Zain Group recorded its record consolidated revenues of USD 7.4 billion, an increase of 26% compared to 2007.[123] The company's consolidated EBITDA increased by 15% for the

same period to reach USD 2.78 billion. Consolidated net profits reached USD 1.2 billion, an increase of 6% on 2007. The earnings per share was USD 0.33 and the shareholders equity was up 36% to USD 8.69 billion. At the same time the company's customer base was 63.5 million up 50% on the previous year.

On-net cross-borderless roaming in OECD countries

In the OECD area one of the first on-net offers with numerous countries was launched by Vodafone in May 2005. In the first 16 months the service signed up 10 million customers or one third of all Vodafone roamers.[124] In January 2007, Hutchison 3 introduced its on-net roaming option "3 Like Home".[125] This plan was later withdrawn from the market in June 2009. The main difference between the two services was that Passport offers domestic prices in return for a fixed fee per call. "Like Home" enabled users to make and receive calls at domestic rates. Both plans enabled users to use their existing inclusive airtime.

Vodafone's ability to launch Passport coincided with, or was enabled by, an improved ability to steer roaming traffic toward its own fully owned networks. This meant the wholesale rates set by other operators became less critical in setting retail prices as the company could "internalise" traffic. In fact by November 2005 Vodafone could retain more than 75% of traffic within their own network footprint.[126] In Vodafone's view it was "…the ability to generate 'on net' propositions internationally that is driving innovation in the international roaming market."[127] In Vodafone's view:

> "Competition in this market will not be driven by regulation but by retail initiatives like Passport which are supported by an on-net footprint. These are forcing our competitors – both alliances and stand alone national operators – to reconfigure their wholesale arrangements. Cross-border acquisitions in the mobile industry will further accelerate this model of competition."[128]

Vodafone's strategy leverages the advantages it has as the largest MNO is the world with ownership of facilities or presence through a partner network in 65 countries. In that sense it is not surprising that it was the market leader in establishing the first widely established on-net tariff. In contrast Hutchison 3 entered numerous markets in OECD countries through successful acquisition of UMTS licences where it had not previously operated second generation mobile networks. As a new entrant Hutchison 3 has had to be innovative and offer attractive tariffs to win market share. In addition as a smaller MNO, in the majority of the markets in which the company operates, Hutchison 3 is also a net-outpayer for wholesale services. Yet, like Vodafone it has numerous countries in which it is a facilities–based operator and is able to leverage that fact into an attractive roaming proposition for customers.

In May 2009 Hutchison 3 announced to its customers in the United Kingdom it was withdrawing "3 Like Home". The company gave two reasons. The first was that by withdrawing the offer they could make available more competitive rates on networks other than affiliates in the countries where the service had been available. The second was that when a user roamed off-net in these countries, without their knowledge, they would incur higher roaming fees. Under the new tariff plan users could continue to receive calls free of charge and prices were significantly lower than roaming in countries where 3 did not have an affiliate. By way of example, after June 2009, a call from Australia to the United Kingdom was priced at USD 0.19 per minute compared to USD 2.21 to call home from New Zealand. The difference between the two prices reflects the influence of wholesale rates.

A relevant question is why more MNOs have not adopted the on-net model of competition. The tariff plans are popular with consumers of those firms and go a long way toward eliminating the dissatisfaction many users express with IMRC. It is perhaps true that cross border consolidation has not occurred as fast as some expected. The most likely explanation, however, is that other MNOs have not felt threatened enough by competition from on-net propositions. The main reason for this is that the majority users do not take roaming into account when they select a service provider. At the same time, MNOs not offering on-

net propositions may believe they can create an environment that retains high volume customers without on-net tariffs that may disrupt the overall wholesale market from which they benefit.

One SIM Card: Two Countries, Two Numbers (MNOs)

Mobile operators can see the competitive threat posed by alternative roaming procedures. This is particularly the case for high volume customers travelling frequently between the same two countries. In March 2009, NTT DoCoMo, began issuing Korean mobile phone numbers to Japan-based customers who subscribe to the company's international roaming service.[129] This enables users to save up to 60% on the price of calls placed while roaming in Korea. The user also retains the DoCoMo number that they use in Japan. To offer the service DoCoMo has partnered with KT Freetel and that company's Korean based customers can receive a mobile number in Japan. The fixed charge for the number is USD 3 per month.

Telefonica has begun a similar service for its customers between Spain and Morocco. To use this service a customer requests a new SIM card from Telefonica that has their Spanish mobile number and a number supplied by Meditel, a Morrocan mobile operator.[130] When the user is in either country calls are made at local rates. To activate both numbers the user needs to input two different PIN codes. Incoming calls can be diverted from one number to the other if the customer elects to do this for a set-up fee of USD 0.63 and USD 0.19 per minute.

Potential substitutes and alternative calling procedures for roaming

Mobile or nomadic wireless alternatives

One SIM Card: Two Countries, Two Numbers (global-MVNOs)

Operators offering alternative roaming procedures are also beginning to market SIM cards with dual numbers. In early 2009, GeoSIM, an international SIM card supplier, announced the launch of a "dual IMSI" Global SIM card.[131] The service offers users a number in both the United Kingdom and the United States. Incoming calls are free for users, in both countries, and outgoing calls are made at GeoSIM rates instead of mobile network operator prices. WorldSIM has also launched a single SIM card which has a telephone number in both the United Kingdom and the United States.[132] The company says local and outbound calls, while foreign users are roaming in the United States, are set at the level as intra-European roaming charges. At the same time users from the United States can roam in the United Kingdom and 55 other countries at steeply discounted prices. WorldSIM say the service also provides access to data and has itemised billing as well as features such as call forwarding and call recording.

Camel Wireless offers a Dual IMSI SIM with two identities for the United Kingdom and the United States. Users purchase a SIM card for USD 36.68 which includes 14.68 pre-loaded credit.[133] Camel's service provides users with +44 United Kingdom mobile number and a +1 United States mobile number. When users receive calls on the +44 number, inbound charges are free in the United States, European Union, and countries such as Australia, South Africa and the United Arab Emirates. Inbound calls on the +1 number are charged at USD 0.35 per minute in these countries. Camel has the same outbound rate for the United States as for Europe. A user from the United Kingdom or France roaming in the other country and calling the United States would be charged USD 0.24 per minute.

The obvious question is how Camel can offer free inbound calls to the United States to a United Kingdom mobile number. This is made possible through Camel having MVNO access to wholesale arrangements in both the United Kingdom and the United States. The Camel SIM offers nationwide coverage in the United States with roaming on both AT&T and T-Mobile, with users being able to elect which network they wish.[134] However, instead of paying wholesale roaming charges to AT&T or T-Mobile Camel pays the MVNO rate.

