3-G Wireless Auctions: A Barrier to New Services for Local Communication

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Abstract

Existing wireless telephony and messaging applications have the potential of being enhanced by broadband applications supported through “Third Generation” wireless services. Across the globe, governments have been allocating electro-magnetic spectrum for these 3-G services through an auction process. The rationale being that the entity that pays the most for a resource will create the greatest value from it. The use of auctions has removed the concept of public ownership of the electromagnetic spectrum and radically redefined performance for this local communications technology. Issues of universal service, equality, and general definitions of performance and service characteristics are no longer directly addressed, but rather, service and performance are driven by marketplace competition. This paper hypothesizes that national and transnational wireless carriers acted to create barriers to new competition through the 3-G auctions by implementing a “win at any cost” strategy then retarding the roll-out of services and subsequently negotiating down the costs of the auction. In testing this hypothesis, analyses of the auction prices for 3-G licenses are compared to the intrinsic value of these licenses based upon a discounted cash flow model. These analyses demonstrate that prices paid for spectrum was an uneconomic decision. That is, economically speaking, these carriers overpaid for the spectrum. Further the actions by these carriers subsequent to the auction are analyzed to show that by retarding the introduction of 3-G services they continue to maximize revenues from existing wireless systems while they attempt to renegotiate auction terms and seek other types of regulatory relief.

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Every society faces fundamental issues in determining how to allocate and use scarce resources. This involves not only the question of the relative economic efficiency of the allocation, that is, the quantity and characteristics of goods and services produced, but also how the goods and services are allocated to members of the society. (Scherer and Ross, 1990) The electromagnetic spectrum is a finite resource that is used as the backbone for wireless telecommunications applications.

Particular frequencies of the can be put to use in a variety of competing applications and associated services (Dodd, 2000). With the exception of frequencies allocated through international treaties or negotiated through international organizations, allocation decisions are left to sovereign governments. In most cases, this allocation of spectrum and subsequent licensing process creates transferable property rights for the licensee (ITU, 2001a, Sewell, 1991). Increasingly, governments have been allocating the “ownership” of these frequencies to private businesses through simultaneous multiple round auctions. (ITU, 2001a)

This study examines whether existing telecommunication companies use this auction process to their advantage by creating barriers to entry for new competitors and retarding the delivery of competing services.
Third Generation (3-G) Wireless Services

The explosive growth of wireless telephony services during the past two decades, the advent of new wireless telephony applications, and the promise of increased technological convergence has resulted in the allocation of a greater portion of electromagnetic frequencies for personal communication services. (ITU, 2000) Recently, governments have been allocating spectrum for “Third-Generation” or 3-G wireless telephony services: Third-Generation services are usually grouped under the umbrella of Universal Mobile Telecommunications Services (UMTS) or IMT 2000 for current GSM systems. (Muratore, 2001) In the US, two different standards are being established, the UMTS W-CDMA standard and a competing standard known as CDMA-2000. (Bolande and Guth, 2002) 3 technologies offer the prospect of greater transmission speeds than existing services and potential to provide a wide variety of new services. This means that a wide variety of new and novel applications can be supported such as videophones, enhanced messaging that includes graphics, instant messaging, m-commerce, and virtually any application that can be supported by high-speed Internet access. Applications would appear to be constrained more by end-user utility than by technology.

Wireless telephony is primarily used for communication to individuals within a local area. Data indicate that some individuals have replaced their fixed wireline telephone service with wireless service, and in some countries with a limited telecommunications infrastructure, wireless service has “leap-frogged” wireline service. 3-G services promises to enhance the applications available to all users.

Novel uses for wireless applications have also been proposed. In a model similar to the Internet, Lessig, Benkler, and others have argued for spectrum allocations that provides the shared use of the spectrum allowing users to develop their own applications. (Benkle 2000, Lessig, 2001) For example, Lessig argues for an open spectrum management policy that would establish a “wireless commons.” Under this proposal, the government would be limited to certifying that the devices using the allocated spectrum are “properly certified technologies” but “an extensive range of new technologies” could be enabled to use this spectrum, as developed by a variety of users. In a model analogous to the Internet, this approach would rely upon “smart radios” or transceivers that focus on the packets of data that they are supposed to receive, allowing for multiple users of the same spectrum. Another quasi-open access approach has been posited by Noam (1998). Under this approach consumers would have access to the spectrum by paying for the duration of transmission and bandwidth used.

Regardless of whether used for currently envisioned broadband applications, or for novel approaches such as open spectrum applications, 3-G wireless promises to provide great utility to users.

