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3G Where Art Thou? On what can and can't be learnt from the 3G Spectrum Allotment Process to-date, 1999-2002

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■ Introduction

Between 1999 and 2002, dozens of nations worldwide allotted spectrum bands aimed at utilizing the newly developed Universal Mobile Telecommunications System (UMTS), a technology more popularly dubbed as the "Third Generation" of cellular telephony or "3G". A total of 112 spectrum bands were allotted during this period ¹ driven by pressure from hardware vendors, network operators and a distorted vision of the future of high-tech markets. The European Union concluded in the beginning of 1999 that, "Member states shall take all actions necessary in order to allow ... the coordinated and progressive introduction of the UMTS services on their territory by 1 January 2001 at the latest and in particular shall establish an authorization system for UMTS no later than 1 January 2000 ²"

By the beginning of February 2003, only a few UMTS networks had been launched. Although the process of allotting spectrum for those networks is virtually complete, it would be far-fetched to claim that the EU's resolution has been implemented. Thus, in addition to stating that something has gone wrong, this paper attempts analyse what went wrong. In particular, this paper focuses on the spectrum allotment process to determine whether differences in the design of allotment may have led to different results in the eventual roll out of the networks.

* The opinions expressed in this paper solely represent those of the authors and in no way can be attributed to the positions of Cellcom Israel Ltd.

** Due to the dynamic nature of the phenomenon studied, this paper serves as a current draft of the study and should not be quoted or cited without specific approval of the authors.

¹ Source: UMTS Forum

(<http://www.umts-forum.org/servlet/dycon/ztumts/umts/Live/en/umts/Home>)

² Ruling No. 128/1999/EC, EC Official Gazette No. L 17 dated 22 January 1999, pp. 1 ff.
See: http://europa.eu.int/eur-lex/pri/en/oj/dat/1999/l_017/l_01719990122en00010007.pdf

The initial investment required by cellular operators in these allotment procedures amounted to payments far exceeding both government and operators' expectations prior to the process. At the same time, the UMTS technology itself, as technologies go, has so far failed to demonstrate its ability to deliver its promise in real market conditions. The technological, and consequently business, uncertainty of UMTS has led to a process whereby operators, bound by regulatory measures to deploy their new networks in a timely fashion, have chosen to focus their efforts either on delaying deployment or lowering their expenses by sharing some of the network costs with their competitors.

The process of allotting 3G spectrum worldwide can be roughly divided into two methods: competitive auctions and beauty contests. While the process leading to the choice of either processes is deeply engrained in the political culture of each of the states involved, this paper totally disregards these differences and concentrates on the outcome of the processes, which is what matters, namely are citizens and consumers benefiting from the policy and receiving better communication services.

This study is a first attempt at putting together all of the information publicly available concerning these procedures into a comparative analysis. It incorporates data from 25 European, Asian and Middle Eastern countries that awarded UMTS licenses during this period. The data includes the results of the spectrum allotment processes and was analysed against different variables hypothesized to be relevant to an assessment of the efficiency of the process, such as population size, GDP, cellular penetration at the time of allotment, the number of licenses put up and the actual number allotted, the size of spectrum bands and the timing of allotment in relation to other countries.

A formula taking into account the price paid for spectrum versus population and GDP data reveals some interesting initial patterns. Reading this formula with geopolitical influences in mind accounts for some, but not all of these patterns. It is clear that the high price paid in some countries resulted in fewer competitors showing up than in other countries. Interestingly enough, the method of selection employed was irrelevant to this trans-national effect. In most countries, when numbers are introduced into the formula, the "price" of the UMTS spectrum is similar, and it is striking that both the absolute price and the relative price was much higher in countries with large populations. GDP, on the other hand, influences the type of selection process chosen. Even though the total time period over which allotments took place was short, certain time sensitive patterns emerge:

changes in price and the number of bands not allotted proved to be time sensitive, as well as the type of allotment chosen. Interestingly enough, the penetration rates of cellular services alone were not good indicators of the price to be paid.

Our conclusions demonstrate that there is no fundamental difference between the two types of spectrum allotment systems that can serve as a predictor for the eventual rate of the actual roll out of the networks, but the inherent flexibility in beauty contests allows regulators to adjust to changing market realities more effectively and to ensure that the public is provided with some form of service, even if this falls short of expectations.

■ Methodology

The study that forms the basis of this paper is the first effort of its kind to generate a comparative analysis of the 3G spectrum allotment processes worldwide. We chose comparative methodology since it allows us to analyse explanations of phenomena by uncovering the differences and the similarities between countries, sectors and issues. Comparative methodology consequently allows us to uncover complicated processes (HAGUE, HARROP & BRESLIN, 1998). UMTS spectrum allotment processes are undisputedly a phenomenon of international visibility and importance and comparative methodology is undoubtedly the best way of studying this phenomenon.

The study compiles information from 25 countries that allotted 3G spectrum in Europe, Asia and the Middle East. The sources for the information include the regulatory bodies that oversaw the processes, international standard organizations and the telecommunications press, especially publications available via the internet.

