

The Cost of Rent-Seeking: Evidence from Cellular Telephone License Lotteries

THOMAS W. HAZLETT

University of California, Davis

Davis, California

ROBERT J. MICHAELS

California State University, Fullerton

Fullerton, California

I. Introduction

The inventors of the theory of rent-seeking used an analogy with competitive markets to conclude that all monopoly rents would be dissipated in the competition to obtain the property rights to them [23; 29]. Subsequent theorists showed that this conclusion is quite sensitive to assumptions about foresight, risk aversion, conjectures, and bias [15; 21; 30]. Since little quantitative information about actual rent-seeking competitions is available, the theory has developed in an empirical vacuum. In this paper, we attempt to fill that vacuum with an estimate of rent-seeking expenditure by applicants in the Federal Communications Commission's (FCC) cellular telephone license lotteries, held between 1986 and 1989. We go on to compare expenditures with estimates of the value of the licenses at stake.

These lotteries constitute a unique natural experiment. Any U.S. citizen was eligible to enter each geographic lottery once, and only once, for an expense which we calculate as modest.¹ The lotteries were widely publicized and heavily entered. There were over 320,000 applications (one per market) filed for 643 cellular licenses, and third-party application preparers entered the market rapidly. Because licenses were awarded sequentially, prospective participants in later lotteries could find out that expected net returns from earlier lotteries were positive because of under-subscription. The value of the prize was known because sales of previously awarded licenses had begun to take place before later lotteries were held, and market analysts were using such sale prices to value licenses not yet awarded. The later lotteries seem almost optimally contrived to maximize the dissipation of rents. Yet comparing the resources invested in entry (the price of a fully-prepared application) with the rents available (the market value of cellular telephone licenses) shows that dissipation was far short of complete.

1. As noted in section III below, institutions arose which assured that neither financial capability nor a lack of technical expertise would pose serious barriers to lottery entrants. Financial barriers were further mitigated by the ability of individuals to form partnerships to share costs and diversify risks.

II. Modeling Rent Dissipation in Lotteries

Assume there are N potential contestants in the lottery for a license. Filling out and filing an application costs T dollars.² The cost is assumed identical for all applicants. A contestant can file at most one application, and a partially completed application is worthless. If all N contestants apply, then a contestant's expected return is V/N , where V is the value of the franchise.

There are then two possible cases. If $NT \leq V$, a player attempting to maximize expected returns buys a ticket. In the Nash equilibrium, everyone does so. If I am expending T on a ticket, your choice of whether to purchase one cannot make my decision a marginal one. Since this holds for all players, in the Nash equilibrium each player purchases a ticket. If $NT > V$, let M be the largest integer less than or equal to V/T . If fewer than M individuals are buying tickets, any non-purchaser who buys one receives a positive return if everyone else's strategy remains unchanged. Since all nonpurchasers have the same incentive, total rents will be overdissipated in ticket expenses, leading individuals to change their desired expenditures to zero. The solution in pure strategies is unstable.

The solution in mixed strategies is not. Consider purchasing a ticket with probability M/N . For a given vector of strategies, no chooser of T has an incentive to change to zero, since at best his gains will be unchanged (if V/M is an integer) and will more likely change from positive to zero (if V/M is not an integer). As M and N become large, the fraction of rents which remain undissipated falls to zero.

In models such as Tullock's [30], where the number of seekers is fixed in advance but their expenditures are unrestricted, Nash equilibrium dissipation is incomplete. In that model, a player's probability of winning is proportional to relative rent-seeking expenses. Increasing the number of players decreases Nash equilibrium expenditures per player but leads to full rent dissipation in the limit. The number of cellular lottery applicants is sufficiently large that if their expenses were unconstrained, a Tullock model would predict virtually complete rent dissipation.³

In market competition, positive expected profits will not persist under free entry.⁴ Such a result may also hold in rent-seeking competitions, but the only rigorously derived results in the literature are driven by highly specific assumptions. In those models, existing seekers are assumed to have poor foresight about entry, and new entrants are assumed to choose from a very limited and naive menu of strategies. If entrants follow the same bidding strategies as incumbents, expected returns fall to zero [5; 14], but there is no good reason to so restrict the choices of either. Because we know of no actual markets which are reopened to monopoly bidding for predictable periods, we cannot test for increasing dissipation over time in a single repeated competition. In cellular telephone lotteries, however, geographically separated markets were sequentially opened. We can thus compare relative rates of entry into earlier and later competitions. Knowing the cost of application and the value of the license, we can go on to estimate rent dissipation.

