Do social image concerns affect technology diffusion? Evidence from mobile banking in Pakistan*

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February 13, 2024

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Abstract

Do social image concerns, such as garnering prestige from others and showing respect to others, affect information-passing about important technologies? In an experiment in rural Pakistan, I measure the effects of social image concerns on information-passing about mobile banking, an important technology in this context, and parse the role of prestige and respect concerns. Villagers (senders) decide whether to pass information designed for high-competence users, a growth-oriented pamphlet, or information designed for low-competence users, a safety-oriented pamphlet, to fellow villagers (receivers). To identify social image concerns, I cross-randomize (i) whether the sender's identity is hidden from the receiver or revealed and (ii) whether the sender's targeting of the receiver is hidden from the receiver (receiver told information passed to "a fellow villager") or revealed (receiver told information passed to "you, specifically"). When senders know their identity and targeting of the receiver will be revealed, they share the growth-oriented pamphlet more and the safety-oriented pamphlet less. These effects are entirely driven by sharing among weak social ties, consistent with signaling concerns being larger among pairs with fewer prior interactions. When only the sender's identity is revealed, effects are smaller and insignificant, suggesting that concerns around showing respect matter more than concerns around garnering prestige in this context. In simulations of a two-topic social learning model using full network data from Indian villages, communication in a network over time amplifies the effect of social image concerns on information diffusion, the frequency of conversations about growth relative to safety, and the adoption of dangerous technologies, relative to the static effects estimated in the experiment. This amplification is stronger when fewer households are given information initially.

*First version: July, 2023. I want to thank all of the study participants and field officers for their time and attention, especially those involved in the pilot studies whose feedback was integral to the development of this study. I am immensely grateful to Arun Chandrasekhar, Pascaline Dupas, and Melanie Morten for their wisdom and advice without which this project would not have been possible. I thank Adrienne Baer, Esther Duflo, Marcel Fafchamps, Matthew Jackson, Phillip Roessler, Hussam Razi, Amna Mahmood, Hina Shaikh, Ali Hasanain, Bilal Gilani, Amnah Imtiaz, Mohsin Ali, Ali Hamza, Anirudh Sankar, Alexandr Lenk, Andrès Felipe Rodriguez, Vijay Singh, Tahir Quereshi, Taimoor Ali, Omar Moeen Malik, Ali Farid Khwaja and seminar participants at Stanford University for sharing useful information in spite of any social image concerns they may have had. Financial support for this project came from the International Growth Centre (IGC), the Stanford King Center on Global Development, the Stanford Institute for Economic Policy Research (SIEPR), and the George P. Shultz Dissertation Fund. The research protocol was approved by Stanford University IRB and registered in the AEA RCT registry (AEARCTR-0011455). Email: mwalsh24@stanford.edu

1 Introduction

Information diffusion is critical to many of the policy challenges facing low-and-middle-income countries (LMICs). Farmers are often unaware of yield-improving technologies (Udry, 2010; Duflo et al., 2011), workers are misinformed about labor market opportunities (Baseler, 2020; Shrestha, 2020), and parents remain ignorant of critical health practices (Rhee et al., 2005; Andrus et al., 2020; Dupas et al., 2023). Since many LMIC communities are remote and distrusting of outside sources, a common approach to information diffusion is seeding information with a few community members and relying on them to share the information with others.[1] Empirical research on these seeding-based information campaigns is decidedly mixed. In some cases, those seeded with information ("seeds") spread information widely (Banerjee et al., 2019), while in others, seeds keep the information to themselves or only inform their strong social ties (Kondylis et al., 2017; Beaman et al., 2021). Understanding why seeds share some types of information more than others could help policymakers more effectively diffuse important information to those who need it.

In this paper, I explore how social image concerns influence information-passing decisions and information diffusion in rural Punjab, Pakistan. Social image concerns may be especially strong in LMIC communities because villagers rely on other community members to weather negative shocks that would otherwise result in severe deprivation (Scott, 1977; Townsend, 1994). Passing information could affect one's social image by signaling one's abilities (e.g., garnering prestige by demonstrating expertise) or signaling one's beliefs about the receiver's abilities (e.g., disrespecting someone's intelligence by sharing elementary information).

In Section 3, I present a model of information-passing with social image concerns. In the model, a Sender decides whether to share information with a Receiver. The Sender cares about the Receiver's payoff (altruism), but also considers how sharing the information affects how others' view them (social image concerns). I distinguish between concerns around garnering prestige for oneself and concerns around showing respect to others.

The first type of social image concern, prestige, captures how information-passing signals the Sender's general type. Prestige concerns arise when sharing a piece of information constitutes a signal of a desirable or undesirable trait. With regard to information-passing, a common form of prestige concerns is the desire to signal high-intelligence or knowledge by sharing novel or complex information. As documented across cultures by anthropologists (Henrich and Gil-White, 2001), individuals defer to those with superior informational goods, providing an incentive to signal high access to informational goods. Consistent with Henrich and Gil-White (2001), recent research has found that villagers in rural South Asia are highly sensitive to other community member's perception of their intelligence

[1] For example, in 2014-15, the government of India spent $250m on agricultural extension and training primarily using this approach (Gulati et al., 2018)

and competence (Banerjee et al., 2018; Chandrasekhar et al., 2018).

The second type of social image concern, respect, is novel in the economics literature and emerges when an action is *targeted toward* another individual. In the existing models of social image concerns, an agent takes an action, such as voting, consumption, or work effort, that is not targeted at any individual. Thus, the observers of the agent only make inferences about the agent's general type (prestige). With a targeted action, the Sender directs their action towards a specific Receiver, meaning that observers can make inferences about the Sender's general type (prestige) and the Sender's type when acting toward the Receiver (respect). In the context of information-passing, respect concerns arise when a piece of information is more beneficial to those with a desirable or undesirable trait. For example, in a community where premarital sex is frowned upon, sharing information about safe sex practices with an unwed friend could be perceived as a signal of low-regard for their moral fiber. If the Receiver believes the Sender has little respect for them, then the Receiver may lower their relational investment as retaliation or because the expected benefits of a relationship are increasing in respect (i.e. it is better to form relationships with people who think highly of you).

The model shows that social image concerns are likely to affect weak social ties more than strong ties. Weak ties typically have less precise priors over the Sender's general type and the Sender's type when acting toward the Receiver since they have had less opportunities to learn about the Sender through repeated interactions. Thus, weak ties make larger updates, on average, upon observing the Sender's information-passing decision. Holding constant across tie strength the relative weight placed on social image concerns vis a vis the Sender's other concerns, these larger updates mean that weak ties alter their information-passing choices more in response to social image concerns. Given the importance of weak ties in the diffusion of novel information (Granovetter, 1973), social image concerns among weak ties could have substantial effects on the speed and breadth of diffusion.

In an experiment in rural Punjab, Pakistan, I measure how social image concerns affect information-passing about mobile banking, an important technology in this context, and separately identify prestige and respect concerns. The experiment offers participants (senders) the opportunity to pass up to two types of mobile banking information to fellow villagers (receivers). I design one pamphlet to primarily be useful to villagers with high-competence using mobile banking. This pamphlet (the growth pamphlet) focuses on advanced mobile banking services, such as savings accounts, e-commerce, and agricultural finance, that few villagers knew about prior to the experiment.[2] I design the second pamphlet to primarily be useful to villagers with low-competence using mobile banking. This pamphlet (the safety pamphlet) focuses on protecting people from mobile banking scams.[3] As expected, villagers report that sharing the growth pamphlet signals higher-regard for the receiver's abilities than sharing

[2]Refer to Appendix S.3.8.1 for growth pamphlet images and English translations.
[3]Refer to Appendix S.3.8.2 for safety pamphlet images and English translations.

the safety pamphlet.

To test whether social image concerns are larger among weak ties, the senders make information-passing decisions to a weak social tie and a strong social tie.[4] The procedure for assigning receivers to senders ensures that the strong and weak tie receivers are balanced on personal characteristics while differing in the strength of their tie with the sender. Senders confirm that they exchange advice, loans, and gifts more frequently with their assigned strong tie. Since the weak ties are fellow villagers of the sender and villages in the sample are relatively small,[5] the sender almost always knows the weak tie receiver and, in most cases, has given advice to them at least once in the past two months.

To identify social image concerns, I randomize how the recommendations are presented to the receiver. In the control group, *Hidden Sender, Hidden Targeting*, the field officer only discloses to the receiver that "a fellow villager recommended that I give this information to a fellow villager." In the main treatment group, *Revealed Sender, Revealed Targeting*, the field officer reveals the sender's identity and their targeting of the receiver by saying "[Sender Name] recommended that I give this information to you, [Receiver Name], specifically." Crucially, the sender always knows how the information will be presented to the receiver before making their information-passing decision, and always knows who will receive their recommendation. Compared to the *Hidden Sender, Hidden Targeting* group, senders in the *Revealed Sender, Revealed Targeting* group are more likely to worry that their information-passing decisions will affect how others' view them and thus, will have higher social image concerns.

I find that social image concerns shift sharing toward the growth-oriented pamphlet and away from the safety-oriented pamphlet, with the effects entirely driven by weak social ties. Among weak ties, revealing the sender's identity and targeting of the receiver increases sharing of the growth pamphlet by 12.9 pps (50.0% of the control mean; $p = .001$) and decreases sharing of the safety pamphlet by 9.0 pps (16.8% of the control mean; $p = .035$). In contrast, sharing among strong ties barely changes for the growth pamphlet (increase of .7 pps; $p = .840$) or the safety pamphlet (increase of 2.5 pps; $p = .531$).

To separately identify prestige from respect concerns, I cross-randomize whether the sender's identity is revealed and whether the sender's targeting of the receiver is revealed. In *Revealed Sender, Hidden Targeting*, the sender knows that the field officer would tell the receiver that, "[Sender Name] recommended that I give this information to a fellow villager." Thus, the receiver is able to make inferences about the sender's general type (prestige) but is not be able to make additional inferences about the sender's type when acting toward the receiver (respect). If social image concerns are primarily driven by prestige, the effect of *Revealed Sender, Hidden Targeting* should be similar to the

[4]Senders surveyed in the first phase of data collection (March-April 2023) (23.1% of the sample) only made one recommendation. It was randomized whether the recommendation was to a strong or a weak social tie.

[5]The villages in the sample contain 100-200 households.

effect of *Revealed Sender, Revealed Targeting*.

The experimental results suggest that respect rather than prestige is the primary driver of social image concerns for senders. As with overall social image concerns, there is no evidence of prestige concerns among strong social ties. Among weak ties, revealing the sender's identity increases sharing of the growth pamphlet by 4.0 pps ($p = .291$) and decreases sharing of the safety pamphlet by 2.6 pps ($p = .535$). These effects are less than one-third the size of the overall social image concerns effect, suggesting that concerns around showing respect to others drive social image concerns more than concerns around garnering personal prestige in this context.

The *Hidden Sender, Revealed Targeting* treatment identifies the sender's general respect concerns. In the *Hidden Sender, Revealed Targeting* group, the sender knows that the field officer would tell the receiver that, "a fellow villager recommended that I give this information to you, [Receiver Name], specifically", meaning that the receiver is able to make inferences about how people, in general, act toward the receiver (general respect). The sender may care about signaling general respect for the receiver because the receiver's general belief about others' respectfulness likely influences their prior on the sender's respectfulness. Alternatively, the sender may intrinsically dislike disrespecting the receiver due to other-regarding preferences.

I estimate a substantial and significant effect of general respect concerns on information-passing, once again driven by passing among weak ties. Among weak ties, sharing of the growth pamphlet increases by 9.4 pps ($p = .017$) and sharing of the safety pamphlet decreases by 4.8 pps ($p = .264$). I find some evidence that other-regarding preferences drive general respect concerns more than other social image concerns. Specifically, heterogeneity analyses reveal that senders who give more in dictator games with other villagers are somewhat more affected by general respect concerns, but are significantly less affected by other social image concerns.

To understand the implications of the experiment for community-level social learning, I simulate a model of communication and learning in a network that embeds my main experimental findings. Most existing models of social learning in a network focus on one topic[6] and assume homogenous communication rates across ties. I augment the Generalized DeGroot Model (Banerjee et al., 2021b) to incorporate simultaneous communication and learning about multiple topics and to vary passing rates by level of social image concerns, tie strength, and information topic. With this augmented model, I simulate the effect of social image concerns on information diffusion, conversation composition (i.e., the likelihood a conversation is about growth relative to safety), and adoption using network data gathered from 75 LMIC villages in Karnataka, India (Banerjee et al., 2013).

Relative to the experimental setting, communication on a network over multiple periods amplifies the

[6]Lazzati (2020) is a notable exception. However, Lazzati (2020) examines complementary technologies and uses a mean-field approximation rather than a graph of social connections.

effect of social image concerns, particularly under sparse seeding. The experiment measures the effect of social image concerns in one period of communication. I will call this object the "static social image concerns effect". In the simulations where the effect of social image concerns can accumulate over multiple communication rounds, the peak effect of social image concerns on the likelihood of a given discussion being about growth is more than double the "static effect". This network amplification seems to be driven by more communication of growth information to uninformed nodes who then can only share growth information in the next period. Consistent with this story, I show that dense seeding (i.e. giving all villagers information on growth and safety in the first period) mutes network amplification by ensuring all nodes are informed about both topics from the beginning. Even without dense seeding, almost all nodes become informed about both topics in the long-run, and the effect of social image concerns converges back to the "static effect".

Even after the network amplification of social image concerns subsides, the communication from these rounds still influences beliefs about the technology, resulting in more adoption of high growth-potential but dangerous technologies when social image concerns are present. Since social image concerns increase communication about growth relative to safety, nodes are more likely to be informed and correct about the growth potential of a technology, but are also more likely to be uninformed or incorrect about the safety of a technology. If a technology is high-growth potential but dangerous, more nodes adopt under social image concerns because more nodes are correct about the growth potential but are unaware that the technology is dangerous.

The simulations also suggest that the concentration of social image concerns among weak ties amplifies their effect on community-level outcomes. In the 75 Indian village networks used for my simulations, I find that weak ties are twice as likely as strong ties to cross social clusters. When I run simulations assuming that social image concerns are concentrated among strong ties rather than weak ties, the effects on information diffusion, conversation composition, and adoption are smaller, likely due to the fact that strong ties are more likely to be redundant.[7]

Overall, the simulations indicate that social image concerns result in more communication and learning on topics beneficial to those with desirable traits (e.g. growth information) and less on topics beneficial to those with less desirable traits (e.g. safety information). These dynamics could help explain why fraud and scams are a persistent problem for users of digital financial services across LMICs (Garz et al., 2021). They could also explain why technologies tend to follow predictable hype and disappointment cycles where users learn about the benefits of a technology before learning about potential downsides and risks. More broadly, these dynamics could illuminate why there is often slow

[7]This result depends on the, potentially incorrect, assumption that weak and strong ties have the same passing rates absent social image concerns. This is an assumption made by most of the extant literature (e.g. Banerjee et al. (2021b)). Even without this assumption, this result still tells us that weak ties hold more critical network positions than strong ties, and thus, that phenomena that affect weak ties are likely to have substantive effects on community-level social learning outcomes.

diffusion of information beneficial to those with undesirable traits such as information on mental health (Smith, 2023), HIV/AIDS (Young and Bendavid, 2010), and social insurance programs (Celhay et al., 2022).

This paper is most directly relevant to the literature on information diffusion in social networks. A long literature explores the importance of weak ties in diffusing novel information (Granovetter, 1973; Jackson, 2008; Aral, 2016). Recent work focuses on the diversity-bandwidth tradeoff where weak ties transmit more novel information but strong ties are able to transmit a larger quantity of information (Aral and Alstyne, 2011). My findings suggest that social image concerns could contribute to the bandwidth-constraints of information transmission across weak ties.

Theoretical models in the networks literature typically focus on the effect of network structure on information diffusion rather than the motivations underlying information-passing decisions. Over the past decade, empirical work testing these models generally finds that seeding information using network theory leads to significant increases in information diffusion (Aral et al., 2013; Banerjee et al., 2013, 2019, 2021a; Beaman et al., 2021). In some cases, these interventions have led to high diffusion, but in others, diffusion is still disappointingly low even when seeds view the information as beneficial (Kondylis et al., 2017; Banerjee et al., 2018; Benyishay and Mobarak, 2019; Duflo et al., 2022; Chandrasekhar et al., 2022). My work provides evidence that differences in social image concerns across information topics could explain why seeding works in some cases but not in others.

Other scholars have explored whether models of endogenous communication can explain social learning failures better than standard information diffusion models, which typically assume exogenous transmission of information. Niehaus (2011) characterizes how complementarities between pieces of information can cause individuals to under-share information, resulting in unbounded welfare losses. Immorlica et al. (2014) model information diffusion when information is rivalrous and nodes communicate strategically. Chandrasekhar et al. (2022) explain their experimental results through a model where sharing information signals an individual's general reliability. My work contributes to this literature by experimentally exploring the motivations behind communication decisions and by incorporating these motivations into a model of social learning on a network.

This paper also builds upon the literature on social image concerns in behavioral economics.[8] This literature has examined social image concerns' influence on untargeted actions, such as voting (Dellavigna et al., 2017), educational choices (Bursztyn et al., 2019a), work effort (Mas and Moretti, 2009), and consumption (Bursztyn et al., 2019b). Chandrasekhar et al. (2018) is one of the few studies to examine social image concerns around a targeted action, a Seeker soliciting information from an Advisor.[9] My paper proposes a novel type of social image concern (respect) that is only

[8]Refer to Bursztyn and Jensen (2017) for a review.

[9]Chandrasekhar et al. (2018) describe an individual seeking information from another as active learning. This paper can

present for targeted actions and provides experimental evidence of its relevance in an economically important context.

The rest of the paper is organized as follows. First, I provide background on social image concerns in my context (Section 2) and present a model of information-passing with social image concerns (Section 3). Then, I outline the sampling procedures and experimental design (Section 4), before presenting the empirical framework (Section 5) and results (Section 6). Motivated by my experimental results, I augment a model of social learning in a network and simulate the effect of social image concerns on village-level social learning (Section 7). I conclude with implications for the design of information campaigns and suggestions for future research (Section 8).

2 Motivation: Information diffusion and social image concerns in rural Punjab, Pakistan

In this section, I provide survey evidence on the nature of social image concerns in the study areas (rural areas of the Gujranwala, Mandi Bahauddin, and Hafizabad districts of Punjab, Pakistan) and how they might affect the diffusion of mobile banking information. In Section 2.1, I discuss the relevant social image concerns in this context and the driving forces behind these concerns. In Section 2.2, I outline why mobile banking in Pakistan is an ideal setting for studying these concerns.

2.1 Social image concerns in rural Punjab, Pakistan

Villagers in the study areas are highly concerned with how others view them. In a descriptive survey of 144 villagers in the study areas (but in non-study villages), I asked a series of questions adapted from Mosquera et al. (2008) to measure the importance of social image. On average, the Pakistani villagers reported higher social image concerns than the Dutch and Moroccan/Turkish-Dutch respondents of Mosquera et al. (2008). 71% of Pakistani villagers report "how others view them" is very or extremely important to them and 73% reported that being seen as deserving of respect by others in their community is very or extremely important.

One reason that villagers are concerned with their social image may be the economic interdependence of villagers in this context. Given the precarity of their economic conditions, villagers must rely on solidarity networks to weather negative shocks that would otherwise result in severe deprivation (Scott, 1977; Fafchamps, 1992; Mobius and Rosenblat, 2016). In the study's sample, 80% would rely on loans/transfers from their social ties if they needed $\approx$ \$30 in the next three days. These levels of interdependence give villagers ample incentive to engage in deliberate management of social interactions in order to control their public image and ensure access to solidarity networks.

be seen as examining passive learning where the Sender/Advisor gives unsolicited advice to the Receiver/Seeker.

When we ask villagers specifically about giving advice, they report that giving bad or disrespectful advice can affect one's social image and access to solidarity networks. 75% of villagers report that giving bad advice would hurt the sender's reputation and 78% agree that the receiver of the advice would be justified in refusing to hire or assist the sender in the future. Similarly, 71% reported that giving disrespectful advice would hurt the sender's reputation and 81% agree that the receiver would be justified in refusing to hire or assist the sender. Understandably, 80% of the study's sample agree that they worry about the prestige and/or respect consequences of sharing information about mobile banking.

2.2 Mobile banking in rural Punjab, Pakistan

In many low-and-middle-income countries, mobile banking has increased account ownership rates among poor households, improving their resilience and ability to invest for the future. Mobile banking allows users to open and manage formal financial accounts through their mobile phones, reducing costs, and increasing convenience for households in rural areas that are unlikely to live near a bank branch. After registering an account, users can avail a network of mobile banking agents in order to make deposits or withdrawals. In general, research has found that mobile banking accounts increase poor households' ability to invest in their farms or businesses and cope with negative shocks.[10] The benefits of mobile banking for poor households may grow over time as firms expand the range of services offered.

In Pakistan, the private and public sector have invested in spreading awareness and improving access to mobile banking services. Pakistan was one of the first low-and-middle-income countries where mobile banking was available (GSMA, 2020). The two largest mobile banking providers in Pakistan, EasyPaisa and JazzCash, have invested in extensive mobile banking agent networks so that users can easily open an account, deposit money, and make withdrawals.[11] Typically, there are no fees on registering or depositing money and 1-3.5% fee on withdrawing money. The State Bank of Pakistan has sought to encourage mobile banking adoption by capping fees, launching an instant interoperable payment switch, and broadcasting information through television, newspaper, and radio advertisements. The private sector has recently expanded the range of digital services offered to include savings accounts (paying 7-15% profit rates),[12] loans, insurance, and e-commerce.

These investments have resulted in relatively high awareness of mobile banking but have failed to

[10] Refer to Suri et al. (2021) for a review of the literature on mobile money and banking

[11] In the 2022 Financial Inclusion Insights Survey, 70% of respondents in the study districts report being under 15 minutes from a mobile banking agent, 81% report being under 30 minutes away, and 99% report being under an hour away (InterMedia, 2022).

[12] Since Pakistan is a Muslim-majority country, banks typically offer savers profit rather than interest to ensure compliance with Sharia law. In this system, banks and customers agree to a profit-sharing ratio rather than a guaranteed interest rate. Usually, banks quote an expected profit rate to customers and gear their investments to meet or exceed this profit rate.

catalyze usage and learning. As of 2017, 77% of Pakistanis were aware of at least one mobile banking provider, but only 12.4% had ever used mobile banking. Even among those using mobile banking, usage is infrequent and typically limited to sporadic transfers to distant friends and relatives (InterMedia, 2020). In terms of learning about the benefits of mobile banking, only a quarter of my study sample mention you can transfer money via your phone or that you can save money on your phone. Even fewer mention advanced uses that are popular in other low-and-middle-income countries such as savings accounts, e-commerce, micro-loans, or paying utility bills (Table S2).

One reason for low usage of mobile banking may be low digital financial literacy. If Pakistanis fear fraud or user errors, then they may be reluctant to use mobile banking extensively. Over half of the study's sample say that they have heard of someone losing money due to mobile banking. About one third report personal experience being contacted on their phone by an unknown person requesting money or their PIN number, and many of them responded to the likely scammer rather than just ignoring them or reporting them to their mobile network operator (Table S3). This low digital financial literacy may be why the sample reports being more comfortable keeping large amounts of money at home compared to storing it in a mobile banking account (Table S3). As Garz et al. (2021) highlight, mobile banking fraud and consumer protection issues are not confined to Pakistan, but, in fact, are present across low-and-middle income countries.

In many cases, mobile banking and consumer financial protection information has reached a given village but has not diffused widely, suggesting communication frictions. For example, in nearly 40% of the sampled villages, one of the 18 sampled respondents knows one can receive profit through a mobile banking account, but this information only diffused to 25% of villagers in these villages. In the realm of consumer financial protection, nearly half of the sampled villages have a villager who knows about mobile banking helplines, but this information only diffused to 21% of villagers in these villages. Similarly, over half of the sampled villages have a villager who knows to ignore likely scammers, but a substantial portion (39%) of villagers in these villages still responded last time they were contacted by a likely scammer. These numbers indicate that improving communication between villagers could increase the proportion of the village with the knowledge necessary to effectively use mobile banking.

3 Model of information-passing

In this section, I model an individual (a Sender) deciding whether to pass information to one of their social ties (a Receiver). In the model, Senders care about the information's benefit to the Receiver (altruism) as well as the effect of information-passing on how they are viewed by the Receiver (social image concerns). First, I detail the model environment (Section 3.1). Then, I analyze the model

(Section 3.2) and derive predictions relevant for the experiment (Section 3.3). Finally, I outline the role of prestige and respect (Section 3.4), generalize my analysis to sharing of multiple types of information (Section 3.5), and summarize the results and predictions of the model (Section 3.6).