Camel's service is available in most OECD countries. In Australia and Japan, for example, Camel say users can roam on Telstra and DoCoMo respectively.[135] If a user from one of these countries was roaming in the other inbound calls would be free. The drawback for an Australian or Japanese user is that the person calling them would have to make a call to the United Kingdom mobile number. If the user used Skype that charge would be USD 0.25 per minute and VAT would not be applicable. If the Japanese user made a call home to a fixed network the charge would be USD 0.48 per minute and to a mobile USD 0.77 per minute. Calls in the reverse direction would be roughly the same cost. While Australian and Japanese users might make savings on inbound and outbound calls the main disadvantages are having a foreign number though they may be able to use call forwarding. For the system to be as advantageous as for a user from the United Kingdom firms such as Camel would have to assess that there is a large enough market between two countries to offer dual ISMI SIM cards. In the meantime users will probably favour ACPs with more seamless solutions.

Purchasing a local SIM card

Roamers have the option to purchase a local SIM card in their country of destination. The advantage of this option is that users can make and receive calls at the prices applicable to services in that country. The disadvantage is that the SIM card will come with a new telephone number. In other words users can not receive calls using their existing 'home number' which detracts from one of the major benefits of roaming. In addition prepaid cards may not be sold in units or have validity durations that match the needs of users. Notwithstanding these disadvantages this option may suit roamers that frequently visit the same country.

Devicom is a Swedish company offering a service based on purchasing a local SIM card which potentially overcomes some of the drawbacks of this approach. The service, called MyCosmik, enables users to retain their existing mobile service provider and number. To use the service the user downloads the MyCosmik software onto their mobile phone and purchases a local SIM card in the country. Users can then be reached on their regular mobile number when they are roaming abroad by forwarding their calls to MyCosmik which then forwards the call to the local SIM card. Users can switch on and off this feature themselves.

The cost of using MyCosmik is made up of the cost of a local SIM card plus the MyCosmik service fee. For example a user from Mexico, travelling in the United Kingdom and making calls to Ireland, would pay USD 0.15 per minute to MyCosmik plus a charge for the United Kingdom SIM card. MyCosmik say a user would save up to 75% to receive a call on their regular mobile number as opposed to the roaming charge of their operator. Devicom say the service also provides access to 40 000 Wi-Fi hotspots around the world. The MyCosmik service is currently available in most, but not all, OECD countries.

For users that are willing to sacrifice the convenience of using their existing number there are a range of possibilities for purchasing SIM cards over the world wide web. A number of entities sell prepaid cards over the Internet which enable travellers to purchase airtime in advance of their trip. In addition some MVNOs offer inexpensive rates without the need for a subscription and credit can be purchased over the Internet. Simyo, for example, is an MVNO of the Dutch operator KPN. It operates in a number of European markets with local rates as low as USD 0.11 per minute in Spain and USD 0.12 per minute in Germany.[136] A call from Spain to Australia, Japan or the United States would cost USD 0.40 per minute.

Dual SIM card handsets and services

One technological development which has complemented the option of purchasing a local SIM card is the emergence of dual SIM card phones. Some of these phones enable dual services to be active at the same time. In other words a roamer may have their home service and, for example, a prepaid card sourced

from the country they are visiting in simultaneous use. Thus, while the user incurs a charge for incoming calls to their home mobile number they can make less expensive outgoing calls. They may also transmit the new number to their most frequent correspondents, and encourage other users to call them on that number, to avoid incoming roaming charges.

"Global SIM" cards

Call back

A number of intermediaries or resellers offer numbers from the user's own country or in another country. The services are generally advertised as so called global SIM cards. One type of service offers users a telephone number from a location such as the Isle of Mann, Iceland and Israel.[137] The user purchases the card online and is able to top up credit as they wish. While roaming internationally incoming calls are generally free for the user though this depends on the country they are roaming in. The person making the call to the roamer, however, will pay for the outgoing call according to the pricing of their own service to terminate on a mobile network in the Isle of Man. In the case of an Isle of Man number, however, a call from another mobile user in the United Kingdom may be included in their tariff plan. In addition users can have calls to their regular fixed or mobile numbers forwarded to this number.[138] While forwarding calls could incur a cost to the roamer, depending on the type of tariff plan they have, it would generally be far less expensive than receiving the same call while roaming with their regular mobile number.

For outgoing calls global SIM cards employ a call-back technique.[139] This means that a user's handset will call them back once they have dialled the number they wish to call. The rates for outgoing calls using these services are generally far less expensive than roaming with a user's own operator. This includes significant price reductions for roamers that are not residents of the United Kingdom such as an Australian roaming in Austria or an Austrian roaming in Australia. In these cases, the user could expect significant price reductions, typically between 70% to 90%, for a call back to their home country. The Australian and Austrian users would, of course, would have the additional cost of currency exchange when purchasing the prepaid card, in United Kingdom Stirling, though this would be relatively minimal compared to the price reductions.

Some call back services operate with the user's existing SIM card. One such provider is Rebtel which offers inexpensive rates for international calls from mobile phones.[140] Rebtel works by offering users local numbers in their home countries matched to their most frequently called numbers. A French user can call an Australian user for USD 0.02 per minute, for calls terminating on fixed networks or USD 0.16 per minute for calls terminating on mobile networks. These charges are additional to what the user pays their mobile provider for a local call. In total the difference between what a user would pay using this method can be substantially less expensive than an international mobile call. The Rebtel user can also elect to utilise call-back and avoid the Rebtel charge. For example, the French user calls their Rebtel number, for the Australian, and asks the Australian to hang up and call the number back that they see on the screen. Rebtel then connects both parties without charge. Rebtel's service is not designed with roamers in mind but can be combined with purchase of a local SIM card. This enables users to make calls back to their home countries at considerably less expense than for an international call using a foreign pre-paid card.

Global SIM with local numbers

MAXroam, owned by Cubic Telecom, provides a further variation on the global SIM card service. Instead of using a mobile number or a toll free number the service provides users with a fixed number (*i.e.* landline) of their choice from any of the following countries: France, Ireland, Italy, Poland, Sweden, the United Kingdom or the United States.[141] Cubic Telecom is also partnering with a number of firms in

other countries. In Australia they partner with RoamingSIM and provide a local Australian number.[142] The price with MAXroam for adding additional local numbers, from around 50 countries, begins at USD 2.58 per month. To use the service users replace their regular SIM card with a MAXroam SIM card. The user then forwards their regular mobile number to their selected MAXroam number. Alternatively the roamer may give prospective callers their MAXroam number.