Spectrum Allocation Policy

The “decision to regulate” the electromagnetic spectrum was based in the chaos of the early days of radio broadcasting and the recognition of the public safety issues associat
with maritime communication. In the United States, early spectrum allocations during the
1920's were to private corporations for the purpose of commercial broadcasting or
spectrum was reserved for public safety applications. (Botein, 1998), Douglas, 1997). In
other nations, spectrum continued to be owned by the government but were allocated for
use under various public trustee or public utility standards (ITU, 2001).

The basis for the regulation is spectrum scarcity and the fact that competing uses of the
same frequencies result in chaos that destroys any fruitful use of radio-based technologie.
There are three primary methods of allocation decisions where there were competing
applicants for the same spectrum bandwidth. There is the market-based approach of
auctions, and non-market based approaches of comparative processes, commonly known
a “beauty contest,” and the use of a lottery to select the licensee. In the case of the non-
market based approaches, some nations such as Spain and Germany charge license fees.
(Gruber, 2001)

Spectrum allocations have the additional issue of the property rights associated with ther
In the United States, the courts have upheld the rights of the licensee to sell a license to a
new holder for a fee. (Sewell, 1991) This means that the licensee who received the right
to use the spectrum, usually for a nominal fee, is able to sell that license. The resulting
windfall profit does not result in any payment being made to the national treasury or to the
“owners” of that spectrum, the citizens.

In most other nations spectrum property rights have evolved as state-owned
telecommunications companies or quasipublic corporations such as broadcasters were
privatized. In assessing the underlying value of these corporations, the services provided
through the use of the electromagnetic spectrum are key elements. In addition, mergers,
acquisitions and asset sales by these companies include spectrum and imply property rigl
(ITU, 2001)

Auctions as an Allocation Alternative

The inherent value of electromagnetic licenses and the scarcity of this resource attracted
interests of economists. The use of auctions as a mechanism for spectrum allocation has
foundation in the work of Coase (1959), where he wrote:

(A)lmost all resources in the economic system (not just radio and
television frequencies) are limited in amount and scarce...Land, labor
and capital are all scarce, but this, of itself, does not call for
government regulation. It is true that some mechanism has to be
employed to decide who, out of the many claimants, should be
allowed to use the scarce resource. But the way this is usually done
in the American system is to use the price mechanism…”

The standard way for the government to allocate a scarce publically owned resource is
through an initial auction, thereby initiating a “market” for the scarce resource. (Scherer,
In terms of the electromagnetic spectrum, industrial organization theory argues that "profit maximization" leads to the best and most efficient use of this resource (Hazlett, 1998). Critics have argued that auctions may maximize revenues from the sale of a public resource, but not necessarily foster competition to the greatest extent possible (Gruber, 2001).

During the 1980's, in the US, the initial rounds of wireless telephone spectrum allocation occurred through comparative hearings, but this was modified to lotteries when the cumbersome and capricious nature of the comparative process became apparent. During the early 1990's, the FCC, Congress and the Executive Branch began considering the use of auctions as a means of allocating spectrum that would be used for wireless telephony services. That rationale being the efficient allocation of resources as well as generating funds for the public treasury that would help produce a "balanced budget." (Brinkley, 1998, Hazlett, 1998) In 1994 the FCC began auctioning spectrum for wireless services when it was mandated in the Omnibus Budget Reconciliation Act of 1993 and this was expanded the Balanced Budget Act of 1997 (FCC, 2002).

The success of the auctions in generating revenues for the public treasury and the optimism for the applications using this newly freed spectrum created a positive response to the FCC auctions. European governments were quick to consider the use of auctions for 3-G spectrum allocations, with some countries (Finland, Spain, Norway, Sweden, France) choosing comparative hearings and others (UK, Holland, Switzerland, Italy, Austria) choosing to use auctions. (ITU, 2000b) Across the globe, most other governments have elected to use comparative hearings or are observing the results of the auction process. Table 1 provides a summary of the results for spectrum auctions to date.