3.1 Environment

I focus on the decision of one social tie (the Sender) to pass information to another social tie (the Receiver). The Sender is denoted by i, the Receiver by j, and the Sender's decision to pass information to the Receiver by $d_{ij} \in \{0, 1\}$. If the Sender shares the information, the Receiver receives an informational payoff, $V(T_j)$, which depends upon their type, $T_j \in \{H, L\}$. Following the convention in the literature, I refer to those with the trait perceived as desirable as the high-types and those with the traits perceived as undesirable as the low-types.

The Sender's expectation of the Receiver's informational payoff depends on their belief about the Receiver's competence. I denote the probability the Sender assigns to the Receiver being a high-competence as $\theta_{ij} = Pr(T_j = H)$. I will refer to θ_{ij} as the Sender's regard for the Receiver. From the perspective of the Sender (the perspective that matters for analyzing the Sender's decision), the Receiver's payoff distribution is $V(\theta_{ij}) = \theta_{ij} * V(H) + (1 - \theta_{ij}) * V(L) + \eta_{ij}$, where η_{ij} is a Sender-Receiver pair idiosyncratic shock that is observable to the Sender but unobservable to the Receiver. Let F_θ be the c.d.f. of $V(\theta)$ for Senders who believe the Receiver is an high-type with probability θ. Let G_θ be the complementary c.d.f..

Since the Sender's regard for the Receiver, θ_{ij}, is static, one can think of θ_{ij} as the Sender's type in relation to the Receiver. I consider θ_{ij} to be static since I am analyzing the case where the Sender must make an information-passing decision without the ability to gather further information about the Receiver. Since θ_{ij} is, essentially, the Sender's type, I consider what inferences the Receiver can make about θ_{ij} upon observing the Sender's decision, d_{ij}.

The Receiver updates their belief about the Sender's regard for them, θ_{ij}, based on the Sender's decision. The Receiver begins with a prior c.d.f., π, over the Sender's regard for them, θ_{ij}. Additionally, the Receiver believes that the Sender has information to share with probability q. Once the Sender makes a decision and the Receiver observes it, the Receiver updates π to a posterior c.d.f., $B(d_{ij}, \pi, q)$, according to Bayes rule.

For the basic analysis, I assume that π and q are fixed across Receivers, so that the Receiver's posterior over the Sender's regard for them only depends on the Sender's decision to share or withhold the information. With these simplifying assumptions, the Receiver's posterior over the Sender's regard can be characterized as $\mathbb{E}(\theta_{ij} \mid d_{ij})$.

The Sender's decision maximizes the following payoff function:

$$U_i = \underbrace{d_{ij} \cdot V(\theta_{ij})}_{\text{altruism}} + \underbrace{\gamma(\mathbb{E}(\theta_{ij} \mid d_{ij}), \lambda, \omega)}_{\text{social image concerns}} \tag{3.1}$$

The Sender's payoff is comprised of two terms: altruism and social image concerns. The altruism term captures that the Sender is likely to care about how beneficial the information is to the Receiver. The altruism term disappears if the Sender does not share information ($d_{ij} = 0$). This assumption may seem unnatural given that the Sender is likely to still care about the Receiver's welfare even when they do not share information, but one can think of this assumption as simply normalizing the Receiver's payoff absent information to 0.[13]

The second term, social image concerns, captures the signaling consequences of the Sender's decision in a given recommendation environment. The bounded, continuous function γ maps the recommendation environment and the Receiver's posterior to an effect on the Sender's payoff. I assume that γ is a continuous, bounded function that is increasing in the Receiver's posterior, $\mathbb{E}_j(\theta_{ij} \mid d_{ij})$, meaning that the Sender prefers to signal high rather than low-regard for the Receiver. The recommendation environment is characterized by the observability of the Sender's identity, λ, and the observability of the targeting of the Receiver, ω. If the Sender's identity and the targeting of the Receiver are hidden, then the Sender will not have social image concerns, $\gamma(., 0, 0) = 0$.

I can distinguish between two forces driving social image concerns, prestige and respect. Re-writing the sender's payoff with prestige and respect yields:

$$U_i = \underbrace{d_{ij} \cdot V(\theta_{ij})}_{\text{altruism}} + \underbrace{\lambda \cdot \phi(\mathbb{E}(\overline{\theta_i} \mid d_{ij}))}_{\text{prestige}} + \underbrace{\omega \cdot \psi(\mathbb{E}(\theta_{ij} - \overline{\theta_i} \mid d_{ij}))}_{\text{respect}} \tag{3.2}$$

I define prestige concerns as the Sender's concerns around signaling their general type. In a community with N people, the Sender's general type can be represented as the average of how the Sender acts toward others in their community, $\overline{\theta_i} = \frac{\sum_{j \in N} \theta_{ij}}{N}$. The Sender's concerns around signaling their prestige depends on the observability of their identity, λ. The bounded, continuous function ϕ maps the Receiver's posterior over the Sender's general type to an effect on the Sender's payoff.

I define respect concerns as the Sender's concerns around signaling their type when acting toward the Receiver, distinct from their concerns around signaling their general type. In other words, respect concerns capture Sender's concerns with signaling $\theta_{ij} - \overline{\theta_i}$, the Sender's type when acting toward toward the Receiver controlling for how the Sender generally acts. The Receiver's ability to learn

[13] While this model does not focus on potential complementarities between the Receiver and Sender, any direct effect of the Receiver's informational payoff on the Sender's welfare would be captured in this first term as well.

about the Sender's respect for them specifically depends on the observability of the fact that the action is targeted toward the Receiver, ω. The bounded, continuous function ϕ maps the Receiver's posterior over the Sender's respect for them to an effect on the Sender's payoff.

Definition 1 (Equilibrium)**.** A (mixed) strategy for the Sender is a map from a level of regard for the Receiver, θ_{ij}, and an idiosyncratic Sender-Receiver shock, η_{ij}, to a probability of sharing the information, $\sigma : [0,1] \times \mathbb{R} \to [0,1]$. Thus, $\sigma(\theta_{ij}, \eta_{ij})$ is the probability $d_{ij} = 1$ given the Sender's regard for the Receiver, θ_{ij} and a Sender-Receiver shock η_{ij}. A belief function for the Receiver is a map from the Sender's decision to a posterior c.d.f over the value of θ_{ij}: $B : \{0,1\} \to \mathcal{P}([0,1])$. Thus, $B(d_{ij})$ is the cumulative distribution function over θ_{ij} induced by the sender decision d_{ij}.

A Bayes-Nash equilibrium is defined to be a pair (σ, B) where B is consistent with Bayesian updating assuming the Sender plays according to σ, and σ maximizes the Sender's payoff taking B as given.

A tuple of primitives $(\pi, q, (F_\theta)_{\theta \in \{0,1\}}, \gamma, \lambda, \omega)$ denotes the environment.

3.2 Basic analysis

I analyze the Bayes-Nash equilibria of the model where the Sender best-responds to the belief-updating function of the Receiver.[14] The key assumption is on the relationship between the Sender's regard for the Receiver and the Sender's perception of the information's benefit to the Receiver.

Assumption 1. If $\theta' < \theta$, then $F_{\theta'}$ strictly first-order stochastically dominates F_θ

This assumption states that Senders with lower-regard for their Receiver perceive greater information benefits for the Receiver.[15] There are a number of cases where this assumption is likely to hold. Highly-regarded Receivers may be more likely to already know the information. Alternatively, highly-regarded Receivers may be able to figure out the information on their own. To simplify the analysis further, I make the following technical assumption:

Assumption 2. For any $\theta \in (0,1)$, the Sender's perception of the Receiver's payoff distribution $V(\theta)$ has an atomless distribution in the positive reals

With these assumptions in place, I can characterize the equilibria of the model. Taking the first derivative of Equation (3.1) with respect to d_{ij}, I get:

$$\Delta U_i = V(\theta_{ij}) + (\gamma(\mathbb{E}(\theta_{ij} \mid 1), \lambda, \omega) - \gamma(\mathbb{E}(\theta_{ij} \mid 0), \lambda, \omega)) \tag{3.3}$$

[14] My analysis follows the same general structure as Chandrasekhar et al. (2018).

[15] In Section 3.3.1, I discuss the implications for the model predictions if I reverse this assumption so that Senders with higher-regard for their Receiver perceive greater information benefits for the Receiver

Therefore, the first-order condition can be written as:

$$V(\theta_{ij}) = \gamma(\mathbb{E}(\theta_{ij} \mid 0), \lambda, \omega) - \gamma(\mathbb{E}(\theta_{ij} \mid 1), \lambda, \omega) \tag{3.4}$$

Notice that the left-hand side of the equation depends on the Sender's regard for the Receiver, θ_{ij}, while the right-hand side only depends on the Receiver's beliefs about the Sender's regard irregardless of the Sender's actual regard. I can use this to characterize equilibria in terms of cutoffs in the Sender's perception of the Receiver's informational payoff, $V(\theta_{ij})$.

Proposition 1. *Under Assumption 2, an equilibrium exists and every equilibrium is in cutoff strategies. An equilibrium is characterized by a cutoff v which satisfies*

$$v = \gamma(B_v(0), \lambda, \omega) - \gamma(B_v(1), \lambda, \omega) \tag{3.5}$$

where $B_v(.)$ is the Receiver's belief-updating function over their c.d.f. for the Sender's regard, θ, induced by this cutoff rule and are uniquely determined by the posterior odds ratios:

$$\frac{B_v(0)}{1 - B_v(0)} = \frac{\pi}{1-\pi} * \frac{1 - q\int_{y=\theta}^{1} G_v(y)}{1 - q\int_{y=0}^{\theta} G_v(y)} \quad \frac{B_v(1)}{1 - B_v(1)} = \frac{\pi}{1-\pi} * \frac{\int_{y=\theta}^{1} G_v(y)}{\int_{y=0}^{\theta} G_v(y)} \tag{3.6}$$

[16] This proposition tells us that the equillibria will be characterized by cutoffs in the Sender's perception of the informational payoff for the Receiver. Since I assume that Senders with lower-regard perceive the information as more beneficial for their Receiver, these Senders will be more likely to be above the cutoff. Thus, I can characterize the signal conveyed by sharing information given a cutoff equilibrium:

Proposition 2. *Under Assumptions 1 and 2, in any equilibrium of the signaling game, for any level of regard for a Receiver's competence $\beta \in (0, 1)$, the mass of Senders with a lower-regard than β, $\theta_{ij} \leq \beta$, choosing to share ($d_{ij} = 1$) is strictly greater than the mass of Senders with a higher-regard than β, $\theta_{ij} > \beta$, choosing to share. Therefore, sharing information signals low regard for the competence of the Receiver.*

$$\mathbb{P}_v(\theta_{ij} \leq \beta \mid d_{ij} = 1) > \mathbb{P}_v(\theta \leq \beta \mid d_{ij} = 0)$$

[17] This proposition tells us that, under the assumption that low-competence Receivers are perceived to benefit more from the information, sharing will signal that the Sender has relatively low-regard for

[16] Refer to Appendix S.3.1 for proof
[17] Refer to Appendix S.3.2 for proof

the Receiver.

3.3 Predictions

With this basic analysis in place, I turn to the predictions of the model that are relevant for the experiment. I explore the model's predictions on type of information shared, low vs. high observability environments, and tie strength.

3.3.1 Type of information

In this section, I consider how social image concerns affect the type of information shared. The key heterogeneity across information types resides in how beneficial the information is perceived to be to low-competence relative to high-competence Receivers. I consider three cases: information perceived as more beneficial to the less-competent, information perceived as more beneficial to the more-competent, and information perceived as equally beneficial across competence.

Under the assumption that information is perceived as more beneficial to the less-competent, social image concerns discourage information-passing. Since the Sender's regard reflects the Sender's probability that the Receiver is competent, Assumption 1 corresponds to assuming that information is perceived as more beneficial to the less-competent. Thus, Proposition 2 holds, meaning that sharing will signal low-regard for the Receiver. Since the Sender's payoff is increasing in the Receiver's posterior over the Sender's regard, the Sender will be more likely to withhold information when social image concerns are present.

Under the assumption that information is perceived as more beneficial to the more-competent, social image concerns encourage information-passing. To analyze the effect of social image concerns on information disproportionately beneficial to the more-competent, I can reverse Assumption 1. Specifically, I can assume that if $\theta' > \theta$, then $F_{\theta'}$ strictly first-order stochastically dominates F_θ. Symmetrically to the case shown in Proposition 2, sharing will signal that the Sender has relatively high-regard for the Receiver, meaning that social image concerns will encourage sharing of this type of information.

Following Chandrasekhar et al. (2018), I show that social image concerns disappear when information is perceived as equally beneficial to either type:

Proposition 3. *Suppose that Assumptions 1 and 2 hold. Take a sequence of environments satisfying the distribution of $F_{\theta=1}$ converging to $F_{\theta=0}$ in the total variation norm, fixing all other parameters. For any sequence of equilibria corresponding to this environment, the cutoff v converges to 0 and the information-passing decision becomes uninformative for any level of regard for a Receiver's ability*

$\beta \in (0,1)$*:*

$$\mathbf{P}_v(\theta \leq \beta \mid d=0) \rightarrow \mathbf{P}_v(\theta \leq \beta \mid d=1).$$

This proposition means that social image concerns will be present if and only if the information is perceived as disproportionately beneficial to more or less-competent Receivers.

To summarize, social image concerns discourage the sharing of information perceived as disproportionately beneficial to those with undesirable traits and encourage the sharing of information disproportionately beneficial to those with desirable traits. Therefore, social image concerns inhibit the sharing of information beneficial to stigmatized-types such as elementary, remedial, or safety information, while encouraging the sharing of information beneficial to esteemed-types, such as advanced, complex, or esoteric information. While not the focus of this paper, this result could explain the persistence of obscurantism which deliberately makes information harder to understand (i.e. increasing the correlation between benefit and ability) without enhancing the information's benefit conditional on understanding.

3.3.2 Low vs. high observability environments

In this section, I consider differences in information-passing in low vs. high observability environments. I derive the following proposition under the assumption that information is perceived as disproportionately beneficial to low-competence Receivers:

Proposition 4. *Fix all parameters except $\lambda + \omega = \delta$. Under Assumptions 1 and 2, there exists $\underline{\delta}$ such that for any $\delta < \underline{\delta}$ the equilibrium is unique. There exists $\overline{\delta}$ sufficiently high such that for all $\delta > \overline{\delta}$, the equilibrium is essentially unique and satisfies:*

$$v\left(\delta_{\text{Low}}, .\right) < v\left(\delta_{\text{High}}, .\right) \forall \delta_{\text{Low}} < \underline{\delta}, \delta_{\text{High}} > \overline{\delta}$$

This proposition tells us that increasing the observability of the Sender's identity and their targeting of the Receiver jointly can raise the threshold for information-passing when information is perceived as disproportionately beneficial to low-competence Receivers. Thus, the model predicts that increasing observability decreases sharing of information disproportionately beneficial to the less-competent. This result reverses when the information is disproportionately beneficial to high-types; the model predicts that increasing observability increases sharing of information disproportionately beneficial to high-types.

This result indicates that exogenously varying the observability of the information-passing environment constitutes a test for the presence of social image concerns. For information perceived

as disproportionately beneficial to the less-competent, the model predicts that information-sharing will be lower when observability is higher. Symmetrically, for information perceived as disproportionately beneficial to the more-competent, the model predicts that information-sharing will be higher when observability is higher. In my experiment, I test these predictions by randomizing the observability of the information-passing environment in a setting where a sender can share information meant for the less-competent or information meant for the more-competent.

3.3.3 Tie strength

In this section, I discuss the predictions of the model for sharing across weak vs. strong ties. Granovetter (1973) defines the strength of a social tie as a combination of time spent together, mutual confiding, and exchange of reciprocal services. These activities give social ties the opportunity to learn about how one of them regards the other. Therefore, it is natural to assume that strong tie Receivers will have more precise beliefs over the Sender's regard than weak tie Receivers.

If strong tie Receivers have more precise beliefs over the Sender's regard, π, than weak tie Receivers, I can characterize the model's prediction with respect to tie strength by characterizing the model's predictions with respect to the precision of π. I derive the following proposition regarding the precision of the π:

Proposition 5. *Suppose that Assumptions 1 and 2 hold. Take a sequence of environments satisfying either $\pi \to 0$ or $\pi \to 1$, fixing all other parameters. For any sequence of equilibria corresponding to those environments, the cutoff v converges to 0 and the sharing decision becomes uninformative for any level of regard for a Receiver's ability $\beta \in (0,1)$:*

$$\mathbf{P}_v(\theta \leq \beta \mid d = 0) \to \mathbf{P}_v(\theta \leq \beta \mid d = 1).$$

In this proposition, I show that social image concerns disappear if the Sender's regard for the Receiver is known. In other words, social image concerns are likely to have larger effects when the Sender-Receiver pair know each other less well, meaning that social image concerns should be larger among weak ties than among strong ties.

One concern with this prediction is that the Sender may care more about social image concerns with their strong ties relative to their weak ties. First, it is important to note that the prediction holds as long as the *relative weight* placed on the social image concerns relative to other concerns (such as altruism) is the same or decreasing across tie strength.[18] If one believes that the relative weight of

[18]The model implicitly assumes that the relative weight is the same by excluding parameters indicating differential

social image concerns is increasing in tie strength, then the experiment should be interpreted as testing the empirical strength of two opposing forces that determine the relationship between tie strength and social image concerns, namely the relative weight placed on social image concerns and the expected magnitude of the Receiver's update over the Sender's regard.

3.4 Mechanisms: Garnering prestige vs. showing respect

In this section, I discuss what the model implies about the identification of prestige and respect concerns. I define prestige concerns as the Sender's concerns around signaling their general type and respect concerns as the Sender's concerns around signaling their type when acting toward the Receiver.

When the targeting of the Receiver is hidden but the Sender's identity is revealed, $\omega = 0$ and $\lambda \neq 0$, the Sender should only have prestige concerns. In this case, the Sender is only signaling their general type since the Receiver does not know that the action was targeted at them. In terms of the model, I can rewrite the Sender's payoff function as:

$$U_i = \underbrace{d_{ij} \cdot V(\theta_{ij})}_{\text{altruism}} + \underbrace{\lambda \cdot \phi(\mathbb{E}(\overline{\theta_i} \mid d_{ij}))}_{\text{prestige}} \tag{3.7}$$

Since Proposition 4 still holds when $\omega = 0$, the model predicts that prestige concerns will depend upon the observability of the Sender's identity, λ. I leverage this fact to identify prestige concerns in the experiment.

By varying the observability of the targeting of the Receiver, ω, I can test for the relevance of respect concerns. Without respect concerns, the model predicts that changing the observability of the targeting of the Receiver, ω, should have no effect on information-passing.[19] With respect concerns, increasing ω increases the magnitude of signaling concerns (Proposition 4). Thus, whether the effect of changing ω differs from 0 constitutes a test for the presence of respect concerns.

Finally, I consider the case where only the targeting of the Receiver is observable, $\lambda = 0$ and $\omega \neq 0$. In this case, the Sender's action signals how others generally act toward the Receiver, allowing the Receiver to make inferences about the mean of how others act toward the Receiver, $\overline{\theta_j} = \frac{\sum_{i \in N} \theta_{ij}}{N}$. I call this object the Sender's concern with signaling "general respect" for the Receiver. When $\lambda = 0$

weights on altruism and social image concerns by tie strength.

[19] Most models of social image concerns do not account for respect concerns, and thus, implicitly assume that changing the observability of the targeting of the Receiver should have no effect. I essentially test whether this assumption is valid in my setting.

and $\omega \neq 0$, I can re-write the Sender's payoff function as:

$$U_i = \underbrace{d_{ij} \cdot V(\theta_{ij})}_{\text{altruism}} + \underbrace{\omega \cdot \psi(\mathbb{E}(\overline{\theta_j} \mid d_{ij})}_{\text{general respect}} \tag{3.8}$$

There are two possible interpretations of the general respect term. The first interpretation is that the Sender has other-regarding preferences and thus, cares about showing respect to others even if it does not affect the Sender's social image in particular. The second interpretation is that the Sender believes they will run into the Receiver with some probability and expects the Receiver's general view of how others act toward them (general respec) will affect how the Receiver acts toward the Sender. Without adding more structure to the model, these interpretations are isomorphic.[20]

3.5 Multiple types of information

In this section, I generalize my analysis to the case where the Sender can share information on one of two topics, X and Y. Appendix S.3.6 shows the generalized set-up for the model. A key assumption for tractability is that sharing about one topic does not cause the Receiver to update about the Sender's probability of knowing about the other topic (i.e. d_X does not affect q_Y and d_Y does not affect q_X).

I consider the following cases: two type-irrelevant topics, one low-type topic and one high-type topic, two high-type topics, and two low-type topics. I define a low-type topic as a topic perceived as disproportionately beneficial to low-type Receivers (a la Assumption 1) and a high-type topic as a topic perceived as disproportionately beneficial to high-type Receivers (the reverse of Assumption 1). With two type-irrelevant topics, social image concerns disappear just as shown in Proposition 3.

When a Sender is choosing between one high-type topic (X) and one low-type topic (Y), additional assumptions are necessary to derive clear predictions. Defining $F_{X-Y,\theta}$ to be the c.d.f. of $V_X(\theta) - V_Y(\theta)$ for Senders who believe the Receiver is an high-type with probability θ, I assume the following:

Assumption 3. If $\theta' > \theta$, then $F_{X-Y,\theta'}$ strictly first-order stochastically dominates $F_{X-Y,\theta}$.

This assumption means that the difference in perceived informational benefits between topic X and topic Y is increasing in the Sender's regard. Based on Proposition 2, social image concerns will encourage the sharing of X and discourage the sharing of Y. Taking the observability towards 0 or making priors arbitrarily precise, shrinks these concerns and can decrease the sharing X and increase the sharing Y as in Proposition 4 and Proposition 5. Taken together, these restatements of the

[20] When discussing results in Section 6.3, I consider heterogeneity across Sender altruism to provide some evidence on the validity of the other-regarding preferences interpretation.

propositions mean that social image concerns encourage information-passing of the high-type topic and discourage information-passing of the low-type topic in this case, with these effects being larger in high-observability environments and when priors are more diffuse (i.e. among weak ties).

With two high or two low-type topics, the model makes clear predictions for the "highest" (or lowest)-type topic but not for the other topic. Focusing on the case of two high-type topics, I, once again, make Assumption 3, that the difference in benefits between topic X and topic Y is increasing in the Sender's regard. With this assumption, social image concerns will encourage information-passing of topic X and these effects will be larger in high-observability environments and when priors are more diffuse. However, the effects on sharing of topic Y are ambiguous. Some senders will shift from sharing topic Y to sharing topic X due to social concerns, while others will shift from sharing nothing to sharing topic Y. The relative magnitude of these two effects will determine the effect of social image concerns on sharing of Y. The results are symmetric when considering two low-type topics.

To summarize, the majority of results go through in the case where the Sender can share information on one of two topics. Social image concerns still disappear when informational benefits are not correlated with Receiver type. When one topic is beneficial to high-types and the other to low-types, social image concerns encourage sharing of the high-type topic and discourage sharing of the low-type topic. When both topics are disproportionately beneficial to high-types, social image concerns encourage sharing of the topic that is more disproportionately beneficial to high-types, while having ambiguous effects on the other topic. Similarly, when both topics are disproportionately beneficial to low-types, social image concerns discourage sharing of the topic that is more disproportionately beneficial to low-types, while having ambiguous effects on the other topic.

3.6 Summary of results and predictions

Below, I summarize the results and predictions of the model:

1. Type of information
    - When informational benefits are perceived to be negatively associated with Receiver competence, social image concerns discourage passing of this information type.
    - When informational benefits are perceived to be positively associated with Receiver competence, social image concerns encourage passing of this information type.
2. Observability of the information-passing environment
    - If social image concerns are present, varying the observability of the Sender's identity and/or targeting of the Receiver should affect information-passing.

- If prestige concerns are present, varying the observability of the Sender's identity should affect information-passing.
- If respect concerns are present, varying the observability of the targeting of the Receiver should affect information-passing.
- When only the Sender's identity is observable, social image concerns are equivalent to prestige concerns.
- When only the targeting of the Receiver is observable, social image concerns are equivalent to general respect concerns.

3. Tie strength
    - Social image concerns are decreasing in the precision of the Receiver's prior over the Sender's type.
    - Assuming stronger ties have more precise priors, social image concerns are decreasing in tie strength.

My experimental design creates variation in the type of information, the observability of the information-passing environment, and the tie strength of the Sender-Receiver pair. Thus, the experiment provides insight into the validity of the model.

4 Experimental design

To measure the influence of social image concerns on information-passing in an economically important context, I design and run an experiment where villagers can share information about mobile banking with their social ties. I run this experiment in 78 villages across the Gujranwala, Hafizabad, and Mandi Bahuaddin districts of Punjab, Pakistan. I overview the study activities in Section 4.1. Then, I detail the procedures for sampling the villagers who make information-passing decisions (senders) (Section 4.2) and for assigning one strong social tie and one weak social tie as the receivers of the information-passing decisions of each sender (Section 4.3). I present descriptive statistics on the sender sample in Section 4.4. I describe the protocol for eliciting information-passing decisions from the senders in Section 4.5, including the type of the information shared (Section 4.5.1), the randomization of the observability of the information-passing environment (Section 4.5.4), and the measurement of the main outcome variables (Section 4.5.5). Finally, I describe the post-intervention data collection from senders (Section 4.6) and receivers (Section 4.7).

