ARE ON-DEMAND PLATFORMS WINNER-TAKE-ALL MARKETS?

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INTRODUCTION

Digital on-demand platforms delivering services such as transportation (e.g. Uber and Lyft), food delivery (e.g. Instacart and Grubhub) and personal services (e.g. TaskRabbit) have surged in popularity in recent years. The ubiquity of smart hand-held devices has enabled largely digital platform companies to bring together customers seeking the time-sensitive delivery of a service, with independent agents able to provide that service (Taylor, 2018). It is frequently observed that significant network externalities exist in these platforms, because more providers make the platform more attractive to customers, and more customers make the platform more attractive to service providers, attracting enormous amounts of entrepreneurial activity and venture capital as a result. Can an on-demand platform capture a market by investing heavily to attract providers and customers, exploiting these network externalities to build an unassailable market position? Will digital platforms produce winner-take-all outcomes in these growing sectors of economy?

It has long been recognized that markets in which network externalities exist can give rise to winner-take-all outcomes (Katz & Shapiro, 1986; Arthur, 1989). These network externalities can be especially strong in two-sided markets, where value is created by bringing parties together who benefit from each other’s participation (Rochet & Tirole, 2003). Whether a market tends towards winner-take-all outcomes has important implications for firm strategy and regulatory policy. The expectation of winner-take-all outcomes often motivates aggressive investments in ‘Get-Big-Fast’ strategies (Sterman, Henderson, Beinhocker, & Newman, 2007), and raises fears of monopoly power. The existence of network externalities, however, is not sufficient for winner-take-all outcomes to eventuate. Prior research has shown that multiple platforms can co-exist in two distinct situations: 1) when platforms differentiate themselves to serve competing user needs, and 2) when switching costs are low (e.g. when ‘multi-homing’—concurrent use of multiple platforms—is possible) and platform-specific shocks (from luck to managerial skill or incompetence) are strong enough to disrupt the dominance of market leader.

Are winner-take-all outcomes a fait accompli in the absence of heterogeneous customer tastes and strong platform-specific shocks? Many start-ups do not appear to believe so, entering digital platform markets already occupied by large players. For example, in ride-hailing markets, there is little heterogeneity in customer taste, and given the distributed nature of supply platform-specific shocks are arguably small. Nevertheless, several players including VIA, Gett, Juno, and Arro entered this market in New York City after it was already contended for by two large players, Uber and Lyft. Should such entries be written off as entrepreneurial over-optimism (McCarthy, Schoorman, & Cooper, 1993; Dosi & Lovallo, 1997) in an otherwise winner-take-all market, or are digital platform markets able to sustain multiple players?
In this paper, we argue that the behavioral learning (March, 1991; Posen & Levinthal, 2012; Puranam, Stieglitz, Osman, & Pillutla, 2015; Denrell & Le Mens, 2017) of customers about platforms provides a potentially sufficient mechanism for multi-platform equilibria to result, even with homogeneous consumers and in the absence of platform-specific shocks. Learning is particularly salient in on-demand platform markets, in contrast to traditional platform markets, because switching costs for customers and even providers are low, and multi-homing is common. Users (the term we use to refer to both providers and customers) have to regularly choose between competing platforms and receive noisy signals about the quality of the underlying platform. That is, they should learn about the utility of alternative platforms through repeated trials, akin to a multi-armed bandit problem (Gittins, Glazebrook, & Weber, 2011; Posen & Levinthal, 2012; Stieglitz, Knudsen, & Becker, 2016). This learning from experience is at the heart of two mechanisms we explore. First, users may need to explore alternative options to learn about the utility of those options, averaging out noise in measuring the inherent quality of different platforms through multiple trials. Second, when market-wide shocks (e.g. due to mismatches between supply and demand, common in on-demand markets) erode the quality of all players, more users negatively update their impressions of platforms with larger market shares. We show that these two mechanisms create balancing feedbacks that can offset the network externalities inherent in on-demand platform markets, promoting outcomes with co-existing platforms.

