

Enhancing Effectiveness of Referral Programs by Promoting Better Matching: Evidence from Field Experiments

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Abstract

In this article, we propose that a firm can enhance the effectiveness of its referral program by promoting better matching between new customers acquired through the referral program and the firm. We develop three strategies aimed to promote better matching, including (1) offering current customers a gift before inviting them to refer friends, (2) notifying current customers about the value that the firm has created for them before inviting them to refer friends, and (3) rewarding referring customers based on the value of their referred customers. We empirically test the effectiveness of the three strategies by conducting two field experiments in collaboration with a leading Chinese online financial services firm. We find that on average all three strategies substantially enhanced the effectiveness of the focal referral program, which is measured for each current customer as the total value of his or her referred customers. We also find that the enhancement was primarily driven by the acquisition of referred customers of higher average value (i.e., those who matched better with the firm), suggesting that the strategies indeed worked by promoting better matching. Moreover, we find considerable heterogeneity in the impact of these strategies across current customers, and use such heterogeneity to explore the mechanisms through which these strategies led to better matching between referred customers and the firm. In particular, we find evidence suggesting that the gift strategy and the notification strategy promoted better matching by inducing reciprocity from current customers.

Keywords: referral programs, better matching, field experiments

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1 Introduction

Customer referral programs, in which a firm's existing customers are rewarded for bringing in new customers, have been widely used by firms for customer acquisition and have fueled the phenomenal growth of many companies, including Dropbox, Uber, and Airbnb. In the case of Dropbox, for instance, a current user receives 500 MB free storage space for each friend being invited to sign up for and install Dropbox. According to Drew Houston, Co-Founder and CEO of Dropbox, this referral program was largely responsible for the growth in Dropbox's user base from 100,000 registered users in September 2008 to more than 4 million in January 2010. Referral programs provide firms an attractive method to acquire new customers, as they are cost-effective to run and provide access to prospective customers that traditional marketing programs may not effectively reach (Berman 2016), and, most importantly, customers acquired through referral programs can be more valuable than customers acquired through other methods (Schmitt et al. 2011).

To explain the positive value differential between referred customers and nonreferred customers of a German bank, Schmitt et al. (2011) propose *better matching*, which refers to the phenomenon that referred customers match with the firm better than nonreferred customers do, as one possible mechanism through which benefits of referral programs are realized.¹ Better matching may operate through two distinct types of matching process: active matching and passive matching. Active matching involves referring customers' deliberate screening of their friends and selective matching of those who they think may be a good fit to the firm. On the other hand, passive matching is implied by homophily, as existing customers tend to refer people who are similar to themselves; since existing customers have an above-average chance of being a good match, referred customers are more likely to match well with the firm compared to nonreferred customers. This better matching

¹The other proposed mechanism is social enrichment, which refers to the phenomenon that the relationship between a referred customer and the firm is enriched by the presence of the referring customer.

mechanism is empirically identified by Van den Bulte et al. (2017), who leverage more comprehensive data from the same German bank to provide evidence that better matching between referred customers and the firm drives the former’s higher margins compared to nonreferred customers.²

In this article, we propose that the implication of better matching goes beyond the comparison between the average value of referred customers and that of nonreferred customers; in fact, it provides firms direct guidance on identifying strategies to enhance the effectiveness of referral programs, a key managerial challenge that they are eager to address given the prominent role of referral programs in new customer acquisition. Specifically, since a key determinant of the effectiveness of referral programs is the total value of referred customers, which is in turn largely impacted by the average value of referred customers, firms may consider designing and implementing strategies aimed to increase the average value of referred customers by promoting better matching.³ Better matching may be promoted by motivating active matching, i.e., motivating referring customers to exert greater effort to identify and refer good matches, or by facilitating passive matching, i.e., motivating a higher proportion of high-value existing customers to refer their friends who, by homophily, are more likely to be good matches than friends of low-value existing customers, or by a combination of both.

We propose three different strategies aimed to promote better matching and ultimately enhance the effectiveness of referral programs. The first strategy is to offer customers a gift (e.g., a coupon, a free sample, or a free service) before inviting them to refer friends. This strategy is motivated by reciprocity, defined as “the behavioral phenomenon of people

²In the economics and sociology literatures, better matching has also been established as a key mechanism through which firms derive value from employee referral programs, a recruiting device that rewards current employees for referring job candidates for hire (Montgomery 1991, Fernandez et al. 2000, Castilla 2005, Beaman and Magruder 2012, Brown et al. 2016, Pallais and Sands 2016).

³The total value of referred customers is also influenced by the number of referred customers. Here, our goal is to use increasing the average value of referred customers as a guidance to develop strategies that can increase the total value of referred customers. Strategies developed in this manner may also have an impact on the number of referred customers.

responding toward (un)kind treatment likewise, even in the absence of reputational concerns” in Kube et al. (2012).⁴ Given the field evidence documented in the economics literature that a fraction of economic agents reciprocate a gift from the other party by providing goods desired by the latter (Gneezy and List 2006, Falk 2007, Alpizar et al. 2008, Kube et al. 2012), as well as the established merchandising practice in which salespeople offer customers a free sample or service to trigger reciprocity which leads to increased sales (Cialdini 1993), we expect that the provision of a gift would make some customers feel obliged to screen their friends more carefully and match those who they think may be valuable to the firm.⁵ Moreover, if the gift is designed in a way such that it is more valuable to high-value customers than to low-value customers, it may make a higher proportion of high-value customers participate in the referral program, which facilitates passive matching.

The second strategy is to notify customers about the value that the firm has created for them before inviting them to refer friends. Possible applications include notifications about customers’ investment return from a financial services firm, and notifications about customers’ money saved from a daily deals website. Such a notification could serve two purposes. First, it may make some customers feel that they have been treated well by the firm and thereby induce a sense of indebtedness and reciprocity. Second, it may serve as a reminder of the quality of the firm (i.e., a quality signal to customers). With either an intention to reciprocate to the firm, or a favorable quality perception of the firm (Gupta and Zeithaml 2006), or a combination of both, we expect the notification to motivate active matching for some customers. In addition, since the value that customers receive from the

⁴Similar definitions of reciprocity have been proposed in the literature. Gouldner (1960) suggests that “a norm of reciprocity, in its universal form, makes two interrelated, minimal demands: (1) people should help those who have helped them, and (2) people should not injure those who have helped them”. Cialdini (1992) describes reciprocity as the norm that “we are *obligated* to the future repayment of favors, gifts, invitations, and the like”. Referring to reciprocity, Fehr and Gächter (2000) state that “People repay gifts and take revenge even in interactions with complete strangers and even if it is costly for them and *yields neither present nor future material rewards*”.

⁵In a similar vein, Schmitt et al. (2011) suggest that the referral reward itself may induce reciprocity from some customers toward the firm, which would lead to active matching.

firm is, in most cases, positively correlated with the value that customers generate for the firm, high-value customers are more likely to have received great value from the firm and therefore more likely to refer friends after receiving the notification. In this case, passive matching is enhanced.

The third strategy is to reward referring customers based on the value of their referred customers, i.e., to offer a value-based referral reward. Most existing referral programs reward referring customers once their referred customers open an account or complete the first purchase, and the reward is not contingent on how much value the referred customers generate for the firm. Such an incentive structure has raised the concern that referral programs may end up rewarding customers for referring low-value new customers (Schmitt et al. 2011). By offering a value-based reward, we modify the incentive structure of referral programs to directly motivate customers to exert more effort to identify and refer good matches. At the same time, since high-value customers are more likely to have friends who are of potentially high value to the firm based on homophily, they are better incentivized in the presence of a value-based reward, implying that passive matching is facilitated.