4.1 Overview of study design

I conducted the experiment in partnership with Gallup Pakistan from March-August 2023. I randomly selected rural communities from the Gujranwala, Mandi Bahuddin, and Hafizabad districts of Punjab, Pakistan as study locations.[21] For each community, Gallup Pakistan assigned two field officers the responsibility for completing the study activities.

The field officers begin work in a village by compiling a list of social ties from two randomly-selected villagers (whom I will call the "lister" respondents). The primary purpose of the listers is to provide a list of their social ties that can be used to assign "weak tie receivers" to later respondents. After completing the two lister surveys, the field officers sample 16 other villagers and elicit recommendation decisions from them under randomly-assigned recommendation environments. Each of these 16 villagers (the "sender-only" respondents) makes a recommendation decision for one of their close social ties (the "strong tie receiver") and for one of the close social ties of a lister (the "weak tie receiver"). The two lister respondents also make recommendation decisions but to two strong tie receivers rather than one strong tie receiver and one weak tie receiver, because field officers do not have a list of weak ties to draw from when interviewing the lister respondent. I will use the term "sender" to refer to the respondents who make recommendations, encompassing both the listers and sender-only respondents. Finally, I randomly-select half of the senders to have a recommendation decision implemented and the relevant receiver interviewed.

4.2 Sender sampling

In each village, two field officers sample a total of 18 villagers as senders. For the two listers, Gallup Pakistan research staff randomly select a geographic starting point for the field officers. The field officers begin work in the village by traveling to this point and engaging the households to its immediate left and right. From each of these households, a field officer selects one household member to be one of the listers for the village. After completing a lister survey, each field officer samples 8 households (16 per village) as the sender-only respondents through circular random sampling.[22]

I require that the senders are potential mobile banking users of working age.[23] These requirements raise the likelihood that the mobile banking information in the pamphlets is relevant for the listers, senders, and their social ties. I also instruct field officers to prioritize the household head or the spouse of the household head so that the respondent is likely to be involved in financial decisions such

[21] I reviewed the list to ensure communities were 1.5 kilometers apart, removing and replacing the handful of communities that did not fit these criteria.

[22] Circular random sampling is a random walk method where the field officer starts at the edge of the village and then, spirals through the village to sample respondents; Refer to Appendix S.3.7 for full description of the random walk procedure

[23] Meaning that they possessed a Pakistani Computerised National Identity Card (CNIC), a phone sim card, and are between 18-65 years old.

as saving/transferring money through mobile banking. The survey protocol calls for field officers to prioritize female household members in half of surveys, but in this context, households are wary of female household members speaking extensively with unfamiliar males. Since the majority of the field officers are male, I end up with a predominantly male sample of senders (Table 1).

4.3 Sender-receiver assignment

A key prediction of the model is that social image concerns affect information-passing more among weak ties, because there is more uncertainty about the sender's regard for the receiver's abilities. To avoid imbalance between the strong tie and weak tie receivers on personal characteristics, which might confound the test of the model's prediction on heterogeneity by tie strength, I use a novel procedure to assign receivers to senders.

First, it is important to note that if I had simply asked senders for a weak social tie and a strong social tie, the strong social ties would have been more socially-central, on average, due to the "friendship paradox", whereby one will have strictly fewer friends than their average friend (Feld, 1991). This difference in social centrality would likely have led to differences on a range of other personal characteristics. With my assignment procedure, the personal characteristics of the strong and weak tie receivers are balanced because I select these groups through the same procedure.

The key element of the assignment procedure is that "weak tie receivers" are elicited through the same process as "strong tie receivers". For strong tie receivers, field officers simply ask the relevant sender to list "people in [Community Name] outside of your household who you give advice to and receive advice from on farming, financial, or health issues?", then a name is randomly selected from this list. For weak tie receivers, field officers select the names from the lists of *other* randomly-selected villagers, specifically the listers. I use the listed strong ties of the listers as the weak tie receivers since they are surveyed prior to any of the sender-only respondents, but are sampled in the same way as the sender-only respondents. Therefore, the weak ties and strong tie receivers are elicited in the same way. Both are selected by asking randomly-chosen villager to list advice-giving relationships, meaning that their characteristics should be the same in expectation. As Table 2 shows, the weak and strong tie receivers are, in fact, balanced across key characteristics such as gender, mobile banking knowledge, and financial literacy.

As expected, the strong tie receivers have a stronger relationship with the sender than the weak tie receivers, on average. It is expected because the sender listed the strong tie receiver as an advising link, while the weak tie receiver is just a randomly-selected advising link from the same village. Table 3 shows that senders report knowing the strong tie receiver better, sharing advice more frequently, and having a higher willingness to help them in a time of need. These results indicate that senders have stronger social ties with their assigned strong tie receivers in the sense of Granovetter (1973); they

spend more time spent together, confide in each other more, and exchange more reciprocal services. It is important to note that the weak tie receiver is almost always still a social tie of the receiver, likely because the villages in the sample only have ≈ 100-200 households. 92% of senders know their assigned weak tie receiver and 75% have given advice to the weak tie receiver in the past two months (Table 3).

The other advantage of this protocol is cost. Most studies that avoid the friendship paradox use full network data to compare interactions across social distance holding social centrality constant (Mobius et al., 2005; Chandrasekhar and Jackson, 2018). Unfortunately, full network data is notoriously costly to gather (Breza et al., 2020).[24] My method of assigning strong and weak ties only requires visiting a few additional household in each village prior to implementing the full experimental protocol.

4.4 Descriptive statistics

In total, field officers surveyed 142 listers and 1,142 sender-only respondents for a total of 1,284 respondents who made recommendations (senders) across 78 villages. These respondents made 2,271 recommendations total.[25] The average listers per village (1.8) and sender-only respondents per village (14.6) are below target because of villages that could not be completed due to Ramadan, political protests in May 2023, or heavy rains.

In Table 1, I present summary statistics on sender characteristics. They are primarily male household heads. The majority have completed some secondary school but very few went on to tertiary education. They are relatively digitally literate with high smartphone ownership rates and comfort using the internet.

Despite this digital literacy, the sample favors informal finance over mobile banking. Only 28% have a mobile banking account (Table 1) and usage is low even among those with an account (Table S2). For savings, most opt to keep their money at home or with a local savings committee (Table S1). Very few mention saving via a bank, microfinance institution, or mobile banking service (Table S1). When facing a financial emergency, they primarily rely on their friends and family rather than formal lending channels (Table S1).

4.5 Recommendation experiment

I estimate the effect of social image concerns on information-passing through an experiment where each sender has the opportunity to recommend a pamphlet designed for high-competence mobile banking

[24] Breza et al. (2020) shows how Aggregational Relational Data can substitute for the full network in many cases. Unfortunately, this method does not address the needs of this study.

[25] For the first 297 respondents, field officers only asked for one recommendation and it was randomized whether the recommendation was for the strong or weak tie receiver.

users and a pamphlet designed for low-competence mobile banking users to their assigned strong tie and weak tie receiver. This section describes the pamphlet content (Section 4.5.1), how the pamphlet is presented to the senders (Section 4.5.2), and how the experimental protocols are introduced to the senders (Section 4.5.3). Then, I detail how I randomize the observability of the information-passing environment Section 4.5.4) and the measurement of the main outcomes (Section 4.5.5).

4.5.1 Pamphlet content

To test the model's prediction on heterogeneity by information type, I worked with a Punjabi graphic designer to create two pamphlets with information about mobile banking but designed for differing levels of mobile banking competence. Both pamphlets include enough information for recipients to open a mobile banking account, but one pamphlet focuses on using advanced mobile banking services (designed for high-competence users) while the other focuses on avoiding mobile banking scams (designed for low-competence users).

To ensure that both pamphlets provide recipients with enough information to open a mobile banking account, I include information about the Asaan Mobile Account. The Asaan Mobile Account is an initiative that the State Bank of Pakistan and the Pakistan Telecommunication Authority launched in December 2021 to enable the financial inclusion of low-income citizens. The Asaan Mobile Account allows any Pakistani holding a valid national ID card (a CNIC) to open a mobile banking account with one of 13 private financial service providers by entering a standardized USSD code on their basic/smart phone and confirming their CNIC's validity.[26] Despite reports that the government of Pakistan allocated Rs 250 million ($\approx$ 15 million USD at the time) for publicity, only 14.0% of the sample had heard of the Asaan Mobile Account during the surveys conducted from March-August 2023 (Table S3).[27]

To test the model's prediction on heterogeneity by information type,[28] the rest of the information on the pamphlets differs. In addition to the information about the Asaan Mobile Account, the "Making your money grow with mobile banking" pamphlet (which I will call the growth pamphlet) provides information about advanced digital financial services. The pamphlet mentions savings accounts where one can earn profit, commitment savings accounts, e-commerce, and agricultural finance.[29] In contrast, the "Keeping your money safe with mobile banking" pamphlet (which I will call the safety pamphlet) focuses on avoiding fraud when using mobile banking. This pamphlet includes information

[26] After signing up via USSD code, the user has 60 days to biometrically verify their account with a mobile banking agent. This process takes 30-60 minutes. As mentioned previously, the majority of the sample likely lives under 15 minutes from a mobile banking agent and almost all live under 60 minutes from a mobile banking agent.

[27] https://profit.pakistantoday.com.pk/2020/08/01/sorry-jazzcash-the-fintech-revolution-for-the-unbanked-is-finally-here/

[28] Refer to Section 3.3.1

[29] For each of these services, under 15% of the sample had previously heard of the product prior to receiving the pamphlet (Table S2).

on protecting your PIN number, identifying common scams, checking your bank statement, and contacting mobile banking helplines.[30] Appendix S.3.8 contains the pamphlets as they appeared to respondents (in Urdu) as well as the English translations of the pamphlet text.

4.5.2 Presentation of pamphlets to the senders

The presentation of the pamphlet is embedded within the field officer's survey of the sender. Since the pamphlets introduce new information to the respondents, the field officer asks about the respondent's mobile banking knowledge and usage prior to giving them any information about mobile banking. After completing the mobile banking knowledge and usage questions, the field officer tells the sender basic information about mobile banking to create a baseline level of understanding (Refer to Appendix S.3.9 for details).

Then, the field officer hands each pamphlet to the sender and reads out a summary of the information on the pamphlet. Refer to Appendix S.3.8 for the summaries that the field officers read. I randomize the order in which the pamphlets are presented so I can control for order effects if necessary. It is important to note that all senders receive both pamphlets. This design choice ensures that senders are equally informed, on average, across treatment arms about the benefits and risks of mobile banking when making recommendation decisions.

4.5.3 Introduction of recommendation experiment

The recommendation experiment is also embedded within the field officer's survey of the sender. The recommendation experiment modules immediately follow the presentation of the pamphlets described in Section 4.5.2.

At the beginning of the recommendation experiment modules, the field officer informs the sender that they are going ask them to decide what pamphlets the field officer may offer to their assigned receiver. At this point, the field officer mentions the name of the assigned receiver for the sender's first recommendation decision.[31]

Regardless of treatment arm, the sender is informed that if they choose to share no pamphlets, then the receiver will not be informed of their decision or their identity. This design choice reflects most information-passing contexts, where the sender has the option to share no information and not have the receiver informed of their decision or their identity.[32]

[30] Only 9.2% had heard of mobile banking helplines previously.

[31] The order of the strong tie and weak tie receiver recommendation is randomized.

[32] In the context of the model (Section 3), this decision means that Receivers might have a lower q, meaning a lower prior over the likelihood that the Sender has information to share.

4.5.4 Treatment arms

I randomize senders into four different information-passing environments which vary in terms of the observability of the sender's identity and targeting of the receiver.[33] After introducing the recommendation experiment, the field officers read a script describing the information-passing environment in the sender's assigned treatment arm.[34] The experiment is a two-by-two design with the following treatments:

1. Hidden or revealed sender identity
    - (Hidden sender): The sender knows that the receiver will be told that "a fellow villager" recommended the pamphlets. Thus, the sender knows that the receiver will not know their identity.
    - (Revealed sender): The sender knows that the receiver will be told that [Insert sender name] recommended the pamphlets. Thus, the sender knows that the receiver will know their identity.
2. Hidden or revealed targeting of the receiver
    - (Hidden targeting): The sender knows that the receiver will be told that the recommendation was made to "a fellow villager" and that Gallup Pakistan randomly selected the receiver. Thus, the sender knows that the receiver will not know that the sender's decision targeted the receiver, specifically.
    - (Revealed targeting): The sender knows that the receiver will be told that the recommendation was made to [Insert receiver name]. Thus, the sender knows that the receiver will know that the sender's decision targeted the receiver, specifically.

Note that the key difference across arms is the information revealed to the receiver. The sender always knows the identity of the receiver and how their recommendation will be presented to the receiver. Therefore, any differences in recommendation decisions across arms are attributable to the sender's concern with how the receiver will react to the information presented given their treatment assignment.[35] In Table 1, I present balance tests on sender characteristics. As expected, the randomization yields balance across the four experimental groups.

[33] Randomization is stratified by community and field officer.

[34] Refer to Appendix S.3.10 for full scripts.

[35] After data checks uncovered that some respondents were misunderstanding the treatments, I added three comprehension checks for senders prior to their recommendations. Field officers could not move forward until the senders correctly answered these comprehension checks. Refer to Appendix S.3.11 for more details

4.5.5 Outcome measurement: Pamphlet recommendations

The main outcome variables, recommendations from senders to receivers, are elicited by the field officers within the sender survey. Immediately after reciting the relevant treatment arm script and ensuring the respondent understands the information-passing environment, the field officer prompts the respondent to make recommendations to their two assigned receivers. The field officer elicits decisions from the sender by asking whether they would prefer to share "Both pamphlets", "No pamphlets", the "Keeping your money safe with mobile banking pamphlet only", or the "Making your money grow with mobile banking pamphlet only". Pooling the recommendations to weak and strong tie receivers in the *Hidden Sender, Hidden Targeting* group, 11.9% recommend no pamphlets, 30.0% recommend both pamphlets, 31.0% recommend the "Keeping your money safe with mobile banking pamphlet only", and 27.1% recommend the "Making your money grow with mobile banking pamphlet only" (Table 4). If the sender selects "Both pamphlets", the field officer asks whether the sender would prefer to share "No pamphlets", the "Keeping your money safe with mobile banking pamphlet only", or the 'Making your money grow with mobile banking pamphlet only" if the sender could only share one pamphlet.

To maximize the statistical power for testing the model's prediction that social image concerns vary by information type (Section 3.3.1), I focus on the sender's preferred option if restricted to sharing one pamphlet. Constructing this outcome requires that I assume independence of irrelevant alternatives, meaning that the senders who selected "No pamphlets", the "Keeping your money safe with mobile banking pamphlet only" , or the "Making your money grow with mobile banking pamphlet only" initially would not have changed their choice if "Both pamphlets" had not been listed. Focusing on when senders are restricted to sharing one pamphlet may also be closer to reality, where individuals likely have a limited amount of time to transmit information to their social ties. Assuming IIA, 17.0% of senders in *Hidden Sender, Hidden Targeting* recommend no pamphlets, 53.1% share the safety pamphlet, and 30.0% share the growth pamphlet when restricted to sharing one pamphlet.

4.6 Post-experiment: Sender survey modules

To ensure the senders are maximally alert and engaged when making the recommendation decisions, I postpone some survey questions to after the pamphlet recommendations. A downside to postponing the questions is that the treatments may affect the responses, but I can test and control for these effects when necessary.

4.6.1 Sender's regard for receivers

To understand the sender's regard for the receiver, the post-intervention questions include the field officer asking the sender to rate their own intelligence and financial literacy as well as the intelligence

and financial literacy of the receivers on a scale from 0-100. To measure the precision of beliefs between strong and weak ties, I ask senders to give their confidence in their ratings of the receivers. About one third of senders report being very confident in their ratings of the strong tie receiver, while only 11-13% report being very confident in their rating of the weak tie receiver (Table 3). This result is consistent with the assumption in Section 3.3.3 that weak ties have more diffuse priors over each other's traits than strong ties.

4.6.2 Sender's beliefs about effects of pamphlets

To capture the respondents' beliefs over the distribution of receiver outcomes, field officers ask senders what would happen, hypothetically, if a fellow villager received the pamphlet/s through a recommendation from them under the recommendation environment of their treatment group. I randomize across senders whether the field officer asks about the effects of the safety pamphlet, the growth pamphlet, both pamphlets, or no pamphlets.[36] The respondent is asked to provide their expectations that the visit would cause the receiver to adopt mobile banking, earn a lot of money, earn a little money, lose a little money, or lose a lot of money over the next eight weeks. For the safety pamphlet, the growth pamphlet, or both pamphlets, the field officer also asks whether the receiver would be happy to have received the information after eight weeks.

4.6.3 Measuring altruism/other-regarding preferences toward strong and weak ties

To measure senders' level of altruism toward fellow villagers, senders play the Dictator game with a strong and a weak social tie near the end of the survey. To avoid any influence of the recommendation experiment on the Dictator game, the senders play with a fellow villager they listed as someone they give/receive advice from (a strong social tie) and a fellow villager listed by the lister respondent (a weak social tie) whom were not the sender's receivers in the recommendation experiment. The sender knows that Gallup Pakistan will not mention the sender's name or decision to the other players in the Dictator game. Of Rs 100 in airtime,[37] senders, on average, give Rs 32 to strong social ties and Rs 24 to weak social ties, suggesting that senders are more altruistic towards strong ties. Note that these differences in altruism are controlled for when testing for heterogeneity in treatment effects across tie strength. These amounts are also similar to the 28-30% average giving rates estimated in meta-analyses of dictator games (Doñate-Buendía et al., 2022).

[36] In all cases (including the no pamphlets case), the field officer mentions that Gallup Pakistan staff would visit the receiver and ask a few questions.

[37] I use airtime instead of cash so that Gallup Pakistan can easily send airtime to the other players even if the field officers never visit that villager.

4.6.4 Suggestive evidence of pamphlets' effect on senders' mobile banking adoption

In this experiment, I am primarily interested in information-passing rather than the effects of the pamphlets on respondent outcomes. Other experiments have studied the effects of directly providing mobile banking services information or consumer financial protection information on household outcomes (Annan, 2021; Riley and Shonchoy, 2022; Lee et al., 2020). Broadly, these studies find that both types of information can benefit households by increasing the usage of digital financial services that, for example, provide a secure place to save and lower transaction costs.

To understand whether the information in this experiment is likely to influence subsequent behavior, field officers record the stated likelihood of registering for mobile banking before and after receiving the pamphlets for a subset of senders. Before receiving both pamphlets, 14.9% state that they are very likely to register a mobile banking account in the next eight weeks. After receiving both pamphlets, this number nearly doubles, with 28.3% stating that they are very likely to register. In the last section of the survey, the field officer offers to help the sender sign up for a mobile banking account on-the-spot. Of those who said they are very likely to register in the next 8 weeks, 27.7% take up the offer compared to 19.2% of other respondents. These results are suggestive evidence that receiving the pamphlets influences subsequent behavior.[38]

4.7 Receiver survey and recommendation implementation

Due to budget constraints, I cannot implement all of the sender recommendations, so I randomly select a subset to implement. First, I randomly select half of the senders to have one of their recommendations implemented. Within the selected senders, I randomize whether the recommendation decision to the strong or weak tie receiver is implemented, meaning that 50% of senders have no recommendation decision implemented, 25% have the strong tie recommendation implemented, and 25% have the weak tie recommendation decision implemented.[39]

The field officers for a given village track the selected receivers and attempt to complete a short survey. If the sender recommends any pamphlet, the field officer offers the pamphlet (or pamphlets) to the receiver regardless of whether the receiver is willing to answer the short survey. If the sender recommended any pamphlets and the field officer could not track the receiver, the field officer slips the pamphlet/s under the door of the receiver's home. If the sender recommended no pamphlets, the field officers do not mention the sender's recommendation decision or their name to the receiver; the

[38] One could attempt to use the treatments as an instrument for the effect of receiving the pamphlet on the receiver's adoption of mobile banking. Unfortunately, since the receiver sample is half the size of the sender sample, estimates using this strategy are very noisy.

[39] I stratify randomization of the weak tie receivers to ensure that no receiver receives more than one recommendation. 50% of listers also have a recommendation implemented with a strong tie receiver since they do not make recommendations to a weak social tie.

field officers still track the receiver and try to complete the short survey. Field officers successfully track 74% of the selected receivers. 98% of tracked receivers consent to take the short survey.

The short receiver survey contains questions on the receiver's demographics, financial behaviors, mobile banking knowledge, and mobile banking usage. The selected receivers also complete the Digit Span test and a financial literacy test. Consistent with past work on peer information in low-income villages (Alatas et al., 2012; Basurto et al., 2019; Beaman and Magruder, 2012; Hussam et al., 2020), the sender's reports of the receivers intelligence and financial literacy (Refer to Section 4.6.1 for details) are predictive of the receiver's scores on these tests. After these modules, the field officer presents the receiver with the recommended pamphlet/s, varying whether sender's identity and/or targeting is revealed based on the treatment group of the sender.

At the end of the survey, the field officer asks about the receiver's likelihood of registering a mobile banking account and then, offers to help the receiver register on-the-spot. 17% of selected receivers take-up this offer.

5 Empirical Framework

I identify the impact of the interventions by estimating the following equation via ordinary least squares (OLS):

$$\begin{aligned} Y_{ij} =& \beta_0 + \beta_1 \textit{Revealed Sender, Hidden Targeting}_i + \beta_2 \textit{Hidden Sender, Revealed Targeting}_i \\ &+ \beta_3 \textit{Revealed Sender, Revealed Targeting}_i + \kappa_{ij} + \epsilon_i \end{aligned} \tag{5.1}$$

i denotes a sender and j denotes a receiver. Y_{ij} is the outcome of interest. The main outcomes of interest for the experiment are whether the sender recommended no pamphlets, the growth pamphlet, or the safety pamphlet when restricted to sharing only one pamphlet.

Each of the main independent variables corresponds to the information-passing environment randomly-assigned to the sender. *Revealed Sender, Hidden Targeting*$_i$ equals 1 when the sender knows their identity is revealed to the receiver but their targeting of the receiver is hidden, and is 0 otherwise. *Hidden Sender, Revealed Targeting*$_i$ equals 1 when the sender knows their identity is hidden from the receiver but the targeting of the receiver is revealed, and is 0 otherwise. *Revealed Sender, Revealed Targeting*$_i$ equals 1 when the sender knows their identity is revealed to the receiver and that their targeting of the receiver is revealed as well, and is 0 otherwise. κ_{ij} is a vector of recommendation-level covariates selected via the double lasso approach of Belloni et al. (2013) as implemented by Ahrens et al. (2019). Standard errors, ϵ_i, are clustered at the sender-level.

5.1 Mapping the empirical framework to the model

In this section, I highlight the correspondence between the empirical framework and the predictions/results of the model (Section 3). First, I describe the relationship between the treatment groups and the predictions/results on observability of the information-passing environment (Section 5.1.1). Then, I outline how I test the predictions on type of information (Section 5.1.2) and tie strength (Section 5.1.3)

5.1.1 Observability of sender identity and targeting of the receiver

In this section, I interpret the coefficients in the empirical framework based on the model presented in Section 3. In general, the coefficients estimate the effect of varying the observability of the sender's identity, λ, and the observability of the targeting of the receiver, ω.

I interpret β_3 as estimating the "full social image concerns effect" on information-passing. More specifically, β_3 captures the difference in information-passing between the *Hidden Sender, Hidden Targeting* group and the *Revealed Sender, Revealed Targeting* group. In *Hidden Sender, Hidden Targeting*, the observability of the sender's identity and targeting of the receiver are near zero. As shown in Proposition 4, social image concerns disappear as these parameters approach zero. In contrast, *Revealed Sender, Revealed Targeting* makes the sender's identity and the targeting of the receiver fully observable to the receiver, meaning that senders experience the full effect of social image concerns. Thus, by comparing no social image concerns (*Hidden Sender, Hidden Targeting*) to full social image concerns (*Revealed Sender, Revealed Targeting*), β_3 estimates the full social image concerns effect on information-passing.

β_1 estimates the effect of prestige concerns on information-passing. In *Revealed Sender, Hidden Targeting*, the sender's identity is observable, but the sender's targeting is not. In this case, the sender should only worry about what the receiver will infer about their general type (prestige) and does not need worry about what the sender will infer about their type when acting toward the receiver (respect) (Refer to Section 3.4 for more details). Thus, I interpret β_1 as the effect of prestige on information-passing.