Methodical analysis of this information enables us to assess whether the method chosen for the allotment of spectrum influences its eventual outcome as far as the rate of deployment of networks is concerned. If a particular method produces better results, namely a functional network providing unprecedented types of service that can advance the social good by being available to all that need them, a study of this sort may serve as a guideline for future regulatory bodies as they generate policies regarding efficient distribution of licenses for spectrum usage.

In order to deal with these goals, we identified two main types of spectrum allotment methods, the "auction" and the "beauty contest." We then asked the following research questions: Can similar characteristics between countries be identified as a result of the method of spectrum allotment chosen; can similar characteristics be identified in the results of the allotments held in each of the methods, and lastly, can similar characteristics be identified between the outcome of the allotment processes and the type of allotment process.

In order to answer these research questions, we created a database from a series of independent variables hypothesized to explain various phenomena that we believed may have reflected some dependence upon them³. The characteristics of cellular markets in each of the countries studied were defined by the following variables: population size, gross national product per capita, number of cellular subscribers and the penetration rate of cellular telephony, all at the time of the spectrum allocation process. The process itself included the following variables: the date of allocation, the number of licenses offered, the total sum of money paid for the spectrum, the price for each carrier relative to the size of the population, and the number of transnational corporations that took part in the process. The outcome of the allocations was tested against the following variables: the number of operators that have started deploying UMTS networks, mergers, bankruptcies, infrastructure sharing agreements, MVNO (Mobile Virtual Network Operator) agreements, operators that returned their licenses and changes in licenses made by regulators.

The different combinations of dependent and independent variables were all presented in graphic tables. In addition, in cases where graphic representation did not fully demonstrate a significant trend, we analysed the mean and the median of the variables in order to identify trends or other distinguishable characteristics more precisely. We would like to highlight that we did not run statistical tests seeking statistical significance.

³ We refrain from using the terms "dependent variables" as we did not conduct statistical tests as the study demonstrates.

■ Characterization of UMTS Spectrum Allocations

The spectrum is a scarce public resource entrusted to the hands of governments. In recent decades, the traditional use of spectrum for radio, television and transmission has given way to the new and lucrative personal communication industry, especially cellular telephony. Different methods of spectrum allotment have emerged over the years, among them "first come – first served" lotteries, "beauty contests" and auctions. In the 25 countries studied, only the latter two methods were employed.

An auction is a competitive process in which the main parameter determining the choice of a winner is the price offered for the spectrum. An auction can be either single round or multi-round, the latter becoming more popular in the late 90's and virtually the only type of auction represented in this study. A beauty contest on the other hand, is also a competitive process, only in this case the winners are chosen according to a pre-defined set of criteria (including price) that regulatory bodies define as ensuring efficient spectrum use. It can safely be said that spectrum allotment methods are characterized by the ideological bias of the governments that endorse them. A belief in market forces as the main designer of economic markets leads to support of auctions, while an ideological understanding that governments have a role in designing markets for the sake of public interest leads to the choice of beauty contests.

The beauty contest (also known in literature as the "administrative process") was very popular among most nations until the beginning of the 1990's. The regulatory reforms launched during this period also led to a rethink of the spectrum allotment processes. The auction represented a shift towards the market approach that the world economy was experiencing, as telecom markets became increasingly privatised and liberalized. Auctions were also made popular by the post cold war atmosphere in which "game theory" was proven to be a good measure for policy planning. The first auctions took place in New Zealand in 1990 (MUELLER, 1993) followed by auctions in the USA, India, Columbia, Australia, the UK, Hungary and Argentina (McMILLAN, 1995).

The beauty contest, popular in the USA until 1982, was found to be too bureaucratic and time consuming and was subsequently replaced by lotteries. Lotteries were in turn criticized for their arbitrariness, which led Congress to adopt auctions as the main spectrum allotment system in 1993. Although not a move one would expect from an administration dominated by the Democrats, the auctions were identified as a means of lowering the

national deficit without raising taxes. This process led to a different critique of the auction process. Instead of being aimed at more efficient spectrum use, Congress found itself directed by the collection of spectrum fees as a goal in itself, thus regulatory decisions were influenced by the government's desire for funds (NOAM, 1998). Similar historical developments occurred in Western Europe and Canada, where the idea of the auction was also introduced in the first half of the 1990's (European Commission, 1994).

There is much to be learnt about the characteristics of these systems by juxtaposing their pros and cons. The advantages of auctions are all based on belief in a free market economy directed by market forces. According to this method "winners" are selected by the "natural" market atmosphere and the choice is based on the winner's own recognition of the profitability gains in the move. The large monetary investment which is part and parcel of this process is seen as an incentive for the winner to roll out and deploy its network quickly and efficiently in order to reap the benefits as soon as possible to cover its outlays. The level of uncertainty for the operator is smaller because it knows the cost of purchasing the license in advance. At the same time governments can rely on income from the auction to lower their deficits without setting more taxes. On the other hand, the high payments imposed on operators can often result in consumers paying higher prices. This in itself leads to a broadening of communication gaps in society. The high price dictated by auctions makes it more difficult for new players to enter the field and may block companies with technological know how and small capital from commercially launching innovative services in the market if they cannot compete for spectrum purchase.