The resulting markets are more likely to accommodate multiple players, and include frequent replacement of the larger player. While users may not realize the full benefits of network effects when no platform is dominant, these dynamics may allay concerns about monopoly power in many on-demand platform markets. Firm strategy is also affected, with Get-Big-Fast approaches becoming less attractive, and increased focus on differentiating features and quality. Late entrants may be successful in joining platform markets, particularly if they monitor the market for windows of opportunity where users are switching away from the dominant platform due to market-wide or platform-specific shocks.

MODEL

We develop a multi-armed bandit model of a platform market focusing on how users learn about competing platforms, and how their choices create the competitive dynamics in the market. For concreteness, consider an on-demand platform market such as ride-hailing services. Multiple (in our base-case two) competing firms are offering their services in this market, and users are choosing between the two, learning about the utility of each service. Our interest is in understanding the dynamics of the market shares ($S$) for the two players. Our model consists of three interconnected parts: user choice (Eq. 1), utility (Eq. 2), and learning (Eq. 3).

\[
Pr(p) = \frac{\exp(EU_p/\lambda)}{\sum_{i \in p} \exp(EU_i/\lambda)} 
\]

\[
U_p = f(S_p) \ast N(\sigma) 
\]

\[
EU_p(t) = (1 - w_p), EU_p(t-1) + w_p U_p(t) \text{ for the chosen platform} 
\]

The choice and learning functions follow standard behavioral formulations in the multi-armed bandit tradition while the utility function captures the network effects key to platform
markets. Users go through this choice process repeatedly, where at a given period each user makes her choices independent of the other users, and updates her expected utility accordingly. Market shares emerge as a collective outcome of these user choices.

**ANALYSIS**

We build intuition about the key mechanisms by conducting four simulation experiments. We begin by examining the dynamics of a market in which agents are very sensitive to differences in utility among different options ($\lambda = 0.01$) and no market-wide shocks to utility are present ($\sigma = 0$). Given our model’s basic assumptions (homogenous customers; information availability; lack of platform or sample-specific shocks) this setting closely approximates the predictions of the standard theory (Figure 1-A). The two competing platforms start from identical market shares (50%), such that customers are initially indifferent between the two platforms. While in expectation both platforms are equality likely to be adopted, platform 2 (solid line) gets slightly more users in the first period by chance, and thus benefits from slightly higher utility subsequently. Users slowly adapt their expectations to these results (see equation 2) and for the first few periods neither platform has the upper hand (in fact there is a temporary reversal of market shares in period 10). However, platform 2 has accumulated enough advantage in the perception of users by the 11th period that they increasingly converge to this option, enhancing its utility, and sealing the fate of the market in favor of this alternative: a winner-take-all market emerges.

In our second experiment (Figure 1-B) we allow agents to explore more ($\lambda = 0.25$). Here, users are still sensitive to expected utility, but are willing to occasionally take risks and try the platform they deem less attractive. The market dynamics unfold more slowly as a result, but the basic story remains the same. Early, random, differences in market share lead to utility differences between the two platforms, which are slowly perceived by the users, increasing the frequency of choices of the initially more attractive platform (platform 1; dashed line). By the 50th period, the market is strongly favoring this platform, and the second platform finds no further opportunities to recover. A subtler change from the standard prediction is visible in the final market shares of the two platforms: the market may be better characterized as ‘winner-take-most’ rather than ‘winner-take-all’, because the exploratory moves sustain a small share (4%) for the second platform.

Two additional experiments (Figure 1, panels C and D) explore the impact of market-wide utility shocks on the competitive dynamics. These shocks may result from any factor that throws the supply and demand sides out of balance. With moderate shocks (Panel C; $\sigma = 0.5$), we see a qualitatively different market dynamic in which the winner-take-all market gives way to two viable firms in continuous competition, with market leadership occasionally changing hands. Outside of these periods, one player is always slightly larger than the other, a size distribution that is not expected in either winner-take-all or fully competitive markets. That distribution changes to a 50-50 split as we significantly increase the magnitude of market-wide negative shocks (panel D; $\sigma = 1$).
In the full paper we make various elaborations on this analysis, exploring the effect of factors including learning rates, market size, the strength of network effects and the number of competing platforms, finding our main results to be robust across plausible model parameterizations.