The prospects of these three strategies, however, are far from certain. For the first strategy, it is ex ante unclear how many customers would reciprocate a gift from the firm, especially given the possibility that the gift may be perceived as a deliberate marketing device rather than a genuine kind treatment, in which case reciprocity can hardly be triggered (Gouldner 1960, Cialdini 1993). The second strategy shares some of the uncertainty facing the first one as far as reciprocity is concerned; on the other hand, since the notification serves as a mere reminder of the value that the firm has created for customers rather than providing any new information, it is unclear how many customers would use the notification to update their quality perception of the firm. For the third strategy, since a value-based reward explicitly links the size of the reward to the value of referred customers, it could impose considerable psychological cost on referring customers as they may feel that they are

exploiting or even selling their social connections to seek economic reward, in which case the value-based reward may become ineffective or even backfire.

We collaborated with a leading Chinese online financial services firm to empirically investigate whether and to what extent the three proposed strategies can enhance the effectiveness of referral programs. The firm offers customers financial deposit services including a flexible deposit and an assortment of fixed deposits in which they can invest money and earn interest. The flexible deposit has a floating interest rate and allows customers to make investments for any duration and withdraw part or all of the investments at any time, whereas each fixed deposit has a fixed interest rate and a fixed investment duration. As part of its customer acquisition strategy, the firm runs a referral program that rewards existing customers an investment coupon that can be used to reimburse a small proportion of their next investment for inviting a friend to open an account at the firm. We conducted two randomized field experiments at the firm, testing the first strategy (i.e., the gift strategy) and the second strategy (i.e., the notification strategy) using the first experiment and testing the third strategy (i.e., the value-based reward strategy) using the second experiment.⁶

In the first experiment, we included 93,288 existing customers in a two-week campaign inviting them to refer friends, and randomly assigned them to a control condition and two treatment conditions that implemented the gift strategy and the notification strategy, respectively. The regular referral program was implemented in all three conditions, and the only difference across conditions was the way by which customers were approached for the campaign. Specifically, at the beginning of the campaign, customers in the control condition received a text message inviting them to refer friends; customers in the first treatment condition received a gift - an investment coupon that could be used to raise the interest rate of their next investment and was valid during the campaign - and a text message inviting them to refer friends; and customers in the second treatment condition received a text

⁶For logistical reasons, we were unable to test all three strategies in a single field experiment.

message notifying them about the investment return that the firm had created for them and inviting them to refer friends. Customers also received a text message as a reminder at the beginning of the second week of the campaign.

In the second experiment, we included 120,258 existing customers in a 30-day campaign, and randomly assigned them to a control condition and two treatment conditions that implemented the value-based reward strategy. During the campaign, the regular referral program was implemented in the control condition, while each of the two treatment conditions augmented the regular referral program with a value-based reward. In particular, a customer in the first treatment condition would receive a cash reward based on the total investments in fixed deposits made by his or her referred customers during the campaign, and a customer in the second treatment condition would receive a cash reward based on the number of his or her referred customers whose total investments in fixed deposits made during the campaign were above a pre-determined threshold. By testing two different value-based rewards, we aimed to document converging evidence for the effect of the value-based reward strategy. Customers in all conditions received a text message each week inviting them to refer friends.

Analyzing data from the two experiments, we find that all three proposed strategies had an economically substantial and statistically significant impact on the effectiveness of the referral program. In particular, the gift strategy and the notification strategy increased the total value of referred customers by more than 200% in the first experiment, while the value-based reward strategy increased the total value of referred customers by more than 100% in the second experiment. We also find that the effects of all three strategies on the total value of referred customers were primarily driven by the positive value differential between referred customers acquired in the treatment conditions and those acquired in the control conditions, i.e., the three strategies helped the referral program acquire new customers of higher average value. This finding suggests that the promotion of better matching is the key channel through which the strategies enhanced the effectiveness of the referral program. On

the other hand, the impact of the strategies on the number of referred customers turns out to be modest in magnitude and mostly insignificant.

Having identified the aggregate effects of the proposed strategies, we investigate customer heterogeneity in these effects to derive deeper insights on the working of these strategies. To this end, we develop testable hypotheses regarding the moderating roles of several customer characteristics in the impact of these strategies on the total value of referred customers and test these hypotheses using data from the two experiments. Specifically, we hypothesize that all three strategies have a larger impact on customers with higher total investment return since account opening (H1). As we pointed out earlier, both the gift strategy and the notification strategy may have enhanced the effectiveness of the referral program by inducing reciprocity from current customers. If reciprocity is the underlying mechanism, we hypothesize that the effects of both strategies are larger on customers whose last investment was more recent (H2a) and those who had referred friends to open an account at the firm prior to the experiment (H3a). On the other hand, the notification strategy may also have worked through the quality signaling mechanism, in which case we hypothesize that the effect of the notification strategy is larger on customers whose last investment was less recent (H2b), contrasting to H2a. In addition, both the gift strategy and the notification strategy may have enhanced the effectiveness of the referral program by making the campaign text message and the referral program more salient to customers. If saliency is the underlying mechanism, we hypothesize that the effects of both strategies are larger on customers who had not referred friends to open an account at the firm prior to the experiment (H3b), contrasting to H3a.⁷ We find evidence from the data supporting H1, H2a, and H3a, and rejecting H2b and H3b. The findings regarding H2a, H3a, H2b, and H3b suggest that reciprocity is the more plausible underlying mechanism for the gift strategy and the notification strategy compared to quality signaling and saliency.

⁷We provide a detailed description of these hypotheses and their theoretical foundation in Section 3.3.

Drawing on these findings, this article contributes to the marketing literature on referral programs, which has studied referral programs from three different perspectives. The first stream of research develops theoretical models of customers' referral decision to determine the optimal design of referral programs. For example, Biyalogorsky et al. (2001) build a theoretical model to investigate how firms can optimally use low price and referral reward to motivate referrals when a customer refers friends if his or her utility exceeds a threshold. Kornish and Li (2010) also study optimal design of price and referral reward by modeling a referral between a customer and his or her friend as a signaling game, in which the customer is assumed to be concerned about both the referral reward and the friend's welfare. The second stream of research empirically investigates the impact of design and communication of referral programs on their effectiveness. Using lab experiments, Ryu and Feick (2007) find that the impact of referral reward on a participant's stated referral likelihood is moderated by the relationship between the participant (i.e., the referring customer) and the targeted prospective customer as well as brand strength; in particular, a referral reward increases referral likelihood more for weak ties than for strong ties and more for weaker brands than for stronger brands. Bapna et al. (2016) conduct a field experiment in which the allocation of the referral reward between the referring customer and the referred customer is manipulated. The authors find that, compared to the referring customer receiving all of the reward, both equally splitting the reward and allocating all of the reward to the referred customer lead to more successful referrals. Jung et al. (2017) compare different framings of call-to-action to encourage customers to make referrals using a field experiment. The authors find that the altruistic framing leads to a higher referral likelihood, more referrals, and more purchases from referred customers compared to the egoistic and equitable framings. The third stream of research empirically examines the relationship between referral programs and customer value. As discussed earlier, Schmitt et al. (2011) document the positive value differential between customers acquired through the referral program and customers acquired

through other channels in the context of a German bank, and propose better matching as one possible mechanism to explain the observed value differential. Van den Bulte et al. (2017) later use more comprehensive data from the same German bank to confirm that better matching is indeed the mechanism that drives referred customers' higher margins compared to nonreferred customers.