Rent dissipation is expectationally complete in a lottery with free entry.⁵ For most other

2. We consider these expenditures to be pure economic investments, with no consumption value, e.g., as gambling.

3. If there are N players, the total amount dissipated in a Tullock game will be $[(N - 1)/N]V$.

4. In a study with some analogies to ours, Selby and Beranek [27] did find overdissipation. They examined "sweepstakes" contests in which prizes are assigned by the random drawing of tickets filled out by consumers. Looking at the actual values of prizes in fifteen contests relative to reasonable assumptions about the cost of entry, they concluded that "less than one-third of the fifteen contests could attract either risk-neutral or risk-averse entrants . . . Yet these contests drew [78 percent of the total entries] for all surveyed contests." [27, 194]

5. We believe that the literature's two examples of overdissipation are not relevant. We know of no realistic ana-

competitions, rents will be less than totally dissipated. The limited dissipation in a Tullock [30] competition can be further curtailed if there is a binding ceiling on investment per player or a bias favoring some players. An auction which is costless to attend dissipates no rents. Regardless of the bidding rule (e.g., first or second price), if there is certainty about the value of the rents at stake, allocation by auction wastes no resources. The auction is efficient because surplus remains intact. It is transferred from the bidders to the auctioneer without being destroyed in extraneous investments. By contrast, in an unbiased lottery with open entry, marginal entrants are discouraged only when all rents have been dissipated. The FCC's cellular license lotteries take this form.

III. The Cellular Telephone License Lotteries

In 1982, the FCC received statutory authority to hold lotteries for spectrum rights [10; 16]. Their first use was to allocate licenses for operation of cellular telephone service in 215 Metropolitan Service Areas (MSAs) and 428 Rural Service Areas (RSAs) between 1984 and 1989. The commission had previously awarded licenses for the 90 largest MSAs.⁶ It awarded two licenses per market, one to a telephone company (Local Exchange Carrier) affiliate and one to a "nonwireline" company. Only LECs in the cellular franchise area could enter the wireline lottery. Any U.S. citizen, however, was eligible to enter the nonwireline lotteries with proof of financial ability to build and operate a cellular telephone system for one year. These requirements were far from onerous. Consulting firms quickly developed standard application forms with technical details of engineering specifications. These firms, known in the industry as "application mills," cooperated with equipment vendors to produce the lines of credit necessary to establish financial ability even where the principals had modest net worth. The lines of credit were conditional on contracts in which the entrant agreed to purchase hardware exclusively from a single vendor if he or she won.⁷

License applications for MSA markets 91-120 were accepted until July 16, 1984. After a long pause, applications for Markets 121-135 were accepted February 3-7, 1986. These were succeeded by five more lottery rounds which ended with markets 241-305 on May 23, 1986. (See Table I.) The RSAs were divided randomly by size into lotteries for which applications closed weekly between July 13, 1988 and January 13, 1989. Drawings (application numbers are painted

logue to Tullock's [30] model of increasing marginal returns to individual rent-seeking expenditures. In Wenders's [32] model, consumers and producers in a market threatened with monopolization make duplicative efforts to obtain and defend their surpluses. It is hard to explain why the political process would create opportunities for rent-seekers to earn negative expected returns, and why anyone would enter such competitions. See Flowers [11] and Michaels [20].

6. Licenses in markets 1-90 (1 being New York, 2 Los Angeles, etc.) were to be allocated after comparative hearings, and those hearings in fact decided the winners in markets 1-30. Markets 31-90 were actually allocated by lottery, but the Commission declared that a lottery would be used only after applications for assignments by hearings had been accepted. In 57 of these 60 markets, the applicants reached "alliance" agreements to split the license awards, and no drawings were held [6]. Only with markets 91-120 did an *ex ante* lottery process commence.