By comparing β_1 and β_3, I can test for the relevance of respect concerns. If respect concerns are irrelevant, then the effect of *Revealed Sender, Revealed Targeting* and the effect of *Revealed Sender, Hidden Targeting* should be identical. In contrast, if respect concerns are relevant, then social image concerns will differ between *Revealed Sender, Revealed Targeting* and *Revealed Sender, Hidden Targeting*, since the sender will have to worry about respect concerns in the former case but not in the latter case. Thus, comparing β_1 and β_3 constitutes a test of respect concerns.

Finally, β_2 estimates the effect of general respect concerns. Recall that I define general respect as the

receiver's perception of how others generally treat them. *Hidden Sender, Revealed Targeting* should cause the sender to worry about general respect concerns but not about prestige concerns. The sender does not worry about prestige concerns since the receiver will not know their identity, so cannot update about the sender's general type. However, the receiver is able to update about how others treat them in general (general respect concerns). Thus, I interpret β_2 as the effect of general respect concerns on information-passing. As mentioned in Section 3.4, the sender may care about general respect concerns because they are intrinsicially motivated to avoid disrespecting the receiver or because they worry that the receiver's general perception of others will affect how the receiver treats the sender.

5.1.2 Type of information

To test the model's predictions on type of information shared, I estimate the effect of social image concerns on sharing of the safety pamphlet and sharing of the growth pamphlet. I interpret the growth pamphlet as information beneficial to high-competence receivers and the safety pamphlet as information beneficial to low-competence receivers. As discussed in Section 4.5.1, the growth pamphlet is meant to be more beneficial to high-competence receivers since it requires effectively using advanced digital financial tools, and the safety pamphlet is meant to be more beneficial to low-competence receivers since it should most benefit those susceptible to frauds and scams.

The descriptive survey provides evidence that sharing the growth pamphlet is, in fact, viewed as signaling higher-regard for the receiver than sharing the safety pamphlet. In the descriptive survey with 144 villagers in the study areas (but in non-study villages), field officers ask the respondents whether a (hypothetical) sender believes the receiver they gave the growth pamphlet or the receiver they gave the safety pamphlet is more competent. Over 70% report the sender believes the receiver they gave the growth pamphlet is more competent, with 52% saying this is definitely the case. This evidence supports my supposition of sharing the growth pamphlet as a signal of higher-regard to the receiver and sharing the safety pamphlet as a signal of lower-regard.

Given these perceptions of the pamphlets, I can test the model's predictions by estimating β_3 with sharing the growth pamphlet and sharing the safety pamphlet as the outcome variables. Since *Revealed Sender, Revealed Targeting* is the full social image concerns effect,[40] the model predicts β_3 should be positive for sharing of the growth pamphlet (i.e. social image concerns encourage sharing of information beneficial to the more-competent) and negative for sharing of the safety pamphlet (i.e. social image concerns discourage sharing of information beneficial to the less-competent).[41]

[40] Refer to Section 5.1.1 for more details on why *Revealed Sender, Revealed Targeting* is the full social image concerns effect.

[41] Refer to Section 3.3.1 for more details on model predictions by information type. Refer to Appendix S.3.6 for generalizing to sharing with multiple pieces of information.

5.1.3 Tie strength

I test the model's prediction on tie strength by comparing the effect of social image concerns on sharing among weak and strong social ties. The sender-receiver assignment procedure described in Section 4.3 means that strong and weak ties are balanced on personal characteristics, allowing us to interpret the differences in the effects as due to tie strength.

Consistent with the assumption that priors are more diffuse among weak ties, villagers express less confidence in their beliefs about the traits of their weak social ties. As mentioned in Section 4.6.1, senders are far less confident in their ratings of the intelligence and financial literacy of weak ties relative to strong ties. In the descriptive survey, I directly probe villagers' confidence in their knowledge of how others regard them. Villagers report that they are far less confident in how casual acquaintances regard their mobile banking knowledge (only 27% are very confident) relative to close friends (67% are very confident).

With this assumption in place, the model predicts that the effect of social image concerns, β_3, will be larger in magnitude among weak social ties relative to strong social ties. Given the more diffuse priors over the sender's regard, the weak tie receivers should update more based on the sender's decision than the strong tie receivers. Thus, when sharing to a weak tie receiver, the sender should be more motivated to share the growth pamphlet to signal high-regard and withhold the safety pamphlet to avoid signaling low-regard.

6 Results

In this section, I describe the results of the experiment measuring the effect of social image concerns on information-passing among social ties. First, I discuss the impact of social image concerns on information-passing (Section 6.1), before turning to the role of prestige and respect (Section 6.2). In Section 6.3, I turn to the effect of general respect on information-passing. Finally, I discuss alternative explanations (Section 6.4) and robustness tests (Section 6.5).

6.1 Do social image concerns affect information-passing?

To measure social image concerns, I compare information-passing when the sender's identity and targeting of the receiver are revealed (*Revealed Sender, Revealed Targeting*) to when the sender's identity and targeting of the receiver are hidden (*Hidden Sender, Hidden Targeting*). First, I estimate the effect pooling strong and weak ties. Then, I estimate the effect separately for strong and weak ties, and test for heterogeneity across tie strength. As mentioned in Section 4.5.5, the main outcomes considered are the information-passing decisions of the senders when restricted to passing no pamphlets, the safety pamphlet only, or the growth pamphlet only.

While the pooled treatment effects give us the greatest statistical power, the estimates are less interpretable than the strong and weak tie estimates. The pooled treatment effect provides a weighted average of the treatment effect among strong ties (55% of the pooled sample) and weak ties (45% of the pooled sample).[42] Since the relative weight given to strong and weak ties is arbitrary, it is unclear how to interpret this object. In contrast, the strong tie estimates should be representative of behavior among strong ties in these communities. As described in Section 4.3, the weak tie receivers are sampled to be balanced with the strong tie receivers on personal characteristics but differ in tie strength with the sender. Thus, comparing the strong and weak tie estimates provides evidence of how tie strength influences social image concerns.

Pooling strong and weak ties, revealing the sender's identity and targeting of the receiver moderately shifts sharing towards the growth pamphlet. I estimate a 5.9 pps (19.7%; $p = .054$) increase in sharing of the growth pamphlet instead of sharing no pamphlets or only the safety pamphlet (Table 4). The percentage of receivers sharing no pamphlets drops by 3.0 pps (17.6%; $p = .166$) and the percentage sharing the safety pamphlet also drops by 2.1 pps (4.0%; $p = .531$).

Looking at strong and weak ties separately, I find large effects among weak ties and null effects among strong ties. Among weak ties, *Revealed Sender, Revealed Targeting* increases sharing of the growth pamphlet by 12.9 pps (50.0%; $p = .001$), while decreasing sharing of the safety pamphlet by 9.0 pps (16.7%; $p = .035$) and sharing of no pamphlets by 2.5 pps (12.2%; $p = .426$; Table 5). In contrast, the effect among strong ties is smaller and statistically insignificant. The effect on sharing of the growth pamphlet of *Revealed Sender, Revealed Targeting* is near zero (.7 pps; $p = .840$) among strong ties, and the effect on sharing of the safety pamphlet goes in the opposite direction of the overall effect (2.5 pps; $p = .531$; ; Table 6).

The differences in treatment effects between strong and weak ties are substantial and statistically significant. When jointly estimated, the treatment effect on sharing of the growth pamphlet is 11.3 pps larger among weak ties than among strong ties ($p = .013$; Table 7). The treatment effect on sharing of the safety pamphlet is 11.0 pps lower ($p = .017$) among weak ties (Table 7).

These results provide strong evidence that social image concerns alter information-passing among weak ties. Simply changing how a recommendation is presented to the receiver causes substantive changes in the composition of information shared. Without social image concerns, senders are more than twice as likely to share the safety pamphlet compared to the growth pamphlet (53.3% safety vs. 24.0% growth) to the weak tie receiver. Introducing social image concerns via the *Revealed Sender, Revealed Targeting* treatment nearly completely closes this gap (41.3% safety vs. 35.8% growth). Given the importance of weak ties in the spread of novel information (Granovetter, 1973), these shifts

[42]There are more recommendations to strong ties because the lister respondents (≈11% of the sample) only make recommendations to strong ties.

would likely alter information diffusion, social learning, and, ultimately, behavior. I further explore the implications of social image concerns for village-level social learning outcomes in Section 7.

6.2 Mechanisms: Showing Respect vs. Garnering Prestige

In this section, I discuss how respect and prestige concerns affect information-passing. To identify the effect of prestige alone, I estimate the effect of revealing the sender's identity but keeping their targeting of the receiver hidden (*Revealed Sender, Hidden Targeting*). Since the receiver should not feel respected/disrespected if the information is not targeted at them, the *Revealed Sender, Hidden Targeting* treatment should identify the effect of prestige alone.

Pooling strong and weak ties, *Revealed Sender, Hidden Targeting* has relatively small, insignificant effects on information-passing. Sharing of the growth pamphlet increases by 2.4 pps ($p = .462$), while sharing of the safety pamphlet decreases by 2.3 pps ($p = .440$; Table 4). These effects are directionally the same as the *Revealed Sender, Revealed Targeting* effects but smaller in magnitude.

Considering weak and strong ties separately, I find stronger effects among weak ties but the estimates are still insignificant. Among weak ties, *Revealed Sender, Hidden Targeting* increases sharing of the growth pamphlet by 4.0 pps ($p = .291$) and decreases sharing of the safety pamphlet by 2.6 pps ($p = .535$; Table 5). Among strong ties, the estimated effects are almost precisely zero (decrease of .1 pp for growth; $p = .976$; decrease of .5 pp for safety; $p = .886$; Table 6). When jointly estimated, the differences in treatment effects between strong and weak ties is not significant (Table 7).

The relatively small and insignificant effects of *Revealed Sender, Hidden Targeting* compared to *Revealed Sender, Revealed Targeting* suggests that showing respect to others is a more important driver of social image concerns in this context than garnering prestige for oneself. A standard social image concerns model would predict that only the observability of the sender's identity should matter. In this context, the substantial effects of social image concerns only emerge when the sender's targeting of the receiver is revealed as well. Among weak ties, the estimated increase in sharing of the growth pamphlet is 8.9 pps smaller (69% of *RS, RT* effect; $p = .105$) when the sender's targeting of the receiver is hidden, while the decrease in sharing of the safety pamphlets is 6.3 pps smaller in magnitude (70% of the *RS, RT* effect; $p = .294$).

6.3 General respect

In this section, I analyze the effects of the *Hidden Sender, Revealed Targeting* treatment. As discussed in Section 3.4, the receiver can only make an inference about how others' regard them generally in this recommendation environment.

Pooling strong and weak ties, *Hidden Sender, Revealed Targeting* reduces sharing of no pamphlets or

the safety pamphlet and increases sharing of the growth pamphlet. Sharing of the growth pamphlet increases by 6.2 pps ($p = .042$) and sharing of the safety pamphlet decreases by 2.8 pps ($p = .394$; Table 4). We also see a substantial decline in sharing no pamphlets (3.7 pps; 21.7%; $p = .087$).

These effects are larger among weak ties but the difference in effects between strong and weak ties is not significant in this case. Among weak ties, only revealing the targeting of the receiver increases sharing of the growth pamphlet by 9.4 pps ($p = .017$) and decreases sharing of the safety pamphlet by 4.8 pps ($p = .264$; Table 5). For strong ties, sharing of the growth pamphlet increases by 3.8 pps ($p = .305$) and sharing of the safety pamphlet decreases by .1 pps ($p = .978$; Table 6). Jointly estimating the effects, I measure a 6.6 pp ($p = .150$) larger increase in sharing of the growth pamphlet for weak ties relative to strong ties, and a 5.4 pp ($p = .195$; Table 7) larger decrease in sharing of the safety pamphlet.

Other-regarding preferences seem to drive general respect concerns more than other social image concerns. Senders may care about signaling general respect due to other-regarding preferences or potential future interactions. In Table S8, I estimate the heterogeneity of the treatment effects for weak ties by the amount the sender gives in a dictator game to other villagers who are not their receivers.[43] While the effects on *Hidden Sender, Revealed Targeting* are larger for senders who give above the median in the dictator game, the effects on *Revealed Sender, Revealed Targeting* are almost entirely driven by senders who give below the median. While these heterogeneities are not statistically significant, they provide weak evidence that other-regarding preferences play a larger role in general respect concerns compared to other social image concerns.

Taken together, these results indicate that villagers alter their information-sharing in this context to signal that, generally, others respect the receiver. Even when the sender knows their identity will not be revealed, I still find that they significantly increase their sharing of the pamphlet for high-competence users, the growth pamphlet, and decrease their sharing of the pamphlet for low-competence users, the safety pamphlet, when it is possible that the receiver will feel disrespected. This finding provides additional evidence that respect concerns substantively affect information-passing decisions in this context, and evidence that general respect concerns matter in small communities, such as villages in rural Punjab.

6.4 Alternative explanations

My identification strategy assumes that the treatments only affect the sender's recommendation through the channel of social image concerns. One identification concern is that the treatments could affect the sender's expectations of the receiver's actions or outcomes, independently of the pamphlets shared. For example, the sender may expect the receiver to place more weight on a recommendation

[43] Refer to Section 4.6.3 for details on implementation of Dictator games.

when the sender's identity and targeting are revealed. If a sender is altruistic and/or complementarities are present, then the sender's payoff from recommending a given pamphlet may change due to this shift in expectations conditional on sharing a given pamphlet.

To understand if altruism or complementarites could explain my results, I turn to the sender's stated expectations of a recommendation's effect on receiver outcomes and actions. Recall from Section 4.6 that field officers ask for the sender's expectations of a given recommendation decision under their assigned recommendation environment (i.e., their experimental group), randomizing across senders what pamphlet is (hypothetically) being recommended to the receiver. If altruism or complementarities drive the results, then the sender should expect sharing the growth pamphlet to be relatively more beneficial than sharing the safety pamphlet under *Revealed Sender, Revealed Targeting*[44] than under *Hidden Sender, Hidden Targeting*.

The sender's expectations for the effect of either pamphlet on the receiver's outcomes do not substantively change between *Hidden Sender, Hidden Targeting* and *Revealed Sender, Revealed Targeting*. To measure receiver outcomes, I create an index of the sender's responses to the likelihood of the pamphlet causing the receiver to earn money, lose money (inverted), and be happy over the next eight weeks. When a pamphlet recommendation is under *Revealed Sender, Revealed Targeting*, the sender expects the receiver to have .146 standard deviation ($p = .523$) better outcomes from receiving the safety pamphlet and .100 standard deviation ($p = .666$) better outcomes from sharing the growth pamphlet relative to when the recommendation is made under *Hidden Sender, Hidden Targeting*.

The Sender's expectations for the effect of either pamphlet on the receiver's adoption of mobile banking are also similar under *Hidden Sender, Hidden Targeting* and under *Revealed Sender, Revealed Targeting*. The Sender's expectation that the Receiver will adopt is .223 standard deviations ($p = .375$) lower if the safety pamphlet is recommended under *Revealed Sender, Revealed Targeting* compared to *Hidden Sender, Hidden Targeting*. For the growth pamphlet, the Sender's expectation that the Receiver will adopt is .211 standard deviations ($p = .431$) lower.

These effects are unlikely to explain the estimated treatment effects on information-passing. In addition to being insignificant statistically, the effects on expected receiver adoption and outcomes do not fit the pattern of estimated treatment effects on pamphlet-sharing. Specifically, in the main results (Table 4), senders share the growth pamphlet more under *Revealed Sender, Revealed Targeting* and the safety pamphlet less. The effect on the sender's expectations for receiver outcomes and adoption conditional on the pamphlet shared do not fit this pattern. Both the safety and growth pamphlet are seen as slightly more likely to lead to good receiver outcomes and slightly less likely to lead to receiver mobile banking adoption under *Revealed Sender, Revealed Targeting*. Since these effects are similar between

[44] I focus on the main treatment group in this section, but the conclusions are the same for the other treatment groups.

the growth and safety pamphlet, they are unlikely to explain the estimated treatment effects which differ substantially by pamphlet.

6.5 Robustness check: Unconstrained recommendation decisions

In this section, I show that the results are robust to using the sender's unconstrained recommendation decisions. In the sender's unconstrained recommendation decision, they could recommend "both pamphlets" in addition to "no pamphlets", "growth pamphlet alone", and "safety pamphlet alone" options. Below, I present the effects of the treatments on the likelihood of choosing each of these four options.

With unconstrained recommendations, revealing the sender's identity and targeting of the receiver still increases sharing of the growth pamphlet alone and reduces sharing of the safety pamphlet alone among weak ties, consistent with the main results. I estimate that *Revealed Sender, Revealed Targeting* increases sharing of the growth pamphlet alone by 11.1 pps ($p = .002$) and decreases sharing of the safety pamphlet alone by 5.9 pps ($p = .115$) in Table S5. There are negative but insignificant effects on sharing of no pamphlets (1.7 pps; $p = .581$) and both pamphlets (3.6 pps; $p = .248$) (Table S6).

Just as with the main outcomes, the results are significantly larger among weak ties than among strong ties. In Table S7, I estimate that *Revealed Sender, Revealed Targeting* increases sharing of the growth pamphlet alone by 10.2 pps more ($p = .015$) among weak ties relative to strong ties, and decreases sharing of the safety pamphlet alone by 8.2 pps more($p = .042$).

In terms of prestige, respect, and general respect concerns, the estimates are roughly the same as well. The effect of *Revealed Sender, Hidden Targeting* is insignificant among weak or strong ties, supporting my conclusion that prestige is not the primary driver of social image concerns in this context (Table S6 and Table S5). *Hidden Sender, Revealed Targeting* has significant effects among weak ties but not among strong ties (Table S6). Among weak ties, *Hidden Sender, Revealed Targeting* increases sharing of the growth pamphlet alone by 8.1 pps ($p = .025$) and decreases sharing of the safety pamphlet alone by 4.2 pps ($p = .268$), while also decreasing sharing of no pamphlets by 4.9 pps ($p = .096$) (Table S5).

7 Implications for community-level social learning

In this section, I explore how the heterogeneity in information-passing across type of information and tie strength induced by social image concerns affects community-level social learning. First, I present an augmented Generalized DeGroot Model where nodes communicate and learn about two topics related to a given technology (Section 7.1). Then, I describe the real-world village network data that I use to simulate the augmented model (Section 7.2), the choice of simulation parameters

(Section 7.3), and the construction of network-level social learning outcomes (Section 7.4). Finally, I discuss what the simulations tell us about the effect of social image concerns on information diffusion and aggregation (Section 7.5).

7.1 Model of social learning

I augment Banerjee et al. (2021b)'s Generalized DeGroot Model (GDM) to allow for variation in information transmission based on social image concerns which vary by tie strength and information topic. In Banerjee et al. (2021b), communication occurs mechanically, but my experimental results show that agents alter their communication based on social image concerns, tie strength, and information topic. To understand the implications of social image concerns for social learning, I can compare the simulation results when I run the model with social image concerns present to the simulations results without social image concerns.

The setup of this model is similar to GDM. Just as in the GDM, I consider a setting where n agents are connected via g,[45] a fully connected and undirected graph for a set period of time, T. Unlike GDM, I consider a weighted graph since I am interested in variation by tie strength.

Instead of a single topic, I allow agents to pass and learn about two aspects of the relevant technology, $W \in X, Y$. I assume one can learn about the growth potential, X, and the safety of the technology, Y. At the outset, $t = 0$, a set S_X nodes are initially seeded with signals on the growth potential and S_Y nodes are initially seeded with signals on safety where the sets are length m_X and m_Y, respectively. The remaining $n_W - m_W$ nodes receive no initial signal about topic W. In any given period, the nodes that have a signal (via seeding or communication from their neighbors) about a topic will be considered informed about that topic, while the other nodes will be considered uninformed about that topic.

To reflect the results of my experiment, the informed nodes receive an information-passing payoff based on social image concerns, tie strength, and the information topic. The information-passing payoff function is similar to Equation (3.1). For tractability, I simplify the sender's payoff by assuming social image concerns are static and independent of the receiver's type.[46] However, I still allow social image concerns to vary by tie strength and social image concerns to capture the main results of the model and experiment. Specifically, the sender chooses to share information across a given link $d_{ijt} \in \{0, X, Y\}$ to maximize the following function:

$$u_{ijt} = 1_{d_{ijt} \neq 0} \cdot V + \gamma(z_{ij}, d_{ij}) + \epsilon_{ijt}(z_{ij})$$

[45] Assume g includes self-loops

[46] Solving a dynamic signaling model in a network would pose issues because each node has a different group of neighbors and thus, would update differently from a given information-sharing decision.

where z_{ij} represents the strength of social tie between node i and node j. The term ϵ_{ij} is a sender-receiver-specific communication difficulty shock that is decreasing in z_{ij} to capture the fact that the difficulty of communicating with a strong tie is lower because one will have more interactions with them in a given period of time. I denote the probability of information-passing from i to j in period t as p_{ijt}.

After agents communicate, nodes aggregate information by averaging the opinions of their neighbors. I denote K_{itW} as the neighbors of i who communicate with i in period t about topic W.[47] The information aggregation process for a given belief $w \in \{x, y\}$ about a topic $W \in \{X, Y\}$ can be characterized as:

$$w_{it} = \begin{cases} \emptyset & \text{if } K_{itW} = \emptyset \\ \frac{1}{|K_{itW}|} \sum_{j \in K_{itW}} w_{jt-1} & \text{if } K_{itW} \neq \emptyset \end{cases}$$

meaning that nodes average their communicating neighbors and their own opinion if any of their neighbors communicate or they have an existing opinion, and otherwise the node has no opinion.

Finally, agents make adoption decisions after T rounds of communication.[48] At the end of the communication rounds, nodes have a belief about the growth potential of product, x_{iT} and the safety of a product y_{iT}. Finally, agents make adoption decisions after T rounds of communication.[49] At the end of the communication rounds, nodes have a belief about the growth potential of product, x_{iT} and the safety of a product y_{iT}. For agents to adopt, I assume they have to believe the product has growth potential and is safe (if they are aware of the safety dimension). Specifically, I assume that:

$$a_i = \begin{cases} 1 & \text{if } x_{iT} > 0 \text{ and } y_{iT} > 0 \\ 1 & \text{if } x_{iT} > 0 \text{ and } y_{iT} = \emptyset \\ 0 & \text{otherwise} \end{cases}$$

I call the first case informed adoption because the agent is aware of the growth and safety dimension. I call the second case uninformed adoption because the agent is unaware of the safety dimension. The final case is non-adoption and can be caused by being uninformed about the growth potential of the technology or by having a negative belief about the growth potential or safety of the technology.

[47] I assume that if i is informed, then i communicates with themselves ($i \in K_{itW}$).

[48] Unfortunately, my experiment and model cannot directly speak to "learning-by-doing" that may occur from experimentation with a new product.

[49] Unfortunately, my experiment and model cannot directly speak to "learning-by-doing" that may occur from experimentation with a new product.

7.2 Village network data description

I simulate the social learning model described above using nearly-complete network data from 75 villages in Karnataka, India. Banerjee et al. (2019) gathered this data by surveying 89.14% of households in each village, resulting in a total of 16,476 households surveyed. I restrict my analysis to the village's giant component, which contains 96% of households in the sample.

The villages in this dataset are relatively similar to the villages in my sample. The villages contain between 100-300 households, which is close to the 100-200 households in my sample's villages. Additionally, these villages are also low-income villages where households primarily work in the agriculture sector, similar to the summary statistics for the households in my sample (Table 1). While there are myriad differences between Karnataka, India, and Punjab, Pakistan, few datasets have near-complete network data from LMIC villages, and it was prohibitively costly to gather full network data for my sample areas.

I use the number of ways two households are linked as a measure of tie strength. The Indian village data records information on 12 different ways two households could be linked. The median number of ways two households are linked, conditional on being linked at all, is 3.2. I define a "strong" social tie as any tie with above the median number of linkages (≥ 4) and a "weak" social tie as any tie with below median number of linkages (< 4).

In the Indian village networks, weak ties are more likely to bridge social clusters than strong ties. I assign social clusters to nodes in the networks by using a spectral clustering algorithm on the unweighted village social graphs. Then, I calculate the likelihood that a given tie crosses between clusters. While only 10.8% of strong ties cross clusters, 24.1% of weak ties cross clusters. In Section 7.5.1, I discuss how this aspect of the network structure affects the simulation results.

7.3 Signal structure and parameter choices

I set up the simulations to draw out the implications of my main experimental result, social image concerns shift information-sharing towards growth and away from safety among weak ties. To this end, I treat the growth and safety topics symmetrically in the seeding and "no social image concerns" simulations, so that any differences in outcomes between the topics in the "social image concerns" simulations can be attributed to the effect of social image concerns.

In the simulations, I randomly seed growth and safety information with 10 villagers ($m_X = m_Y = 10$). I assume the villagers communicate for a maximum of 50 periods, $T = 50$. For each village, I simulate the model 60 times. I simulate three different seedings for each village and simulate the model 20 times holding the seeding constant.