Beauty contests provide an opportunity for governments to dictate their policy choices to operators and ensure that the market develops in a planned fashion. They allow innovative new players that do not necessarily dispose of a large capital to enter the market. Contests also ensure that services of a higher and more controlled quality are provided at prices that more consumers can afford. As for operators, they are not burdened by the high price of the spectrum (in most cases) and are thus not in danger of running out of funds before fully deploying their networks. However, beauty contests exclude international players, which deprives a local economy of the inherent advantages of joining the global economy. Since the incentive for operators to roll out their networks is not based on the true market needs of its subscribers, they face high risks in deploying a network due to coercion rather than rational economic planning. Another uncertainty faced by operators is the fact that the pay off for licenses is usually lengthy and is

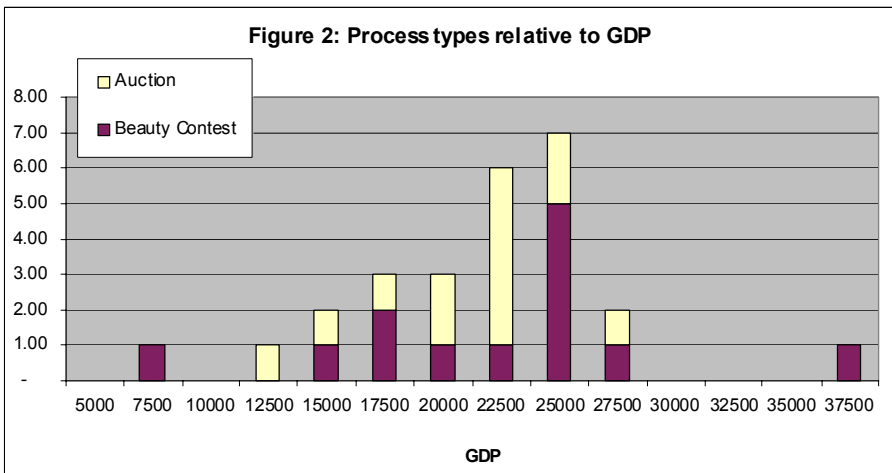
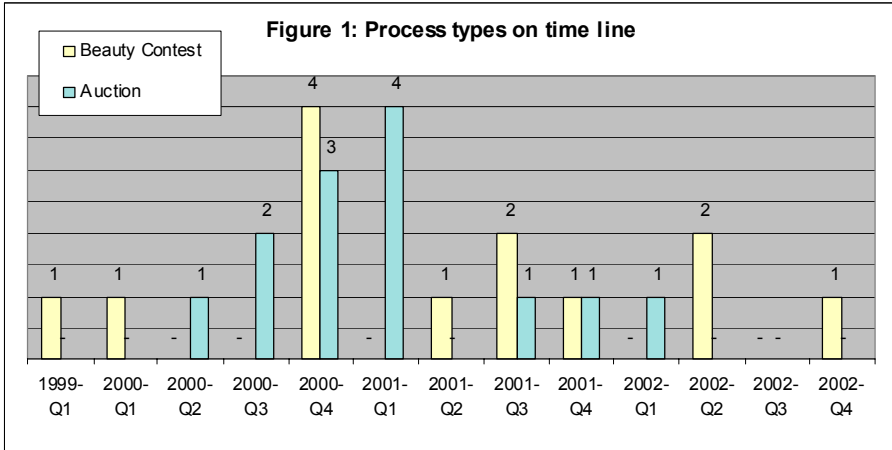
based on a percentage of income or profit, which cannot be determined in advance (GENTY, 1999; McMILLAN, 1995).

■ Can Countries be Characterized by their Spectrum Assignment Methods?

The first UMTS spectrum allotment was a beauty contest that took place in Finland in March 1999. The first auction took place in the United Kingdom in April 2000. Following these two breakthroughs scores of UMTS spectrum bands were allotted in Europe, Asia and the Middle East. In February 2003 the FCC announced its allocation of UMTS spectrum for the U.S. market and Norway announced that it was to auction two more 3G licenses. Due to the large number of countries involved in the process and the dichotomous choice between allotment systems, we first tried to find similarities and differences between the countries allotting UMTS spectrum along the lines of their allocation procedure.

In order to make these observations we collected relevant data on the cellular markets of these countries including the timing of allocation, population size, the rate of per capita GNP, the number of cellular subscribers and the penetration rate of cellular services. We believe that this data offers the key to an understanding of the potential market, its growth and the popularity of cellular services. In addition to ideological biases, regulators should also take these considerations into account before deciding how to allot spectrum.

The first variable we tested was how time affected the decision of which spectrum allocation system to employ. This decision is of significance, since it can shed light on the level of influence that global economic trends have on local decisions. The time line was divided into quarters over the studied period. As Figure 1 demonstrates, most allotments took place between Q4 2000 and Q1 2001. Out of the 25 cases we studied, 16 took place until and including this period, while 11 occurred within the period itself. Of these initial 16, 10 were auctions and only 6 were beauty contests, while of the latter 9 that took place during the subsequent period, only 3 were auctions while 6 were beauty contests.