The advantage of the MAXroam system, over previous global SIM card offers, is the option of having a local number in the country in which the user is roaming. Prospective callers located in that country can then call that user for the cost of a local call rather than an international call. As termination on fixed lines is generally less expensive than mobile the calling party is also paying less than they would otherwise to call the roamer using a mobile phone. MaxRoam says that the roamer will typically save between 60% to 80% on the cost of outbound roaming calls. As with most other global SIM services, Maxroam uses call-back for outgoing calls.

A number of other entities have announced plans for services similar to MaxRoam. Truphone, a provider of VoIP software and services, has said it will provide a global SIM card during the second half of 2009.[143] Unlike approaches that use two SIM Cards, Truphone says its service, called "Local Anywhere", will have one SIM card and provide local prices for roaming services. Truphone says the service will allow users to add multiple "home" destinations, all of which allow home rates in that country and have a local number.[144] They also plan to enable customers to get other numbers, where they don't have home rates in the country, but enabling residents in another country to call them at local rates.

Regional SIM Cards

Some MVNOs offer services not unlike MaxRoam aimed at regular travellers for a particular group of countries. A further difference is that they identify the network operators they are reselling. Launched in March 2009, Transatel offers a service in the Netherlands, Belgium, France and Luxembourg.[145] Transatel provides users with a SIM card with which they can have one phone number per subscribed country. This enables users to make calls at local tariffs in all the countries to which they subscribe. Take the example of a Belgian user of Transatel. In Belgium they have a Belgian number and make calls at local rates and receive calls without charge.[146] The Belgian user may also have a Dutch number. If they were roaming in the Netherlands they would pay the local rates per minute for Telfort – a Dutch MNO. Calls received on the Dutch number are transferred to the user's Belgian number. The first 30 minutes of incoming calls are free after which the rate is USD 0.24 per minute. The service claims to offer discounts between 60% to 100%, depending on the service used, on the Eurotariff ceiling. In addition, the service enables number portability so that users retain their existing number in their home country.

Bypass using a second global SIM card with retention of regular service

There are several services emerging that offer users the opportunity to use their own SIM card when roaming. These services either combine the user's regular SIM card, with a second SIM global card, or use Wi-Fi or another Internet connection to connect to the users 'home network'.

The "CallGSM" service enables users to insert their local SIM into a handset purchased from the company and make savings on roaming calls in over 152 countries.[147] The so called "Global Roaming Phone", which is sold by CallGSM, comes bundled with a second SIM card and software that initiates least cost routing. In other words, when a user makes a roaming call the handset determines the lowest cost to make that call. The company claims prices that are 80% lower than a user's own provider and up to 50% less expensive than other SIM providers. Users can have up to 50 identities on their SIM card so that they are roaming on local terms in up to 50 countries. If no call activity is recorded for a period of three months

a rental of USD 12.84 is applied by CallGSM. This fee is not applicable if a user tops up their airtime during this period.

An alternative to having a second SIM card is to use a service called Skuku.[148] Operated by an Israeli company Skuku enables users to place their regular SIM card into a USB device (a so called Skuku stick or Skuku phone connected to the laptop). To utilise this service users must have an Internet connection such as through a Wi-Fi hotspot. Once they have logged on Skuku connects to their home country mobile network and shows their numbers of their contacts and so forth. Users can then make calls at their usual domestic mobile rates or be called on their regular number. The pricing of Skuku is one of either a daily rate of USD 2.57, a monthly rate of USD 12.87 or an annual rate of USD 153.19 irrespective of the number or duration of calls. The advantage of Skuku is that it provides the user with the functionality and pricing of their SIM card on their home network. The disadvantage is that the user needs to be in a location with Internet access.

Another alternative that may be envisaged is that local operators provide the visiting customer directly with the service, keeping only a relationship with the home operator for billing purposes. This way, the visited network would provide the service to the roamer and would transmit the bill to the home operator for the (retail) service provided. The home operator would then bill the customer, thus only acting as a gateway for billing purposes. This would not be a perfect substitute for roaming, since some features like the use of home short codes or call forwarding would not be supported. This type of provision would also require the use of multi-IMSI SIM cards, if not a second SIM card, and it is not clear to what extent it may be against the current roaming agreements within the GSMA framework, since there must be a relationship between home and visited operators at least for billing purposes.

Wi-Fi roaming

The prevalence of paid and unpaid Wi-Fi hotspots has proliferated over recent years particularly in places frequented by travellers such as cafes, hotels and airports. Any user with a device capable of accessing the Internet over Wi-Fi (*e.g.* laptop, PSP, smartphone, PDA), can make calls using VoIP services such as Skype or Jajah. Such services are either free or extremely inexpensive relative to roaming prices but rely on users having an appropriate terminal device and being able to access the Internet.

In some locations Wi-Fi access is free with the costs being absorbed by the provider. Several commercial services have emerged which aggregate hotspots around the world. Some of these services offer rates for handheld devices to access their hotspots. Boingo Mobile, for example, provides users with unlimited access to the public Internet in commercial hot spots around the globe with a Wi-Fi enabled mobile devices for USD 7.95 per month.[149] Boingo says it has over 100 hundred thousand hotspots available to its clients.

FON is a Wi-Fi service with a different business model than Boingo. FON users (so called Foneros) share their Internet connection via Wi-Fi with other Foneros.[150] In return they can log on to other Fonero's hotspots for free as well as being remunerated when Foneros not sharing their home connections log onto their hotspots. FON not only has many thousands of users who have created hotspots using their home Internet connections but have also formed partnerships with several large ISPs (*e.g.* BT in the United Kingdom, Neuf in France) to enable their users to take advantage of the service. In densely populated urban centres such as London and Paris coverage is very extensive due to such partnerships. This enables Foneros with appropriate handheld devices to make VoIP calls whenever they are in a FON hotspot.

There are commercial services that partner with hotspot providers to provide Wi-Fi VoIP roaming at flat monthly rates. One example is DeFi which not only partners with FON but also mobile networks such as T-Mobile, AT&T and Orange as well as hotels and airports.[151] For a flat rate of USD 40 per month

(EUR 30 for France, GBP 23 in the United Kingdom) a user can make up to 3 000 minutes of calls, terminating on any fixed or mobile network around the world, whenever they are in a hotspot operated by one of DeFi's partners. When users are not in DeFi hotspots their default is their usual roaming service. For an additional fee DeFi also offers users up to three local numbers in different countries.

Mobile network service substitution

Under any of the foregoing options for IMRS, connectivity is provided by alternative facilities (*e.g.* fixed network, Wi-Fi) or by using cellular networks but substituting a supplier for a particular service segment (*e.g.* substituting a local SIM Card, telephone number, user identity or direction of traffic in the case of call-back). A further group of services substitute VOIP for cellular telephony using either traditional voice channels or data connectivity provided by mobile operators.