For the "no social image concerns" simulations, I assume that the passing rates for safety information

and growth information are equal. I assume that a node informed about one topic passes information on that topic 10% of the time. For nodes informed about two topics, I assume that they pass information about one topic 5% of the time and about the other topic 5% of the time, meaning that their probability of sharing any information is still 10%. It is important to note that since the length of a given time period is arbitrary, the magnitude of passing rates is also arbitrary.[50] By choosing relatively low passing rates, I am able to more closely track how the outcomes would evolve over time.

In the "social image concerns" simulations, passing rates among weak social ties are higher for the growth topic and lower for the safety topic, and passing rates among strong ties are unaffected, reflecting the experimental results. Among strong ties (households linked in ≥ 4 ways), the passing rates are the same as the passing rates in the "no social image concerns" simulations (refer to the previous paragraph). Among weak ties (households linked in > 0 but less than < 4 ways), I assume social image concerns increase passing rates of the growth topic by 33.4% relative to the "no social image concerns" simulations and decrease passing rates of the safety topic by 33.4%. I choose to make the effects symmetric so that the analysis speaks to the general pattern of social image concerns encouraging one topic while discouraging another, rather than depending the precise point estimates in the experiment. I choose 33.4% as the magnitude since it is the average of the magnitudes of the "full social image concerns" effect on sharing of the growth pamphlet and on sharing of the safety pamphlet. Table 8 summarizes the passing rates to strong/weak ties with/without social image concerns in the simulations.

7.4 Constructing community-level social learning outcomes

I construct outcomes in three domains to characterize the effect of social image concerns on community-level social learning. The first domain (information diffusion) characterizes how quickly any information about a topic reaches nodes. The second domain (conversation composition) is novel and characterizes the frequency of information-passing about growth relative to safety. The final domain (adoption) examines whether villagers adopt technologies that are high growth potential and safe, while rejecting useless/dangerous technologies.

For information diffusion, my primary outcome will be whether a node is informed about nothing, the safety topic only, the growth topic only, or both topics. Following the definition of informed in the augmented GDM (Section 7.1), I consider a node informed about a topic if they are seeded with information or a neighbor passes information about the topic to them. This measure captures whether social image concerns affect whether nodes hear about a given topic at all.

While receiving information is a necessary condition for making informed decisions, past work shows

[50] For example, if time periods are very short, then the passing rates tend toward zero.

that repeated conversations are often necessary for learning about a topic.[51] If multiple conversations are necessary for learning, then nodes will learn faster about a topic that is communicated about more.

The second domain (conversation composition) captures the relative speed of learning about one topic relative to another and is novel in the networks literature. To construct this outcome, I count the number of growth conversations, meaning the number of times a node passes information about growth $\sum_{i \in n} K_{itX}$, and the number of safety conversations occurring in each communication round for each simulation, $\sum_{i \in n} K_{itY}$. Then, I divide the number of growth conversations in a given communication round of a simulation by the total number of conversations in that round $\frac{\sum_{i \in n} K_{itX}}{\sum_{i \in n} K_{itX} + \sum_{i \in n} K_{itY}}$. This calculation yields the proportion of conversations about growth in a given communication round for a given simulation, which I will call the conversation composition of that simulation round. Assuming that learning about a topic is increasing in number of conversation, this measure captures how quickly the network is learning about growth information relative to safety information. In the context of technology adoption, this measure is relevant in situations where one topic (e.g. growth potential) dominating the conversation may cause nodes to take particularly harmful actions (e.g. fall for mobile banking scams).

The final domain (adoption) requires additional structure but highlights one way that social image concerns could affect villager welfare. As described in Section 7.1, I assume that nodes adopt if they believe the technology has growth potential and do not believe the technology is dangerous, meaning that their belief about the growth potential is positive and their belief about the safety is not negative. I calculate the adoption rate for each simulation for each communication round. Calculating adoption for each communication round allows us to characterize adoption if communication about the technology ended in that round. Communication might end relatively early due to a number of reasons including boredom with the topic or the information becoming stale/outdated.

To understand whether nodes adoption decisions are wise, I characterize whether nodes make the "right" adoption decision, meaning the decision they would have made if fully informed, in a setting where signal quality is imperfect but correlated with the true state of the world. I consider four possible states of the worlds: "high growth potential and safe" technology ($s_X = 1$ and $s_Y = 1$), "high growth potential but dangerous" technology ($s_X = 1$ and $s_Y = -1$), "useless but safe" technology ($s_X = -1$ and $s_Y = 1$), and "useless and dangerous" technology ($s_X = -1$ and $s_Y = -1$). Since nodes only want to adopt if a technology is high-potential and safe, I consider adoption the right decision if $s_X = 1$ and $s_Y = 1$, and, otherwise, I consider non-adoption the right decision.

[51] For example, Banerjee et al. (2018) find that communities who frequently communicate about a topic make better decisions than communities where all villagers received information on the topic directly in the context of India's 2016 demonetization. This idea of requiring multiple conversations to learn also corresponds to the assumption in complex diffusion models that a node needs to hear about a technology multiple times before adopting.

To create an imperfect correlation between initial signals and the true state of the world, I assume the initial signals reflect the true state of the world with probability .7, ($\alpha = .7$). If networks learn "wisely", in terms of converging to the best approximation of the truth given the initial signals,[52] then all nodes would make the right decision. However, if networks do not converge to wise beliefs or converge slowly, then nodes are more likely to make incorrect decisions because they believe a technology is high-potential when it is actually useless or believe it is safe when it is actually dangerous.

7.5 Simulation results

In this section, I describe how social image concerns affect community-level information diffusion, conversation composition, and adoption of a technology. First, I describe the effects of social image concerns on the diffusion of growth and safety information through the network. Then, I turn to the effects on the frequency of conversations about the growth potential of the technology relative to conversations about the safety of the technology. Finally, I characterize the effect on adoption of the technology.

Social image concerns speed the diffusion of growth information and slow the diffusion of safety information, resulting in far more nodes with only growth information. It is important to note that the simulation parameters are chosen so that there will be no overall effect on quantity of information shared, consistent with the experimental results. In Figure 1a, one can see that the transition from only the 10 seeds having information to all nodes having some information is equally fast with and without social image concerns, as one would expect given the simulation parameters. However, there are substantial differences in the information topic a node hears about first. With social image concerns, nodes are more likely to first hear about the growth potential of a technology, while without social image concerns, nodes are equally likely to hear about either topic first (Figure 1c) and Figure 1d). This disparity peaks after seven communication rounds with nearly twice as many nodes informed only about growth relative to the simulations without social image concerns. In the long-run, the simulations with and without social image concerns converge in terms of information diffusion as over 90% of nodes in either setting end up being informed about both topics (Figure 1b). It is important to note that if communication ceases after a few communication rounds, then this convergence may never occur. Thus, the simulations suggests social image concerns' effect on diffusion will be stronger for information that individuals relatively quickly become bored of discussing and/or information that quickly becomes stale/outdated.

The effect of social image concerns on conversation composition is amplified by the network structure in the medium-run. Given the passing rates chosen for the simulations (Table 8), it is mechanical that

[52] The best approximation of the truth is an average of all initial signals, often-called the "wisdom of the crowds" in prior literature (e.g., Golub and Jackson (2010))

after one period the conversation composition will be, on average, 58.5% growth with social image concerns and 50% growth without social image concerns.[53] I call this 8.5 pp effect of social image concerns on conversation composition after one period the "static effect", noting that this object is what I identify in my experiment since I examine one round of communication. Without social image concerns, topics are treated symmetrically so the conversation composition remains at 50% throughout the communication rounds (Figure 2). With social image concerns, the "static effect" in the first round results in more nodes with only growth information in the second round (Figure 1c). Since these nodes can only share growth, the conversation composition in the second round will be tilted even more towards growth. This dynamic will continue until rate of increase of nodes with only growth information slows. Reflective of this process, social image concerns' effect on conversation composition peaks at an over 23.6 pp effect in the 7th and 8th communication round before converging back to the "static effect" as the number of nodes with only growth information heads toward zero (Figure 2). Therefore, one should also expect social image concerns' effect on conversation composition to be stronger for information that individuals relatively quickly become bored of discussing and/or information that quickly becomes stale/outdated.

In terms of adoption, social image concerns most increase the adoption of high-growth potential but dangerous technologies. In Figure 3c, villagers in simulations with social image concerns are over 11 pps (48% of the average adoption for simulations with no social image concerns) more likely to adopt a high-growth potential but dangerous technology after 10 communication rounds.[54] Even after 20 communication rounds, there is still a 5.2 pps (28% of the average adoption for simulations with no social image concerns) difference between the simulations with and without social image concerns.

On the other hand, social image concerns speed adoption of high-growth potential and safe technologies, though by less than high-growth potential but dangerous technologies. After 10 communication rounds, social image concerns increase adoption of safe high-growth potential technologies by 9.5 pps (25% of no social concerns simulations average). After 20 communication rounds, the average effect is 3.2 pps (6% of no social concerns simulations average).

Combined with effects on adoption of dangerous technologies, these results suggest that whether to activate social image concerns with an information campaign should depend on a policymaker's level of confidence in the safety of the technology. When a technology is almost certainly safe, a policymaker would want to activate social image concerns to speed adoption. If a policymaker is less certain and believes that the community has signals of safety that the policymaker is not privy to, then they would

[53] Each seed is informed about both topics. Thus, I can simply take the average of the growth sharing rate when both informed divided by the average of the overall sharing when both informed (Table 8) using that half of ties are strong and half are weak by construction.

[54] Note that this is the peak effect over all communication rounds.

want to lower social image concerns to allow this information to emerge.

The pattern of adoption effects is explained by the influence of social image concerns on the accuracy of villagers' beliefs. Figure S1a and Figure S1b show that social image concerns increase the percentage of nodes with correct beliefs about the growth potential of the technology but decrease the percentage of nodes with correct beliefs about the safety of a technology. This result explains why villagers in simulations with social image concerns are more likely to adopt high-growth potential but dangerous technologies. These villagers learn quickly (and correctly) that the technology is high-growth, but are less likely to know that the technology is dangerous.

In terms of persistence, it is important to note that the size of the social image concerns effect on beliefs and adoption continues to grow even after the effects on diffusion and conversation composition begin to fade. This result is driven by the fact that the total amount of communication over all communication rounds determines when the network converges to the same belief about a given topic (often-called the network's limit belief (Banerjee et al., 2021b)). Thus, the especially slow communication about safety in the early periods causes the "social image concerns" simulations to persistently be behind the "no social image concerns" simulations in terms of converging to the limit belief. Since the limit belief of the network is typically more accurate than any individual, slowing convergence to the limit belief causes more nodes to have incorrect safety beliefs, leading to more adoption of dangerous technologies.

One caveat to these results is that this social learning model does not account for learning from experience. For example, negative outcomes from technology adoption, such as falling for mobile banking scams, might discourage communication in later rounds. These dynamics could cause social image concerns to lead to over-adoption in the short-run but under-adoption in the long-run. Given the high rate of individuals who have heard of someone losing money due to mobile banking in the study villages (57%), this mechanism could be one explanation for Pakistan's relatively low mobile banking adoption rate.

7.5.1 Social image concerns among weak ties vs. social image concerns among strong ties

To understand whether the network position of weak ties contributes to the amplification of social image concerns when accounting for social learning in a network, I consider how the simulation results change when I concentrate social image concerns among the strong ties in the Indian village networks rather than the weak ties. To do this, I re-simulate the model following the procedure in Section 7.3, flipping the passing rates for the weak and strong ties recorded in Table 8, so that the passing rates of strong ties are influenced by social image concerns but the passing rates of weak ties are not.

In Figures S2-S4, I show that the network position of weak ties moderately amplifies the effect of

social image concerns on social learning outcomes. In terms of information diffusion, the peak effect of social image concerns on the percentage with only growth information is 3.1 pps higher when social image concerns are concentrated among weak ties compared to when social image concerns are concentrated among strong ties (Figure S2c). For conversation composition, the simulations where weak ties experience social image concerns have a 2.5 pp higher peak effect relative to the simulations where strong ties experience social image concerns (Figure S3). For adoption, there is a 1.6 pp greater effect on adoption of high-growth potential but dangerous technologies when social image concerns are concentrated among weak ties rather than strong ties (Figure S4c).

These simulations show that the network position of weak ties causes them to have more influence on social learning outcomes. In Section 7.2, I calculated the likelihood of weak or strong ties crossing social clusters, finding that weak ties are more than twice as likely to cross social clusters compared to strong ties. Almost by definition, links that cross social clusters will have less redundancy in terms of alternative routes for information to reach the receiving node. Thus, social image concerns disproportionate effect on weak ties also means that social image concerns have a disproportionate effect on these essential bridges between social clusters.

7.5.2 Sparse vs. dense seeding of information

In this section, I test whether increasing the number of nodes initially informed about both topics (i.e., seeded with information) reduces the network amplification of social image concerns. As discussed in Section 7.5, network amplification is driven by the increase of nodes with only growth information, meaning that they do not even have the option of sharing safety information. One way to forestall amplification is to seed all nodes with information on both topics. I empirically test this supposition by re-simulating the model following the procedure in Section 7.3, but seeding all nodes with information on both topics rather than seeding only 10 nodes.

These simulations confirm that dense seeding mutes the network amplification of social image concerns, reducing the influence of social image concerns on village-level social learning. For conversation composition, Figure S5 demonstrates that there is no amplification of the social image concerns effect under dense seeding.[55] Instead, the social image concerns effect is roughly equal to the static effect in all communication rounds. On technology adoption, the effects are far smaller under dense seeding (Figure S6), revealing the importance of network amplification to the influence of social image concerns in the sparse seeding simulations.

These simulations suggest that dense seeding could be used by policymakers to reduce the impact of social image concerns. Under dense seeding, the network will not amplify social image concerns,

[55] I do not include a figure on information diffusion since by construction, all nodes are always informed about both topics.

though the static effect of social image concerns will still influence the village's social learning. One downside of dense seeding is that it is costlier than sparse seeding. In addition, dense seeding has been found to discourage conversations in some settings (Banerjee et al., 2018). I discuss alternative policy solutions in Section 8.

8 Conclusion

The diffusion of new technologies, practices, and ideas is often determined by the willingness of individuals to share information with their social ties. In this paper, I find that social image concerns substantially alter the type of information shared among villagers in rural Punjab, Pakistan. Specifically, villagers shift toward sharing information about advanced mobile banking services and away from sharing information about consumer financial protection. I find evidence that these shifts are due to a desire to show respect to the receiver by signaling high-regard for the receiver's abilities, and that these effects are amplified if information spreads through a network.

Policymakers aiming to diffuse new technologies should be cognizant of potential users' social image concerns. One potential policy option is to circumvent social learning processes by broadcasting information to all potential users (i.e., dense seeding). However, broadcasting is often infeasible and can be ineffective since understanding, remembering, and trusting information often requires discussion with others (Banerjee et al., 2018).

When broadcasting is ill-advised or ineffective, interventions designed to reduce social image concerns may be necessary. First, policymakers would need to identify the type of social concern present in their context. Knowing that benefiting from a technology is correlated with an undesirable trait[56] points toward respect concerns. To assuage respect concerns, policymakers could create channels where information can be shared with multiple people at once. While community discussion groups backfired in the context of an agricultural technology in Kenya (Chandrasekhar et al., 2022), this failure may have been because prestige rather than respect was the primary concern in this context. In the context of consumer financial protection in mobile banking, Darko-Osei et al. (unpublished) find that seeding the leader of a microfinance group with consumer financial protection information and encouraging them to share it with the group increases the knowledge of group members about fraud and their confidence in using mobile banking. Another approach would be to seed information in each cluster of close social ties since "disrespectful" information can more easily spread among close social ties. The network of close social ties will be sparser than the network of all social ties, meaning that an information campaign would need to rely on more seeds to reach the same level of diffusion.

This research is particularly applicable to the spread of digital technologies in low-and-middle-income

[56]This may often be the case for mental health services or social insurance programs.

countries. As smartphones continue to spread in these contexts, poor households gain access to a range of new digital services. Unfortunately, their lack of experience with digital technologies makes them prime targets for scammers and opportunists.[57] As in the case of mobile banking, these frequent scam attempts can make digital technologies seem like (or even actually be) risky endeavors.

When digital technologies are seen as risky, individuals will be reluctant to share information about them, stalling the learning necessary to create comfort with these new technologies. Reducing social image concerns around digital technologies could catalyze a virtuous cycle where, for example, sharing information on avoiding fraud, reduces fear around mobile banking, and encourages discussion and usage of beneficial digital financial services. The exponential rise of some digital financial services in areas such as India (Kearns and Mathew, 2022) and Kenya (Suri and Jack, 2016) attests to how these virtuous cycles can quickly result in widespread comfort with new digital technologies in low-income contexts.

One limitation of the present study is that the sample is $\approx 90\%$ male. In areas with strong gender norms, such as Pakistan, women may be especially concerned that sharing information may be perceived as disrespectful by men, which could be another contributor to poor intra-household learning (Ashraf, 2009; Conlon et al., 2021). Future work could examine cross-gender information-passing to test this hypothesis.

While this paper tests the implications of social image concerns for bilateral information-passing, future work could explicitly test the implications of social image concerns on diffusion and learning processes at the level of the social network. Important considerations, such as the mediating effects of network structure, require using the social network rather than the individual as the unit of analysis. Longitudinal network-level analysis could also allow scholars to investigate how social image concerns affect endogenous formation of social ties. Just as theoretical work has characterized the network structures that promote quick diffusion and wise learning, future work could characterize the social environments that consistently engender these outcomes.

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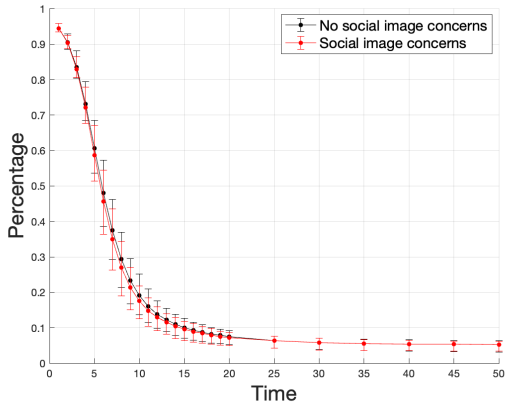
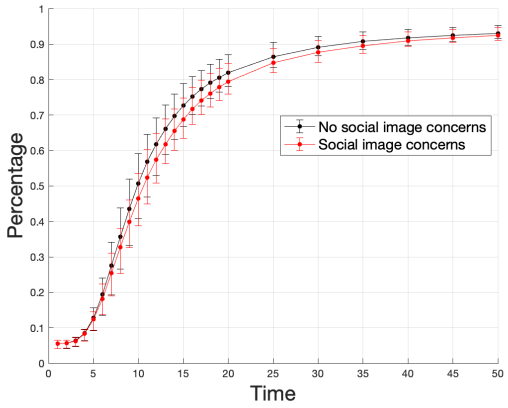
Figures

Figure 1: Information diffusion in simulations, with and without social image concerns

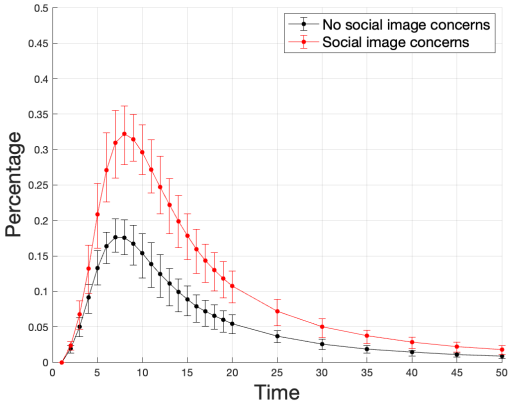
(a) Percentage with no information



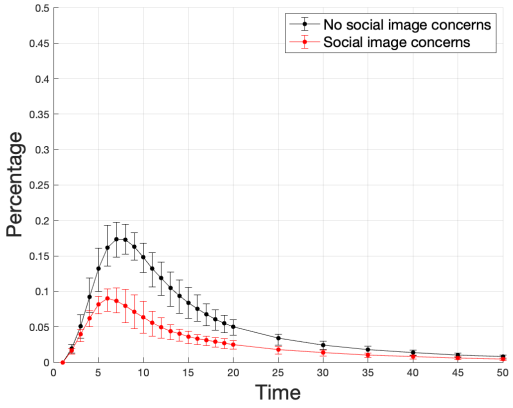
(b) Percentage with growth and safety information



(c) Percentage with only growth information

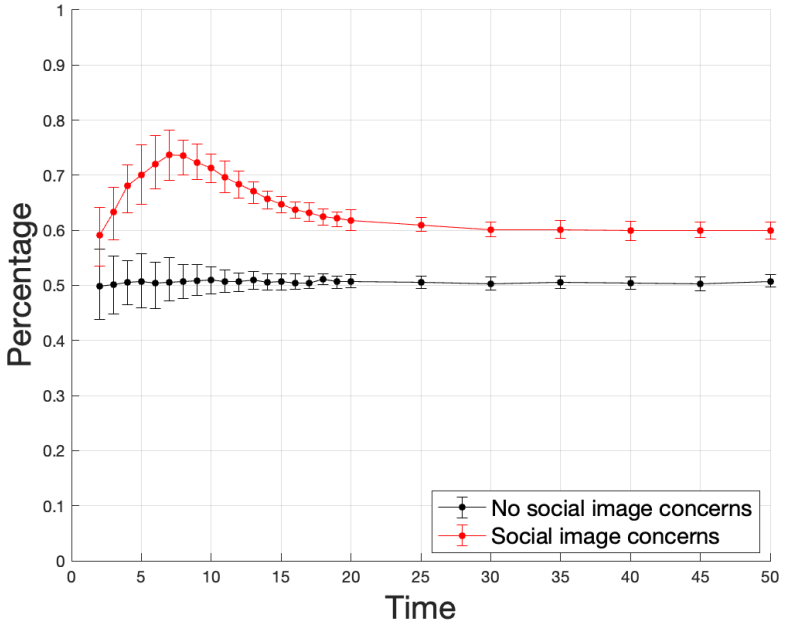


(d) Percentage with only safety information



Notes: These figures are based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the percentage of the village informed in specified manner across all simulations and networks. The x-axis is the number of time periods where villagers had the opportunity to communicate information. In the simulations, I seed 10 nodes in an Indian village network with a signal about the growth potential and safety of a technology. The red line are results from simulations with social image concerns and the black line are results from simulations without social image concerns. Refer to Table 8 for the passing rates used in the simulations. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across simulations.

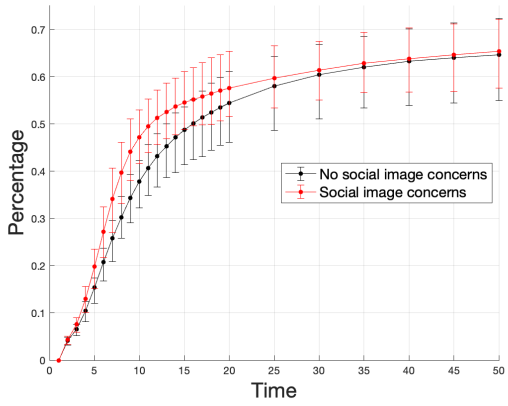
Figure 2: Percentage of conversations about growth potential of technology in simulations, with and without social image concerns



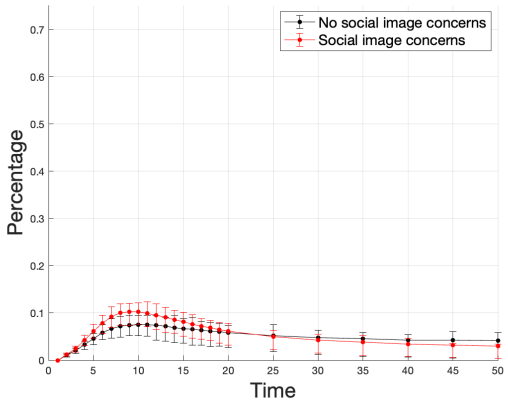
Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average across nodes of the number of times neighbors passed about growth divided by the total number of times neighbors passed information (growth + safety). In the simulations, I seed 10 nodes in an Indian village network with a signal about the growth potential and safety of a technology. In each period, informed nodes have an opportunity pass information across their links about one of the two topics. The x-axis is the number of time periods where villagers had the opportunity to communicate information. The red line are results from simulations run with social image concerns and the black line are results from simulations without social image concerns. Refer to Table 8 for the passing rates used in the simulations. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across networks.

