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3-G wireless auctions as an economic barrier to entry: the western european experience

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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 electro-magnetic 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 theorizes 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 perspective, the allocation and implementation of 3-G services in Western Europe are used as a case study. 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 were uneconomic decisions. 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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1. Introduction

Particular frequencies of electromagnetic spectrum 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, 2001; Sewell, 1991). Increasingly, governments have been allocating the "ownership" of these frequencies to private businesses through simultaneous multiple round auctions (ITU, 2001).

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.

2. 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, 2000a,b). 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 Mobil Telecommunications Services (UMTS) or IMT 2000 for current GSM systems (Muratore, 2001). 3-G technologies offer the prospect of greater transmission speeds. This means that new and novel applications can be supported. Initial services rolled out include 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.

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 provide for the shared use of the spectrum allowing users to develop their own applications (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. Noam has posited another quasi-open access approach (Noam, 1998). Consumers would have access to the spectrum by paying for 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.

2.1. Spectrum allocation policy and property rights

The basis for the regulation of the electro-magnetic spectrum is scarcity and the fact that competing uses of the same frequencies result in chaos that destroys any fruitful use of radio-based technologies. 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 as a "beauty contest," and the use of a lottery to select the licensee. In the case of the non-market based approaches, some nations charge license fees (Gruber, 2001).

Spectrum allocations have the additional issue of the property rights associated with them. In most nations spectrum property rights have evolved as state-owned telecommunications companies or quasi-public 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 rights (ITU, 2001).

2.2. Auctions as an allocation alternative

The use of auctions as a mechanism for spectrum allocation has its foundation in the work of Coase (1959). 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 and Ross, 1990, p.109) 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).

In the US, in 1994 the FCC began auctioning spectrum for wireless services (Brinkley, 1998; FCC, 2002). The success of the auctions in generating revenues for the public treasury and the optimism by the applicants 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).

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, 2000; 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 in 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).

3. Auctions and corporate strategy

A key element of business strategy as pioneered by Porter is the development of barriers to entry to new competition (Porter, 1984). These are defined as structural market characteristics that prohibit the entry of new firms into a market where they would others enter because existing firms have market power or the ability to make supranormal profits (Scherer and Ross, 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).

A government license to use the electromagnetic spectrum is a key barrier to entry and can be considered within both of Porter's contexts. Once successful in an auction for 3-G services, the winning firms have an absolute barrier to entry. Further, an incumbent licensee with 1-G or 2-G spectrum that wins an auction for 3-G spectrum is reacting to potential entry and 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 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 rational 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 four and eight licenses allocated.

4. Hypotheses

This study hypothesizes that in Western Europe, 3-G wireless auctions have been used by the large incumbent licensees, primarily transnational telecommunications companies, as a strategic barrier to entry 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. In 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.

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 two licenses allocated) the study assumes, in a view consistent with the findings of Jehiel and Moldovanu, that the aggregate market value of the licenses is independent of the number of licenses auctioned in each nation.

Hypothesis 1. In Western Europe, winning bids in 3-G auctions were based upon a "win-at-any-cost" strategy and the bids were uneconomical and irrational.

Hypothesis 2. In Western Europe, winning bidders are delaying the introduction of services, thereby maximizing cash flow from existing wireless telephony services, while at the same time attempting to negotiating the prices paid for spectrum to lower levels.

5. Methods

5.1. 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. 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 an non-existing technology is difficult to project.

The formula used in this analysis is:

$$\mathrm{NPV} = \sum C_t/(1 + r_t)^t$$

$C =$ 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 discounted payback is uses NPV to calculate future cash flows to determine the attractiveness of an investment and logic of an investment. 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 + 175 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 size and characteristics differed by license allocated to individual firms. Finally, by analyzing at the national level, differences in population can be controlled.

5.2. 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.

6. Results

6.1. Hypothesis one

The test of the first hypothesis indicates that there is evidence that companies overpaid for 3-G spectrum. In testing this hypothesis, the data used in finding these results were based on existing ITU studies, secondary data from regulatory agencies within each country, company financial reports, and information reported in the financial press. Table 1 provides a summary of the analysis.

Table 1
Net present value analysis of western european 3-G auctions

Nation	Population (mm)	3-G licenses/ incumbent winners	Cellular penetration (%)	Auction price ($-mm)	7-year break-even/all users	8% take rate 7-year break-even/user	30% take rate 7-year break-even/user
Austria	8.14	6/4	80.66	714	180.5	2256.3	601.7
Belgium	10.29	4/3	74.72	421	90.9	1136.3	303.0
Denmark	5.37	4/3	73.67	472	197.7	2471.3	659
Germany	82.36	6/4	68.29	46214	1363.3	17 041.3	4544.3
Netherlands	16.1	5/4	73.91	2515	350.9	4386.3	1169.7
Switzerland	7.22	4/2	72.38	120	38.1	476.3	127.0
United Kingdom	60.08	5/4	78.28	35411	1250.0	15 625.0	4166.7

Sources: ITU, Status of IMT 2000 (UMTS) 3-G Licensing in Western Europe; ITU, Status of 3-G Auctions, www.3gnewsroom.com; Federal Communications Commission, www.fcc/gov/3g: Country-by-country guide to European 3-G, Financial Times, 9/20/02; Brearley and Myers (1991, pp. 95–119).

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 videophone service, also know 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, 2002).

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 standout 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 more a month. 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 subscribes 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 1, the "8% take-rate" demonstrates the cash flow required to pay for the license portion of the 3-G 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 sill 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.

6.2. Hypothesis two

The test of the second hypothesis was accomplished through a qualitative methodology. The information used in finding these results was based on company reports to shareholders, company press releases, financial press interviews and analysis data.

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 delayed, 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. 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 of 3-G networks by 2005 (New York Times, 2001). In the US, 3-G networks have been held-up spectrum issues, with key spectrum not 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, 2001). 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 two and eight. Following the auctions, several of the winning companies have sought permission to share facilities (Shillingford, 1992). "In Europe, several operators that have acquired 3-G licenses... have been lobbying EU and individual country officials and politicians to get some relief" (Scanlan, 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 to the crippling third generation wireless spectrum auctions of 2000.... and that mergers are a must" (Waters, 2002a; Waters, 2002b). The results of the auctions are now being referred to 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 these 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." (Bickerton, 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.

7. 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 very limited research on the practical effects of these

auctions. The net present value analysis undertaken in this study indicates that some winning bidders 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 the theories of business strategy and based upon a case study of Western Europe, we argue that the auction process appears to have been used to create barriers to new competition in some markets. The large telecommunications firms that have dominated early generations of wireless telephony appear to have paid an uneconomic or irrational amount of money for the licenses. This can either be attributed to bad decision-making or perhaps be 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 allows 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.

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