In 2006, Hutchison 3 became the first mobile network to offer Skype services to its mobile customers using its traditional voice channels. The service carries Skype calls over voice channels to the radio towers from whence they are transferred to the Internet. A Hutchison 3 customer can make calls to other Skype users (*e.g.* a user with a Skype on their PC) without incurring additional charges. If they are roaming on-net, across the countries in which Hutchison has its own network facilities, this opened an option to bypass roaming charges. The service has proven popular with users and in December 2008 users made 34 Million Skype calling minutes which was approximately 3% of Hutchison 3's total voice traffic. The service also enables Skypechat with 39 million sessions being recorded for that month.

Initially Hutchison used a service call iSkoot to provide a bridge between its network and Skype.[152] At this time, iSkoot used a call-back system over Hutchison 3's network for setting up the call. As the service grew in popularity Hutchison launched it in eight other countries together with a handset with Skype functionality pre-installed. In addition they continued to partner with iSkoot to build their functionality into the network to increase the seamless nature of the service to customers.

In April 2009 Hutchison 3, in the United Kingdom, began to sell pre-paid SIMs starting at around USD 3 per card.[153] The cards enable Skype to be used on Hutchison 3's cellular network in that country. This meant that users of other operators in the United Kingdom or abroad, with a compatible handset, could purchase a card and make free calls or instant messages to users with Skype on their PC. In addition users can make Skype-Out calls at Skype-Out rates to international destinations. This offer opened the possibility for roamers to make free or inexpensive calls while visiting the United Kingdom.

An alternative to using voice channels is for users to download VoIP software and use the various data services provided by mobile operators. Recently some handset manufacturers have bundled VoIP software such that phones are pre-loaded with the capability to use either WiFi or UMTS data connections.[154] One example is Nokia pre-installing Skype on their Nseries phones. Not all mobile operators reportedly welcome these capabilities and they may not stock these handsets for their customers.[155] Furthermore some operators prohibit their users, in their customer terms of agreement, from using data services for the transmission of VoIP or disable VoIP functionality on the handsets they sell to consumers.[156]

Even without the opposition some operators mount to the use of VoIP over mobile data services, their effectiveness for avoiding roaming charges is limited. Skype, for example, does not recommend its customers to use their service on a mobile network when travelling abroad due to high roaming prices for data.[157] By way of example Fring, a service that bridges various VoIP and messenger services on mobile phones, says that one of its users will consume 133.33 kbytes for a one minute phone call and 8 megabytes for a 60 minute call.[158] If a user has a subscription that charges, for example, USD 15 to USD 20 per megabyte, for international data roaming, the cost of a VoIP call using this option may be prohibitive.

If the price for international data roaming charges decreases and operators permit users to use VoIP this situation may change. At the same time some services attempt to reduce the scale of data roaming charges by integrating call-back services with web–enabled handsets. Take, for example, a service called Webtel.mobi.[159] Here the user opens their mobile phone browser, selects the service they wish to use (*e.g.* telephony) and the Webtel.mobi service sets up a call between the caller and the receiver. For a mobile to fixed line call between France and Australia a user would be charged a set-up fee of USD 0.06 plus USD 0.19 per minute by Webtel.mobi. If the user was an Australian roamer they would also pay to receive the call as well as the data roaming charge to reach the Webtel.mobi website. Users can also send SMS using the Webtel.mobi service.

Arrived OK

The foregoing section contains examples of users substituting one service for another using wireless connectivity provided by MNOs and MVNOs. There is, however, a long history of users taking advantage of the positive externalities created by some network features to communicate in ways that bypass some types of pricing. Consider the example of using ring tones to signal pre-arranged messages such as safe arrival after a journey.[160] When the prices of long distance telephony were relatively expensive some users would agree to call at a pre-arranged time or with a certain number of rings to let others know that they had completed their journey. For their part the recipient would not answer the phone and surmise, on hearing the phone ring, that the object of the pre-agreed message was met. By the time caller line identification and special ring tones for different callers came along the price of calls on fixed networks had come down to an extent that this practice has probably become less widespread.

In mobile networks the use of caller line identification gave new impetus to the use of a positive externality to bypass pricing. This is most evident in some developing countries where CLI proved so popular with users for signalling that they would like another user to call them back, that operators internalised this externality by making it a service. In respect to IMRS it may still be the case that some users signal their arrival at an international destination through such features. In addition markets are ingenious at creating new services around positive externalities. This can include the substitution of one service for another.

"ArrivedOK" is a service that uses network presence to enable users to substitute one set of services (*e.g.* voice calls or SMS at roaming prices) with domestic SMS prices.[161] To use the service a user prepares an SMS message they would like sent to a number or numbers when they arrive in a foreign country. The "ArrivedOK" service scans the GSM or UMTS networks in the foreign country starting 30 minutes prior to the arrival of the traveller. If the user is travelling by plane they switch off their phone prior to boarding and after arrival. Once the "ArrivedOK" service detects they are logged on to the foreign network the pre-arranged message (*e.g.* "arrived safely" or "in transit lounge waiting for next leg of the journey") is sent to the recipients. One additional feature of ArrivedOK is that users can equally schedule the service to message others through Twitter, Email and Blog posts.

If an Orange UK subscriber makes three one minute calls from Singapore to the United Kingdom (to spouse, mother, and boss), the total cost would be USD 6.26.[162] If instead of calling the user sent three text messages the total cost would be USD 2.15. With Arrived OK the three text messages would cost in total USD 0.72. The benefits of the service may not be restricted to price. In some airports around the world use of mobile phones is restricted until the user clears customs.[163] It may not, however be prohibited to switch on a handset. As the "ArrivedOK" service sends the SMS independently from the user it may be a convenient way for passengers to signal their arrival during this period (*e.g.* "arrived safely please pick me up at the airport). In March 2009 "ArrivedOK" was being beta tested with 29 mobile networks in 10 selected countries.[164]

Voice Mail

Users may be charged for receiving Voice Mail when roaming in foreign countries. The United Kingdom consumer advisory service 'Which' provides the following advice in respect to Voice Mail and roaming:

> "Unless you need to be contactable while abroad, set your mobile phone to divert incoming calls to voicemail (not just if you don't answer the call or you're engaged). If a mobile call tries to connect to the foreign mobile network first and subsequently diverts to voicemail because you fail to answer the call, you'll still have to pay as if you received the roaming call. If possible, don't check your mobile voicemail until you get home. Listening to messages costs the same as making an international call to the UK. If you do need to be reachable, deactivate mobile voicemail diverts. You'll be able to see incoming mobile roaming calls and choose whether to answer, but as your voicemail won't be accessible you won't be charged for someone leaving a voicemail. If you don't answer a mobile call while abroad and mobile voicemail is inactive, you won't be charged. If a mobile call tries to connect to the foreign mobile network first and subsequently diverts to voicemail because you fail to answer the call, you'll still have to pay as if you received the roaming call."[165]