The next independent variable we tested was the per capita GDP against the method of allocation. The results compiled in Figure 2 demonstrate that no clear trend between these two variables emerges, thus per capita GDP is not a determinant of the method of spectrum allocation. However, based on analysis of the countries with the top 10 per capita GDP figures, Table 1 demonstrates a slight advantage for the beauty contest over the auction.

To obtain a wider and clearer picture, we tested the mean and average scores of the per capita GDP figures of all the states in Table 2. The results show insignificant differences, which are nevertheless consistent to the extent that we can identify a pattern. The mean (USD 20,465) and median (USD 21,600) per capita GDP of countries in which a beauty contest was

held are higher than in those in which an auction was held (USD 20,350 and USD 21,492 respectively).

Table 1: Process types by GDP per capita

Country	Process types	GNP (US \$)
Luxembourg	Beauty contest	36,400
Switzerland	Auction	27,400
Denmark	Beauty contest	25,500
Hong-Kong	Beauty contest	25,000
Norway	Beauty contest	24,700
Austria	Auction	24,127
Belgium	Auction	23,863
France	Beauty contest	23,300
Finland	Beauty contest	22,900
Germany	Auction	22,458

A similar and probably insignificant trend, which is nevertheless consistent, emerges when we compare the mean and median of penetration rates for the group of states in which beauty contests and an auctions were held respectively. The former group enjoyed a higher penetration rate (mean 49%; median 46%) than in the latter (mean 47%; median 42%). At the same time, a comparison of population size in these two groups shows that countries which held auctions are more densely populated (mean 23,361,801; median 10,623,835) than those that held beauty contests (mean 19,259,300; median 7,99,677). Naturally, larger countries are more diverse in their populations, thus their average per capita GNP and the average wealth of their inhabitants is lower, which can be deduced from cellular telephone ownership.

Table 2: Central tendency measures for process types

Measures of central tendency	Process type	Population in millions	GNP (US \$)	Penetration rate
Mean	Auction	23,361,801	20,350	47%
	Beauty contest	19,259,300	20,465	49%
Median	Auction	10,623,835	21,402	42%
	Beauty contest	7,994,677	21,600	46%

Setting aside the numbers and looking at political trends and the identity of the nations studied, we can conclude that the trend in spectrum allocation methods changed considerably due to changes in the world economy in the periods before and after mid 2001. For a while auctions were seen as a way

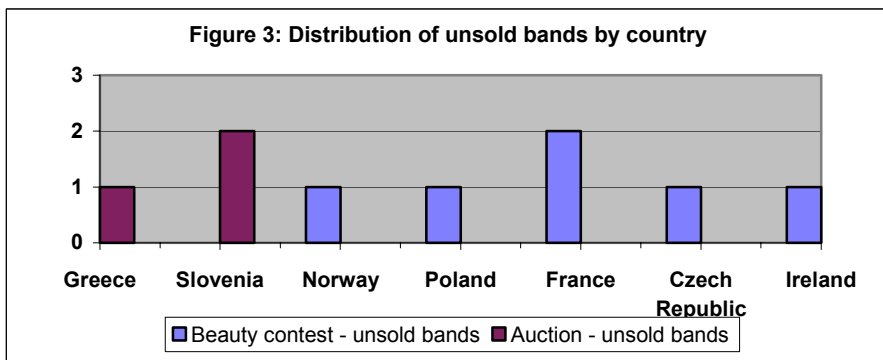
of filling budgetary gaps (KALBA, 2002) and countries that believed in free market economies like Germany and the UK chose the auction as their method of allocation. In Scandinavian nations, which can more generally be categorized as "welfare states", the beauty contest was the leading method of allocation. These countries are also characterized by an uneven dispersion of population over huge areas of land, a reality that calls for governmental intervention in order to ensure quality of service for all.

The bottom line is still that no dichotomous relationship can be identified between countries based on their spectrum allocation method alone.

■ Identifying Similarities in Allocation Results

Another way to try and identify similarities and differences between methods is by comparing their results. In order to conduct this analysis we compared the following variables between the two allocation systems: the number of licenses offered, the number of licenses actually granted, the price paid for the licenses and the number of regional and trans-national corporations that took part in the process.

Figures 3 and 4 demonstrate the number of licenses offered and granted and the type of allocation process that took place. Altogether these numbers are very small. In total only 10 licenses were not granted (out of over a 100 offered), and these were divided almost evenly between the beauty contests (6) and the auctions (4). However, until Q3 2001, all bands that were not sold were in beauty contests, while from then onwards, bands remained unsold in auctions as well.