**DISCUSSION**

Our findings provide guidance on the opportunities and challenges that firms (including entrepreneurs and venture capitalists) face when competing in on-demand markets. First, we find that while the ‘Get Big Fast’ strategy of rapidly scaling-up an on-demand platform to capture the market and lock-out competitors is an important strategic possibility, it cannot be relied upon in many settings. We show that market share advantage can be eroded not only as a result of mistakes made by the dominant platform, but also due to the natural exploration and learning of customers and market-wide shocks. Attempts to achieve market shares beyond those inherent in the equilibria created by the learning dynamics are destined to be successful only temporarily. At any point in time, some number of users are in the process of learning about the utility of competing platforms. It may further be inevitable that the dominant platform occasionally cedes the dominant market position as a result of market-wide shocks. To the extent that larger firms can buffer their operations against these shocks, they can push up the viable market share. However, attempts to swim against the current and reach shares beyond the inherent equilibrium may be costly and ultimately unsustainable.

What then are the leverage points that firms can exploit to become the dominant on-demand platform? Key is to minimize the impact of negative shocks that might motivate platform users to explore and switch. First, while negative shocks can result from shortages of supply or shortages of demand, shortages of supply are likely to be particularly costly, because customers are often more sensitive to delays or lack of service. Maintaining a more-than-adequate supply of providers, even paying them to be available regardless of the existence of demand, may reduce the impact of costly market-wide shocks. Second, measures that increase the stickiness of platforms such as loyalty programs and customized service will reduce the attractiveness of exploring alternative platforms even after a negative shock has occurred. Third, platform operators can attempt to remediate the effect of negative shocks for users. Doing so should encourage continued use of the same platform, such as providing a voucher for a future transaction, rather than simply refunding the user for the unpleasant transaction. On the other hand, while larger players attempt to reduce the impact of periods with market-wide shocks, those periods are exactly when a window of opportunity opens for entrants, who may be able to catch up by capitalizing on the switching of disillusioned users of larger players. Finally, platforms should be aware that the market may never offer any player the luxury of dominance and large margins that come with it. Playing for the long-run will entail the continuous allocation of effort to improving quality, recruiting and maintaining customers, and contending with the competitive moves of other platforms.

For regulators, our findings suggest that the need for monopoly regulation in on-demand markets may be reduced when compared with traditional platform markets. Winner-take-all and winner-take-most markets are possible when users have a low willingness to explore and when the magnitude of market shocks is small. Otherwise, even starting with a dominant market position, platforms have a hard time sustaining their shares in the presence of competition and user exploration. This is not to suggest that regulation may not be needed. Some settings may be
prone to risk of monopoly because exploration and different types of shocks are limited or switching costs are high. For example, many on-demand platforms have an intimate understanding of their users’ real-world locations, behaviors and preferences, revealed by their repeated platform usage decisions. To the extent that the platform can leverage a user’s accumulated data to increase her switching costs, regulatory intervention may be needed to reduce those costs, e.g. by restoring to users the ownership of their data. Other relevant regulatory safeguards to consider may relate to protection of the privacy of users of on-demand platforms. Our paper does not focus on exploring alternative regulations, but we hope it updates some priors on the likelihood of monopoly risks, the factors determining those risks, and leverage points available to moderate those risks.

REFERENCES ARE AVAILABLE FROM THE AUTHORS

Figure 1-Market shares of two competing platforms in four experiments with 100 customers. A) Very strong preferences for best known platform; no market shocks. B) Modest preference for best platform; no market shocks. C) Modest preference for best platform; modest market-wide shocks. D) Modest preference for best platform; strong market shocks.