Critics of the auction process argue that instead of allocating spectrum efficiently, the net result has been the transfer of a public asset to corporate interests with the net result being that consumers pay a tax in the form of higher prices, and that corporations use the auctions to protect their corporate interests and legacy technologies (Cave and Valletti, 2002, Lessig 2001). The principal objection to the auction process made by the telecommunications industry and consumer groups is that it tends to overprice spectrum, create uncertainty and undermine the development of a healthy industry. In auction theory this is known as the "winners curse." (European Commission, 1997) Gilder criticizes the auctions stating "the very auction process entrenches obsolescent technology and promotes the false idea that spectrum is the basis of a natural monopoly." (Gilder, 2000, p.160)

Auctions and Corporate Strategy

Industrial Organization Theory is the branch of economics that examines market structure, firm conduct, and performance. The goal is to understand how to maximize social welfare through the efficient allocation of resources by shaping economic competition and public policies. (Scherer, 1990) Critics have charged that this theoretical perspective is
insufficient or inappropriate for the purpose of policy outcomes when analyzing
communication and information industries (Babe, 1995, Baker, 2002) Criticisms of firm
conduct analyses have primarily focused on the assumption of profit maximization as the
guiding primary goal of decision-making and less on the analytical framework, the
principal basis for antitrust analysis.

This theoretical approach is widely used as the basis for analyzing and developing business
strategies. (Porter, 1984). A key element of business strategy as pioneered by Porter is the
development of barriers to entry to new competition. These are defined as structural
market characteristics that prohibit the entry of new firms into a market where they would
they would normal be attracted to the supranormal profits available, or attracted to the
ability to wield have market power. (Scherer, 1990, p. 18). The threat of entry is a function
of “the barriers of entry that are present, coupled with the reaction from existing
competitors.” (Porter, 1984 p.7)

Porter identifies a government license, such as that to use the electromagnetic spectrum, as
a key barrier to entry. (Porter, 1984 p.14) Once successful in an auction for 3-G service
the winning firms have an absolute barrier to entry. Further, an incumbent licensee with
G or 2-G spectrum that wins an auction for 3-G spectrum is reacting to potential entry as
it has expanded its barrier to entry to new wireless telephony service.

Jehiel and Moldovanu (2001) examined the outcomes of European UMTS/IMT-2000
auctions based upon their structure. The study focused upon two potentially intervening
factors, the cost advantage of incumbent 2-G carriers and the number of licensees allocated
der per country. Incumbent carriers consistently paid more than new entrants. Arguably, this
could be the result of the barrier to entry strategies rather than cost advantages and ration
bidding. There appears to be no consistent difference in the number of licenses allocated
and the result of the auctions. All countries in their sample had between 4 and 8 licenses
allocated.

Hypotheses

This study hypothesizes that the 3-G wireless auctions have been used by the large
incumbent licensees, primarily transnational telecommunications companies, as a strategy
to enter the market with the result that entry by new competitors and new potential services
such as “open spectrum” initiatives do not have access to the electromagnetic spectrum.
The case where new entrants are licensed, the cost of entry causes severe economic distress
particularly since these companies are not migrating from existing 2-G or 1-G networks.

Hypothesis 1:

Winning bids in 3-G auctions were based upon a “win-at-any-cost” strategy and the
bids were uneconomical and irrational.
Hypothesis 2:

Winning bidders are delaying the introduction of services, thereby maximizing cash flow from existing wireless telephony services, while at the same time attempting to negotiate the prices paid for spectrum to lower levels.

Methods

Hypothesis 1

The method used in testing the first hypothesis is a standard financial methodological framework, a net present value analysis (NPV) used to determine the future cash flow required from the services to justify the payment for the license portion of 3-G services. (Brealey and Mills, 1991). This does not include the costs of the network portion, selling, general and administrative expenses or other fixed costs. A “pay-back period” analysis can be used to test the economic logic of the transaction prices on a prima facie basis.

(NPV) analysis is one of three approaches used in the valuation of intangible assets, such as a spectrum license. (Smith and Parr 2000). The two existing alternative approaches, comparable transaction and cost-replacement analyses, are inappropriate because the 3-G technologies do not have existing comparables and the replacement cost of a non-existing technology is a non sequitur.

The formula used in this analysis is:

$$\text{NPV} = \sum_{t=1}^{\infty} \frac{C_t}{(1+r)^t}$$

$C_t =$ Cash flow produced per period
$r =$ The discount rate or cost of capital during the period
$t =$ the number of discrete time periods over which cash flow is collected

A payback period refers to the period over which an investment is recovered. A discount payback uses NPV to calculate future cash flows to determine the attractiveness of an investment and logic of an investment. (Brealey and Mills, 1991, p.77) Alternatively, firms may use discounted cash flow to calculate the value of an asset by determining the Internal Rate of Return. This study uses the concept of the payback period to assess the attractiveness of the aggregate prices paid to win the auctions within each nation. We focus on a seven-year time horizon for two reasons. First, it is a standard benchmark in financial analysis for the outer parameters of projectable economic performance, and, second, because due to the discounting formula, out-year cash flows contribute less to the NPV total. The discount rate used is 7.5%, which is assumed to be the cost of capital for the telecommunications companies in a new venture (10 year US Treasuries + 200 bps).
The unit of analysis for this NPV test is at the nation level. The concept being that the population of the nation represents the relevant market and that 3-G auction payments represent the aggregate amount paid to hold the spectrum that serves that market. An analysis at the firm level provides only a partial picture of the aggregate market and is confounded by assumptions concerning market share allocation. In addition, spectrum sizes and characteristics differed by license allocated to individual firms.