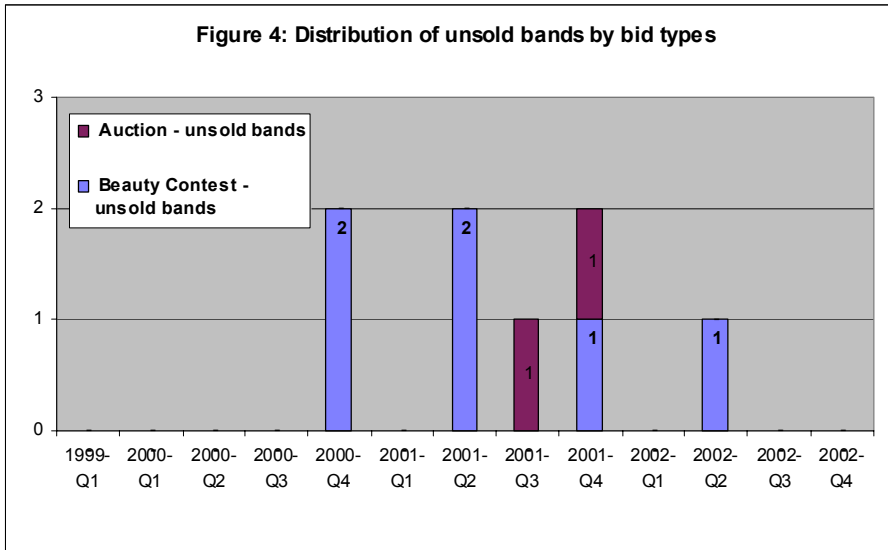
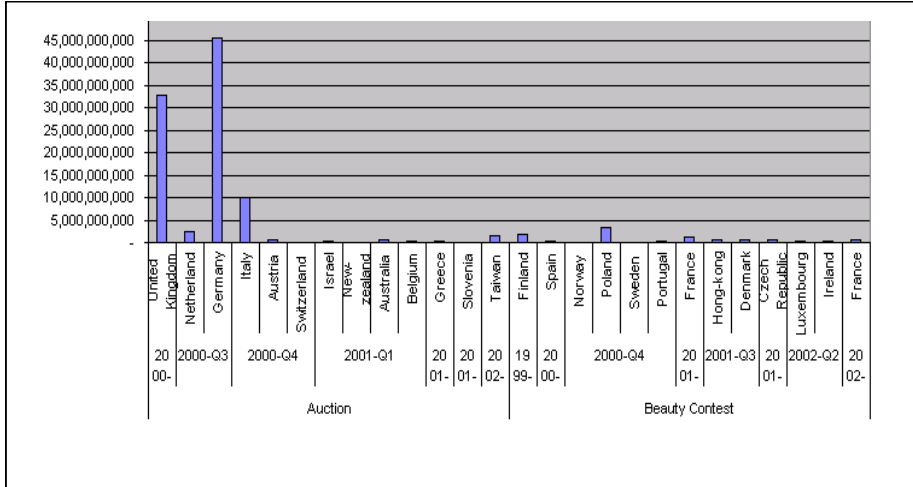


Figure 5 illustrates how time has affected license prices. As we know from the previous chapter, until mid 2001 there were more auctions than beauty contests and the prices paid were higher than in the following period. This figure shows that in the three countries in which the licensing returns were higher (UK, Germany and Italy), an auction took place before mid 2001. However, if these three very large nations are considered atypical and their numbers are withdrawn from the figure, a very monotonous graph emerges concerning both allocation systems. A comparison of the average sums collected shows the same picture ⁴.

⁴ It should be noted that France held two beauty contests in Q2 2001 and in Q4 2002. (See: <http://www.art-telecom.fr/eng/index.htm>)

Figure 5: Distribution of amounts paid for bands by countries and by bid types on time line

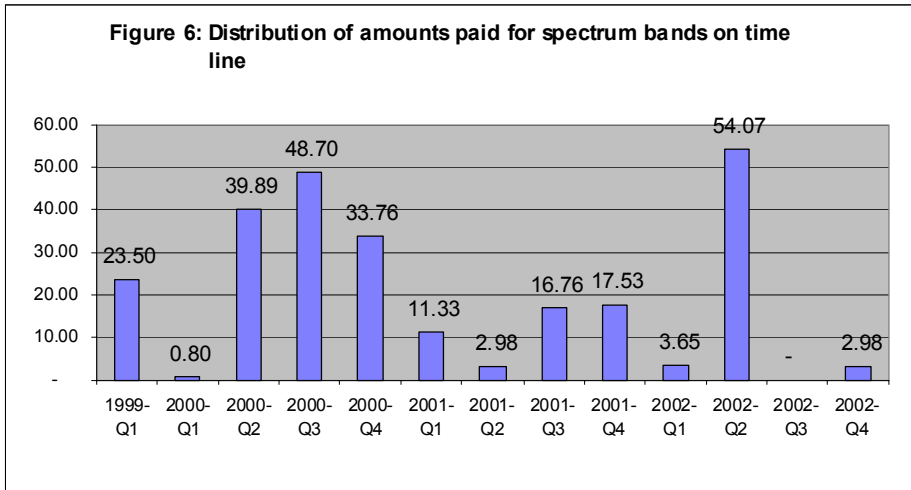


Similar distribution along the time line can be observed when we test the prices paid for each spectrum band, as demonstrated in Figure 6. We created a formula in order to harmonize and mainstream the price per spectrum band, eliminating unnecessary "noise" created by differences in the number of licenses in each process and the size of the country in which the process was held. In order to achieve this, we divided the total sum paid in the process by the number of carriers⁵ and population size. The figure represents the USD/carrier/population results.

The average sum paid in all beauty contests and auctions was USD 23. The highest prices were paid between Q2 2000 and Q2 2001. As we know from Figure 1 this period was characterized by more auctions than beauty contests⁶.