New services are emerging which may be able to reduce the cost of utilising Voice mail while roaming. Services such as SpinVox and Phonetag convert voice mail into text which can then be forwarded to users via SMS or e-mail.[166] How economical this would be for users depends on a number of factors including whether there is a charge to divert calls to the voicemail box of the service provider (*e.g.* SpinVox).[167] That being said if a user can receive SMS for free, while they are roaming, it can provide an alternative to listening to Voice Mail. SpinVox charges range depending on the number of message conversions a user selects. For example 10 message conversions may cost USD 0.41 per message and 50 messages USD 0.27 per message. PhoneTag offers unlimited text conversion for USD 29.95 per month, USD 0.20 per message for 40 conversions per month or USD 0.35 per message.[168]

Google Voice, based on the former Grand Central service, also offers transcription of voicemail. In March 2009, when the service was only open for Grand Central users, transcribed messages were sent to them by SMS and e-mail for free and supported by advertising. If the service continued with this model, when commercialised may offer users an economical way to manage Voice Mail whilst roaming.[169]

Fixed location alternatives

A number of "fixed location" alternatives to cellular networks exist for international roamers. These include public payphones, including the use of telephone cards, and telephone services in locations such as hotel rooms or accessing Internet telephony services at cybercafés. These are imperfect substitutes in that the user can not be called when they are not at these locations and in some cases, such as in hotel rooms, the charges may be more expensive than roaming prices.

Satellite roaming

Roaming via the use of satellite phones is an option for users particularly in areas not covered by terrestrial networks. At the end of 2007, there were over 1.1 million mobile satellite service subscribers in the United States, a 23% increase over year-end 2006.[170] Typically mobile handsets cost in the vicinity of USD 500 to USD 4000 though service providers typically offer short and longer–term rental options.[171] One service supplier in the United States offers handsets, suitable for the Iridium service, for weekly rentals ranging from USD 25 to USD 70[172]. For a user purchasing 60 minutes of calls using the Iridium system the airtime price was USD 1.59 per minute. This price decreased to USD 0.99 per minute if 2 000

minutes were purchased. Incoming calls to Iridium users are free to the receiver but are relatively expensive for the calling party. For the most part satellite services are viewed as complimentary rather than competitive with terrestrial services. In 2009 two new satellite systems, targeting the United States market, aim to offer roaming between terrestrial and satellite systems.[173] The handsets, with built in antennas, will be of a similar size to terrestrial models with a starting price of around USD 700.

For international travellers, Globalstar offers two plans, Emergency Plan and Global Traveler Plan. Emergency Plan offers an annual or monthly system access fee with per minute fees based on usage, combined with USD 1.39 international roaming rates. Global Traveler Plan offers an annual pre-paid plan that costs USD 750 for up to 750 minutes. The annual service fees for Globalstar's SPOT products and services range from USD 99.99 for the basic level plan, with the option of additional tracking capability for USD 149.98. The maximum suggested retail price for the SPOT equipment is USD 169.00 per unit.

In April 2007, Iridium also introduced a new pricing plan for calls originating in or coming to United States, Canadian and Caribbean customers. Under the new structure, Iridium will offer prepaid airtime packages for six months of service for as low as 30 to 40 cents per minute. Additional discounted packages for higher use customers begin at rates below 15 cents per minute. Iridium also offers a network quality guarantee programme, providing credits of up to 100 minutes of airtime and three months of free subscription fees if the Iridium network fails to complete properly initiated voice calls. Iridium's service plans are often bundled with equipment sales. One user estimated a 96-handset system would cost between USD 300 000 to USD 400 000." [174]

ANNEX. 1 METHODOLOGY FOR DATA COLLECTION ON INTERNATIONAL MOBILE ROAMING CHARGES

The following data were collected during February 2009:

1. Retail charges for the mobile operator with the largest market share in each OECD country (*e.g.* Telstra in Australia, Cosmote in Greece). In the case of the foregoing example the data collected were the prices for a Telstra customer from Australia roaming on Cosmote's Greek network and vice versa. In the case where roaming on the largest operator's network is not available, charges for roaming on the largest available operator's network were collected. Data were also collected for Israel. The selected operator in each country was based on market share for September 2008.

2. Intra-European Union area roaming data were not collected (*e.g.* a Belgium roamer in Denmark).

3. Data collection was limited to voice and SMS.

4. Four categories of charges were collected:
   - Making a call terminating on the SIM holder's home country network while that user is abroad
   - Making a call terminating in the same country in which the user is roaming
   - Receiving a call while the user is roaming abroad
   - Sending an SMS terminating on the SIM holder's home country network while the sender is roaming

5. The data were collected per one single minute for voice as well as any additional set up or airtime charges and for sending a single SMS.

6. Only standard retail charges were collected.

7. Only retail charges for post-paid subscribers were collected. The most favourable charges were collected, if charges were different between high and low volume users.

8. Both peak and off-peak charges were collected, but peak charges were used for comparison.

9. Charges for calls to both fixed and mobile were collected, but charges for calls to mobile were used for comparison.

10. Third country roaming charges (*e.g.* UK user in NZ calls Turkey) were not considered.

11. Value added or other taxes, if applicable, were included in comparisons.

ANNEX. 2 DATA ON INTERNATIONAL MOBILE ROAMING CHARGES

(a) Charges for making a call terminating in the same country as that in which the user is roaming (3 minutes) (USD)