7. The FCC stipulated that entrants prove financial qualifications to build and operate a cellular system within eighteen months, with a five-year completion schedule. This showing could be made either by demonstrating "sufficient internal sources of funding, or a firm financial commitment from a third party, at the time they file their RSA applications" [2, 1]. Clients of Communications Management, which marketed the services of Romulus Engineering, a major application mill, were told that the agreement "simply means that there is at least one company . . . who will be willing to finance the entire start-up operation (should you win) without any capital input from the partners. If you decide to use the Novatel [equipment firm] agreement, you are not obligated to use their financing . . . but you are obligated to use their equipment or pay a penalty" [22].

Table I. Cellular Lottery Entries for MSAs

Markets	Closing Date	Number of Entries	Entries/Market	Pop ($\times 1,000$)	Pop/Mkt ($\times 1,000$)	Pop/Entry (/1,000)
91-120	07-16-84	5,178	172.6	10,994	366	212.3
121-135	02-07-86	8,007	533.8	4,134	276	516.3
136-150	02-28-86	7,436	495.7	4,017	268	540.2
151-165	03-21-86	6,367	424.7	3,462	231	543.8
166-180	04-11-86	8,471	564.7	2,905	194	342.9
181-240	05-02-86	25,018	417.0	9,000	150	359.7
241-305	05-23-86	37,650	579.2	7,040	108	187.0

Table II. Cellular Lottery Entries for RSAs

Lottery	No. Mkts	Date	Entries	Entries/Mkt	Pop ($\times 1,000$)	Pop/Mkt ($\times 1,000$)	Pop/Entry (/1,000)
RSA #2	14	07-22-88	8,859	632.8	1,408	100.6	158.9
RSA #5	18	08-12-88	10,977	609.8	2,127	118.2	193.8
RSA #10	18	09-23-88	13,155	730.8	3,743	207.9	284.5
RSA #11	21	10-07-89	13,914	662.6	2,741	130.5	197.0
RSA #17	23	11-18-89	17,170	746.5	3,699	160.8	215.4
RSA #20	22	12-16-88	17,006	773.0	3,297	149.9	193.9
RSA #22	23	01-13-89	18,144	788.9	3,793	164.9	209.0

on ping pong balls and randomly chosen out of a wind machine) for the RSAs were completed in late 1989. (See Table II.)

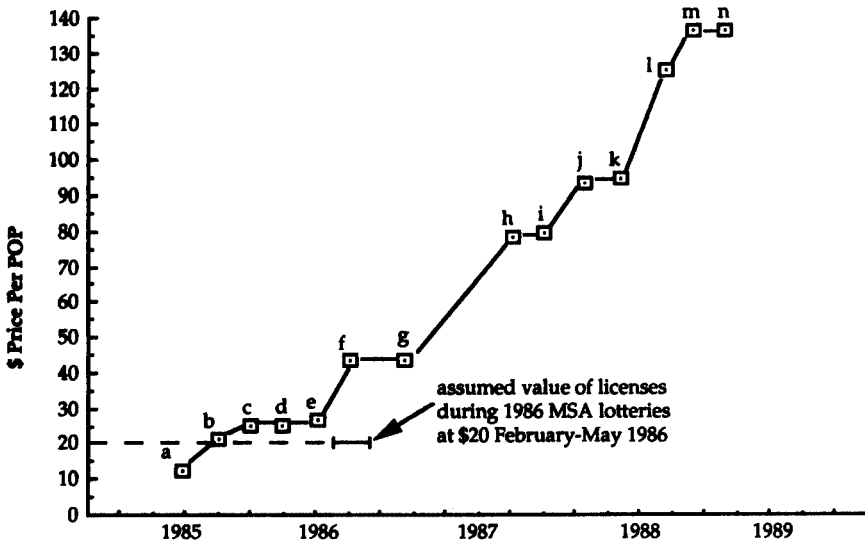
IV. The Evidence

Because licenses are frequently bought and sold, their prices are estimates of the rents at stake. For the economist, such prices are superior to measures of rents taken from values of assets into which license rights are bundled, such as stock in diversified firms or real estate. Market analysts were in fact studying such transaction prices and communicating them to others. The major costs of entering a lottery are expended on obtaining the non-trivial engineering, financial, and legal services offered by application mills. The unique availability of price data for both inputs and outputs makes the cellular lottery an exceptional case study in rent seeking.