⁵ A carrier was defined as 2x15MHz of FDD spectrum and 5 MHz of TDD spectrum.

⁶ The anomalous figure in Q2 2002 represents the principdom of Luxembourg. Although we left it in the data, we believe that this very small nation with very high per capita GDP and income and unique economic standing is unrepresentative of Europe in order to be referred to when looking at the trends.



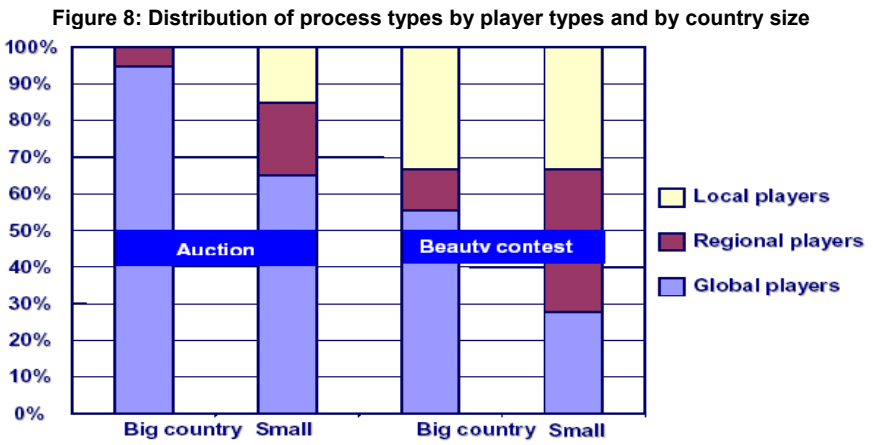
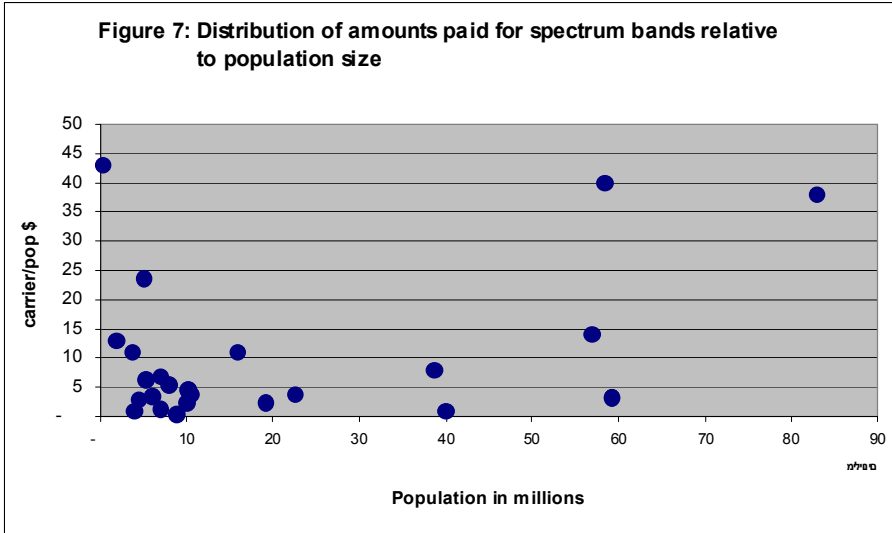
At the same time no clear conclusion can be drawn concerning the relationship between population size and the relative price paid for spectrum bands, as they are represented in Figure 7. What is very visible is the “cloud” consisting of countries in which the population is less that 10,600,000 and the price paid per carrier was less than USD 14. Two exceptions to this rule in nations of the same size are Finland (USD 23.50) and Luxembourg (USD 43.10), both of which held beauty contests. The three outlying countries in which more that USD 25 were paid per carrier are extremely unrepresentative in either size (UK and Germany where the auctions raised average payments of USD 40 and USD 38 respectively) or wealth (Luxembourg).

Table 3: Total sums paid in each of the allotment systems

Measures of central tendency	System types	Total sums paid for spectrum (USD)	USD/carrier/pop
Mean	Auction	7,273,954,615	10.8
	Beauty contest	4,891,646,923	9.6
Median	Auction	610,000,000	4.6
	Beauty contest	459,250,000	6.5

Table 3 summarizes the means and medians of the total sums paid in each of the allotment systems and the relative payments according to the comparative formula described above. The table demonstrates that the average of the total sums paid in auctions is significantly higher than that paid in beauty contests, a finding that is also true of the mean values. However, when these same systems are compared using the formula that

removes distortions of country size, the total opposite is true. The median of price per carrier in beauty contests is 40% higher than in auctions. This result suggests that national income does not have to be generated at the expense of ensuring service within public interest standards dictated by consumer benefit conscious regulators.