Origin \ Destination	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States	Average
Australia		3.67	3.61	4.35	3.59	1.54	2.15	2.85	2.85	2.44	2.22	1.76	1.64	3.74	3.10	2.69	1.23	2.69	3.30	3.24	3.61	2.87	1.76	3.08	2.17	3.24	3.00	3.53	3.04	3.06	5.03	2.90
Austria	9.22			9.22										16.91		16.91	16.91		16.91		8.07							4.61	8.84		8.07	11.57
Belgium	10.57			7.69										10.57		10.57	10.57		17.29		10.57							7.69	7.69		7.69	10.09
Canada	2.41	3.62	2.41		6.03	3.62	3.62	2.41	2.41	3.62	3.62	2.41	2.41	6.03	2.41	4.82	3.62	4.82	6.03	2.41	6.03	3.62	4.82	3.62	3.62	2.41	3.62	2.41	7.23	2.41	2.29	3.69
Czech Republic	7.24			7.24										7.24		7.24	7.24		7.24		7.24							4.67	4.67		7.24	6.73
Denmark	5.16			5.16										5.16		5.16	5.16		5.16		5.16							2.21	2.58		5.16	4.60
Finland	7.11			8.07										11.34		7.11	7.11		11.34		7.11							3.27	9.99		8.07	8.05
France	11.14			4.53										11.14		11.14	11.14		11.14		11.14							11.14	4.53		4.53	9.16
Germany	11.49			5.73										11.49		11.49	11.49		11.49		11.49							5.73	5.73		5.73	9.18
Greece	4.57			4.57										4.57		4.57	4.57		4.57		4.57							4.57	4.57		4.57	4.57
Hungary	4.87			6.50										6.50		11.06	7.12		11.06		7.12							4.87	3.64		6.50	6.92
Iceland	12.26			7.48										12.26		7.48	7.48		12.26		12.26							2.21	6.30		7.48	8.75
Ireland	12.68			6.15										11.53		12.68	12.68		6.15		12.68							2.15	3.42		5.38	8.55
Israel	2.88	5.40	3.87	3.81	3.22	2.51	2.31	4.74	3.58	5.40	1.84	1.25	1.89		7.46	2.73	2.42	2.46	4.21	4.42	4.28	2.71	1.99	2.49	2.71	3.66	2.66	4.49	5.02	6.49	8.36	3.71
Italy	11.53			7.69										11.53		11.53	11.53		23.06		11.53							3.84	7.69		7.69	10.76
Japan	2.59	2.59	2.59	4.04	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59		1.62	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	4.04	2.65
Korea	1.49	1.83	1.49	2.98	1.61	1.26	0.92	1.83	1.83	1.03	0.92	1.26	0.92	1.95	2.06	1.15		1.26	2.52	1.61	1.95	1.38	0.80	2.06	1.38	1.49	1.26	1.49	1.38	1.26	2.52	1.56
Luxembourg	12.68			12.68										15.69		15.69	15.69		15.69		12.68							1.99	1.99		12.68	11.75
Mexico	8.97	8.97	8.97	4.14	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97		8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	4.14	8.65
Netherlands	7.69			7.69										6.72		7.69	7.69		4.65		7.69							4.42	7.69		5.76	6.77
New Zealand	3.13	4.27	4.18	5.40	3.48	3.39	2.09	5.14	3.31	2.44	2.18	1.74	1.92	4.27	5.40	3.13	2.61	3.13	3.83	3.66		3.05	1.74	3.05	2.52	3.66	3.48	3.83	3.39	3.57	10.79	3.59
Norway	2.28			4.10										3.96		2.40	2.07		2.90		3.81							3.05	3.05		4.10	3.17
Poland	6.61			4.29										6.61		6.61	6.61		6.61		6.61							4.05	4.05		4.29	5.63
Portugal	7.84			7.84										10.84		10.84	10.84		10.84		10.84							5.76	7.84		7.84	9.13
Slovak Republic	15.03			15.03										15.03		15.03	15.03		15.03		15.03							5.92	10.47		10.47	13.20
Spain	11.22			8.10										11.22		11.22	11.22		11.22		11.22							8.10	8.10		8.10	9.97
Sweden	4.22			3.43										2.91		4.22	4.22		2.61		4.22							1.90	3.43		3.43	3.46
Switzerland	3.61	2.19	2.19	3.61	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	4.13	2.19	4.13	4.13	2.19	4.13	2.19	3.61	2.19	2.19	2.19	2.19	2.19	2.19		3.61	2.19	3.61	2.69
Turkey	8.65	6.34	6.34	8.65	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34	8.65	6.34	8.65	8.65	6.34	8.65	6.34	8.65	6.34	6.34	6.34	6.34	6.34	6.34	6.34		6.34	8.65	6.96
United Kingdom	3.67			5.92										8.60		8.60	8.60		8.60		3.67							1.64	5.92		5.92	6.12
United States	5.58	4.26	4.26	2.61	7.56	4.26	4.26	4.26	4.26	4.26	4.26	4.26	4.26	8.22	4.26	7.56	7.56	4.26	3.27	4.26	7.56	4.26	7.56	6.57	6.57	4.26	4.26	4.26	7.56	4.26		5.16
Average	7.28	4.31	3.99	6.29	4.56	3.67	3.54	4.13	3.83	3.93	3.51	3.28	3.31	8.34	4.48	8.10	7.86	3.87	8.48	3.97	7.73	3.80	3.88	4.10	3.90	3.88	3.84	4.39	5.50	4.11	6.34	

(b) Charges for making a call terminating on the SIM holder's home country network while that user is abroad (3 minutes) (USD)