Further, by analyzing at the national level, differences in population can be controlled. The countries used in this analysis are Western European nations. This is the only geographic region where auctions have been completed, except Australia and New Zealand. (ITU, 2000b). The sample is also limited to Western Europe in order to control for potential macro-economic differences. Given the oligopolistic market resulting from the auctions, and the similarity in the number of licenses auctioned (except Switzerland with 2 licenses allocated) the study assumes that the aggregate market value of the licenses is independent of the number of licenses auctioned in each nation.

Hypothesis 2:

This hypothesis is tested through the examination of corporate actions subsequent to the auctions. Information was analyzed from company regulatory filings, press releases and statements, and interviews in the financial press.

Results

Hypothesis 1

The test of the first hypothesis indicates that there is evidence that companies overpaid for 3-G spectrum. Table 2 provides a summary of the analysis. The table provides an aggregate value of cash flow per subscriber over the seven-year period that is required to pay for the “license portion” of a 3-G service. This could be considered a “surcharge” on 3-G services. Note that this does not include the hundreds of millions to billions of dollars required to construct the network or annual operating expenses. (Muratore, 2001) Thus charges for specific services are not included. These service charges will be significant. For example, two European services have priced video phone service, also known as multimedia messaging. Norway’s Telenor is charging $1.30 per message and Deutsche Telecom has announced a monthly fee of $29 for 350 picture messages. (Nakamoto, 2000)

Insert Table 2 Here

As discussed in the methods section, this analysis uses a seven-year time horizon for the analysis. The “Break-Even All Users” column amortizes the required cash flow over all current wireless users. Under this model, the German and UK auctions stand-out as appearing to have an unrealistic cash flow requirement. The other auctions appear feasible. However, not all users will be subscribing to 3-G, and we argue that not all users would be willing to pay several hundred dollars per annum for services beyond voice telephony an...
SMS messaging. Further, 3-G networks would not have the capacity to provide service to this number of subscribers.

What is the proper penetration or “take-rate” for the initial years of 3-G? If wireline broadband can be used as a surrogate, the rate would approach 10%. In the US, after 6 years of wide scale broadband services available, approximately 1 out 14 households subscribe to a broadband service. (UCLA, 2002) The others use narrowband connections. This may be somewhat analogous to the future 3G/2.5G relationship.

In Table 2, the “8% Take-Rate” demonstrates the cash flow required to pay for the license portion of the 3-G service if 8 out of 100 of users sign up for this broadband service. As indicated, over the seven year period, this would require as much as $200 per month per subscriber in Germany just to pay for the “license overhead.” In the more realistically bid nation of Switzerland, this would still be a $9 per month charge. This is perhaps realistic but still a significant monthly surcharge on top of operating expenses.

A best-case scenario during the initial seven years of service could possibly be at a 30% take-rate. This would make the license portion or surcharge of monthly cash flow manageable in Switzerland, but still at about the $7 per month level for Austria and Denmark. The cash flow requirement is between $14 and $54 per month for the Netherlands, Germany and the UK. Arguably, this is a significant monthly surcharge to be added to service pricing.

Hypothesis 2

The test of the second hypothesis was accomplished through a qualitative methodology. Evidence indicates the following four trends: (1) 3-G network development and services have been delayed (2) Payments to governments by the winning bidders have been delay and there have been requests to reduce the final bid amounts (3) Companies are seeking mergers or network sharing agreements in order to reduce costs and decrease the number of competitors (4) The delayed roll-out of networks is allowing the incumbent licensees to continue to generate revenues from existing 2-G networks.

There is widespread evidence of the delays in the introduction of 3-G services. NTT DoCoMo is the largest 3-G provider and reports 112,300 subscribers to its UMTS during the first 8 months of operation. (Bolande and Guth, 2002). In Europe the “wireless industry is delaying introduction of 3-G.” (Roberts, 2001a) Industry analysts are now forecasting that only 15% of Europe will have coverage by 3-G networks by 2005. (New York Times 2001). In the US, 3-G networks have been held-up spectrum issues, with key spectrum scheduled to be auctioned until 2003 and possibly not available until 2007. (Dreazen, 2002).