Our work fits in the second stream of research, i.e., research that empirically investigates the impact of design and communication of referral programs on their effectiveness. Extant work has measured the effectiveness of referral programs using existing customers' referral likelihood (Ryu and Feick 2007, Jung et al. 2017) and the number of successful referrals, where a successful referral is defined as one that leads to the referred customer's sign-up (Bapna et al. 2016) or first purchase (Jung et al. 2017). On the other hand, the impact of the strategies considered in this stream of research on the total value of referred customers has not been assessed and hence remains unclear. This is an important limitation since the total value of referred customers is the performance measure of referral programs that managers care most about, and information about the value of referred customers is critical to our theoretical understanding of customer referrals. We contribute to this stream of research by developing three different strategies designed to increase the total value of referred customers by promoting better matching and empirically testing their effectiveness using data from field experiments. We find that all three strategies substantially increased the total value of referred customers, and that the improved effectiveness was primarily driven by the acquisition of referred customers of higher value rather than the acquisition of more referred customers, which confirms our expectation that the promotion of better matching is the key channel through which the proposed strategies impact the effectiveness of the referral program. One interesting implication of the limited effects of the proposed strategies on the number of referred customers who opened an account at the firm is that, if we were to assess the effectiveness of the focal referral program using the number of successful referrals as has

been done in the extant work, we would conclude that these strategies are fairly ineffective. Our findings should be particularly relevant to managers who are interested in enhancing the effectiveness of their referral programs, especially given their concern about the quality of new customers acquired through referral programs (Schmitt et al. 2011). Moreover, our work complements the third stream of research, i.e., research that has proposed and identified better matching as a key mechanism driving the positive value differential between referred customers and nonreferred customers, by providing evidence that the mechanism can be proactively leveraged by firms to enhance the effectiveness of referral programs.

The remainder of the article is organized as follows. In Section 2, we describe the research setting for our study, including the design and implementation of the two experiments. We analyze the data from the two experiments to identify the effects of the proposed strategies and investigate how these effects vary across customers in Section 3. We conclude the article in Section 4.

2 Empirical Setting

For our study, we conducted two randomized field experiments in collaboration with a leading Chinese online financial services firm. The firm offers customers financial deposit services accessible via both a website and a mobile application, in which they can invest money and earn interest. There are two types of financial deposits: a flexible deposit and an assortment of fixed deposits. In the flexible deposit, customers can make investments for any duration and withdraw part or all of the investments at any time. The flexible deposit has a floating interest rate (i.e., the interest rate varies daily) that is always lower than the interest rates of the fixed deposits. Each fixed deposit has a fixed interest rate and a fixed investment duration. In fixed deposits, customers receive both the principal and the interest of an investment at maturity, and, if they decide to withdraw the investment prior to its maturity,

a transaction fee is incurred. Fixed deposits vary in terms of duration (from 3 months to 24 months) and interest rate (from 7% to 10.5% annually), with a longer-duration deposit having a higher interest rate. Both durations and interest rates are comparable to those offered by competing firms.

The firm runs a referral program as part of its customer acquisition strategy. Similar to referral programs of many competing firms, this referral program rewards existing customers an investment coupon for referring a friend to open an account at the firm. Specifically, an existing customer can share a referral link to a friend via either WeChat (a popular Chinese mobile messaging application), social media, or email, and, if the friend opens an account using the referral link, the referring customer receives a one-time coupon for his or her future investment in fixed deposits. When applied to an investment in a fixed deposit, this reward coupon reimburses a customer for 0.5% of the investment for up to 20 RMB. For example, if a customer applies the reward coupon to a fixed-deposit investment of 3,000 RMB, he or she receives a reimbursement of 15 RMB at the time of investing and the coupon becomes nullified. A customer can neither apply more than one reward coupon nor apply a reward coupon together with any other coupons to the same investment. On the other hand, any new customer, irrespective of the acquisition method, receives a welcome coupon that reimburses 0.5% of his or her fixed-deposit investments for up to 50 RMB and can be applied to multiple investments until the total reimbursements reach 50 RMB. Both the reward coupon for referring customers and the welcome coupon for new customers expire in 30 days.

2.1 The First Experiment

The first experiment was conducted in December, 2016. Right before the start of the experiment, we selected a random sample of 93,288 customers from the firm's customers who satisfied two criteria: (1) had at least 500 RMB invested in all deposits combined at the

time of sampling and (2) had earned between 100 RMB and 10,000 RMB in interest since account opening. These two criteria were imposed to ensure that customers included in the experiment were in an active relationship with the firm and had received a nontrivial return on their investments, and therefore might consider participating in the referral program. We randomly assigned these customers to a control condition and two treatment conditions, with the control condition including 30,977 customers, the first treatment condition including 31,241 customers, and the second treatment condition including 31,070 customers.

The experiment involved a two-week campaign inviting customers to participate in the referral program. The regular referral program was implemented in all three conditions, and the conditions only differed in how customers were approached for the campaign. In the control condition, customers received a text message encouraging them to refer friends at the beginning of the campaign. Specifically, the text message stated “Dear customer, please invite your friends to invest with us, who provide reliable and high-return financial deposit services!”, and included a link to the referral program page in the mobile app.⁸ Customers received the same text message again one week later as a reminder.

In the first treatment condition, customers received a one-time 1% interest-raising coupon for their future investment in fixed deposits as a gift and a text message explaining the coupon and encouraging them to refer friends at the beginning of the campaign. The gift coupon was valid for 14 days, i.e., it expired at the end of the campaign. The text message stated “Dear customer, you have received a 1% interest-raising coupon as a gift for being a valued customer. Please feel free to use it. Also please invite your friends to invest with us, who provide reliable and high-return financial deposit services!”, and included a link to the referral program page in the mobile app. One week later, customers received a text message reminding them about the gift coupon and the invitation to refer friends. In the following, we refer to this treatment condition as the gift condition.

⁸The text quoted here and those quoted in the following are translated from Chinese.

We make several observations on the 1% interest-raising coupon offered as a gift. First, as the name suggests, this coupon can be used to raise the annual interest rate of an investment in any fixed deposit by 1 percentage point. For example, if a customer applies this coupon to an investment in the 3-month fixed deposit, the annual interest rate of the investment changes from 7% to 8%. Since the economic value of this coupon is proportional to the amount of the investment, it was likely to be more valuable to high-value customers who, compared to low-value customers, were likely to make larger investments during the campaign. Second, this coupon was familiar to customers, as interest-raising coupons with comparable raise in interest rate are offered to all customers multiple times a year. This coupon differs from other interest-raising coupons in that it did not require a minimum investment amount and that it was framed as a gift as opposed to a promotion. Third, since this coupon and the referral reward coupon cannot be applied together to the same investment, there was a substitution between the two.⁹ In particular, if a customer found the 1% interest-raising coupon more valuable, it would effectively void the value of the referral reward coupon and consequently remove the economic incentive of referring friends.

In the second treatment condition, customers received a text message notifying them about their total investment return and encouraging them to refer friends at the beginning of the campaign. More specifically, customers in this condition were divided into four subgroups based on their total investment return: those whose total investment return was at least 100 RMB and less than 500 RMB were included in the first subgroup; those whose total investment return was at least 500 RMB and less than 1,000 RMB were included in the second subgroup; those whose total investment return was at least 1,000 RMB and less than

⁹Which coupon was more valuable to a customer depended on the customer's time preferences and the amount and the duration of his or her investment. The economic value of the 1% interest-raising coupon is proportional to the investment duration and is received by the customer at maturity, whereas the economic value of the referral reward coupon is not contingent on the investment duration and is received by the customer at the time of investing. In addition, there is no upper limit on the economic value that the 1% interest-raising coupon can generate as the investment amount increases, in contrast to the upper limit of 20 RMB for the referral reward coupon.

5,000 RMB were included in the third subgroup; and those whose total investment return was at least 5,000 RMB and no greater than 10,000 RMB were included in the fourth subgroup. At the beginning of the campaign, customers in the first subgroup received a text message that stated “Dear customer, do you notice that we have helped you earn at least 100 RMB on your investment? Please invite your friends to invest with us, who provide reliable and high-return financial deposit services!”, and included a link to the referral program page in the mobile app. Customers in the three other subgroups received the same text message except that 100 RMB was replaced by 500 RMB, 1,000 RMB, and 5,000 RMB, respectively. Customers in each subgroup received the same text message again one week later as a reminder. In the following, we refer to this treatment condition as the notification condition.