(Source: UMTS Forum - October 2001)

The high visibility of the "global economy" demonstrated by both the amount of economic activity and the elimination of national boundaries is highly relevant to the allocation of UMTS spectrum. The countries ready to

make the necessary transition to the "third generation" are generally all countries that subscribe at some level to the effects of economic globalisation. To encounter this effect, we chose to question the role of trans-national corporations in the process of UMTS spectrum allocation. Information supplied by the UMTS forum⁷ was used for this analysis. The forum's analysis presented in Figure 8 shows the relationship between the size of the country in which the process was held, the type of selection process used and the number of local, regional and international players that took part in it. Unfortunately, due to the nature of the source, there were no definitions of types of players (i.e. what defines regional vs. international). Some lessons can be clearly learnt here nevertheless. Local and small players stand less of a chance in auctions, but won a third of the licenses offered in beauty contests.

To conclude we can say that in beauty contests more licenses remain unsold, even though this trend changed over time, while bands also remained unsold as the popularity of auctions diminished. The size of a nation does not clearly determine the outcome of the allotment process. At the same time, auctions are more attractive as they reap the benefits of globalisation. It remains to be seen whether the participation of international forces is beneficial to local economies.

■ What Can the Outcome of the Processes Tell Us

To assess the outcome of the processes, we assumed that a comparison of the number of changes made to licenses following allocation, the number of operators who have either ceased to exist or otherwise slowed down their deployment, the number of interim solutions to ease the burden on license holders such as introduction of MVNOs or network sharing agreements and the number of actual deployments and commercial trials initiated would shed some light on what can be defined as success or failure of the processes.

Changes made in the licenses *ex post facto*

The second half of 2001 saw a slowdown in investment in UMTS licenses. A significant turning point was October 2001 when the French

⁷ <http://www.umts-forum.org/servlet/dycon/ztumts/umts/Live/en/umts/Home>

regulator set a precedent by retrospectively changing licenses awarded and easing the requirements of these licences. The changes included license prices, payment schedules and duration ⁸. A few months later, in December 2001, Italian licenses were changed in a manner that required new legislation to allow a lowering of the fees to be paid and license duration ⁹. While a beauty contest was held in France, the initial entry price was so high that two licenses remained unsold. In Italy an auction was held that ended abruptly at near the minimum fee due to the withdrawal of one competitor. Thus, both countries represent anomalous processes evolving into much needed correction procedures.

Other *ex post facto* changes were made in Finland, Belgium, Portugal ¹⁰ and Poland ¹¹ (who all held beauty contests) where deployment was pushed back a year, in the Czech Republic where license prices were lowered ¹² and in Spain where required investment in infrastructure was lowered ¹³. The European Union in turn moved to ease conditions for bleeding operators by allowing infrastructure sharing and spectrum trading ¹⁴ and is considering allowing the German and French governments to support their ailing telecom operators.

Most of the *post factum* changes were made following beauty contests. Apparently, these contests offer regulatory bodies greater flexibility in their rulings. However, at the same time beauty contests make stricter and more pretentious demands of operators, that once found to be unrealistic, require immediate changes. One exception to this rule is Sweden, which, although it held a beauty contest, has to-date refused to make any changes to licenses, even at the price of having them returned ¹⁵.

⁸ <http://globalarchive.ft.com/globalarchive/article.html?id=010530000677>

⁹ From: www.totaltele.com (December 12th 2001)

¹⁰ From: www.totaltele.com (February 11th 2002).

¹¹ <http://www.totaltele.com/view.asp?articleID=92851&Pub=TT&categoryid=625&kw=poland>

¹² From: www.totaltele.com (December 7th 2002).

¹³ From: www.FT.com (December 26th 2002).

¹⁴ From: www.totaltele.com (May 31st 2002).

¹⁵ <http://www.totaltele.com/register/upgrade.asp>

Licenses returned or operations ceased

Quam, a joint venture by the Finnish company Sonera and the Spanish player Telefonica, ceased operations in Germany, where a rather expensive and unusual auction was held¹⁶. Another German corporation, MobilCom, has also reached the verge of collapse due to the same auction¹⁷. At the same time, Telefonica of Spain ceased operations of three of its subsidiaries that held licenses in different European nations, Austria, Italy and Switzerland, all which held auctions. A similar phenomenon has affected countries that held beauty contests such as Norway, where the Swedish telecom operator Tele2 and the local bankrupt Broadband returned their licenses¹⁸, and Orange that returned its license to the Swedish regulator. In both these Scandinavian nations, regulators refused to bend the rules set in their beauty contests.

If one rule can be deduced from all these changes, it is that the globalisation of UMTS licenses is a very fragile process. International corporations are the first to pull out of markets, leaving unused spectrum bands. Since the introduction of trans-national corporations is generally an outcome of auctions, this leaves a major question mark hanging over their efficacy. However, trans-national corporations that took part in beauty contests behaved in a similar way.

Interim solutions aimed at easing license requirements: MVNOs and infrastructure sharing

In order to overcome the late introduction of UMTS technology and the unforeseen crisis in the telecom markets and to avoid the liquidation of more license holders and a further delay to the introduction of 3G services, some countries adopted solutions that allowed for an easing of the economic burdens of the operators. These include two that are more apparent and visible, the Mobile Virtual Network Operator (MVNO) and infrastructure sharing.