Value of the Rents

The trade press reports prices of cellular licenses on a "\$price/pop" (i.e., per capita) basis. While differences between markets can be significant [25], they tend to cancel from the perspective of a ticket holder participating in several lotteries. Our measure of price accounts for differences among markets which stem from population size. Here, we examine the value of licenses across many markets collectively, 15 to 65 per MSA round and 14 to 23 per RSA round.

Cellular licenses have traded since 1985, with per pop prices estimated by industry analysts and cited in the trade press. The MSA licenses were issued first and traded first; Figure 1 shows



- | | | |
|---------------------------------------|----------------------------------|---|
| a) MCI to McCaw
\$12/POP | f) Metromedia to SWB
\$44/POP | k) MCCA to BS (2nd)
\$95/POP |
| b) Charisma to McCaw
\$23/POP | g) Detroit to Pactel
\$44/POP | l) Amcell to Comcast
\$125/POP |
| c) Maxwell to McCaw
\$25/POP | h) Norfolk to Centel
\$77/POP | m) Portsmouth NH to Vanguard
\$136/POP |
| d) San Diego to U.S. West
\$25/POP | i) Miami to McCaw
\$79/POP | n) McCaw to BT (22%)
\$136/POP |
| e) MCCA to BS (1st)
\$26/POP | j) United to Centel
\$93/POP | |

Figure 1. MSA Cellular License Values: 1985-88

the almost monotonic increase in their values from 1985 through 1988. During this period, cellular telephone business prospects became progressively brighter due to larger than anticipated decreases in cellular telephone handset prices, larger than anticipated penetration in markets already served, and rising expectations of improved digital technology.⁸ Prices of cellular telephone stocks increased 683% from their October 1987 low through May 1989 [17, May 23, 1989, p. 1].

The rapid rise in license prices ended in mid-1989. Price/pop for MSA licenses hit an average of \$177 by spring 1989 [17, April 28, 1989]. It has since maintained this level, averaging \$189 for the 75 transactions which occurred during 1991 [17, Jan. 21, 1992, p. 4]. These end-points, however, mask much variance; prices actually peaked in the summer of 1989, crashed during the first half of 1990 (losing about half their value), and recovered to their previous levels

8. On February 28, 1989, a leading industry newsletter noted the following reappraisal: "We have raised our subscriber projections for the cellular industry by a whopping 4 mil. customers in five years and 12 mil. customers in 10 yrs. We noted last fall in our first estimates . . . that cellular's infancy would require visiting our forecast frequently. What happened in six months that would change our estimates to reflect such an increase in cellular usage? . . . Prices of portable and mobile phones . . . have continued to plummet, the reality of pocket phones has moved to within inches and the advantages and economics of digital have excited the industry . . . Premium services such as voice mail and wide area calling have sold well and have increased cellular talk time to boot. Encouraged by these developments, carriers are confidently aiming at higher market penetrations sooner. And, putting their money where their budgets are, they are buying pops on that basis too" [17, 2].

early in 1991 [7, Spring 1991, p. 49]. Asset values in this emerging industry were proving very elastic with respect to both macro conditions and evolving information about demands and costs.

What value would a rational investor have attached to a randomly drawn license, given the information available when deciding on entry? At the time of MSA lottery rounds 121–305 (February–May, 1986), MSA licenses were changing hands at prices in excess of \$20/pop (Figure 1). We thus use \$20 as a conservative estimate of the value of these markets.⁹ The dramatic rise in prices after the lotteries is interesting in itself, but of little help for explaining the ex ante behavior of participants.

Market analysts believe that RSA licenses are on average less valuable than MSA licenses. Rural areas generally produce lower revenues because of their lower population densities, lower business demands, and shorter auto commute times. Because no RSA licenses had been assigned prior to the lotteries for them, no resale prices were available for observation by entrants. In lieu of market price, we use Kidder, Peabody's [1] September 29, 1988 prospective estimate of a mean RSA license value of \$20/pop.¹⁰ Since the same Kidder analysis set a value of \$70/pop for MSA licenses and such values appeared conservative in September 1988 (Figure 1), we view their RSA figure as a reasonable lower bound.¹¹

The trend in RSA license values after September 1988 was similar to that seen in the MSA market. The first trades occurred in July and August 1989, at prices ranging from \$65/pop to \$120/pop.¹² In December 1989 *Forbes* reported that "rural cellular licenses are changing hands at prices that work out to about \$85 a pop on average" [26]. Hence, the RSA market began trading at a level far above what the market analysts had predicted during the lottery entry period.¹³ The average value of the 238 RSA licenses traded in 1991 was \$61/pop [17, Jan. 21, 1992, p. 4].

