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The impact of competition on prices with numerous firms ☆

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Abstract

This paper describes a mechanism that sustains high markups, even in markets with homogenous goods and many competing firms. We show that random utility models with idiosyncratic taste shocks driven by standard noise distributions produce, in large markets, robustly high equilibrium markups that are insensitive to the degree of competition. For example, with Gaussian noise and n firms, markups are asymptotically proportional to $1/\sqrt{\ln n}$; consequently, a hundred-fold increase in n, from 10 to 1000 competing firms, only

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halves the equilibrium markup. The elasticity of the markup with respect to n asymptotically equals the distribution's tail exponent from extreme value theory. Only noise distributions with very thin tails have negative asymptotic markup elasticities.

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1. Introduction

This paper studies the impact of competition on prices in large markets. It focuses on random utility models in a setting of monopolistic competition, where consumer choice is influenced by firm-specific 'noise' shocks (e.g., Luce, 1959; McFadden, 1981; Anderson et al., 1992). We derive a tractable general expression for equilibrium markups in symmetric random utility models with many competing firms.[1] This expression allows us to characterize the impact of different noise distributions on competitive outcomes. We find that high mark-ups are a robust feature of such models. Specifically, random utility models with standard (thin-tailed) noise distributions produce high markups, even with homogenous goods *and* many competing firms; increased competition in large markets only weakly drives down equilibrium mark-ups.

Explicit expressions for equilibrium markups in random-utility settings have previously been derived only for some specific distributions of noise. In these special cases, equilibrium markups turn out to be either completely unresponsive or extremely responsive to competition. Consider the Perloff and Salop (1985) random utility model. If consumer noise has an exponential density or a logit (i.e., Gumbel) density, then markups converge to a strictly positive value as the number of competing firms n goes to infinity: asymptotic markups have zero elasticity with respect to n (Perloff and Salop, 1985; Anderson et al., 1992). In contrast, when noise is uniformly distributed, markups are proportional to $1/n$: markups have unit elasticity and thus decrease strongly with n (Perloff and Salop, 1985).

These special cases — exponential, logit, and uniform — are appealing for their analytic tractability rather than their realism. Relative to the Gaussian distribution, the exponential and logit cases have relatively fat tails while the uniform case has no tails. We seek to understand how prices respond to competition in the general case; in particular, for empirically realistic noise distributions.

Applying tools from Extreme Value Theory (EVT), we show that markups are asymptotically proportional to $1/\left(nf\left[F^{-1}\left(1-1/n\right)\right]\right)$, where F is the cumulative distribution function (CDF) of the noise and $f = F'$ is the corresponding density function. This expression is easy to compute. Further, it highlights a simple 'limit pricing' logic for the determination of equilibrium markups. Heuristically, each firm sets prices by conditioning on receiving the best random shock amongst all competing firms, then choosing a markup corresponding to the expected difference

[1] The restriction to the symmetric-firm case maintains tractability. This precludes us from addressing instances of asymmetries; see the discussions in Bajari and Benkard (2003) and Armstrong (2016). Consequently, our propositions can be viewed as only suggestive of what happens in the richer structural models that are most frequently used in empirical industrial organization.