As we discussed earlier when developing the notification strategy, the notification could serve two purposes: inducing a sense of indebtedness and reciprocity from customers, and serving as a quality signal to customers. While both mechanisms are expected to promote better matching and ultimately enhance the effectiveness of the referral program, it would be interesting to use data from the experiment to explore which mechanism (or both) is at work. In addition, we chose to divide customers into subgroups and sent a unified notification to customers in each subgroup instead of sending each customer a personalized notification about his or her total investment return given managers’ concern that the latter approach might be perceived as intrusive by customers. If a customer would like to access the exact value of his or her total investment return, he or she could log into the account anytime via either the website or the mobile app in which the information is prominently displayed.

2.2 The Second Experiment

The second experiment was conducted in April and May, 2017. Right before the start of the experiment, we selected a random sample of 120,258 customers from the firm’s customers

who had at least 500 RMB invested in all deposits combined at the time of sampling. We randomly assigned these customers to a control condition and two treatment conditions, with the control condition including 40,076 customers, the first treatment condition including 40,037 customers, and the second treatment condition including 40,145 customers.

The experiment involved a 30-day campaign inviting customers to participate in the referral program. In the control condition, the regular referral program was implemented and customers received a text message encouraging them to refer friends each week. The text message stated “Invite friends to invest with us and earn investment coupons!”, and included a link to the referral program page in the mobile app.

In the first treatment condition, a value-based reward was added to the referral program. For each customer, the value-based reward was specified as follows: (1) new customers who used his or her referral link to open an account (i.e., referred customers) during the campaign were identified, (2) the total investments in fixed deposits made by all referred customers during the campaign were calculated, and (3) for every 10,000 RMB in the total investments, the referring customer would receive 50 RMB in cash at the end of the campaign. For example, if the referred customers invested a total of 45,000 RMB in fixed deposits, their referring customer would receive a cash reward of 200 RMB. A detailed description of this value-based reward was shown on the referral program page. Customers also received a text message encouraging them to refer friends each week. The text message stated “Invite friends to invest with us and earn investment coupons and cash rewards!”, and included a link to the referral program page in the mobile app. In the following, we refer to this treatment condition as the first value-based reward condition.

In the second treatment condition, a different value-based reward was added to the referral program. For each customer, the value-based reward was specified as follows: (1) new customers who used his or her referral link to open an account (i.e., referred customers) during the campaign were identified, (2) the total investments in fixed deposits made by each

referred customer during the campaign were calculated, and (3) for every referred customer whose total investments were at least 10,000 RMB, the referring customer would receive 50 RMB in cash at the end of the campaign. For example, if a referring customer had three referred customers, the first one investing 30,000 RMB in fixed deposits, the second one investing 10,000 RMB in fixed deposits, and the third one investing 5,000 RMB in fixed deposits, the referring customer would receive a cash reward of 100 RMB. Other than the specification of the value-based reward, the second treatment condition was identical to the first value-based reward condition, including the text message. In the following, we refer to this treatment condition as the second value-based reward condition.¹⁰

2.3 Data

For each customer in each of the two field experiments, we observe the following variables that were collected right before the experiments: total investment return since account opening, investment amount in all financial deposits combined, tenure since account opening, recency of the last investment, and whether the customer had successfully referred any friend to open an account. For each referral made by a customer, it is recorded in the data if and only if it is used by the receiving friend to open an account at the firm. Ideally, it would be helpful if we can observe each referral irrespective of whether it is accepted by its receiver or not. However, since a customer can use a variety of channels including WeChat, various social media platforms, and email that the firm cannot track to share referral links to friends, his or her sharing of a referral link is not recorded in the data; it is only when the receiver of the referral link uses it to open an account that we can observe this referral and map the referred new customer to the referring customer. Once a new customer opens an account, we observe his or her investment behavior in all financial deposits.

¹⁰We tested two different value-based rewards in order to document converging evidence for the effect of the value-based reward strategy. The optimal design of value-based reward is an interesting question that we leave for future research.

3 Empirical Findings

In this section, we analyze data from the two field experiments to investigate whether and to what extent the three proposed strategies can enhance the effectiveness of referral programs. First, we verify that the random assignments of customers in both experiments were valid. Then, we estimate the aggregate effects of the gift treatment, the notification treatment, and the two value-based reward treatments on the effectiveness of the referral program. Finally, we investigate the heterogeneity in the treatment effects to derive deeper insights on the working of the proposed strategies.

3.1 Randomization Check

We assess the validity of the randomization in each experiment by comparing customers across conditions with respect to their behaviors before the experiment. With a valid random assignment, we should observe little or no systematic differences in customers' pre-experiment variables across conditions. The details of the randomization check of the first experiment and those of the second experiment are reported in Tables 1 and 2, respectively. It is evident from the tables that customers' pre-experiment variables are well balanced across conditions in both experiments, confirming the validity of the random assignments.

Insert Tables 1 and 2 here.

3.2 Aggregate Effects of the Treatments

3.2.1 The First Experiment

To study the effects of the gift coupon and the notification on customer referrals, we focus on new customers who opened an account at the firm using a referral link during the two-week campaign period, and we refer to them as referred customers in the current section. For each

existing customer in the experiment, we consider the following three outcome variables: (1) whether he or she has any referred customers (Yes/No), (2) the number of his or her referred customers, and (3) the total value of his or her referred customers. To construct (3), we adopt a simple method to assess the value of a referred customer: we track the investment behavior of referred customers for another ten weeks after the campaign, and define the value of a referred customer as his or her investment amount in all financial deposits combined at the end of the ten-week period (i.e., 12 weeks after the beginning of the experiment). (3) is then calculated as the sum of the value of all referred customers of an existing customer or set to zero if the existing customer does not have any referred customer.¹¹ While (1) and (2) provide useful measures of the customer referral process, we focus on (3) in this article and use it to measure the effectiveness of the referral program.

Given the experimental data, the average effect of either the gift coupon or the notification on the outcome variables can be identified using a direct mean comparison between the control condition and the corresponding treatment condition. We summarize results of the mean comparisons based on two-sided t-tests in Table 3.

Insert Table 3 here.

We find from Table 3 that the effects of both treatments on the incidence of having any referred customer and the number of referred customers are small in magnitude and statistically insignificant. On the other hand, both treatments had a great impact on the total value of referred customers. In particular, the gift treatment and the notification treatment on average increased the total value of referred customers of an existing customer by 27.64 RMB and 26.85 RMB, respectively. Both treatment effects amount to more than 200% lift over the baseline value of 10.76 RMB, and are statistically significant with $p = 0.004$ for the gift treatment and $p = 0.018$ for the notification treatment.

¹¹We choose this particular method to measure the value of a referred customer due to its simplicity and plausibility. There are other informative value measures and, as the next step, we plan to use these other value measures to assess the robustness of the current findings.

Given the small and insignificant effects of both treatments on the number of referred customers, it is likely that their effects on the total value of referred customers were driven by positive value differential between referred customers in the two treatment conditions and those in the control condition. To confirm this intuition, we compare the average value of referred customers in the two treatment conditions and that in the control condition and report the results in the last row of Table 3. Clearly, referred customers in the two treatment conditions are of considerably higher value than those in the control condition.¹²

We corroborate the findings from mean comparisons using a regression analysis. For each outcome variable, we consider the following linear regression model:

$$Y_i = \alpha + \beta_g T_{g,i} + \beta_n T_{n,i} + \theta^\top X_i + \epsilon_i, \quad (1)$$

where Y_i is the outcome variable, $T_{g,i}$ is the dummy variable for the gift treatment, $T_{n,i}$ is the dummy variable for the notification treatment, X_i is the vector containing all pre-experiment variables, and ϵ_i is the idiosyncratic term. We estimate this model both with and without controlling for pre-experiment variables using ordinary least squares (OLS). The results of the OLS estimation are reported in Tables 4 and 5 and they are highly consistent with the findings based on direct mean comparisons.¹³

Insert Tables 4 and 5 here.

