Contests for Revenue Share∗

Uriel Feige† Ron Lavi‡ Moshe Tennenholtz§

We analyze a model where budget-constrained buyers need to partition their budgets among multiple capacity-constrained sellers. Each seller designs his allocation rule endogenously, as part of a two-stage game: First, sellers simultaneously design allocation rules. Second, given these rules, buyers simultaneously decide how to partition their budgets among the different sellers. The goal of each seller is to obtain the largest possible revenue share, i.e., to maximize the sum of budgets she receives. Our main interest is in understanding what types of allocation rules maximize their designer’s revenue share. This setting is related to literature on capacity-constrained competition and the Bertrand paradox, search with costs, and the recently expanding literature on antitrust economics, on top of the obvious connection to the two frameworks of contest design and of Blotto games. More details are given below.

Our particular interest in this setting stems from observations regarding the market for Internet search advertising. This is now a multi-billion dollar market, where thousands of advertisers post hundreds of millions of ads every day. Quite interestingly, market shares differ significantly from revenue shares in this market. In 2012, for example, Google had a market share of about 65% and a revenue share of about 75%, while Microsoft (Bing) had a market share of about 20% but a revenue share of less than 10% which is less than half of its market share.

There could be a variety of reasons for differences in revenue shares. For example, it might be that the “items” are valued differently, and this can be checked empirically. Another reason could be that sellers can somehow leverage their market share to obtain a disproportionally higher revenue share. In this paper we focus on this latter hypothesis, and study the connection between market shares and revenue shares in cases where all items are in fact identical.

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†Weizmann Institute of Science. Email: uriel.feige@weizmann.ac.il.
‡Technion – Israel Institute of Technology. Email: ronlavi@ie.technion.ac.il.
§Technion – Israel Institute of Technology. Email: moshet@ie.technion.ac.il.

1The “items” in this market are ad slots on users’ search results pages. The “market share” of a certain search engine is its number of available ad slots divided by the total number of available ad slots of all search engines. Its “revenue share” is the budget spent on ads in this search engine relative to the budgets spent on all search ads. In other industries, what we refer to as a market share is also commonly termed unit market share or volume market share, and what we refer to as revenue share is also commonly termed dollar market share or value market share.
3For example, an ad slot for a search “pizza in NYC” on Google might provide a different value than the same ad slot for the same search on Bing. We are not aware of any empirical investigation of this.
Our theoretical abstraction captures markets with three main properties. First, each seller has a fixed number of goods to sell. For example, increasing the market share of a search engine requires increasing the number of users of the search engine. This is a long-term technological effort, not a short-term strategic production decision. Thus, in our model, a firm’s market share is exogenously fixed, and firms aim to maximize their revenue shares given their fixed market shares. Second, the sales tools that we consider are quite general, and can capture various methods like bundling and non-linear pricing, exclusive contracts, quantity discounts, etc., in addition to standard linear pricing. In our model, a seller has a large and realistic strategy space to choose from, and a large strategy space of the opponent to defend against. Third, we are interested to focus attention on the supply side and study asymmetries, even extreme, among the sellers, while assuming the simpler case of identical buyers on the demand side. An important property of the buyers that we do capture is their budget-constraints. This is a significant characteristic of Internet advertisers that influences most of their actions and considerations.

Previous literature studies revenue maximization (effort maximization) in a single contest, and various settings of multiple contests (Blotto games) with exogenously fixed contest success functions. The issue of competing contests that are endogenously designed to maximize revenue shares is rarely touched upon. Other related literature on capacity-constrained competition mostly focuses on standard linear pricing in contrast to contests that capture a much wider variety of sales tools. The recently expanding literature on antitrust economics does study various pricing tools like exclusivity contracts but focuses mainly on how to increase market shares endogenously. The issue of market shares versus revenue shares is not dealt with in this literature. The full paper provides many references and a detailed discussion.