Perhaps a more interesting element of the auction process is the delay in auction payments. In the US, of the $41 billion bid in wireless auctions, only $14 billion has been collected. Evidence shows “ a similar pattern is already playing out in Europe.” (New York Times,
Companies are also requesting that amount of the winning bids be reduced. Spain and Germany, both countries that used beauty contests, have agreed to reduce the license fees. Similar requests have been made in England and Germany, two nations that used auctions, but regulators have denied the requests. (New York Times 2001) As 3-G network construction is delayed, it is very possible that there will be additional requests for a reduction fees.

The number of licenses granted per nation varies between 2 and 8. Following the auction several of the winning companies have sought permission to share facilities. (Shillingford 2002) “In Europe, several operators that have acquired 3-G licenses … have been lobbying EU and individual country officials and politicians to get some relief.” (Scanlon, 2001). Hutchison 3-G has already agreed to lease MMO network facilities. (Roberts, 2001b) A more radical solution is the industry contention that “…problems can almost all be traced the crippling third generation wireless spectrum auctions of 2000…. and that mergers are must.” (Waters, 2002a, Waters 2002b) The results of the auctions are now being referred as “regulatory burdens.”

Finally, most of the winners of 3-G auctions were incumbents, or owners of existing 2-G licenses. These companies continue to generated revenue and positive cash flow from their facilities while 3-G is delayed. Wireless telecommunication companies have “put a brave face on these (3-G) delays by pointing to higher-than-expected revenues from existing services like text messaging, which means there is less urgency to launch new services.” (Bicerton, 2002) Given the expense of the 3-G licenses, the cost of rolling out services, and the uncertainty of demand, the appropriate profit maximizing strategy may be to delay payment, delay services, and continue making a profit with existing networks.

Discussion

Much of the literature concerning the results of auctions of the electromagnetic spectrum has focused on auction design and mathematical issues relating to bidding strategies. There has been limited research on the practical effects of these auctions. The net present value analysis undertaken in this study indicates that some winning bid either had to be widely enthusiastic and irrationally exuberant about the prospects for 3-G wireless services or integrated their auction strategies with subsequent business strategies.

By focusing on theories of business strategy, this study argues that the auction process appears have been used to create barriers to new competition in some markets. The large telecommunications that have dominated early generations of wireless telephony appear have paid an uneconomic or irrational amount of money for the licenses. This can either attributed to bad decision-making or perhaps part of a larger strategy.

The establishment of barriers to entry to providers of new 3-G services, allows the incumbent carriers to delay new services while continuing to generate cash flow from existing wireless networks. These barriers and the “ownership” of the spectrum also allo these companies to ensure that they cannot be allocated to unique applications such as
“open spectrum” initiatives or other wireless packet data applications that allow for shared spectrum. A third part of an integrated strategy could include the subsequent lobbying for a reduction in the actual monies paid for the spectrum, or cost reduction initiatives such as the sharing of network facilities between two or more licensees. As indicated by initiatives and other actions by the companies, this third strategy is underway.

The implications of this study are that policymakers should reexamine the implications of spectrum auctions. If the net result is to either keep the spectrum from being utilized or being utilized in sub-optimal ways, alternative means of spectrum management should be considered. “open spectrum” approaches would appear to hold great promise. Alternatively, modified open spectrum approaches, where spectrum access is allocated dynamically and incremental charges are based on amount of bandwidth and time of use, also appears an appealing alternative.

Finally, regulators should consider any request by the winning bidders to change the terms of the auction after contest with skepticism. Such actions may be a fallback strategy to the “win-at-any-cost” outcome of wireless telephony auctions.

References


<table>
<thead>
<tr>
<th>Nation</th>
<th>Number of Winners</th>
<th>Incumbent Winners</th>
<th>Auction Total (S-millions)</th>
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<tr>
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<td>3</td>
<td>610</td>
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<td>Austria</td>
<td>6</td>
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<td>3</td>
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<td>2</td>
<td>200</td>
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Table 2: Net Present Value Analysis of European 3-G Auctions

<table>
<thead>
<tr>
<th>Nation</th>
<th>Population (mm)</th>
<th>Cellular Penetration (%)</th>
<th>Auction Price ($-mm)</th>
<th>7-Year Break-Even/All Users</th>
<th>8% Take Rate 7-Yr Break-Even/User</th>
<th>30% Take Rate 7-Yr Break-Even/User</th>
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<td>80.66</td>
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