3.2.2 The Second Experiment

To study the effects of the two value-based rewards on customer referrals, we focus on new customers who opened an account at the firm using a referral link during the 30-day campaign

¹²Unlike mean comparisons on the three outcome variables, the comparison on the average value of referred customers across conditions is purely descriptive and does not have a causal interpretation, as referred customers were not observational units of the experiment.

¹³When the outcome variable is whether an existing customer has any referred customers (Yes/No), we also estimate a binary logit model. The results are similar to those obtained using the linear probability model.

period, and we refer to them as referred customers in the current section. We consider the same three outcome variables, with a modification to how the value of a referred customer is measured. As we only have the investment behavior of referred customers during the campaign at this time, we define the value of a referred customer as his or her investment amount in all financial deposits combined at the end of the campaign (i.e., 30 days after the beginning of the experiment).

Similar to Section 3.2.1, we identify the average effects of the two value-based rewards using mean comparisons and summarize the results in Table 6.

Insert Table 6 here.

We find that the effects of both value-based rewards on the incidence of having any referred customer and the number of referred customers are small and only the effect of the first value-based reward on the number of referred customers is statistically significant. On the other hand, both rewards had a great impact on the total value of referred customers. In particular, the first and second value-based rewards on average increased the total value of referred customers of an existing customer by 80.20 RMB and 91.09 RMB, respectively. Both treatment effects amount to more than 100% lift over the baseline value of 60.22 RMB, and are statistically significant with $p = 0.008$ for the first value-based reward and $p = 0.007$ for the second value-based reward. Again, we find that referred customers in the two treatment conditions had a higher average value than those in the control condition.

We corroborate the findings from mean comparisons using a regression analysis similar to that conducted in Section 3.2.1. We report the results of the regression analysis in Tables 7 and 8 and note that they are highly consistent with the findings based on direct mean comparisons.

Insert Tables 7 and 8 here.

3.2.3 Summary

Analyzing data from the two field experiments, we find that all four treatments, including the gift coupon, the notification, and the two value-based rewards, substantially and significantly increased the total value of referred customers, which we use as the measure of the effectiveness of the referral program. We also find that these effects were primarily driven by the considerable value differential between referred customers in the treatment conditions and those in the control conditions, i.e., referred customers in the treatment conditions are on average more valuable to the firm than those in the control conditions. This indicates that, as we have conceptualized when developing these treatments, the promotion of better matching is indeed a key channel through which the treatments impacted the effectiveness of the referral program.

3.3 Customer Heterogeneity in Treatment Effects

In Section 3.2, we have identified the aggregate effects of the gift treatment, the notification treatment, and the two value-based reward treatments using data from the two field experiments. The effects of these treatments, on the other hand, are likely to vary across customers. Investigating such customer heterogeneity in treatment effects has both theoretical and managerial value. Theoretically, it may help us better understand the underlying mechanisms through which our proposed strategies impacted customer referrals. Managerially, it could provide firms guidance on identifying customers on whom these strategies are likely to be effective and hence may serve as good targets for future implementations of these strategies. In the following, we propose three customer characteristics that may moderate the effects of the gift, notification, and two value-based reward treatments on the total value of referred customers, the key outcome variable that we focus on in this section.

Total investment return. We hypothesize that total investment return since account opening would positively moderate the effects of all four treatments. First, the 1% interest-raising gift coupon used in the first experiment was likely to be more valuable to customers with high total investment return than to those with low total investment return. This argument is based on the observations that (1) compared to the latter, the former were more likely to have a good match with the firm’s service offerings and hence had a higher likelihood of investing during the campaign period of the first experiment (i.e., before the gift coupon expired), and, when they decided to invest, the investment was likely to be larger, and (2) the economic value of the gift coupon was proportional to the amount of the investment. Consequently, if reciprocity is the mechanism through which the gift coupon influenced customer referrals, customers with higher total investment return would be more likely to reciprocate by participating in the referral program and exerting effort to identify and refer good matches. Second, for two customers in the notification condition of the first experiment, if they were allocated to different subgroups based on their total investment return, the customer with the higher total investment return would receive a notification mentioning a larger value. Since a larger value was more likely to induce reciprocity from customers and could also serve as a stronger quality signal, the notification treatment was more likely to make the customer with the higher total investment return consider referring friends and exert effort to screen for good matches, regardless of the mechanism underlying the treatment being reciprocity or quality signaling. Third, since the economic value of both value-based rewards in the second experiment was contingent on the value of referred customers, customers with high total investment return were likely to be better incentivized as they might perceive referring friends of high value as more feasible compared to customers with low total investment return. Finally, for all treatments, once customers with high total investment return decided to refer friends, homophily implies that they were likely to encounter a better pool of prospective customers, which made the referring of good matches

more likely. In sum, we propose the following hypothesis regarding the moderating role of customers' total investment return:

H1: All four treatments would have a larger impact on customers with high total investment return than those with low total investment return.

Recency of the last investment. If reciprocity is the mechanism through which the gift treatment and the notification treatment in the first experiment impacted customer referrals, we predict that customers' investment recency would negatively moderate the effects of these two treatments, i.e., the effects would be larger on customers whose last investment was more recent. This is because customers with low investment recency were likely to have a more engaged relationship with the firm at the time of the experiment and therefore were more likely to reciprocate to the firm after receiving the gift coupon or the notification compared to those with high investment recency. On the other hand, if quality signaling is the mechanism through which the notification treatment impacted customer referrals, we predict that customers' investment recency would positively moderate the effect of the notification treatment. This prediction is based on the observations that (1) for customers with low investment recency, their latest investment at the firm suggests that they were likely to have a high quality perception of the firm before the experiment, otherwise they would not have made the investment, and (2) when they made their latest investment through either the web account or the mobile app, they were exposed to the exact value of their total investment return at that time. Both observations suggest that the notification was likely of little informational value to customers with low investment recency, whereas customers with high investment recency might find the notification informative. Therefore, if the notification served as a quality signal, it should have a larger impact on the latter. We note that as the reciprocity mechanism and the quality signaling mechanism yield competing predictions on the moderating role of customers' investment recency in the effect of the notification

treatment, we have an opportunity to shed light on which of the two mechanisms is more likely to be the mechanism at work for the notification treatment. In sum, we propose the following hypotheses regarding the moderating role of customers' investment recency:

H2a: If reciprocity is the underlying mechanism, the gift treatment and the notification treatment would have a larger impact on customers whose last investment was more recent.

H2b: If quality signaling is the underlying mechanism, the notification treatment would have a larger impact on customers whose last investment was less recent.

Whether had successful referrals. If reciprocity is the mechanism through which the gift treatment and the notification treatment impacted customer referrals, we predict that the effects of these two treatments would be larger on customers who had referred some friends to open an account at the firm prior to the experiment. The rationale for this prediction is that customers who had made successful referrals were likely to be more satisfied with the firm's service offerings (Verhoef et al. 2002, Wirtz and Chew 2002) and more loyal (Gupta and Zeithaml 2006), and therefore were more likely to reciprocate to the firm after receiving the gift coupon or the notification compared to those who had not. On the other hand, the saliency mechanism is an alternative mechanism for the gift treatment and the notification treatment that makes an opposite prediction. The saliency mechanism posits that the mentioning of the gift coupon and the notification made the campaign text message and the referral program more salient to customers, which led to the enhanced effectiveness of the referral program. If the saliency mechanism is at work, we predict that the effects of these two treatments would be smaller on customers who had made successful referrals than those who had not, since the former were well aware of the referral program and hence were less likely to be impacted by the enhanced saliency of the referral program than the latter, of whom many customers had not participated in or were even unaware of the

referral program. Therefore, by examining the moderating role of whether a customer had successful referrals in the effects of the gift treatment and the notification treatment, we have an opportunity to assess which of the two mechanisms, reciprocity or saliency, is more likely to be the mechanism at work for the gift treatment and the notification treatment. In sum, we propose the following hypotheses regarding the moderating role of customers' past referral behavior:

H3a: If reciprocity is the underlying mechanism, the gift treatment and the notification treatment would have a larger impact on customers who had referred friends to open an account at the firm prior to the experiment.