¹⁶ <http://www.totaltele.com/view.asp?articleID=90042&Pub=TT&categoryid=625&kw=Quam>

¹⁷ <http://www.totaltele.com/view.asp?articleID=93795&Pub=TT&categoryid=889&kw=MobilCom>

¹⁸ <http://www.cellular-news.com/3G/norway.shtml>

MVNOs were originally introduced in GSM systems as means by which corporations without an infrastructure could enter the market utilizing the network of an existing operator with enough available capacity to "host" an additional label. Once the financial burden set on UMTS operators was obvious, some sought to minimize their cost and expenses by "hosting" an operator who was unfortunate enough not to receive a license itself. The first such arrangement was between the Swedish operator Tele2 that signed an MVNO agreement with its neighbour Telenor, claiming savings would amount to EUR 500 million¹⁹. In other cases, regulators offered spectrum for the use of potential MVNOs on existing networks²⁰. As for infrastructure sharing, that was first introduced and accepted by the German regulator in July 2001. The sharing of masts, antennae and certain elements of the B-node (base stations) were seen as compatible with the rules of competition and approved by regulators, as long as no information concerning subscribers was transferred between operators. In August 2002 a cooperation agreement was signed by the German player T-Mobile and the British MMO2. This agreement also received the approval of the European Commission²¹. In the interim period Britain, Austria, Switzerland, Belgium, Italy and Greece, all countries that conducted auctions and France, Sweden, Ireland and Norway that conducted beauty contests, approved similar agreements.

To-date only the Australian Telstra has inaugurated a full UMTS system on a commercial basis for its business sector clientele. All information concerning other trials, shown in Table 4, was published in newspapers and internet-based periodicals. From the data gathered, we find that 61% of countries that held auctions have started these trials, versus only 41% of those that held beauty contests. The operators that started deploying networks and conducting these trials mostly received their licenses before or during 2001 and the full picture will be available only by the end of 2003, which marks the date when most license holders need to roll out their networks.

¹⁹ From: www.totaltele.com (16 September 2002).

²⁰ From: www.totaltele.com (29 January 2002).

²¹ http://www.oftel.gov.uk/publications/oftel_response/2002/share1002.htm

Table 4: UMTS trials launched (February 2003)

Auction	Beauty contest
Vodafone (United Kingdom)	Telefonica (Spain)
Orange (United Kingdom)	Vodafone (Spain)
Hutchison (United Kingdom)	Sonera (Finland)
Hutchison (Italy)	Telenor (Norway)
Telecom Italia Mobile (Italy)	NetCom (Norway)
Vodafone D2 (Germany)	
Mobilkom (Austria)	
Telstra (Australia)	

Given that early roll out is a consequence of earlier spectrum allocations and since those were mainly auctions, the methodological problem with Table 4 is that it is hard to tell whether auctions truly represent a method that leads to a faster roll out and deployment. This is especially true since, as we describe above, more concessions were made to participants in beauty contests and more withdrawals and liquidations took place following auctions. The overall picture consequently remains unclear.

■ What Can and Can't be Learnt about UMTS Spectrum Allocations

One thing is clear: UMTS spectrum was allocated far too soon and before technology reached a stage justifying the process. Nevertheless, while the world turned its head in astonishment at the German and UK auctions, these were an exception to the rule and most allocations represented moderate and reasonable investments, although not all have produced a swift deployment of the new networks.

This paper tried to determine whether there were distinguishable characteristics for the types of allotment processes held by which we can possibly foresee if the eventual deployment will be successful. As we have demonstrated, nations are only characterised by the regulatory process they choose to a very minor degree. However, certain trends created by global influences and the passage of time are more clearly visible. The paper clearly demonstrates that national income does not need to be generated at the expense of ensuring service within public interest standards dictated by consumer benefit conscious regulators. At the same time, it reveals that beauty contests favour local corporations and that local corporations have

less of a tendency to return their licenses, which leads us to the question of the actual deployment of networks. It is still too early to judge, as 2003 will serve as the "test" year for the actual roll out of the new technology. Yet we were able to show that the flexibility given to regulators by beauty contests allows them to better control the market and improve the competitive field by attending to economic and technological needs of the operators. It is true that more trials have started in countries that used auctions as their method to-date, but more bankruptcies have also occurred in these countries. Since beauty contests became more popular in the latter period of the allotment process, it is yet to be seen whether the eventual "corrections" made by regulators will give beauty contests the edge as far as processes in which the public interest is better served.

The UMTS spectrum allocation frenzy was part of a global movement. The new solutions, MVNOs, infrastructure sharing and their likes, which are unprecedented as such, are local ways for regulators to try to reduce the "damage" of globalisation. We also demonstrated that the first operators to pull out of their obligations were international corporations that mostly received their licenses through auctions. We can thus conclude that both the initial hype and the eventual doldrums are a consequence of the economic globalisation movement. This trend at least needs to be reconsidered and no additional studies in this regard are called for. In terms of global and regional influences, it should be noted that the European Union served as both the catalyst for the process and the authority called upon to remedy its failures. Some may see this as justification of the central role of the Union in designing policy, to the dissatisfaction of NRAs. At the same time this can also serve as a warning sign regarding intervention. While a clearer picture should emerge by the end of 2003, at this stage it is safe to say that 3G still has a long way to go.

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