Figure 3: Adoption across states of the world in simulations, with and without social image concerns

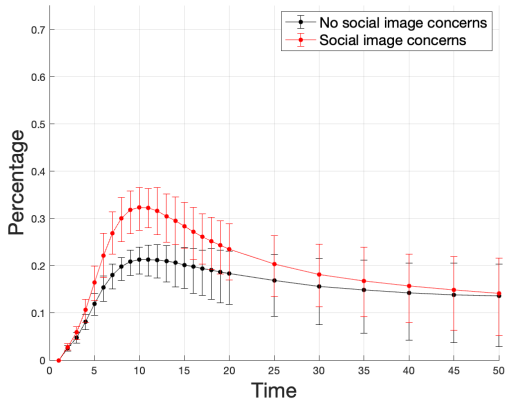
(a) Percentage adopting when technology is high growth potential and safe



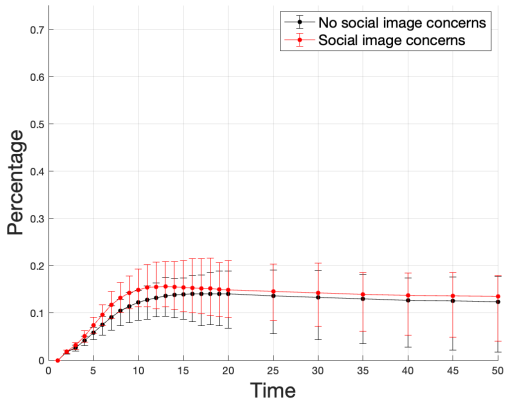
(b) Percentage adopting when technology is useless and dangerous



(c) Percentage adopting when technology is high growth potential but dangerous



(d) Percentage adopting when technology is useless but safe



Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average percentage of the village who adopt across simulations if communication ended after the given number of rounds. In the simulations, I seed 10 nodes in an Indian village network with a signal about the growth potential and safety of a technology. Each signal reflects the true state of the world with probability .7. In each period, informed nodes have an opportunity pass information across their links about one of the two topics. Refer to Section 7.1 for more details on the communication and learning processes. Villagers adopt if they believe a technology has growth potential and do not believe the technology is dangerous. Thus, if fully informed, the villagers would only adopt in Panel A (when the technology is high-growth potential and safe). The x-axis is the number of communication rounds. The red line are results from simulations run with social image concerns and the black line are results from simulations without social image concerns. Refer to Table 8 for the passing rates used in the simulations. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across simulations.

Tables

Table 1: Balance across treatment groups for senders and listers

	Control		**RS, HT**		**HS, RT**		**RS, RT**		C=RS,HT	C=HS,RT	C=RS,RT
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p-val	p-val	p-val
Under 30 years old	0.27	0.45	0.28	0.45	0.27	0.45	0.31	0.46	0.774	0.948	0.295
Over 50 years old	0.10	0.29	0.08	0.27	0.07	0.25	0.06	0.23	0.410	0.185	0.070
Male	0.90	0.30	0.89	0.31	0.87	0.34	0.88	0.33	0.801	0.269	0.379
HH head	0.82	0.39	0.83	0.38	0.78	0.41	0.80	0.40	0.697	0.240	0.631
Completed some secondary education	0.63	0.48	0.69	0.46	0.67	0.47	0.72	0.45	0.124	0.388	0.021
Completed some tertiary education	0.03	0.16	0.02	0.16	0.03	0.16	0.06	0.23	0.949	0.995	0.041
Primary income: Wages	0.47	0.50	0.48	0.50	0.46	0.50	0.44	0.50	0.796	0.844	0.541
Primary income: Selling agricultural goods	0.39	0.49	0.37	0.48	0.34	0.47	0.36	0.48	0.636	0.151	0.446
Primary income: Selling non-ag. goods	0.18	0.38	0.18	0.39	0.20	0.40	0.21	0.41	0.819	0.426	0.207
Owns land	0.20	0.40	0.25	0.43	0.19	0.40	0.19	0.39	0.227	0.856	0.841
Has bank account	0.11	0.32	0.13	0.33	0.12	0.32	0.13	0.34	0.568	0.878	0.421
Has mobile banking account	0.28	0.45	0.26	0.44	0.26	0.44	0.27	0.44	0.658	0.619	0.797
Has smartphone	0.85	0.36	0.87	0.34	0.87	0.34	0.87	0.33	0.401	0.485	0.343
Comfortable searching internet	0.62	0.49	0.69	0.46	0.66	0.47	0.68	0.47	0.062	0.233	0.100
F-test p-value									0.874	0.809	0.292
Observations	314		324		315		331				

This table contains the summary statistics for each experimental group and balance tests between the control group and each treatment group. The "HS, HT" columns contain the means and standard deviations of the variable for the villagers whose identity and targeting of a receiver would be revealed if they recommended a pamphlet to a receiver, the *Hidden Sender, Hidden Targeting* group/the control group. The "RS, HT" columns are respondents whose targeting of the receiver would be hidden from the receiver and their identity would be revealed if they recommended a pamphlet to the receiver, the *Revealed Sender, Hidden Targeting* group. The "HS, RT" columns are the respondents whose identity would be hidden from the receiver and their targeting would be revealed, if they recommended a pamphlet to the receiver, the *Hidden Sender, Revealed Targeting* group. The "RS, RT" columns are respondents whose identity and targeting of the receiver would be revealed from the receiver if they recommended a pamphlet to the receiver, the *Revealed Sender, Revealed Targeting* group. The p-values in the last three columns are from tests for significant differences between the control group, *Hidden Sender, Hidden Targeting*, and the three treatment groups. The seventh column reports p-values from testing for differences between the control group and *Revealed Sender, Hidden Targeting*. The eighth column is comparing control group and *Hidden Sender, Revealed Targeting*. The ninth column is comparing Control and *Revealed Sender, Revealed Targeting*. The "F-test p-value" row at the bottom of the table reports the test for the joint significance of the differences between the control group and the treatment groups using all of the variables reported in the table.

Table 2: Balance in personal characteristics across strong and weak tie receivers

	Weak tie		**Strong tie**		ST=WT
	Mean	SD	Mean	SD	p-val
Reached	0.74	0.44	0.74	0.44	0.976
Agrees to answer questions	0.98	0.14	0.96	0.20	0.167
Male	0.92	0.27	0.89	0.31	0.275
Has smartphone	0.90	0.30	0.90	0.30	0.914
Has a mobile banking account	0.22	0.41	0.20	0.40	0.602
Financial literacy score	-0.00	0.40	0.00	0.39	0.875
Mobile banking knowledge score	0.01	0.64	-0.01	0.60	0.834
Comfortable searching internet	0.71	0.45	0.69	0.46	0.675
Digit Count Score	0.04	0.89	-0.05	0.96	0.325
F-test p-value					0.845
Observations	328		315		

This table includes the receiver respondents that the field officers attempted to survey. The data in this table is from the surveys directly with the receivers. The strong tie receivers are those who the sender respondents listed as someone they give advice to/receive advice from. The weak tie receivers are those who the lister respondents listed as someone they give advice to/receive advice from and who were, later, assigned to a sender as their weak tie receiver in the recommendation experiment. The p-value in the last column tests for differences between the strong tie and weak tie receivers. The F-test p-value reported at the bottom of the table is for the joint significance of the differences between the types of receivers for all of the variables reported in the table.

Table 3: Differences in sender-receiver relationship across strong and weak tie receivers

	Weak Tie		**Strong Tie**		ST=WT
	Mean	SD	Mean	SD	p-val
Knows a bit or more about	0.92	0.28	0.99	0.12	0.000
Part of same clan/extended family	0.12	0.33	0.19	0.39	0.000
Made a transfer in last year	0.29	0.45	0.43	0.50	0.000
Gave advice to in last two months	0.75	0.43	0.97	0.17	0.000
Very confident in rating of intelligence	0.13	0.34	0.34	0.47	0.000
Very confident in rating of financial literacy	0.11	0.32	0.33	0.47	0.000
F-test p-value					0.000
Observations	1,002		1,269		

Notes: This table includes all receivers who senders made a recommendation to. The data in this table is from the sender's reports of their relationship with the receiver. Refer to Table 2 for additional details.

Table 4: Treatment effects on pamphlet-sharing, pooling recommendations to strong and weak ties

	(1) None	(2) Safety	(3) Growth
Revealed Sender, Hidden Targeting	-0.006	-0.024	0.023
	(0.023)	(0.033)	(0.030)
Hidden Sender, Revealed Targeting	-0.037	-0.028	0.062
	(0.022)	(0.032)	(0.030)
Revealed Sender, Revealed Targeting	-0.030	-0.021	0.059
	(0.021)	(0.032)	(0.031)
RS,RT-RS,HT	-0.023	0.003	0.036
RS,RT-RS,HT p-val	0.458	0.945	0.405
Control Mean	0.170	0.531	0.300
N	2271	2271	2271

*** p<0.01, ** p<0.05, * p<0.1

Notes: An observation is a recommendation from one villager (the sender) to a fellow villager (the receiver). The regressions includes recommendations to strong ties (55% of recommendations) who the sender listed as someone they share information with and weak ties (45%) who a neighbor of the sender listed as someone they share information with. Covariates are flexibly selected using double lasso approach of (Belloni et al., 2013; Ahrens et al., 2019). The outcomes in each column represent the choices made by the sender between sharing no pamphlets, the safety pamphlet, and the growth pamphlet when constrained to sharing one pamphlet at most. The first row is the coefficient on a dummy variable for being in the *Revealed Sender, Hidden Targeting* treatment group. The second row is the coefficient on a dummy for being in Revealed Targeting, Hidden Sender. The third row is the coefficient on a dummy for being in *Revealed Sender, Revealed Targeting*. The fourth row reports the difference between *Revealed Sender, Revealed Targeting* and *Revealed Sender, Hidden Targeting*. The fifth row reports the p-value when testing for differences between *Revealed Sender, Revealed Targeting* and *Revealed Sender, Hidden Targeting*. The sixth row reports the *Hidden Sender, Hidden Targeting* group mean for the outcome variable. Standard errors in parentheses below the coefficients and are clustered at the sender-level.

Table 5: Treatment effects on pamphlet-sharing among weak ties

	(1) None	(2) Safety	(3) Growth
Revealed Sender, Hidden Targeting	-0.011	-0.026	0.040
	(0.031)	(0.043)	(0.038)
Hidden Sender, Revealed Targeting	-0.035	-0.048	0.094
	(0.031)	(0.043)	(0.039)
Revealed Sender, Revealed Targeting	-0.025	-0.090	0.129
	(0.031)	(0.043)	(0.039)
RS,RT-RS,HT	-0.014	-0.063	0.089
RS,RT-RS,HT p-val	0.750	0.294	0.105
Control Mean	0.205	0.537	0.258
N	1002	1002	1002

Notes: The table includes recommendations to weak ties of the sender who a neighbor of the sender listed as someone they share information with. Refer to Table 3 for summary statistics on the relationship between the sender and the weak tie receiver. Refer to Table 4 for additional details on the table formatting.

Table 6: Treatment effects on pamphlet-sharing among strong ties

	(1) None	(2) Safety	(3) Growth
Revealed Sender, Hidden Targeting	0.007	-0.001	-0.005
	(0.024)	(0.040)	(0.037)
Hidden Sender, Revealed Targeting	-0.024	-0.001	0.038
	(0.022)	(0.039)	(0.037)
Revealed Sender, Revealed Targeting	-0.029	0.025	0.007
	(0.022)	(0.039)	(0.037)
RS,RT-RS,HT	-0.036	0.026	0.013
RS,RT-RS,HT p-val	0.266	0.644	0.807
Control Mean	0.142	0.526	0.332
N	1269	1269	1269

Notes: The table includes recommendations to strong ties of the sender who the sender listed as someone they share information with. Refer to Table 3 for summary statistics on the relationship between the sender and the strong tie receiver. Refer to Table 4 for additional details on the table formatting.

Table 7: Heterogeneity by tie strength of treatment effects on pamphlet-sharing

	(1) None	(2) Safety	(3) Growth
Revealed Sender, Hidden Targeting	-0.005	-0.011	0.006
	(0.835)	(0.784)	(0.878)
Hidden Sender, Revealed Targeting	-0.032	-0.005	0.033
	(0.173)	(0.895)	(0.372)
Revealed Sender, Revealed Targeting	-0.025	0.029	0.009
	(0.287)	(0.443)	(0.800)
Weak Tie	0.079	0.007	-0.092
	(0.001)	(0.832)	(0.007)
Weak Tie*RS, HT	-0.005	-0.029	0.048
	(0.869)	(0.519)	(0.276)
Weak Tie*HS, RT	-0.015	-0.054	0.066
	(0.633)	(0.231)	(0.150)
Weak Tie*RS, RT	-0.014	-0.110	0.113
	(0.657)	(0.017)	(0.013)
Control Mean	0.142	0.526	0.332
N	2271	2271	2271

Notes: "Receiver is a weak social tie" is a dummy variable equal to 1 if the receiver was drawn from the list of social ties of a neighbor of the sender and 0 if the receiver was drawn from the sender's list of social ties. Refer to Table 3 for summary statistics on the relationship between the sender and the strong/weak tie receivers. Refer to Table 4 for additional details on the table formatting.

Table 8: Passing rates by type of information and tie strength across simulations

	Without Social Concerns		With Social Concerns	
Sender Information	Safety	Growth	Safety	Growth
Panel A: Weak Ties				
Informed of Both	5%	5%	3.3%	6.7%
Informed of Safety only	10%		6.6%	
Informed of Growth only		10%		13.4%
Panel B: Strong Ties				
Informed of Both	5%	5%	5%	5%
Informed of Safety only	10%		10%	
Informed of Growth only		10%		10%

Notes: Passing rates for simulations discussed in Section 7. I assume that a node informed about one topic passes information on that topic 10% of the time. For nodes informed about two topics, I assume that they pass information about one topic 5% of the time and about the other topic 5% of the time when there are no social image concerns, meaning that their probability of sharing any information is still 10%. Among strong ties (households linked in ≥ 4 ways), the passing rates are unaffected by social image concerns. Among weak ties (households linked in > 0 but less than < 4 ways), social image concerns in the simulations increase passing rates of the growth topic by 33.4% relative to the "no social image concerns" simulations and decrease passing rates of the safety topic by 33.4%. I choose 33.4% as the magnitude since it is the average of the magnitudes of the "full social image concerns" effect on sharing of the growth pamphlet and on sharing of the safety pamphlet.

Supporting Information for

Do social image concerns affect technology diffusion? Evidence from mobile banking in Pakistan

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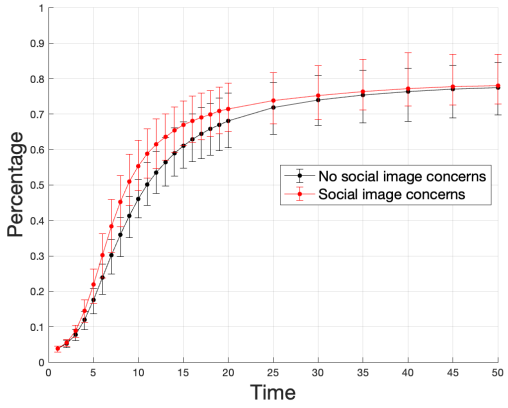
This appendix includes details about the study and analysis omitted from the manuscript due to space constraints. In order, this section includes information for:

1. Appendix Tables
2. Appendix Sections

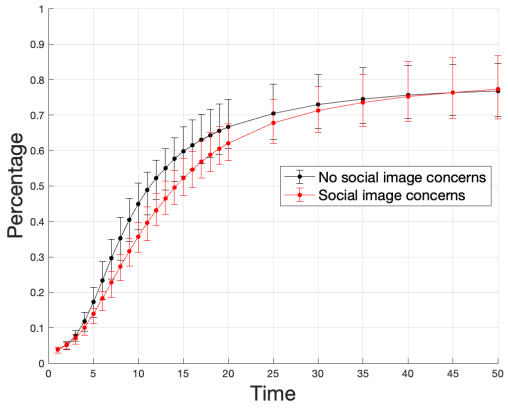
S.1 Appendix Figures

Figure S1: Percentage with correct beliefs, with and without social image concerns

(a) Percentage w/ correct belief on growth potential



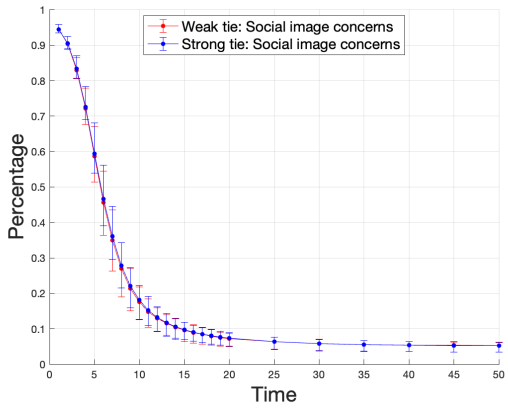
(b) Percentage w/ correct belief on safety



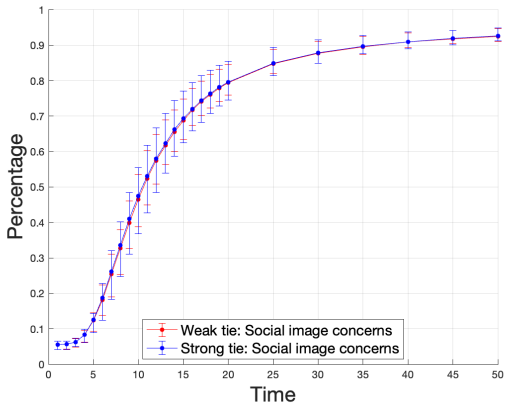
Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average percentage of the village who have correct belief about a given topic. In the simulations, I seed 10 nodes in an Indian village network with a signal about the growth potential and safety of a technology. Each signal reflects the true state of the world with probability .7. In each period, informed nodes have an opportunity pass information across their links about one of the two topics. Beliefs are updated each period by averaging one's own belief with that of their communicating neighbors. Refer to Section 7.1 for more details on the communication and learning processes. The x-axis is the number of communication rounds. The red line are results from simulations run with social image concerns and the black line are results from simulations without social image concerns. Refer to Table 8 for the passing rates used in the simulations. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across simulations.

Figure S2: Information diffusion in simulations, with social image concerns concentrated among weak vs. strong ties

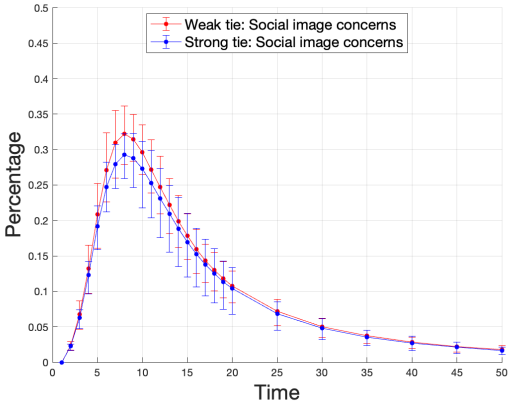
(a) Percentage with no information



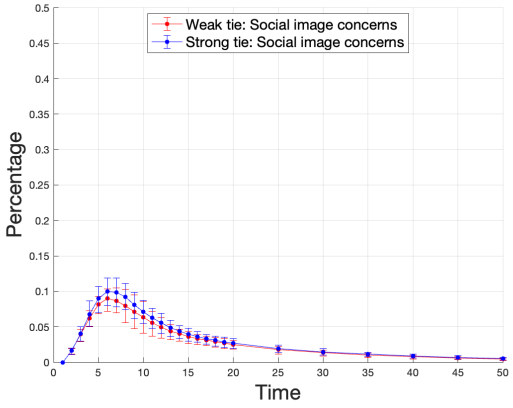
(b) Percentage with growth and safety information



(c) Percentage with only growth information

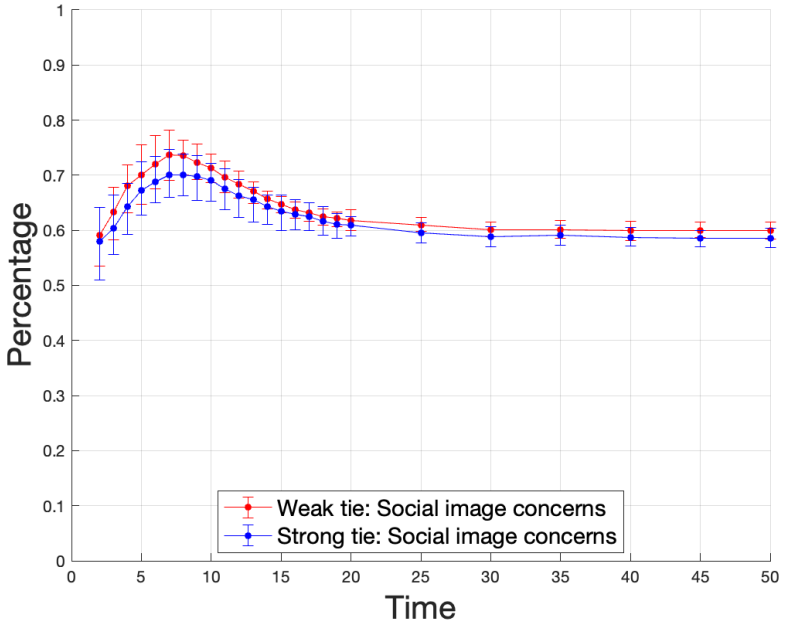


(d) Percentage with only safety information



Notes: These figures are based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average percentage of the village who adopt across simulations. In the simulations, I seed 10 nodes in an Indian village network with a signal about the growth potential and safety of a technology. Villagers adopt if they believe a technology has growth potential and do not believe the technology is dangerous. Thus, if fully informed, the villagers would only adopt in Panel A (when the technology is high-growth potential and safe). The x-axis is the number of communication rounds. The red line is results from simulations run with social image concerns concentrated among weak ties. The blue line is results from simulations with social image concerns concentrated among strong ties. Refer to Table 8 for the passing rates used in the simulations, recalling that weak and strong tie numbers are flipped for the blue line. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across networks.

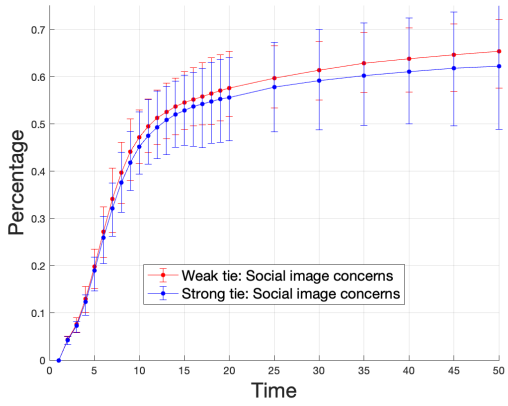
Figure S3: Percentage of conversations about growth potential of technology in simulations, with social image concerns concentrated among weak vs. strong ties



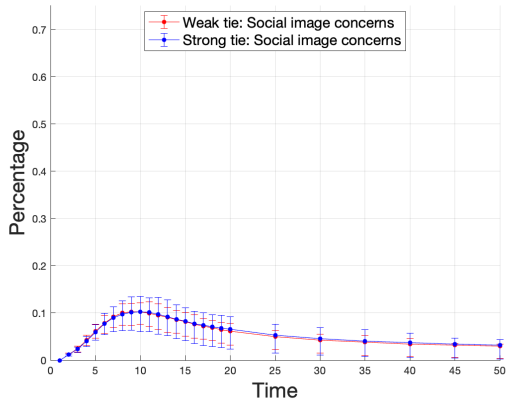
Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the amount of information passed about growth divided by the total amount of information passed (growth + safety) in a given period . The x-axis is the number of time periods where villagers had the opportunity to communicate information. The red line is results from simulations run with social image concerns concentrated among weak ties. Refer to Table 8 for the effect of social image concerns on passing rates used in the simulations, recalling that weak and strong tie numbers are flipped for the blue line. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across networks.