Costs of Lottery Entry.

In 1985, the FCC estimated the cost of preparing a lottery entry for MSA Markets 91–120 at \$3,500 per market, inclusive of attorneys' fees and labor inputs [18]. We use this figure for MSA lotteries. It is an upper bound, since costs fell dramatically as application mills prepared an increasing fraction of entries in later rounds. As noted above, these firms filled out forms and arranged for technical qualifications to be in order, supplying information cheaply and exploiting economies in processing [6; 9; 26].¹⁴

9. We exclude MSA Markets 91–120 from this analysis for two reasons: First, there was some confusion regarding the changeover to a lottery described in note 6 above. Second, since no licenses had been traded as of July 1984, there are no data with which to estimate rents at the time the competition for these markets took place.

10. This is only coincidentally equal to our 1986 MSA estimate. The Congressional Budget Office has cited the Kidder figure in policy discussions [4]. It was also featured in a major application mill's detailed outline of the business opportunity in license lotteries [24].

11. Indeed, it proved conservative. Donaldson, Lufkin, and Jenrette [7] estimated RSA values of \$40/pop in May 1989, \$80/pop in Fall 1989, \$80/pop in Spring 1990, and \$48/pop in Winter 1990–91.

12. These trades included Yuma, Ariz. (\$85/pop), Clallam, Wash. ("over \$120"/pop), Kauai, Ha. (\$65/pop), Hawaii, Ha. (\$100/pop), and Grays Harbor, Wash. ("over \$85/pop" [17, Aug. 31, 1989].

13. We cite these figures to emphasize the ex post conservatism of our assumptions. We wish to make it clear that we are not using post-lottery price data to estimate ex ante market values. Rather, we rely wholly on transactions prices for MSAs extant at lottery entry dates, and on Kidder Peabody's [1] pre-RSA lottery valuation. We do not assume that lottery entrants have any ability to forecast future prices.

14. Romulus's legal agreement with lottery entrants stated that "Romulus shall prepare for Applicant an Application for each RSA ordered by Applicant, which shall include all information required by the FCC for filing an initial Application, including all engineering, engineering forms required under the FCC reports and orders, rules, regulations, technical memoranda, releases, and other guidelines required by the Commission." [A copy of one executed agreement is on file with the authors.]

Table III. Entry Costs, Rents, and Dissipation Ratios

Round	Entries	Costs ($\times 1,000$)	Rents ($\times 1,000$)	Diss. Ratio
MSA 121-135	8,007	28,025	82,680	0.34
MSA 136-150	7,436	26,026	80,340	0.32
MSA 151-165	6,367	22,285	69,240	0.32
MSA 166-180	8,471	29,649	58,100	0.51
MSA 181-240	25,018	87,563	180,000	0.49
MSA 241-305	37,650	131,775	140,800	0.94
RSA #2	8,859	5,776	28,160	0.21
RSA #5	10,977	7,157	42,540	0.17
RSA #10	13,155	8,577	74,860	0.11
RSA #11	13,914	9,072	54,820	0.17
RSA #17	17,170	11,195	73,980	0.15
RSA #20	17,006	11,088	65,940	0.17
RSA #22	18,144	11,830	75,720	0.16

For the RSA rounds, we use the cost of purchasing an entry from a major application mill. Romulus Engineering of San Francisco prepared over 52,000 of the approximately 280,000 RSA lottery applications, the most of any supplier. As of June 1988, just prior to the opening rounds, Romulus would construct a 422 market application (i.e., one lottery ticket for each market)¹⁵ for \$275,000, or \$652 per market, inclusive of a \$200 FCC filing fee per market.¹⁶ Partnerships routinely purchased such blanket applications.