H3b: If saliency is the underlying mechanism, the gift treatment and the notification treatment would have a larger impact on customers who had not referred friends to open an account at the firm prior to the experiment.

In the following, we use data from the two field experiments to empirically investigate customer heterogeneity in treatment effects and test the proposed hypotheses regarding the moderating roles of total investment return, investment recency, and whether a customer had successful referrals. As a first step, we provide descriptive evidence for heterogeneous treatment effects by dividing customers into different segments based on each of the three characteristics and comparing the effects of the treatments across segments. We note that such comparisons are suggestive but not conclusive, as they do not assess the statistical significance of the heterogeneity in treatment effects. The results are summarized in Table 9 for the first experiment and in Table 10 for the second experiment.

Insert Tables 9 and 10 here.

We make a few observations. First, consistent with the hypothesis on the moderating role of total investment return (H1), all four treatments had a larger impact on customers with

higher total investment return. Second, the effects of the gift treatment and the notification treatment are larger on customers with lower investment recency, which is consistent with the hypothesis on the moderating role of investment recency assuming that reciprocity is the underlying mechanism (H2a); on the other hand, the pattern of the heterogeneous effects is inconsistent with the competing hypothesis assuming that quality signaling is the underlying mechanism for the notification treatment (H2b). Third, the effects of the gift treatment and the notification treatment are larger on customers who had successful referrals, which is consistent with the hypothesis on the moderating role of whether a customer had successful referrals assuming that reciprocity is the underlying mechanism (H3a); on the other hand, the pattern of the heterogeneous effects is inconsistent with the competing hypothesis assuming that saliency is the underlying mechanism (H3b).

To assess the statistical significance of the heterogeneity in treatment effects and formally test the proposed hypotheses, we conduct a regression analysis in which the treatment dummies are interacted with the three customer characteristics hypothesized to moderate the treatment effects. In particular, for the first experiment, we consider the following linear regression model:

$$Y_i = \alpha + \beta_g T_{g,i} + \beta_n T_{n,i} + \theta^\top X_i + \gamma_g^\top T_{g,i} X_i + \gamma_n^\top T_{n,i} X_i + \epsilon_i, \quad (2)$$

where Y_i is the total value of referred customers, $T_{g,i}$ is the dummy variable for the gift treatment, $T_{n,i}$ is the dummy variable for the notification treatment, X_i is the vector containing the three customer characteristics, and ϵ_i is the idiosyncratic term. For the second experiment, we use an identical linear regression model except that the treatment dummies represent the two value-based rewards. Since the distribution of total investment return in the second experiment is heavily right-skewed, we include the logarithm of total investment return instead of total investment return in X_i for both experiments. We also

mean-center the logarithm of total investment return and investment recency. The results of the OLS estimation are summarized in Table 11 for the first experiment and in Table 12 for the second experiment.

Insert Tables 11 and 12 here.

From the first column of both tables (i.e., “Model 1”), we find that total investment return positively moderates the effects of all four treatments, with three of the four interactions being statistically significant at $p < 0.1$. This provides evidence that the notification and both value-based rewards had a larger impact on customers with higher total investment return and suggests that the same pattern may also hold for the gift coupon, supporting H1. The second column of Table 11 (i.e., “Model 2”) shows that the interactions between investment recency and the gift and notification treatments are both negative and statistically significant at $p < 0.1$, which supports H2a and rejects H2b. The third column of Table 11 (i.e., “Model 3”) shows that whether a customer had successful referrals positively moderates the effects of the gift and notification treatments, with its interaction with the gift treatment being statistically significant at $p < 0.05$. This provides evidence that the gift coupon had a larger impact on customers who had successful referrals and suggests a similar pattern for the notification, which supports H3a and rejects H3b. These findings are robust when all three characteristics and their associated interactions are simultaneously included in the model, as shown in the last column of both tables (i.e., “Model 4”), except that the negative interactions between investment recency and the gift and notification treatments become insignificant. While the insignificant interactions weaken the evidence supporting H2a and rejecting H2b, the fact that the interactions remain negative and are close to being statistically significant ($p = 0.14$ and $p = 0.12$) still suggests that the data are more consistent with H2a compared to H2b. Based on our testing of H2a vs. H2b and H3a vs. H3b, we conclude that, compared to quality signaling and saliency, reciprocity seems

to be the more plausible mechanism through which the gift treatment and the notification treatment impacted customer referrals.

4 Conclusions

Enhancing the effectiveness of referral programs is a key challenge facing firms that use referral programs to acquire new customers. In this article, we propose three strategies to enhance the effectiveness of referral programs by promoting better matching between referred customers and firms, including (1) offering current customers a gift before inviting them to refer friends, (2) notifying current customers about the value that the firm has created for them before inviting them to refer friends, and (3) rewarding referring customers based on the value of their referred customers. We test the effectiveness of the three strategies by conducting two field experiments in collaboration with a leading Chinese online financial services firm. We find that all three strategies substantially enhanced the effectiveness of the focal referral program, which is measured for each current customer as the total value of his or her referred customers. The enhancement was primarily driven by the acquisition of referred customers of higher average value (i.e., those who matched better with the firm), suggesting that the strategies indeed worked by promoting better matching. We also find considerable heterogeneity in the effects of these strategies across current customers. In particular, all three strategies had a larger impact on customers with higher total investment return since account opening, while at the same time the gift strategy and the notification strategy had a larger impact on customers whose last investment was more recent and those who had referred friends to open an account at the firm prior to the experiment. The latter finding suggests that the gift strategy and the notification strategy enhanced the effectiveness of the referral program by inducing reciprocity from current customers.

Our research has several direct managerial implications. First, it suggests that firms

can promote better matching and ultimately enhance the effectiveness of referral programs by inducing reciprocity from current customers. While we have proposed and evaluated the gift strategy and the notification strategy as two proactive approaches to inducing reciprocity from customers that firms can readily adopt, firms may also consider exploring other approaches and settings to leverage the power of reciprocity. For example, reciprocity does not always have to be elicited by proactive treatments from firms as there are naturally occurring interactions between customers and firms in which customers may feel that they have been treated well and reciprocity is spontaneously triggered. In the case of the Chinese online financial services firm with which we collaborated, the firm may consider sending a text message to invite customers to refer friends right after the maturity of their fixed-deposit investments, at which time customers may feel like to reciprocate the return on their investments. By fully exploiting both proactively-induced and naturally-occurred reciprocity, firms have the potential to substantially enhance the effectiveness of their referral programs.

Second, our research suggests that rewarding referring customers based on the value of their referred customers (i.e., the value-based reward strategy) can be a viable approach to enhancing the effectiveness of referral programs. While the positive effect of the value-based reward strategy is well predicted by standard economic theory, its adoption has been limited in practice, possibly due to firms' concern that the introduction of value-based referral rewards may impose considerable psychological cost on referring customers and hence make them less willing to refer friends. Our findings suggest that firms could potentially benefit from the adoption of the value-based reward strategy and therefore it may be advisable for firms to be open about its adoption. In particular, firms may empirically assess the usefulness of this strategy in their own settings and consider its adoption if it is found to be viable.