Figure S4: Adoption across states of the world in simulations, with social image concerns concentrated among weak vs. strong ties

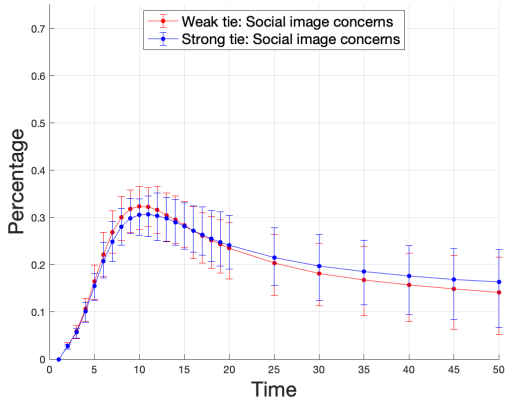
(a) Percentage adopting when technology is high growth potential and safe



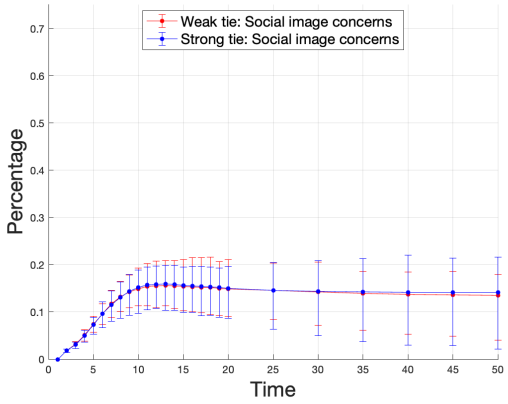
(b) Percentage adopting when technology is useless and dangerous



(c) Percentage adopting when technology is high growth potential but dangerous

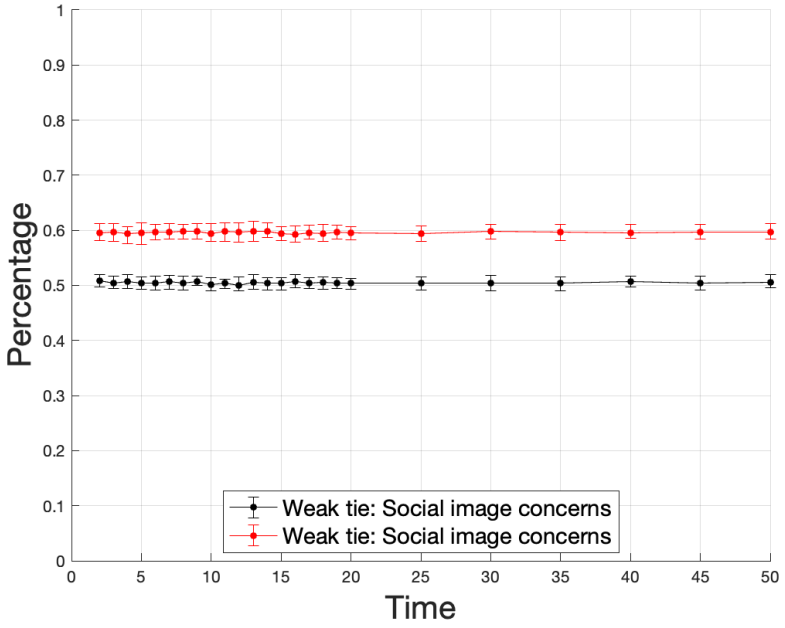


(d) Percentage adopting when technology is useless but safe



Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average percentage of the village who adopt across simulations. The x-axis is the number of time periods where villagers had the opportunity to communicate information. The red line is results from simulations run with social image concerns concentrated among weak ties. The blue line is results from simulations with social image concerns concentrated among strong ties. Refer to Table 8 for the passing rates used in the simulations, recalling that weak and strong tie numbers are flipped for the blue line. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across networks.

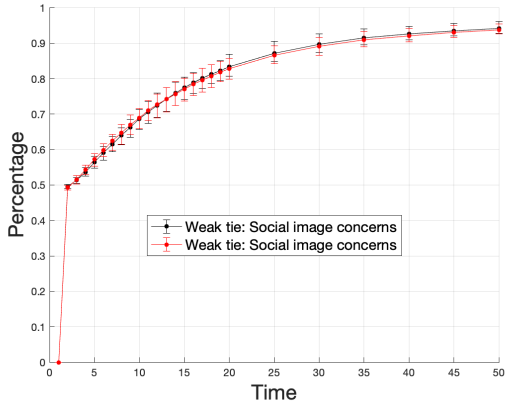
Figure S5: Percentage of conversations about growth potential of technology in simulations, dense seeding



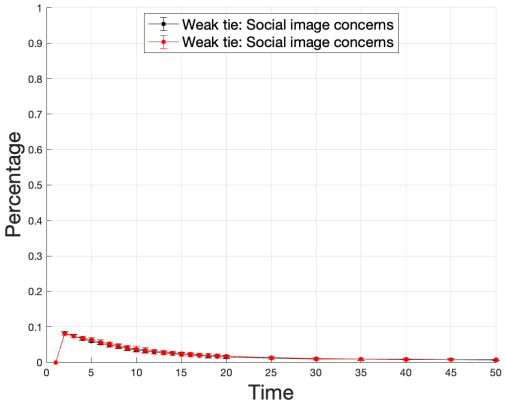
Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average across nodes of the number of times neighbors passed about growth divided by the total number of times neighbors passed information (growth + safety). In the simulations, I seed all nodes in an Indian village network with a signal about the growth potential and safety of a technology. In each period, informed nodes have an opportunity pass information across their links about one of the two topics. The x-axis is the number of time periods where villagers had the opportunity to communicate information. The red line are results from simulations run with social image concerns and the black line are results from simulations without social image concerns. Refer to Table 8 for the passing rates used in the simulations. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across networks.

Figure S6: Adoption across states of the world in simulations, dense seeding

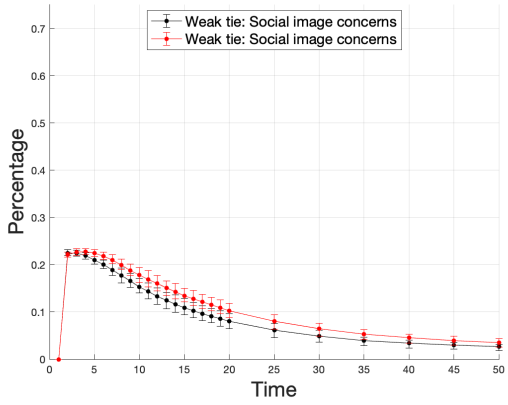
(a) Percentage adopting when technology is high growth potential and safe



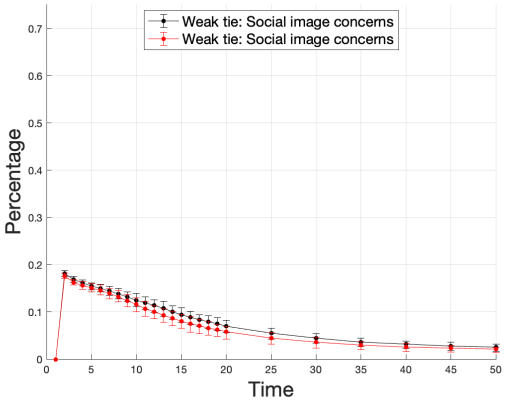
(b) Percentage adopting when technology is useless and dangerous



(c) Percentage adopting when technology is high growth potential but dangerous



(d) Percentage adopting when technology is useless but safe



Notes: This figure is based on the simulations on 75 Indian village networks described in Section 7. The y-axis is the average percentage of the village who adopt across simulations if communication ended after the given number of rounds. In the simulations, I seed all nodes in an Indian village network with a signal about the growth potential and safety of a technology. Each signal reflects the true state of the world with probability .7. In each period, informed nodes have an opportunity pass information across their links about one of the two topics. Refer to Section 7.1 for more details on the communication and learning processes. Villagers adopt if they believe a technology has growth potential and do not believe the technology is dangerous. Thus, if fully informed, the villagers would only adopt in Panel A (when the technology is high-growth potential and safe). The x-axis is the number of communication rounds. The red line are results from simulations run with social image concerns and the black line are results from simulations without social image concerns. Refer to Table 8 for the passing rates used in the simulations. The dots represent the averages across simulations for the simulations. The bars represent the interquartile range across simulations.

S.2 Appendix Tables

Table S1: Summary statistics of villager sharing information: Household financial behavior

	(1)	(2)	(3)	(4)	(5)

	All	HS, HT	RS, HT	HS, RT	RS, RT
Saves cash at home	0.501	0.490	0.488	0.492	0.532
	(0.500)	(0.501)	(0.501)	(0.501)	(0.500)
Savings committee	0.192	0.204	0.182	0.213	0.169
	(0.394)	(0.403)	(0.387)	(0.410)	(0.375)
Saves in Bank/MFI/mobile banking	0.00935	0.0127	0.0123	0.00317	0.00906
	(0.0963)	(0.112)	(0.111)	(0.0563)	(0.0949)
Gift from friends/fam if 10k emer.	0.350	0.363	0.330	0.359	0.350
	(0.477)	(0.482)	(0.471)	(0.480)	(0.478)
Loan from from friends/fam if 10k emer.	0.579	0.557	0.565	0.590	0.604
	(0.494)	(0.497)	(0.497)	(0.493)	(0.490)
Use savings kept at home if 10k emer.	0.201	0.182	0.210	0.197	0.215
	(0.401)	(0.386)	(0.408)	(0.398)	(0.411)
Observations	1284	314	324	315	331

Notes: Means are in the first row; Standard deviations are below in parentheses. The first column contains all senders. The second column contains the senders assigned to the *Hidden Sender, Hidden Targeting* group.The third column contains the senders assigned to the *Revealed Sender, Hidden Targeting* group. The fourth column contains the senders. assigned to the *Hidden Sender, Revealed Targeting* group. The fifth column contains the senders assigned to the *Revealed Sender, Revealed Targeting* group

Table S2: Summary statistics of villager sharing information: Mobile banking knowledge

	(1) All	(2) HS, HT	(3) RS, HT	(4) HS, RT	(5) RS, RT
Comfortable texting	0.768	0.764	0.787	0.775	0.746
	(0.422)	(0.425)	(0.410)	(0.419)	(0.436)
Comfortable using WhatsApp/Facebook	0.717	0.688	0.698	0.730	0.749
	(0.451)	(0.464)	(0.460)	(0.445)	(0.434)
Heard of Konnect by HBL	0.230	0.217	0.229	0.218	0.253
	(0.421)	(0.413)	(0.421)	(0.414)	(0.436)
Heard of Daraz (e-commerce site)	0.0534	0.0461	0.0441	0.0480	0.0735
	(0.225)	(0.210)	(0.206)	(0.214)	(0.261)
Heard of JazzCash	0.737	0.696	0.744	0.721	0.784
	(0.440)	(0.461)	(0.437)	(0.450)	(0.413)
Heard of Dost Kissan	0.0386	0.0372	0.0417	0.0363	0.0390
	(0.193)	(0.190)	(0.200)	(0.187)	(0.194)
Heard of the Asaan Mobile Account	0.140	0.154	0.172	0.0984	0.137
	(0.347)	(0.362)	(0.378)	(0.299)	(0.344)

Knows of MB use: Transfer through an agent	0.394	0.360	0.389	0.390	0.435
	(0.489)	(0.481)	(0.488)	(0.489)	(0.497)
Knows of MB use: Transfer through your phone	0.252	0.248	0.222	0.235	0.299
	(0.434)	(0.433)	(0.416)	(0.425)	(0.459)
Knows of MB use: Save money on your phone	0.241	0.229	0.222	0.254	0.260
	(0.428)	(0.421)	(0.416)	(0.436)	(0.439)
Knows of MB use: Borrow money	0.153	0.121	0.160	0.178	0.151
	(0.360)	(0.327)	(0.368)	(0.383)	(0.359)
Knows of MB use: Buy mobile packages	0.206	0.201	0.225	0.187	0.211
	(0.405)	(0.401)	(0.418)	(0.391)	(0.409)
Knows of MB use: Pay utility bills	0.123	0.134	0.117	0.127	0.115
	(0.329)	(0.341)	(0.322)	(0.333)	(0.319)
Knows of MB use: Savings account with profit	0.0974	0.0860	0.0988	0.108	0.0967
	(0.297)	(0.281)	(0.299)	(0.311)	(0.296)
If MB: Used to transfer money in past 8 wks	0.534	0.557	0.478	0.514	0.588
	(0.500)	(0.500)	(0.503)	(0.503)	(0.496)
If MB: Used to save money in past 8 wks	0.0662	0.0828	0.0648	0.0476	0.0695
	(0.249)	(0.276)	(0.247)	(0.213)	(0.255)
Observations	1284	314	324	315	331

Notes: Means are in the first row; Standard deviations are below in parentheses. The first column contains all senders. The second column contains the senders assigned to the *Hidden Sender, Hidden Targeting* group.The third column contains the senders assigned to the *Revealed Sender, Hidden Targeting* group. The fourth column contains the senders. assigned to the *Hidden Sender, Revealed Targeting* group. The fifth column contains the senders assigned to the *Revealed Sender, Revealed Targeting* group

Table S3: Summary statistics of villager sharing information: Consumer financial protection

	(1)	(2)	(3)	(4)	(5)
	All	HS, HT	RS, HT	HS, RT	RS, RT
Heard of someone losing money due to mobile banking	0.576	0.602	0.545	0.588	0.571
	(0.495)	(0.491)	(0.499)	(0.493)	(0.496)
Very comfortable leaving 30k in MB for 60 days	0.221	0.223	0.243	0.204	0.214
	(0.415)	(0.417)	(0.430)	(0.404)	(0.411)
Very comfortable leaving 30k cash at home for 60 days	0.409	0.425	0.392	0.407	0.413
	(0.492)	(0.495)	(0.489)	(0.492)	(0.493)
Contacted by likely scammer	0.281	0.267	0.278	0.315	0.264
	(0.450)	(0.443)	(0.449)	(0.465)	(0.442)
If contacted: Responded to likely scammer	0.443	0.487	0.412	0.446	0.425

	(0.497)	(0.503)	(0.495)	(0.500)	(0.498)
Heard of a mobile banking helpline	0.0924	0.0677	0.114	0.0534	0.131
	(0.290)	(0.252)	(0.319)	(0.226)	(0.339)
Observations	1127	269	280	284	294

Notes: Means are in the first row; Standard deviations are below in parentheses. The first column contains all senders. The second column contains the senders assigned to the *Hidden Sender, Hidden Targeting* group.The third column contains the senders assigned to the *Revealed Sender, Hidden Targeting* group. The fourth column contains the senders. assigned to the *Hidden Sender, Revealed Targeting* group. The fifth column contains the senders assigned to the *Revealed Sender, Revealed Targeting* group

Table S4: Treatment effects on alternative pamphlet-sharing outcomes, pooling strong and weak ties

	(1)	(2)	(3)	(4)	(5)	(6)
	None	Safe only	Grow only	Both	Rec. growth	Rec. safe
Revealed Sender, Hidden Targeting	-0.008	-0.006	0.040	-0.019	0.022	-0.027
	(0.021)	(0.031)	(0.029)	(0.024)	(0.033)	(0.033)
Hidden Sender, Revealed Targeting	-0.039	-0.016	0.044	0.015	0.066	-0.000
	(0.020)	(0.031)	(0.029)	(0.025)	(0.033)	(0.033)
Revealed Sender, Revealed Targeting	-0.027	0.009	0.053	-0.027	0.028	-0.021
	(0.021)	(0.031)	(0.030)	(0.024)	(0.033)	(0.033)
RS,RT-RS,HT	-0.019	0.015	0.013	-0.008	0.006	0.006
RS,RT-RS,HT p-val	0.520	0.728	0.760	0.810	0.894	0.899
Control Mean	0.146	0.307	0.240	0.307	0.547	0.614
N	2271	2271	2271	2271	2271	2271

Notes: Outcome variables in first four columns are sender choice between sharing no pamphlets, safety pamphlet alone, growth pamphlet alone, or both pamphlets. Outcome variable in fifth column is whether the sender shared the growth pamphlet (i.e. chose growth pamphlet alone or both pamphlets). Outcome variable in sixth column is whether the sender shared the safety pamphlet (i.e. chose safety pamphlet alone or both pamphlets). Refer to Table 4 for other table notes.

Table S5: Treatment effects on alternative pamphlet-sharing outcomes, among weak ties

	(1) None	(2) Safe only	(3) Grow only	(4) Both	(5) Rec. growth	(6) Rec. safe
Revealed Sender, Hidden Targeting	-0.021	-0.014	0.055	-0.023	0.038	-0.034
	(0.030)	(0.039)	(0.036)	(0.030)	(0.042)	(0.041)
Hidden Sender, Revealed Targeting	-0.049	-0.042	0.081	-0.001	0.091	-0.038
	(0.029)	(0.038)	(0.036)	(0.031)	(0.041)	(0.040)
Revealed Sender, Revealed Targeting	-0.017	-0.059	0.111	-0.036	0.074	-0.091
	(0.030)	(0.038)	(0.036)	(0.031)	(0.042)	(0.041)
RS,RT-RS,HT	0.004	-0.045	0.056	-0.012	0.037	-0.057
RS,RT-RS,HT p-val	0.925	0.403	0.267	0.778	0.535	0.328
Control Mean	0.180	0.303	0.201	0.316	0.516	0.619
N	1002	1002	1002	1002	1002	1002

Notes: Outcome variables in first four columns are sender choice between sharing no pamphlets, safety pamphlet alone, growth pamphlet alone, or both pamphlets. Outcome variable in fifth column is whether the sender shared the growth pamphlet (i.e. chose growth pamphlet alone or both pamphlets). Outcome variable in sixth column is whether the sender shared the safety pamphlet (i.e. chose safety pamphlet alone or both pamphlets). Refer to Table 5 for other table notes.

Table S6: Treatment effects on alternative pamphlet-sharing outcomes, among strong ties

	(1) None	(2) Safe only	(3) Grow only	(4) Both	(5) Rec. growth	(6) Rec. safe
Revealed Sender, Hidden Targeting	0.005	-0.008	0.026	-0.035	-0.005	-0.026
	(0.021)	(0.037)	(0.036)	(0.030)	(0.040)	(0.039)
Hidden Sender, Revealed Targeting	-0.034	-0.004	0.021	0.026	0.051	0.028
	(0.021)	(0.037)	(0.036)	(0.030)	(0.040)	(0.038)
Revealed Sender, Revealed Targeting	-0.023	0.037	0.017	-0.025	-0.002	0.026
	(0.020)	(0.037)	(0.036)	(0.029)	(0.039)	(0.038)
RS,RT-RS,HT	-0.028	0.046	-0.009	0.010	0.003	0.052
RS,RT-RS,HT p-val	0.336	0.388	0.859	0.808	0.953	0.341
Control Mean	0.119	0.310	0.271	0.300	0.571	0.610
N	1269	1269	1269	1269	1269	1269

Notes: Outcome variables in first four columns are sender choice between sharing no pamphlets, safety pamphlet alone, growth pamphlet alone, or both pamphlets. Outcome variable in fifth column is whether the sender shared the growth pamphlet (i.e. chose growth pamphlet alone or both pamphlets). Outcome variable in sixth column is whether the sender shared the safety pamphlet (i.e. chose safety pamphlet alone or both pamphlets). Refer to Table 6 for other table notes.

Table S7: Heterogeneity by tie strength of treatment effects on alternative pamphlet-sharing outcomes

	(1) None	(2) Safe only	(3) Grow only	(4) Both	(5) Rec. growth	(6) Rec. safe
Revealed Sender, Hidden Targeting	-0.012	0.004	0.040	-0.027	0.006	-0.031
	(0.620)	(0.911)	(0.253)	(0.354)	(0.887)	(0.413)
Hidden Sender, Revealed Targeting	-0.035	0.002	0.023	0.020	0.042	0.017
	(0.118)	(0.965)	(0.525)	(0.502)	(0.291)	(0.658)
Revealed Sender, Revealed Targeting	-0.034	0.054	0.021	-0.026	-0.012	0.020
	(0.125)	(0.139)	(0.548)	(0.360)	(0.754)	(0.604)
Weak Tie	0.075	-0.002	-0.083	0.005	-0.074	0.005
	(0.002)	(0.950)	(0.006)	(0.843)	(0.036)	(0.886)
Weak Tie*RS, HT	0.008	-0.023	0.012	0.011	0.037	0.001
	(0.795)	(0.585)	(0.763)	(0.731)	(0.423)	(0.987)
Weak Tie*HS, RT	-0.010	-0.048	0.060	-0.010	0.058	-0.046
	(0.749)	(0.237)	(0.145)	(0.777)	(0.213)	(0.289)
Weak Tie*RS, RT	0.015	-0.102	0.082	-0.007	0.092	-0.094
	(0.635)	(0.015)	(0.042)	(0.849)	(0.050)	(0.033)
Control Mean	0.119	0.310	0.271	0.300	0.571	0.610
N	2271	2271	2271	2271	2271	2271

Notes: Outcome variables in first four columns are sender choice between sharing no pamphlets, safety pamphlet alone, growth pamphlet alone, or both pamphlets. Outcome variable in fifth column is whether the sender shared the growth pamphlet (i.e. chose growth pamphlet alone or both pamphlets). Outcome variable in sixth column is whether the sender shared the safety pamphlet (i.e. chose safety pamphlet alone or both pamphlets). Refer to Table 7 for other table notes.

Table S9: Expected effect of anonymity on monetary outcomes

	(1) Receiver expected adoption	(2) Receiver outcome index	(3) Receiver earn index	(4) Receiver loss index
Revealed Sender, Hidden Targeting	0.102	-0.084	0.133	0.168
	(0.140)	(0.192)	(0.125)	(0.143)
Hidden Sender, Revealed Targeting	0.118	-0.049	0.150	0.167
	(0.146)	(0.178)	(0.116)	(0.130)
Revealed Sender, Revealed Targeting	0.210	-0.090	-0.040	0.062
	(0.178)	(0.173)	(0.134)	(0.136)
Safety pamphlet only	0.145	0.049	0.113	0.071
	(0.159)	(0.181)	(0.145)	(0.150)
Growth pamphlet only	0.222	-0.051	0.049	0.114
	(0.183)	(0.161)	(0.122)	(0.140)
Safety only*RS, HT	-0.088	-0.103	-0.231	-0.077
	(0.226)	(0.267)	(0.195)	(0.207)
Growth only*RS, HT	-0.024	0.331	-0.118	-0.363
	(0.258)	(0.240)	(0.184)	(0.199)
Safety only*HS, RT	-0.099	-0.042	-0.152	-0.054
	(0.239)	(0.235)	(0.195)	(0.194)
Growth only*HS, RT	-0.033	0.302	-0.113	-0.366
	(0.241)	(0.221)	(0.166)	(0.186)
Safety only*RS, RT	-0.223	0.146	0.133	0.019
	(0.251)	(0.229)	(0.192)	(0.193)
Growth only*RS, RT	-0.211	0.100	0.029	-0.051
	(0.268)	(0.231)	(0.175)	(0.197)
Control Mean	-0.126	-0.079	-0.106	-0.033
N	487	804	804	804

Notes: Field officers ask the sender the likelihood that the receiver adopts and earns/loses money over the next eight weeks if the field officer gives the receiver the safety pamphlet, the growth pamphlet, or both pamphlets and conveys that it was recommended according to the sender's treatment arm. Indices constructed following Anderson (2008)'s proposed method for implementing variance-weighted summary indices. The "Receiver outcome index" includes the likelihood of earning a little money, earning a lot of money, being happy to have received the pamphlet, losing a little money (inverted), and losing a lot of money (inverted). The earn index includes earning a little money, earning a lot of money, being happy to have received the pamphlet. The loss index includes losing a little money and losing a lot of money. In addition to the controls listed in Table 4, controls also include whether the field officer asks about the effect of recommending the safety pamphlet, the growth pamphlet, or both pamphlets. Refer to Table 4 for additional details.

Table S8: Heterogeneity by giving in Dictator game of treatment effects on pamphlet-sharing, among weak ties

	(1) None	(2) Safety	(3) Growth
Revealed Sender, Hidden Targeting	0.040	-0.102	0.069
	(0.054)	(0.070)	(0.070)
Hidden Sender, Revealed Targeting	-0.023	-0.032	0.062
	(0.056)	(0.071)	(0.070)
Revealed Sender, Revealed Targeting	-0.020	-0.161	0.183
	(0.054)	(0.067)	(0.068)
Above median giving in dictator game	-0.012	-0.076	0.082
	(0.051)	(0.073)	(0.069)
Above median giving*RS, HT	-0.063	0.073	-0.024
	(0.065)	(0.088)	(0.085)
Above median giving*HS, RT	0.001	-0.049	0.038
	(0.065)	(0.088)	(0.084)
Above median giving*RS, RT	-0.000	0.129	-0.121
	(0.064)	(0.086)	(0.084)
Control Mean	0.230	0.471	0.299
N	872	872	872

Notes: 'Above median giving in dictator game' is 1 if the sender gave at or above the median in a dictator game where the sender split 100 PKR in airtime between themselves and a fellow villager (though not their receivers). Median amount given was 20 PKR. In the dictator game, the sender knows that the other player will receive the gift anonymously. Refer to Table 7 for other table notes.

S.3 Appendix Sections

S.3.1 Proof of Proposition 1

I adapt the strategy of Chandrasekhar et al. (2018) to prove the the existence of equilibria in cutoff strategies.

Suppose a cutoff strategy where $d = 1$ iff $V(\theta) \leq v$. In this case, the Sender should be indifferent between sending and withholding when $\theta = t$. Using the Sender payoff function, I can solve for v when a Sender is indifferent to get:

$$v = \gamma(B(0), \lambda, \omega) - \gamma(B(1), \lambda, \omega) \tag{S.3.1}$$

By the Intermediate Value Theorem, there exists a v that satisfies Equation (S.3.1). The IVT requires that v is continuous and $\gamma(B(0)) - \gamma(B(1))$ is in the domain of V. v is continuous by Assumption 2. v's domain contains $\gamma(B(0)) - \gamma(B(1))$ because V contains all positive reals by Assumption 2 and γ is a bounded function.

