

Invite Your Friend and You'll Move up in Line: Optimal Design of Referral Priority Programs

Many technology companies are breaking new ground today as they introduce sign-up waitlists for a limited release of their products to eager customers before a mass-market launch. Notable examples include Dropbox, a file-hosting service, Mailbox, an email inbox-management application, and Robinhood, a mobile application for commission-free stock trading. These companies have enjoyed such sensational success that they are forced to create sign-up waitlists to ensure that everyone has a fantastic, reliable experience. Today's apps and services are increasingly relying on massive cloud backends, which makes scaling capacity particularly challenging at the initial stage, so companies use waitlists as a buffer to clear technological hurdles based on feedback from real users. Thus, customer activation can only be done cautiously at a limited rate, which may cause nontrivial wait times for later arriving customers.

Recognizing this situation, some of these firms embrace a novel mechanism that allows customers to shorten their wait times and move up in line if they invite their friends to also sign up on the waitlist. For instance, Robinhood's confirmation email reads, ``Interested in priority access? Get early access by referring your friends. The more friends that join, the sooner you will get access." Robinhood is by no means alone. This referral scheme has enjoyed such widespread popularity that companies like Waitlisted.co---a third-party startup specialized in helping hundreds of client companies build waitlists---made it a standard built-in feature; more than 99% of Waitlisted.co's clients have integrated this scheme into their waitlists. Like Waitlisted.co, many other growth-hacking companies jump on the bandwagon and support customer referrals

on waitlists, such as Kickoff Labs, Maitre, Prefinery, just to name a few. We call this emerging business practice the *referral priority program*.

The ingenuity of the referral priority program is that it cleverly leverages customers' dislike of waiting to create an incentive for spreading positive word of mouth and acquiring new customers on behalf of the firm. Unlike the traditional referral reward program, which offers monetary compensation to motivate referrals, the referral priority program ``recruits" existing customers as sales agents without the firm incurring any explicit cost. However, the referral incentive in this setting is intricate because it is generated by the interactions among customers on the waitlist. A customer's spot in line is relative, and non-referring customers could move backwards when referring customers are granted priority access.

The growing adoption of the referral priority program combined with the intricate nature of customer incentives and system dynamics begs an important question: is this scheme truly effective? Our paper tackles this issue by carefully modeling customers' strategic joining and referral behavior. In doing so, we investigate the effectiveness of the program as a marketing tool for the firm (measured by system throughput, the rate of customer acquisition).

To model customer referrals on a waitlist, we consider a queueing game played by delay-sensitive customers. *Base customers* arrive to the queueing system (waitlist) spontaneously at a rate termed the *base market size*. Customers make both joining and referral decisions based on their rational beliefs of expected delays in different priority classes and the probability that a *referred customer* converts, i.e., joins the queue. Customers who make a successful referral join the priority class, and customers who do not refer or refer in vain are placed in a regular class.

We find that referrals are generated when the base market size is intermediate and the customer population sufficiently values the service. If the base market size is too small, the benefit of

gaining priority is too incremental to cover the cost of referrals; if the base market size is too large, despite customers' desire for priority, the conversion rate of referrals is low because referred customers are turned away by excessive congestion. In both cases, customers would rather not refer.

When referrals are generated, the sign-ups of referred customers *cannibalize* the demand of base customers: more base customers balk because their expected delay is prolonged by the presence of referred customers. Thus, how the total system throughput fares is unclear. If the base market size is intermediately small (but not small enough to completely discourage referrals), we show that the demand creation of referred customers is the primary force and the referral program is effective in enhancing the total system throughput. Nevertheless, if the base market size is intermediately large (but not large enough to deter referrals altogether), the demand cannibalization effect becomes so severe that the total system throughput will actually be *lower* than if the referral priority program is not used. The key driver to this result is that referrals make the arrival process more *bursty*, which, when the base market size is intermediately large, prolongs delay to such an extent that too many base customers are turned away, thereby jeopardizing the overall system throughput.

Our results have important managerial implications for firms that entertain the use of referral priority programs within their waitlists as a means to acquire new customers. In particular, we show that the referral priority program may hurt companies' system throughput. Thus, firms cannot be agnostic of their business environment when deciding whether to run the referral priority program, but must conduct serious market research to gauge the base market size, a key determinant of a referral priority program's success.