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Table 1: Randomization Check: The First Experiment

	Control	Gift	Notification	C vs. G	C vs. N	G vs. N
Total Investment Return (in RMB)	2,443.38 (13.94)	2,439.09 (13.91)	2,450.22 (13.90)	$p = 0.83$	$p = 0.73$	$p = 0.57$
Investment Amount (in RMB)	37,682.66 (330.30)	38,051.21 (319.42)	37,941.05 (318.91)	$p = 0.42$	$p = 0.57$	$p = 0.81$
Tenure (in Days)	556.46 (1.56)	555.10 (1.57)	555.91 (1.56)	$p = 0.54$	$p = 0.80$	$p = 0.71$
Recency of Last Investment (in Days)	98.30 (0.64)	97.64 (0.64)	97.07 (0.63)	$p = 0.47$	$p = 0.17$	$p = 0.53$
Had Successful Referrals (Yes/No)	0.1307 (0.0019)	0.1294 (0.0019)	0.1293 (0.0019)	$p = 0.61$	$p = 0.60$	$p = 0.98$
Sample Size	30,977	31,241	31,070			

Notes. The columns “Control”, “Gift”, and “Notification” report means and standard errors (in parentheses) of pre-experiment variables in the control condition, the gift condition, and the notification condition, respectively. The column “C vs. G” reports p -values of two-sided t -tests comparing the control condition and the gift condition on pre-experiment variables. The columns “C vs. N” and “G vs. N” report the counterparts in the comparison between the control condition and the notification condition and those in the comparison between the gift condition and the notification condition, respectively.

Table 2: Randomization Check: The Second Experiment

	Control	First Reward	Second Reward	C vs. F	C vs. S	F vs. S
Total Investment Return (in RMB)	9,239.12 (125.94)	9,425.45 (130.09)	9,412.78 (131.48)	$p = 0.30$	$p = 0.34$	$p = 0.95$
Investment Amount (in RMB)	72,213.53 (913.36)	73,013.00 (861.17)	72,492.67 (875.08)	$p = 0.52$	$p = 0.83$	$p = 0.67$
Tenure (in Days)	601.56 (1.79)	604.53 (1.80)	601.62 (1.80)	$p = 0.24$	$p = 0.98$	$p = 0.25$
Recency of Last Investment (in Days)	92.38 (0.58)	92.34 (0.58)	91.83 (0.57)	$p = 0.96$	$p = 0.50$	$p = 0.53$
Had Successful Referrals (Yes/No)	0.1110 (0.0016)	0.1119 (0.0016)	0.1124 (0.0016)	$p = 0.68$	$p = 0.54$	$p = 0.83$
Sample Size	40,076	40,037	40,145			

Notes. The columns “Control”, “First Reward”, and “Second Reward” report means and standard errors (in parentheses) of pre-experiment variables in the control condition, the first value-based reward condition, and the second value-based reward condition, respectively. The column “C vs. F” reports p -values of two-sided t -tests comparing the control condition and the first value-based reward condition on pre-experiment variables. The columns “C vs. S” and “F vs. S” report the counterparts in the comparison between the control condition and the second value-based reward condition and those in the comparison between the first value-based reward condition and the second value-based reward condition, respectively.

Table 3: Aggregate Effects of Treatments: The First Experiment

	Control	Gift	Notification	Control vs. Gift			Control vs. Notification		
				Difference	SE	p-Value	Difference	SE	p-Value
Had Referred Customers (Yes/No)	0.0025	0.0032	0.0027	0.0007	0.0004	0.092	0.0002	0.0004	0.591
Number of Referred Customers	0.0027	0.0032	0.0030	0.0006	0.0005	0.230	0.0003	0.0005	0.513
Total Value of Referred Customers	10.76	38.39	37.61	27.64	9.63	0.004	26.85	11.37	0.018
Value of Each Referred Customer	4,014.65	11,876.02	12,565.11	7,861.37	2,767.45	0.005	8,550.46	3,587.98	0.019

Notes. The columns “Control”, “Gift”, and “Notification” report means of outcome variables in the control condition, the gift condition, and the notification condition, respectively. The columns under “Control vs. Gift” report the inference of the effects of the gift treatment and those under “Control vs. Notification” report the inference of the effects of the notification treatment, all based on two-sided t-tests.

Table 4: Regression Analysis of Aggregate Treatment Effects: The First Experiment

	Had Referred Customers (Yes/No)	Number of Referred Customers
Gift Treatment	0.0007 (0.0004) 0.0007 (0.0004)	0.0006 (0.0005) 0.0005 (0.0005)
Notification Treatment	0.0002 (0.0004) 0.0002 (0.0004)	0.0003 (0.0005) 0.0003 (0.0005)
Total Investment Return	-0.0028** (0.0009)	-0.0025* (0.0010)
Investment Amount	0.0003** (0.0001)	0.0003** (0.0001)
Tenure	-0.0009 (0.0007)	-0.0012 (0.0008)
Recency of Last Investment	-0.0085** (0.0011)	-0.0094** (0.0012)
Had Successful Referrals	0.0043** (0.0008)	0.0048** (0.0009)
Intercept	0.0025** (0.0003) 0.0029** (0.0005)	0.0027** (0.0003) 0.0032** (0.0006)
R^2	3.256×10^{-5} 0.0022	1.469×10^{-5} 0.0021
Observations	93, 288	93, 288

Notes. * $p < .05$. ** $p < .01$. Results are from a linear model estimated using ordinary least squares (OLS). Robust standard errors are reported in parentheses. Total investment return and investment amount are in 10,000 RMB, and tenure and recency of last investment are in 1,000 days.

Table 5: Regression Analysis of Aggregate Treatment Effects Continued: The First Experiment

	Total Value of Referred Customers	Value of Each Referred Customer
Gift Treatment	27.64** (9.63)	7,861.37** (2,781.56)
Notification Treatment	26.85* (11.37)	8,550.46* (3,607.57)
Total Investment Return	-10.68 (39.27)	
Investment Amount	5.64 (4.35)	
Tenure	-1.00 (23.48)	
Recency of Last Investment	-56.89 (33.87)	
Had Successful Referrals	69.46** (25.05)	
Intercept	10.76** (2.62)	4,014.65** (882.44)
R^2	7.368×10^{-5}	0.0215
Observations	93,288	277

Notes. * $p < .05$. ** $p < .01$. Results are from a linear model estimated using ordinary least squares (OLS). Robust standard errors are reported in parentheses. Total investment return and investment amount are in 10,000 RMB, and tenure and recency of last investment are in 1,000 days.

Table 6: Aggregate Effects of Treatments: The Second Experiment

	Control vs. First Reward			Control vs. Second Reward					
	Control	First Reward	Second Reward	Difference	SE	<i>p</i> -Value	Difference	SE	<i>p</i> -Value
Had Referred Customers (Yes/No)	0.0058	0.0069	0.0064	0.0010	0.0006	0.067	0.0005	0.0005	0.351
Number of Referred Customers	0.0064	0.0079	0.0073	0.0015	0.0007	0.024	0.0010	0.0007	0.146
Total Value of Referred Customers	60.22	140.42	151.31	80.20	30.02	0.008	91.09	33.96	0.007
Value of Each Referred Customer	9,427.67	17,791.37	20,590.90	8,363.71	3,828.91	0.029	11,163.23	4,552.69	0.015

Notes. The columns “Control”, “First Reward”, and “Second Reward” report means of outcome variables in the control condition, the first value-based reward condition, and the second value-based reward condition, respectively. The columns under “Control vs. First Reward” report the inference of the effects of the first value-based reward and those under “Control vs. Second Reward” report the inference of the effects of the second value-based reward, all based on two-sided t-tests.

Table 7: Regression Analysis of Aggregate Treatment Effects: The Second Experiment

	Had Referred Customers (Yes/No)	Number of Referred Customers
First Value-Based Reward	0.0010 (0.0006)	0.0015* (0.0007)
Second Value-Based Reward	0.0005 (0.0005)	0.0010 (0.0007)
Total Investment Return	-0.0004** (0.0001)	-0.0002 (0.0003)
Investment Amount	0.0001** (0.0000)	0.0001** (0.0000)
Tenure	-0.0026** (0.0007)	-0.0035** (0.0009)
Recency of Last Investment	-0.0177** (0.0014)	-0.0210** (0.0017)
Had Successful Referrals	0.0094** (0.0011)	0.0106** (0.0013)
Intercept	0.0058** (0.0004)	0.0064** (0.0004)
R^2	2.798×10^{-5}	4.158×10^{-5}
Observations	120, 258	120, 258

Notes. * $p < .05$. ** $p < .01$. Results are from a linear model estimated using ordinary least squares (OLS). Robust standard errors are reported in parentheses. Total investment return and investment amount are in 10,000 RMB, and tenure and recency of last investment are in 1,000 days.