The application fee can be seen as the opportunity cost of bringing those unknowledgeable about the telecommunications industry into the lottery. Indeed, industry insiders complained about the application mills precisely because of this. In essence, while the lottery gamble was a business proposition that would not, perhaps, be sold at shopping malls, the opportunity to enter was sold as a turnkey proposition. No resources, apart from information and paperwork costs, were needed to accompany the mill-prepared applications. Accordingly, we believe that Romulus's \$652 charge is a reasonable estimate of the per-market cost of entering the RSA lotteries for a marginal applicant.¹⁷

V. Dissipation Ratios

The above data allow us to compare rent-seeking expenditures, E , with the market value of rights won, R , to estimate a dissipation ratio, $\delta = E/R$. Free entry and unbiasedness of the lottery suggest a null hypothesis of full dissipation, $\delta = 1$. Table III displays dissipation ratios, calculated by combining the above value and cost data with application and population data from Tables I and II.

15. Six of the 428 RSA markets were excluded in the belief that they were noneconomic.

16. This cost is within the range cited in popular articles on the subject. Davis [6] gives the MSA application mill cost as \$500 to \$5,000 per market. One individual is cited as spending \$40,000 to file applications in 140 markets at \$286 per market. Meeks [19], in presenting a wildly pessimistic view of the RSA license lottery, claimed entry costs of between \$400 and \$5,000 per market, with a \$1,500 average. More plausibly, Ellen [9] identified "application engineering operations where word processors churn out customized FCC forms and supplementary materials for a quick \$250 per application."

17. The FCC-imposed \$200 entry fee is a transfer to the federal government from lottery players and is not a social cost. We, however, include it as a subjective rent-seeking expense. It appears that virtually all other expenditures are pure social cost.

Expenditures are below costs in every case. The final MSA lottery is the only instance where δ approaches unity, and it probably reflects the growing role of application mills in producing entries at costs below those estimated by the FCC.¹⁸

The subsequent steadiness of the dissipation ratios in the RSA lotteries provides support for this view. This under-entry is of particular note because application mills badly underestimated the likely numbers of applicants. In the RSA markets, the projections of the largest application mill were low by a factor of 2.¹⁹ It is clear that information about the existence of sizable rents was filtering to investors, and that the supply of applications was somewhat elastic. The sales pitch based on a low forecast of this elasticity should by itself have acted as a force to counter any tendency towards less-than-full dissipation. Yet even with such optimistic odds, the license lotteries were undersubscribed.

It is possible that our focus on the costs of an application prepared by a consulting firm misses some relevant costs. Applicants must become informed about the existence of the lotteries, must read and sign significant paperwork, and must be available for post-lottery partnership meetings in the event they win. While such costs are difficult to quantify, there is no reason to believe that they dominate our assumed \$652 cost of entry. Once informed about the lotteries, an individual applicant bears no new information costs if he chooses to enter more than one of them, although he does bear the costs associated with extra applications. Even if the assumed preparation and filing costs were doubled, dissipation ratios would be less than 0.4 in all but one RSA lottery. (In two MSA lotteries, such a doubling would lead to $\delta > 1$.)

VI. Conclusions

One cannot *a priori* measure rent dissipation without going into the microfoundations of the particular situation . . . Only a careful description of the rent-seeking game can allow us to give an order of magnitude for this [dissipation] fraction. As the rent-seeking games vary considerably in practice, we are obliged to analyze the issue case by case [28, 77–78].

The FCC's cellular telephone license lotteries are useful sources of data with which to measure waste due to rent-seeking. The data include market prices for both resold licenses and for applications. In these lotteries, dissipation was far from total, despite the theoretical expectation that open entry and unbiasedness would lead to full dissipation. It appears that a marginal rent-seeker could have purchased a ticket with positive expected profits, even without possessing specific capital or inside information as traditionally defined. The length of time during which such positive profit opportunities remained available is striking.

It is difficult to explain the persistence of positive expected profits using transactions costs. The marginal rent-seeker may in fact have faced high information costs in discerning the returns available in a new and unfamiliar investment market. These high costs can be adduced from the disdain generally shown by traditional Wall Street analysts.²⁰ The application mill market was

18. The *Wall Street Journal* reported much lower application costs than the FCC estimate during these rounds (\$286 versus \$3,500 per entry for "franchises in 140 small cities" [6]).

19. Romulus Engineering was "projecting that there would be 250 average applications filed per market," based on "applications filed for MSAs 151–305 for which engineering fees were actually paid" [3]. The number of applicants per RSA market turned out to be more than twice this projection.