Origin \ Destination	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States	Average
Australia		6.20	8.27	5.48	13.63	6.26	5.99	5.50	7.53	6.10	9.30	4.92	7.55	11.14	9.05	8.64	5.32	4.23	10.84	5.46	6.98	4.19	7.49	6.94	6.46	8.99	6.32	5.11	9.62	5.34	6.01	7.16
Austria	9.22			9.22										16.91		16.91	16.91		16.91		8.07							4.61	8.84		8.07	11.57
Belgium	4.61			4.23										4.61		4.61	4.61		7.69		4.61							4.23	4.23		4.23	4.76
Canada	4.82	6.03	4.82		8.44	6.03	6.03	4.82	4.82	6.03	6.03	4.82	4.82	8.44	4.82	7.23	6.03	7.23	8.44	4.82	8.44	6.03	7.23	6.03	6.03	4.82	6.03	4.82	9.64	4.82	4.10	6.08
Czech Republic	7.24			7.24										7.24		7.24	7.24		7.24		7.24							4.67	4.67		7.24	6.73
Denmark	6.19			6.19										12.38		6.19	12.38		12.38		6.19							2.21	4.13		6.19	7.44
Finland	7.11			8.07										11.34		7.11	7.11		11.34		7.11							3.27	9.99		8.07	8.05
France	11.14			4.53										11.14		11.14	11.14		11.14		11.14							11.14	4.53		4.53	9.16
Germany	11.49			5.73										11.49		11.49	11.49		11.49		11.49							5.73	5.73		5.73	9.18
Greece	10.05			10.05										10.05		18.28	18.28		18.28		18.28							6.87	6.87		10.05	12.71
Hungary	4.87			6.50										6.50		11.06	7.12		11.06		7.12							4.87	3.64		6.50	6.92
Iceland	12.26			7.48										12.26		7.48	7.48		12.26		12.26							2.21	6.30		7.48	8.75
Ireland	6.92			6.15										6.53		6.92	6.92		6.15		6.92							2.15	3.42		5.38	5.74
Israel	19.15	13.64	13.84	9.53	14.30	9.46	6.60	14.71	10.13	13.65	7.66	5.83	4.98		18.46	15.14	10.04	3.61	13.87	10.88	14.93	4.36	13.53	12.44	8.04	14.93	8.24	11.14	10.48	8.89	14.32	11.23
Italy	11.53			7.69										11.53		11.53	11.53		23.06		11.53							3.84	7.69		7.69	10.76
Japan	5.82	5.82	5.82	4.52	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	12.28	5.82		4.04	5.82	12.28	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	4.52	6.10
Korea	5.28	4.13	5.85	4.82	8.49	6.08	3.67	5.05	4.59	2.18	6.42	4.01	7.22	7.34	6.88	2.75		2.75	9.63	2.75	8.26	2.75	6.42	7.00	6.54	5.28	4.24	5.62	5.05	6.08	5.05	5.41
Luxembourg	8.79			8.79										11.00		11.00	11.00		11.00		8.79							1.99	1.99		8.79	8.32
Mexico	4.50	4.50	4.50	1.74	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50		4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	1.74	4.32
Netherlands	4.42			4.42										6.72		7.69	7.69		15.10		7.69							4.42	4.42		5.76	6.83
New Zealand	12.45	9.23	14.89	20.11	16.45	9.49	5.40	20.80	9.23	14.89	8.97	5.66	8.70	12.53	14.89	10.01	8.10	6.44	12.53	8.88		4.27	11.49	14.89	12.36	10.97	7.22	10.18	16.80	6.70	9.84	11.14
Norway	5.27			8.12										11.80		10.07	7.45		7.45		8.64							3.05	3.05		7.00	7.19
Poland	6.61			4.29										6.61		6.61	6.61		6.61		6.61							4.05	4.05		4.29	5.63
Portugal	7.84			7.84										10.84		10.84	10.84		10.84		10.84							5.76	7.84		7.84	9.13
Slovak Republic	15.03			15.03										15.03		15.03	15.03		15.03		15.03							5.92	10.47		10.47	13.20
Spain	11.22			8.10										11.22		11.22	11.22		11.22		11.22							8.10	8.10		8.10	9.97
Sweden	7.74			5.28										8.81		7.74	7.74		8.60		7.74							1.90	4.22		5.28	6.50
Switzerland	5.68	2.19	2.19	5.68	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	9.55	2.19	9.55	9.55	2.19	9.55	2.19	5.68	2.19	2.19	2.19	2.19	2.19	2.19		5.68	2.19	5.68	3.75
Turkey	8.65	6.34	6.34	8.65	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34	8.65	6.34	8.65	8.65	6.34	8.65	6.34	8.65	6.34	6.34	6.34	6.34	6.34	6.34	6.34		6.34	8.65	6.96
United Kingdom	3.67			5.92										7.35		7.35	7.35		7.35		3.67							1.51	5.92		5.92	5.60
United States	5.58	4.26	4.26	2.61	7.56	4.26	4.26	4.26	4.26	4.26	4.26	4.26	4.26	8.22	4.26	7.56	7.56	4.26	3.27	4.26	7.56	4.26	7.56	6.57	6.57	4.26	4.26	4.26	7.56	4.26		5.16
Average	8.17	6.23	7.08	7.13	8.77	6.04	5.08	7.40	5.94	6.60	6.15	4.83	5.64	9.80	7.72	9.38	9.03	4.74	11.04	5.59	8.77	4.47	7.26	7.27	6.48	6.81	5.52	5.01	6.51	5.49	6.82	

(c) Charges for receiving a call while the user is roaming abroad (3 minutes) (USD)

Origin \ Destination	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States	Average
Australia		2.19	2.62	5.39	2.44	2.11	1.94	1.92	1.92	1.66	2.44	2.41	1.76	1.78	1.84	1.92	2.25	2.00	5.70	2.11	1.51	2.19	2.70	3.11	1.74	2.35	1.92	1.92	2.27	1.63	5.84	2.45
Austria	7.49			7.49										7.49		7.49	7.49		7.49		7.49							2.50	3.65		7.49	6.61
Belgium	4.23			3.46										4.23		4.23	4.23		8.07		4.23							3.46	3.46		3.46	4.30
Canada	4.82	6.03	4.82		8.44	6.03	6.03	4.82	4.82	6.03	6.03	4.82	4.82	8.44	4.82	7.23	6.03	7.23	8.44	4.82	8.44	6.03	7.23	6.03	6.03	4.82	6.03	4.82	9.64	4.82	2.89	6.04
Czech Republic	5.63			5.63										5.63		5.63	5.63		5.63		5.63							2.41	2.41		5.63	4.99
Denmark	6.19			6.19										12.38		6.19	12.38		12.38		6.19							1.06	2.06		6.19	7.12
Finland	7.11			6.34										6.34		7.11	7.11		6.34		7.11							2.11	4.03		6.34	5.99
France	5.38			2.11										5.38		5.38	5.38		5.38		5.38							5.38	2.11		2.11	4.40
Germany	6.88			5.53										6.88		6.88	6.88		8.95		6.88							2.65	2.65		5.53	5.97
Greece	2.31			2.31										2.31		4.13	4.13		2.58		2.31							2.31	2.31		2.31	2.70
Hungary	1.55			1.93										1.93		3.64	2.78		3.64		2.78							1.55	1.31		1.93	2.30
Iceland	2.35			4.98										2.35		1.95	1.95		5.35		2.35							1.05	1.55		5.30	2.92
Ireland	7.69			4.19										7.69		7.69	7.69		4.19		7.69							1.04	2.65		4.19	5.47
Israel	3.25	4.31	1.55	5.52	1.78	2.73	3.47	1.59	1.54	1.90	2.05	1.78	3.47		1.61	1.56	2.22	1.50	4.75	1.54	1.57	3.25	4.24	4.18	4.91	1.68	2.81	1.65	2.27	1.50	5.67	2.73
Italy	7.51			9.45										7.51		7.51	7.51		14.26		7.51							1.93	5.78		10.35	7.93
Japan	2.59	3.56	3.56	5.66	3.56	3.56	3.56	3.56	3.56	3.56	3.56	3.56	3.56	4.52	3.56		2.26	3.56	5.82	3.56	2.59	3.56	3.56	3.56	3.56	3.56	3.56	3.56	3.56	3.56	5.66	3.70
Korea	0.85	1.33	1.38	3.15	1.40	1.38	1.38	0.78	0.77	1.38	1.40	1.38	1.38	1.83	0.78	0.55		1.38	4.42	0.85	0.92	1.40	1.43	0.66	1.40	0.85	1.38	0.85	0.66	0.78	2.78	1.36
Luxembourg	3.27			3.27										4.33		4.33	4.33		4.33		3.27							0.93	0.93		3.27	3.23
Mexico	8.97	8.97	8.97	4.14	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97		8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	4.14	8.65
Netherlands	2.08			2.08										5.00		5.96	5.96		5.96		5.96							2.08	2.08		5.00	4.21
New Zealand	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74		1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74
Norway	1.50			5.08										4.47		2.01	2.29		7.81		4.04							1.74	1.74		5.08	3.58
Poland	4.13			2.48										4.13		4.13	4.13		4.13		4.13							1.65	1.65		2.48	3.30
Portugal	3.04			3.04										5.99		5.99	5.99		5.99		5.99							2.03	3.04		3.04	4.42
Slovak Republic	3.62			3.62										3.62		3.62	3.62		3.62		3.62							3.62	3.62		3.62	3.62
Spain	11.22			8.10										11.22		11.22	11.22		11.22		11.22							8.10	8.10		8.10	9.97
Sweden	5.63			2.37										8.92		5.63	5.63		5.63		5.63							0.88	1.85		2.37	4.45
Switzerland	2.06	1.03	1.03	4.13	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	3.10	1.03	3.10	7.74	1.03	7.74	1.03	2.06	1.03	1.03	1.03	1.03	1.03	1.03		3.10	1.03	4.13	1.96
Turkey	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30		3.30	3.30	3.30
United Kingdom	4.80			4.45										6.09		6.09	6.09		6.09		4.80							0.78	3.67		4.45	4.73
United States	5.58	4.26	4.26	2.61	7.56	4.26	4.26	4.26	4.26	4.26	4.26	4.26	4.26	8.22	4.26	7.56	7.56	4.26	3.27	4.26	7.56	4.26	7.56	6.57	6.57	4.26	4.26	4.26	7.56	4.26		5.16
Average	4.56	3.67	3.32	4.32	4.02	3.51	3.57	3.20	3.19	3.38	3.48	3.32	3.43	5.53	3.19	5.09	5.48	3.50	6.14	3.22	5.04	3.57	4.18	3.91	3.92	3.26	3.50	2.68	3.35	3.16	4.48	