Table 8: Regression Analysis of Aggregate Treatment Effects Continued: The Second Experiment

	Total Value of Referred Customers	Value of Each Referred Customer
First Value-Based Reward	80.20** (30.02)	8,363.71* (3,835.40)
Second Value-Based Reward	91.09** (33.96)	11,163.23* (4,560.70)
Total Investment Return	-2.01 (17.88)	
Investment Amount	6.88* (2.76)	
Tenure	-43.34 (47.21)	
Recency of Last Investment	-181.44** (68.14)	
Had Successful Referrals	-8.23 (38.43)	
Intercept	60.22** (14.16)	9,427.67** (2,115.30)
R^2	6.655×10^{-5}	0.0067
Observations	120,258	867

Notes. * $p < .05$. ** $p < .01$. Results are from a linear model estimated using ordinary least squares (OLS). Robust standard errors are reported in parentheses. Total investment return and investment amount are in 10,000 RMB, and tenure and recency of last investment are in 1,000 days.

Table 9: Heterogeneous Effects of Treatments: The First Experiment

Sample	N	Control	Gift	Notification	Control vs. Gift			Control vs. Notification		
					Difference	SE	p -Value	Difference	SE	p -Value
All Customers	93,288	10.76	38.39	37.61	27.64	9.63	0.004	26.85	11.37	0.018
By Total Investment Return (in RMB)										
[100, 500)	22,134	12.98	29.68	5.60	16.70	12.96	0.198	-7.38	5.79	0.203
[500, 1,000)	14,438	5.17	19.41	2.26	14.24	11.90	0.232	-2.91	3.60	0.419
[1,000, 5,000)	41,502	12.68	43.85	59.92	31.17	15.89	0.050	47.24	20.75	0.023
[5,000, 10,000]	15,214	7.52	54.28	56.54	46.76	33.64	0.165	49.02	39.49	0.215
By Recency (in Days)										
≤ 50	43,403	17.19	65.01	59.31	47.82	19.53	0.014	42.12	20.52	0.040
> 50	49,885	5.20	14.79	18.96	9.59	5.51	0.082	13.77	11.67	0.238
By Whether Had Successful Referrals										
Yes	12,110	25.54	171.45	86.39	145.91	60.28	0.016	60.85	51.56	0.238
No	81,178	8.53	18.62	30.37	10.09	6.48	0.119	21.83	10.58	0.039

Notes. The column “ N ” reports sample sizes. The columns “Control”, “Gift”, and “Notification” report means of the outcome variable (i.e., total value of referred customers) in the control condition, the gift condition, and the notification condition, respectively. The columns under “Control vs. Gift” report the inference of the effects of the gift treatment and those under “Control vs. Notification” report the inference of the effects of the notification treatment, all based on two-sided t-tests.

Table 10: Heterogeneous Effects of Treatments: The Second Experiment

Sample	N	Control vs. First Reward			Control vs. Second Reward					
		Control	First	Second	Difference	SE	p-Value			
All Customers	120,258	60.22	140.42	151.31	80.20	30.02	0.008	91.09	33.96	0.007
By Total Investment Return (in RMB)										
$\leq 2,000$	58,167	24.05	38.25	45.90	14.20	15.53	0.361	21.85	15.92	0.170
$> 2,000$	62,091	94.07	235.28	251.05	141.20	56.10	0.012	156.98	64.29	0.015
By Recency (in Days)										
≤ 50	59,892	105.07	143.39	184.82	38.32	38.95	0.325	79.75	56.62	0.159
> 50	60,366	15.85	137.46	118.16	121.62	45.74	0.008	102.31	37.77	0.007
By Whether Had Successful Referrals										
Yes	13,439	93.51	172.24	142.00	78.74	77.40	0.309	48.50	71.34	0.497
No	106,819	56.07	136.41	152.49	80.35	32.37	0.013	96.42	37.18	0.010

Notes. The column “N” reports sample sizes. The columns “Control”, “First”, and “Second” report means of the outcome variable (i.e., total value of referred customers) in the control condition, the first value-based reward condition, and the second value-based reward condition, respectively. The columns under “Control vs. First Reward” report the inference of the effects of the first value-based reward and those under “Control vs. Second Reward” report the inference of the effects of the second value-based reward, all based on two-sided t-tests.

Table 11: Regression Analysis of Heterogeneous Treatment Effects: The First Experiment

	Model 1	Model 2	Model 3	Model 4
Gift	27.69*** (9.65)	27.60*** (9.63)	10.09 (6.48)	10.83 (6.66)
Notification	26.74** (11.33)	26.71** (11.35)	21.83** (10.58)	23.04** (10.91)
Log(Return)	0.12 (2.05)			-1.06 (2.06)
Recency		-0.06*** (0.02)		-0.06*** (0.02)
Had Referrals			17.01* (10.31)	16.04 (10.52)
Gift × Log(Return)	13.19 (9.23)			8.26 (7.81)
Notification × Log(Return)	20.64** (9.54)			18.80** (8.26)
Gift × Recency		-0.11* (0.06)		-0.07 (0.05)
Notification × Recency		-0.12* (0.07)		-0.09 (0.06)
Gift × Had Referrals			135.83** (60.63)	130.00** (58.03)
Notification × Had Referrals			39.01 (52.64)	28.00 (50.09)
Intercept	10.76*** (2.62)	10.79*** (2.63)	8.53*** (2.61)	8.69*** (2.69)
R^2	2.066×10^{-4}	1.952×10^{-4}	5.252×10^{-4}	6.924×10^{-4}
Observations	93,288	93,288	93,288	93,288

Notes. * $p < .1$. ** $p < .05$. *** $p < .01$. Results are from a linear model with total value of referred customers as the dependent variable. The model is estimated using ordinary least squares (OLS). Robust standard errors are reported in parentheses. Logarithm of total investment return and investment recency have been mean-centered.

Table 12: Regression Analysis of Heterogeneous Treatment Effects: The Second Experiment

	Model 1	Model 2	Model 3	Model 4
First Reward	79.18*** (29.90)	80.20*** (30.03)	80.35** (32.37)	85.98** (34.63)
Second Reward	91.05*** (34.03)	90.88*** (33.93)	96.42*** (37.18)	103.42** (40.52)
Log(Return)	20.59*** (7.92)			19.00** (8.49)
Recency		-0.27*** (0.08)		-0.23*** (0.07)
Had Referrals			37.44 (50.38)	8.56 (55.33)
First Reward \times Log(Return)	43.32** (17.88)			45.31** (18.93)
Second Reward \times Log(Return)	40.67* (21.75)			43.55* (23.22)
First Reward \times Recency		-0.06 (0.12)		0.01 (0.12)
Second Reward \times Recency		-0.18 (0.18)		-0.12 (0.16)
First Reward \times Had Referrals			-1.61 (83.90)	-60.83 (91.83)
Second Reward \times Had Referrals			-47.92 (80.46)	-111.45 (97.34)
Intercept	60.43*** (14.23)	60.28*** (14.17)	56.07*** (14.75)	59.51*** (16.05)
R^2	5.254×10^{-4}	1.336×10^{-4}	7.027×10^{-5}	5.806×10^{-4}
Observations	120, 258	120, 258	120, 258	120, 258

Notes. $*p < .1$. $**p < .05$. $***p < .01$. Results are from a linear model with total value of referred customers as the dependent variable. The model is estimated using ordinary least squares (OLS). Robust standard errors are reported in parentheses. Logarithm of total investment return and investment recency have been mean-centered.