20. *Forbes's* very hostile article ("Cellular Suckers") purported to show that lottery entrants were being fleeced by fly-by-night application mills [19].

underdeveloped and imperfect. Some operations were shut down as fraudulent by the courts and the Federal Trade Commission [6], and at least one mill operator was convicted of fraud [8]. Advertising by application mills may have both informed investors of the opportunity and misstated the likely returns.²¹ Even winning applicants bore the risk of a challenge. In the RSA lotteries about 40 winning tickets were challenged, and 13 were denied and subsequently redrawn [17, Dec. 29, 1989, p. 9; Mar. 20, 1990, p. 11]. Presumably, better information about the market arises in the long run. In the short run, those with knowledge about rent-seeking opportunities receive positive returns. In the case at hand, insiders attempted to use their information strategically to deter the entry of new applicants.²² They also endorsed those barriers to applicants that existed.²³

Conventional wisdom among industry insiders was that the FCC had done three things to limit applications: (1) It instituted a \$200 per market application fee; (2) It instituted stricter rules regarding proof of financial qualifications; and (3) It eliminated pooling of applications. The first is straightforward. In fact, the application fee was the FCC's attempt to (partially) skirt Congress's ban on auctions.²⁴ Since the application fee is a transfer rather than a social cost, setting it so that just one application per market was received would have eliminated rent-seeking altogether. The financial barrier posed by the second requirement was in one way mitigated by the efforts of equipment vendors and application mills. As noted above, applicants received letters of credit from vendors in exchange for exclusive dealing agreements. In another way, finance may have been an important constraint. To protect the lottery investments of their clients against unforeseen changes in FCC policy, some application mills began imposing financial requirements of their own.²⁵

Prohibiting individuals from mitigating risk by pooling may have discouraged some applicants, even where entry involved relatively small sums and chances were spread over 428 markets.²⁶ In the lotteries for MSAs 31 through 90, mergers of 100 percent of the applicants occurred in all but three of the markets.²⁷ In later markets with far larger numbers of entrants, mergers were commonplace but lottery draws were still necessary because of holdouts. According to promotional materials for General Cellular Corporation, prohibiting these "alliances" among RSA

21. Advertising appeared in such media as the Financial News Network, *USA Today*, and the *Wall Street Journal*. One application mill retained Mike Douglas to tout it as the "investment of the decade . . . possibly of the century" [9].

22. Romulus Engineering, for example, declined to publicly answer the economic miscalculations which appeared in "Cellular Suckers" [19]. Romulus informed its clients that "we want *Forbes* readers to continue to believe what they read, so that as many potential applicants as possible will be discouraged from filing applications for cellular telephone authorization" [3]. Romulus [2; 3] was not taking new clients at this time, so that further diffusion of information about the lotteries would have adversely affected its clients without directly resulting in new business.

23. "[O]rganizations such as Telocator Network of America [made up of existing cellular licensees] had supported the financial requirement for RSA applications as one way of reducing speculative applications" [24].

24. The agency had requested permission to employ auctions instead of lotteries, but Congress turned it down [12; 13].

25. For example, Romulus required bank letters (or other proof) certifying that partnerships possessed the requisite \$750,000 in liquid assets to create such a cellular operation themselves. Since the typical partnership application had 40 shares, each shareholder only needed to show \$18,750 in liquid assets. The FCC rejected many MSA applications on financial grounds, but not those of Romulus's clients [3]. That firm also rationalized its financial requirement by noting that "there is no guarantee that the Commission will not, at the eleventh hour, make some additional rule changes which adversely impact applicants" [2, 1, 2].

26. A \$5,500 share could typically be purchased in the Romulus partnerships.

27. Very few applications had been received in markets 31 through 90 because, as noted above, the Commission did not formally announce that a lottery would be used until it allocated market 91. Prior to that, applicants could expect that comparative hearings would determine the winner.

applicants was the major factor leading to "drastically lower" applications for RSAs relative to MSAs. While quantitative evidence is not available, it appears that insiders can successfully protect some of their rents, even in lotteries such as this one, where they seem most vulnerable to erosion by entry.

The degree of inelasticity in the supply of rent-seekers is anomalous. It appears, as Tirole suggests, that such dissipation ratios are highly sensitive to the particular rules that define the competition for rents. Rent-seeking theory itself is notably silent about the possibility that insiders can erect barriers to entry of new seekers. As industrial organization theorists have discerned [31], such barriers may increase efficiency, at least in the short run.

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