(d) Charges for sending an SMS terminating on the SIM holder's home country network while the sender is roaming (per SMS) (USD)

Origin \ Destination	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States	Average
Australia		0.51	0.37	0.44	0.40	0.46	0.34	0.43	0.34	0.38	0.31	0.38	0.33	0.88	0.43	0.38	0.41	0.25	0.39	0.39	0.40	0.34	0.27	0.49	0.33	0.60	0.45	0.42	0.33	0.31	0.51	0.41
Austria	0.54			0.54										0.54		0.54	0.54		0.54		0.54							0.41	0.41		0.54	0.51
Belgium	0.64			0.64										0.64		0.64	0.64		0.64		0.64							0.64	0.64		0.64	0.64
Canada	0.48	0.48	0.48		0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Czech Republic	0.48			0.48										0.48		0.48	0.48		0.48		0.48							0.43	0.43		0.48	0.47
Denmark	0.43			0.43										0.43		0.43	0.43		0.43		0.43							0.43	0.43		0.43	0.43
Finland	0.37			0.37										0.37		0.37	0.37		0.37		0.37							0.37	0.37		0.37	0.37
France	0.36			0.36										0.36		0.36	0.36		0.36		0.36							0.36	0.36		0.36	0.36
Germany	0.50			0.50										0.50		0.50	0.50		0.50		0.50							0.50	0.50		0.50	0.50
Greece	0.53			0.53										0.53		0.61	1.89		1.89		0.61							0.46	0.46		0.53	0.80
Hungary	0.34			0.52										0.52		0.75	0.59		0.75		0.59							0.34	0.34		0.52	0.52
Iceland	0.65			0.65										0.65		0.65	0.65		0.65		0.65							0.65	0.65		0.65	0.65
Ireland	0.37			0.37										0.37		0.37	0.37		0.37		0.37							0.37	0.37		0.37	0.37
Israel	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45		0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Italy	1.14			0.63										1.14		1.14	1.14		1.14		1.14							0.37	0.63		0.63	0.91
Japan	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08		1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Korea	0.23	0.23	0.23	0.11	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.11	0.23	0.11		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.11	0.21
Luxembourg	0.59			0.59										0.74		0.74	0.74		0.74		0.59							0.32	0.32		0.59	0.60
Mexico	0.63	0.63	0.63	0.40	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.40	0.40	0.63		0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.40	0.60
Netherlands	0.70			0.70										0.70		0.70	0.70		0.70		0.70							0.70	0.70		0.70	0.70
New Zealand	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46		0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Norway	0.58			0.58										0.58		0.58	0.58		0.58		0.58							0.58	0.58		0.58	0.58
Poland	0.41			0.41										0.41		0.41	0.41		0.41		0.41							0.41	0.41		0.41	0.41
Portugal	0.61			0.61										0.61		0.61	0.61		0.61		0.61							0.61	0.61		0.61	0.61
Slovak Republic	0.55			0.60										0.70		0.60	0.50		0.60		0.70							0.50	0.50		0.50	0.58
Spain	1.11			1.11										1.11		1.11	1.11		1.11		1.11							1.11	1.11		1.11	1.11
Sweden	0.47			0.47										0.69		0.47	0.47		0.41		0.47							0.35	0.35		0.47	0.46
Switzerland	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34		0.34	0.34	0.34	0.34
Turkey	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38		0.38	0.38	0.38
United Kingdom	0.43			0.36										0.58		0.58	0.58		0.58		0.43							0.36	0.43		0.36	0.47
United States	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55		0.55
Average	0.55	0.51	0.50	0.52	0.50	0.51	0.49	0.50	0.50	0.50	0.49	0.50	0.49	0.59	0.50	0.54	0.61	0.49	0.61	0.50	0.56	0.49	0.49	0.51	0.49	0.52	0.51	0.50	0.51	0.49	0.52	

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NOTES

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[20] http://plans.boostmobile.com/walkie-talkie.aspx

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Averages for roaming in 31 countries in Table 8 are calculated based on data in area (a), (b) and (c)
Averages for roaming in the 10 non-EEA countries inTable 8 are calculated based on data in area (a) and (c)
Averages for roaming from 31 countries in Table 9 are calculated based on data in area (a), (b) and (c)
Averages for roaming from the 10 non-EEA countries in Table 9 are calculated based on data in area (a) and (b)

		Country of destination	
		Non-EEA	EEA
Country of origin	Non-EEA	(a)	(b)
	EEA	(c)	

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