On top of our original motivation, the study of contests and Blotto games stems from numerous economic applications, which are also relevant to our results. Examples include situations of rent-seeking and lobbying (Tullock, 2001) where instead of treating the regulatory committee as a single entity we study the case that the committee is composed of several distinct members, multiple simultaneous R&D races each aiming to attract the most research efforts (generalizing a single R&D race as in Che and Gale (2003)), and many other situations of competing all-pay auctions.

Our first result identifies a very simple contest that provides a strong safety level to each seller that uses it. If a specific seller, $i$, chooses this contest, then for any choice of contests of the other sellers, the revenue share of seller $i$ in any pure or mixed NE of the resulting Blotto game will be at least her market share minus $\frac{1}{n}$, where $n$ is the number of buyers. This also implies that $i$’s revenue share in any subgame perfect equilibrium will be at least her market share minus $\frac{1}{n}$. Thus, if $\frac{1}{n}$ is negligible relative to the market share of a certain seller, she can obtain a revenue share very close to her market share in all possible (pure as well as mixed) Nash equilibria outcomes.

However, cases where the market share of a seller is comparable to $\frac{1}{n}$ are important. In particular, in our motivating scenario of online advertising, the number of buyers (advertisers) in a given
market is usually small, as advertisers target very specific user features. For example, there could be a market for advertisers who target users that searched “best pizza in NYC” and a different market for advertisers who target users that searched “SFO to JFK flights”. These are two separate markets. The thousands of Internet advertisers target such specialized markets, resulting in very few advertisers per market. In such cases, the above result no longer provides a tight connection between market shares and revenue shares. In fact, the full paper shows examples where an extremely large seller can obtain a revenue share of 100%, effectively driving his much smaller competitor out of the market. Thus, our results demonstrate a sharp contrast between the case of near-symmetric supply sizes and the case of extremely-asymmetric supply sizes. In the former case, all sellers are able to obtain revenue shares almost the same as their market shares, in all equilibria outcomes. In the latter case, a large seller may decrease the revenue share of her significantly smaller opponent substantially below her market share.

What tools are most useful in our theoretical framework for a very large seller competing against a very small seller? Does the answer vary according to the extent of differences in supply sizes? How to quantify “very large” vs. “very small”? These questions turn out quite challenging and we leave the full characterization of the powers of a large seller, as the market share of her smaller opponent gradually increases from $\frac{1}{n}$ to $\frac{1}{2}$, for future research. In this paper we make a first step towards answering these questions by characterizing the case when the large seller has a market share of $1 - \frac{1}{n}$ and the small seller has a market share of $\frac{1}{n}$. We believe that the analysis of this case is quite revealing. To begin with, we prove that any monotone contest (where a bidder that increases his bid never receives a strictly smaller prize) used by the large seller cannot eliminate the possibility that the small seller will end up with a revenue share close to her market share in some equilibria outcomes. Despite this, our analysis of this case shows that the revenue share of the small seller will be significantly lower than her market share in all subgame perfect equilibria. To achieve this, the large seller relies on a certain non-monotonicity, alongside exclusivity, to overcome the limitations of monotone contests. Broadly speaking, this non-monotonicity is conceptually related to situations where a seller offers attractive deals to her rival’s customers.

The fact that such non-monotonicity is helpful may seem to contradict an intuitive rule of thumb, phrased by McAfee (2005) as follows: “If you offer discounts to your rival’s customers, it will cause your rival to fight to hold onto his customers, and he will do this by cutting prices. He will then take some of your customers away from you. In the end, you will get some of his customers, he will get some of yours, and you will both be selling at lower prices. If, on the other hand, you reward loyalty by offering a better deal to customers that have been with you for a while, you make your customers expensive to poach. Your rivals are discouraged from poaching them, and tend to respond in kind.” We view our analysis as suggesting that this argument (and in particular the optimality of the stability that it suggests) depends on the underlying details of the market more than what initially may seem. We further discuss this in the full paper.
References