Next, I characterize B under cutoff v using Bayes Rule:

$$B_v(0) = P_v(\theta \geq x \mid d = 0) = \frac{P_v(d = 0 \mid \theta \geq x) * \pi(x)}{P_v(d = 0)}$$
$$B_v(1) = P_v(\theta \geq x \mid d = 1) = \frac{P_v(d = 1 \mid \theta \geq x) * \pi(x)}{P_v(d = 1)}$$

I can simplify the probability that information is shared if $\theta > x$ to the probability that the Sender has information q and a high enough V to motivate sharing:

$$\mathbf{P}_v(d = 1 \mid \theta > x) = q \int_{y=\theta}^{1} G_y(v) \tag{S.3.2}$$

The probability that information is not shared if $\theta > x$ is just the $1 - \mathbf{P}_t(d = 1 \mid \theta > x)$

$$\mathbf{P}_v(d = 0 \mid \theta > x) = 1 - q \int_{y=\theta}^{1} G_y(v). \tag{S.3.3}$$

Using these equations, I simplify the formulas for B_v:

$$B_v(0) = \frac{1 - q \int_{y=\theta}^{1} G_y(v) * \pi(x)}{P_v(d = 0)}$$

$$B_v(1) = \frac{q \int_{y=\theta}^{1} G_y(v) * \pi(x)}{P_v(d = 1)}$$

We can then divide through both equations by $1 - B_v(d)$. Since $1 - B_v(d) = P(\theta < x \mid d) = \frac{P(d=0|\theta<x)(1-\pi)}{P(d)}$ and $P(\theta < x \mid d = 0) = 1 - q \int_{y=0}^{\theta} G(y, t)$, this allows us to re-write the equations

as:

$$\frac{B_v(0)}{1-B_v(0)} = \frac{\pi}{1-\pi} * \frac{1-q\int_{y=\theta}^{1} G_y(v)}{1-q\int_{y=0}^{\theta} G_y(v)}$$

$$\frac{B_v(1)}{1-B_v(1)} = \frac{\pi}{1-\pi} * \frac{\int_{y=\theta}^{1} G_y(v)}{\int_{y=0}^{\theta} G_y(v)}$$

S.3.2 Proof of Proposition 2

I will show that the c.d.f of beliefs when the Sender shares $B_v(1)$ first order stochastically dominates the c.d.f. of beliefs when the Sender withholds $B_v(0)$. Therefore, I must show that $B_v(0)(x) < B_v(1)(x)$ for all $x \in (0,1)$, where B_v are the beliefs induced in the equilibrium where v is the cutoff.

I start from the posterior c.d.f.s characterized in Appendix S.3.1:

$$\frac{B_v(0)}{1-B_v(0)} = \frac{\pi}{1-\pi} * \frac{1-q\int_{y=\theta}^{1} G_y(v)}{1-q\int_{y=0}^{\theta} G_y(v)}$$

$$\frac{B_v(1)}{1-B_v(1)} = \frac{\pi}{1-\pi} * \frac{\int_{y=\theta}^{1} G_y(v)}{\int_{y=0}^{\theta} G_y(v)}$$

Importantly $z \mapsto \frac{z}{1-z}$ is strictly increasing for $z \in (0,1)$, so I just need to show that $\frac{B_v(0)(x)}{1-B_t(1)(x)} < \frac{B_{t,0}(x)}{1-B_{t,0}(x)}$ for all $x \in (0,1)$ to show that sharing signals low-regard.

I start by noting that $\int_{y=\theta}^{1} G_y(t)$ is the expected value of V from θ to 1 and $\int_{y=0}^{\theta} G_y(t)$ is the expected value of V from 0 to θ.

By Assumption 1 on FOSD, $G_{\theta'} < G_\theta$ if $\theta' > \theta$. Thus, the expected value from θ to 1 will be lower than the expected value from 0 to θ giving us that $\int_{y=\theta}^{1} G(y,v) < \int_{y=0}^{\theta} G(y,t)$. Since $G = 1-F$, $\int_{y=\theta}^{1} F(y,t) > \int_{y=0}^{\theta} F(y,t)$. Putting these expressions together gives me:

$$\frac{\pi}{1-\pi}\frac{\int_{y=\theta}^{1} G_y(v)}{\int_{y=0}^{\theta} G_y(v)} < \frac{\pi}{1-\pi}\frac{\int_{y=\theta}^{1} F_y(v)}{\int_{y=0}^{\theta} F_y(v)}$$

Assumption 2 on FOSD also means that:

$$\frac{\pi}{1-\pi}\frac{\int_{y=\theta}^{1} G(y,t)}{\int_{y=0}^{\theta} G(y,t)} < \frac{1}{1}$$

Following Chandrasekhar et al. (2018), I note that for any positive reals x, y, z, y', z' if we have $x < y'/z'$

then it follows that $x < \frac{qy+(1-q)y'}{qz+(1-q)z'}$. Thus,

$$\frac{\pi}{1-\pi}\frac{\int_{y=\theta}^{1} G_y(t)}{\int_{y=0}^{\theta} G_y(v)} < \frac{\pi}{1-\pi}\frac{q\int_{y=0}^{\theta} F_y(t)+(1-q)}{q\int_{y=0}^{\theta} F_y(t)+(1-q)}$$

I can then use the identity $G_y(t) = 1 - F_y(t)$ to show

$$\frac{\pi}{1-\pi}\frac{\int_{y=\theta}^{1} G_y(t)}{\int_{y=0}^{\theta} G_y(t)} < \frac{\pi}{1-\pi}\frac{q\int_{y=\theta}^{1} F_y(t)+(1-q)}{q\int_{y=0}^{\theta} F_y(t)+(1-q)} = \frac{\pi}{1-\pi}\frac{1-q\int_{y=\theta}^{1} G_y(t)}{1-q\int_{y=0}^{\theta} G_y(t)} \tag{S.3.4}$$

This proves that $B_v(1) < B_v(0)$ because $z \mapsto \frac{z}{1zx}$ is strictly increasing for $z \in (0,1)$ as noted above.

Combining $B_v(1) < B_v(0)$ with the result from Proposition 1 that the cutoff does not differ across sender-types (i.e. across values of θ) results in:

$$\mathbf{P}_t(\theta \leq \beta \mid d = 1) > \mathbf{P}_t(\theta \leq \beta \mid d = 0)$$

S.3.3 Proof of Proposition 3

I start from the posterior c.d.f.s characterized in Appendix S.3.1:

$$\frac{B_v(0)}{1-B_v(0)} = \frac{\pi}{1-\pi} * \frac{1-q\int_{y=\theta}^{1} G_y(v)}{1-q\int_{y=0}^{\theta} G_y(v)}$$

$$\frac{B_v(1)}{1-B_v(1)} = \frac{\pi}{1-\pi} * \frac{\int_{y=\theta}^{1} G_y(v)}{\int_{y=0}^{\theta} G_y(v)}$$

I follow Chandrasekhar et al. (2018)'s proof. If $F_{\theta=1}$ converges to $F_{\theta=0}$ in the total variation norm, then F_θ converges $F_{\theta'}$ for any θ and θ' in $(0,1)$ because any $\mathbf{E}(V(\theta)) = \theta * V(1) + (1-\theta) * V(0)$.

As this occurs, then $B_v(d)$, for any v and any d, tends to π since the action loses signaling value. Thus, the right-hand side of Equation (S.3.1) tends pointwise to 0 so the v solving Equation (S.3.1) must be very close to 0. Using the posterior odds ratios above, it follows that

$$\frac{B(1)}{1-B(1)} - \frac{B(0)}{1-B(0)} \to 0$$

Since the function $x \mapsto \frac{x}{1-x}$ is increasing and continuous, this shows that

$$B(1) - B(0) \to 0.$$

which means that the social image concerns effect disappears.

S.3.4 Proof of Proposition 4

In this proof, I draw upon the proof of Proposition 4 in Chandrasekhar et al. (2018) and the proof of Proposition 6.1 in Chandrasekhar et al. (2022). I start from Equation (S.3.1) and separate social image concerns into prestige and respect concerns:

$$v = \lambda \cdot \phi(B(0)) + \omega \cdot \psi(B(0)) - (\lambda \cdot \phi(B(1)) + \omega \cdot \psi(B(1))$$

Now define the function $R(v)$ such that:

$$R(v) = \frac{v}{\lambda + \omega} = \widehat{\phi}(B(0)) + \widehat{\psi}(B(0)) - (\widehat{\phi}(B(1)) + \widehat{\psi}(B(1))$$

Starting with λ_{Low}. If $\frac{1}{\lambda+\omega}$ is larger than the maximum slope of the right-hand side, it is clear (from the Mean Value Theorem) that there cannot be two values of v satisfying the equation.

Turning to λ_{High}. $R(v) \neq 0$ by Assumption 1. Consider an arbitrarily large v_0. Let R_0 be the minimum of R over $[0, v_0]$, which is strictly positive. Choose λ so large that v/λ remands less than R_0 over the same interval. Then any intersection must satisfy $v_0 > 0$. For v_0 chosen large enough, the probability of sharing will be arbitrarily small.

Now for the "large λ " result: first note that $R(v) \neq 0$ for any v by the "strict" aspect of Assumption 1 on first-order stochastic dominance. Choose an arbitrarily large v_0. Let R_0 be the minimum of R over $[0, v_0]$, which is strictly positive. Choose λ so large that v/λ remands less than R_0 over the same interval. Then any intersection must satisfy $v_0 > 0$. For v_0 chosen large enough, the probability of sharing will be arbitrarily small.

S.3.5 Proof of Proposition 5

I start from the posterior c.d.f.s characterized in Appendix S.3.1:

$$\frac{B_v(0)}{1 - B_v(0)} = \frac{\pi}{1-\pi} * \frac{1 - q\int_{y=\theta}^{1} G_y(v)}{1 - q\int_{y=0}^{\theta} G_y(v)}$$

$$\frac{B_v(1)}{1 - B_v(1)} = \frac{\pi}{1-\pi} * \frac{\int_{y=\theta}^{1} G_y(v)}{\int_{y=0}^{\theta} G_y(v)}$$

I follow Chandrasekhar et al. (2018)'s proof. If priors become precise, then $B_v(d)$, for any v and any d, tends to π. Thus, the right-hand side of Equation (S.3.1) tends pointwise to 0 so the v solving Equation (S.3.1) must be very close to 0. Just as in Appendix S.3.3 using the posterior odds ratios

above, it follows that

$$\frac{B(1)}{1-B(1)} - \frac{B(0)}{1-B(0)} \to 0$$

Since the function $x \mapsto \frac{x}{1-x}$ is increasing and continuous, this shows that

$$B(1) - B(0) \to 0.$$

which means that the social image concerns effect disappears.

S.3.6 Model with multiple types of information

S.3.6.1 Environment

I focus on the decision of one social tie (the Sender) to pass information on one of two topics to another social tie (the Receiver). The Sender is denoted by i, the Receiver by j, and the Sender's decision to pass information to the Receiver by $d_{ij} \in \{0, X, Y\}$. If the Sender shares the information, the Receiver receives an informational payoff, $V_d(T_j)$, which depends upon their type, $T_j \in \{H, L\}$. I normalize $V_0 = 0$ without loss of generality.

From the perspective of the Sender, the Receiver's payoff distribution is $V_d(\theta_{ij}) = \theta_{ij} * V_d(H) + (1 - \theta_{ij}) * V_d(L) + \eta_{ij}$, where η_{ij} is a Sender-Receiver pair idiosyncratic shock that is observable to the Sender but unobservable to the Receiver. Let $F_{d,\theta}$ be the c.d.f. of $V_d(\theta)$ for Senders who believe the Receiver is an high-type with probability θ. Let $G_{d,\theta}$ be the complementary c.d.f..

The Receiver updates their belief about the Sender's regard for them, θ_{ij}, based on the Sender's decision. The Receiver begins with a prior c.d.f., π, over the Sender's regard for them, θ_{ij}. Additionally, the Receiver believes that the Sender has information to share with probability q_X and q_Y. Once the Sender makes a decision and the Receiver observes it, the Receiver updates π to a posterior c.d.f., $B(d_{ij}, \pi, q)$, according to Bayes rule.

For the basic analysis, I assume that π and q are fixed across Receivers, so that the Receiver's posterior over the Sender's regard for them only depends on the Sender's decision to share or withhold, d_{ij}. With these simplifying assumptions, the Receiver's posterior over the Sender's regard can be characterized as $\mathbb{E}(\theta_{ij} \mid d_{ij})$.

The Sender's decision maximizes the following payoff function:

$$U_i = V_d(\theta_{ij}) + \gamma(\mathbb{E}(\theta_{ij} \mid d_{ij}), \lambda, \omega) \tag{S.3.5}$$

Definition 2 (Equilibrium)**.** A (mixed) strategy for the Sender is a map from a level of regard for the Receiver, θ_{ij}, and an idiosyncratic Sender-Receiver shock, η_{ij}, to a probability of sharing the X or Y, $\sigma : [0,1] \times \mathbb{R} \to [0,1] \times [0,1]$. A belief function for the Receiver is a map from the Sender's decision to a posterior c.d.f over the value of θ_{ij}: $B : \{0,1\} \to \mathcal{P}([0,1])$. Thus, $B(d_{ij})$ is the cumulative distribution function over θ_{ij} induced by the sender decision d_{ij}.

A Bayes-Nash equilibrium is defined to be a pair (σ, B) where B is consistent with Bayesian updating assuming the Sender plays according to σ, and σ maximizes the Sender's payoff taking B as given.

A tuple of primitives $(\pi, q, (F_{X,\theta})_{\theta\in\{0,1\}}, (F_{Y,\theta})_{\theta\in\{0,1\}}, \gamma, \lambda, \omega)$ denotes the environment.

S.3.7 Random walk procedure for sampling households

In order to randomly sample households, the field supervisors randomly pick a starting point in each community. The field officers survey a member of the household to the left and the right of this starting point (these are the lister respondents described in Section 4.2. Then, the field officers sample 16 households for the sender survey through circular random sampling. In circular random sampling, the field officers start at the same randomly-chosen point on the boundary of the village. One field officer begins walking around the boundary of the village keeping the houses on their right. This field officer would count each household they pass and attempt to survey an eligible member of the 4th household passed on their right. The other field officer would do the same but keeping households on their left. Once the boundary of the village was covered by one of the field officers. The field officers would move to the next layer of the village and do the same. They would keep moving to further in layers until completing 16 sender surveys.

If unable to survey this household, the field officer attempts to survey a member of the next household to the right. The field officer would then repeat this process.

S.3.8 Mobile banking pamphlets

I designed the pamphlets in collaboration with a designer from Lahore whom I contacted through the freelancing platform Upwork. The design of the two pamphlets are nearly identical besides the color. I used different colors for each pamphlet to enable us to better trace the diffusion of the pamphlets through the network.

For both pamphlets, the front-side contains five points related to mobile banking, while the back-side contains tables related to the information conveyed on the front-side. The first point on the front-side for each pamphlet is "Open a reliable account such as the Asaan Mobile Account." The Asaan Mobile Account is an initiative by the Pakistani government to expand financial access among low-income segments. In the pamphlets, I directly use the framing of the Asaan Mobile Account used on the State Bank of Pakistan's website as of February 2023.[58] I then provide the USSD code that respondents can enter on their basic/smart phones to initiate the registration process. I also provide the USSD code for registering with the partner bank of one's mobile network operator in case respondents prefer this option. The remaining information differs between pamphlets.

[58]Link to State Bank of Pakistan Asaan Mobile Account website as of March 2023.

S.3.8.1 "Making your money grow with mobile banking" pamphlet

Points 2-5 on the front-side of the "Making your money grow with mobile banking" relate to benefits of using mobile banking that are not well-known in the context. Point 2 tells the reader that one can earn profits by using a mobile banking savings account. In this context, savings accounts provide benefits through profit rates rather than interest rates in order to comply with the strictures of Sharia law. Point 3 mentions the commitment savings products of Konnect by HBL. This product provides high profit rates relative to other savings accounts. Furthermore, the demand for commitment devices among low-income households has been demonstrated in a number of contexts (Ashraf et al., 2006; Gugerty, 2007; Dupas and Robinson, 2013). Point 4 mentions products that allow for online marketing or sale of product which could allow them to use e-commerce to grow their businesses. Preliminary results from a forthcoming study in Tanzania provides evidence of increasing use of digital payments to remote collection of payment for goods and services delivered to one's home. Point 5 highlights services related to farming and livestock that may be especially useful for the sample. The Dost Kissan product provides weather, crop, and livestock advice via SMS or Interactive Voice Recording. DigiBoP Whatsapp Banking provides financing for agricultural inputs to qualifying farmers.

On the back of the pamphlet, I provide information on a number of savings account products including the provider of the product, the expected annual profit rate as of February 2023, the minimum account balance, how to open the account, and how to use the account.

The field officer read the following summary of the pamphlet to the senders:

"You can make your money grow with mobile banking by following these tips:

Open a reliable account such as the State Bank of Pakistan-sponsored Asaan Mobile Account.

Open a savings account and earn profits ranging from 5.5% to 14.5% per annum.

Used fixed term or commitment savings such as HBL's Gulak where you commit to saving for 1, 3, 6 or 12 months and can earn up to 13.5% profit.

Open a business mobile banking account to market and sell to distant consumers on online marketplaces such as daraz.pk.

Access agricultural advisory services through Mobilink's DOST Kissan or agricultural finance through DigiBoP WhatsApp Banking.

Refer to the pamphlet for more information on these services. On the back of the pamphlet, there is a list mobile savings account products with relevant information."

Figure S7: Growth pamphlet: Front-side

S.3.8.2 "Keeping your money safe with mobile banking" pamphlet

Points 2-5 of the "Keeping your money safe with mobile banking" pamphlet are about avoiding negative events that could occur when one uses mobile banking. The second point implores respondents to protect their PIN number. The third point tells respondents to ignore contact from unknown numbers and informs that their service providers will use short-code or toll-free numbers. The results of the baseline survey confirm that this is useful advice. 42% of respondents reported being contacted by unknown numbers with 35% of those contacted responded to the numbers instead of ignoring or reporting it. Among the 63% who ignored the contact, the most common reason was that the number was not a short-code or toll-free. The fourth point informs the reader of common scams in this context, including encouragements to use unauthorized services. The final point provides instructions for monitoring your mobile banking account by checking your bank statement and on how to contact

Figure S8: Growth pamphlet: Front-side (English translation)

Making your money grow with mobile banking

Here is information on how one can make their money grow with mobile banking:

1. **Open a reliable account such as the Asaan Mobile Account (AMA)**: The AMA is a State Bank of Pakistan (SBP) and Pakistan Telecommunication Authority (PTA) initiative to facilitate the swift, easy, safe, and affordable opening of mobile banking accounts. Dial *2262# to open an AMA. Mobile bank accounts can also be opened by dialing *786# on Jazz, Telenor, or Ufone sims or via apps.
2. **Savings accounts:** Earn profits ranging from 5.5% to 14.5% per annum. The longer your money stays in a savings account, the more profit it earns. You can open a savings account via USSD code or phone app. Refer to back of this pamphlet for more information.
3. **Commitment savings:** With the Konnect by HBL's Gulak product, you commit to saving for 1, 3, 6 or 12 months and earn up to 13.5% annual profit rate. If you withdraw earlier, you will have to pay a fee. Refer to the back of this pamphlet for more information.
4. **Online business marketing:** With Business mobile accounts, you can send promotional SMS messages to your consumers. A mobile banking account allows you to receive payments digitally so you can sell goods and services to consumers living far away. You can access distant consumers via marketplaces like daraz.pk.
5. **Services for farming and livestock:** Mobilink's DOST Kissan from Mobilink Microfinance Bank provides agricultural advisory services through Interactive Voice Recordings and SMS. The Bank of Punjab offers agricultural finance through their DigiBoP WhatsApp Banking.

Figure S9: Growth pamphlet: Back-side

بچت پروڈکٹ کا نام	فراہم کنندہ	متوقع سالانہ منافع کی شرح*	کم از کم بیلنس	کہاں کھول سکتے ہیں	استعمال
آسان ڈیجیٹل بچت اکاؤنٹ	الائیڈ بینک	14.5%	0	بینک کی برانچ	ایپلیکیشن
آسان ڈیجیٹل بچت اکاؤنٹ	بینک الفلاح	14.5%	0	بینک کی برانچ	ایپلیکیشن
ایزی پیسہ بچت	ایزی پیسہ	7-14%**	2000	ایپلیکیشن /ایجنٹ	ایپلیکیشن
ڈیجیٹل بچت	میزان بینک	12.6%	0	بینک کی برانچ	ایپلیکیشن
بچت کے منصوبے	جاز کیش	7.15-10.15%***	2000	یو ایس ایس ڈی/ (USSD) ایپلیکیشن /ایجنٹ	یو ایس ایس ڈی/ (USSD) ایپلیکیشن
گلک (Gulak)	HBL Konnect	13.5% ****	1000	ایس ایم ایس ***** / ایپلیکیشن	ایس ایم ایس SMS/ ایپلیکیشن

فروری 2023 سے۔ مستقبل میں تبدیل ہو سکتا ہے۔

2000 روپے سے کم کے لیے 0 فیصد ، 2000-5000 روپے تک کے لیے 7 فیصد ، 5000-20000 روپے تک کے لیے 9 فیصد ، 20000-50000 روپے تک کے لیے 11 فیصد ، 50000 روپے سے زیادہ کے لیے 14 فیصد

2000روپے سے کم کے لیے 0 فیصد ، 2000-5000 روپے کے لیے 7.15 فیصد ، 5000-20000 روپے کے لیے 9.15 فیصد ، 20000 روپے سے زیادہ کے لیے 10.15 فیصد

گلک (Gulak) کی مدت اور بیلنس کے سائز کی بنیاد پر مختلف ہوتی ہے۔ اگر آپ 1، 3، 6، یا 12 ماہ کی کمٹمنٹ/ فکسڈ سونگ سے پہلے پیسے نکلواتے ہیں، تو آپ کو منافع نہیں ملے گا اور آپ فیس ادا کریں گے۔

آپ درج ذیل ایس ایم ایس (SMS) 8425 پر بھیج کر اکاؤنٹ کھول سکتے ہیں

BBAO< SPACE > CNIC > SPACE > CITY > 8425

Figure S10: Growth pamphlet: Back-side (English translation)

Savings product name	**Provider**	**Expected annual profit rate***	**Minimum balance**	**Opening**	**Usage**
Asaan Digital Savings Account	Allied Bank	14.5%	0	Bank branch	App
Asaan Digital Savings Account	Bank Alfalah	14.5%	0	Bank branch	App
EasyPaisa Savings	EasyPaisa	7-14%**	2000	App/Agent	App
Digital Savings	Meezan Bank	12.6%	0	Bank branch	App
Bachat Plans	JazzCash	7.15-10.15%***	2000	USSD/App/Agent	USSD/App
Gulak	Konnect by HBL	13.5%****	1000	SMS*****/App	SMS/App

* As of February 2023. May be changed in the future.

** 0% for under 2000 PKR balance, 7% for 2000-5000 PKR, 9% for 5000-20000 PKR, 11% for 20000-50000 PKR, 14% for over 50000 PKR

*** 0% for under 2000 PKR balance, 7.15% for 2000-5000 PKR, 9.15% for 5000-20000 PKR, 10.15% for over 20000 PKR

****Varies based on duration of Gulak and size of balance. If you withdraw prior to commitment of 1, 3, 6, or 12 months, you will not receive profit and will pay a fee.

***** You can open via SMS by sending the following SMS: BBAO< SPACE >< CNIC >< SPACE >< CITY > to 8425.

mobile banking helplines.

On the back of the pamphlet, I include a list of authorized services and unauthorized services to help respondents understand when they are dealing with scammers as compared to legitimate mobile banking service providers. In addition, I provide a list of helplines and complaint registration services for common mobile banking providers and the helpline of the State Bank of Pakistan's Consumer Protection department.

The field officer read the following summary of the pamphlet to the senders:

"You can keep your money safe with mobile banking by following these simple tips.

Open a reliable account such as the State Bank of Pakistan-sponsored Asaan Mobile Account.

Protect your PIN by picking a hard-to-guess number and not sharing it with others.

Do not respond to calls or SMSs from unknown numbers since these may be scammers.

Check your banking statement and report any issues.

Refer to the pamphlet for information on how to open a mobile banking account, easily avoid common scams, and check your bank statement. Refer to the back of the pamphlet for a list of approved mobile banking services and banned services as well as the helplines for mobile banking where you can report any issues."

S.3.9 Basic mobile banking information read by field officers to senders

"Many households use their mobile wallets to store or save money. Typically, you deposit and withdraw money by visiting banking agents or branches and then, you can manage your money via USSD code or mobile app. Usually, there are no fees for depositing money and fees ranging from 1-3.5% for withdrawals. If you open a mobile savings account, you often earn profit on these deposits."

S.3.10 Treatment Group: Scripts

S.3.10.1 Control group: Hidden Targeting , Hidden Sender

For the senders in Hidden Targeting, Hidden Sender, field officers read: "If you recommend any pamphlets and I visit [Receiver Name] for your recommendation, I would tell [Receiver Name] that another co-villager recommended that I give this information to one of their co-villagers and say that we, Gallup Pakistan, randomly selected [Receiver Name] specifically. Therefore, they would not know that it was you specifically who recommended this offer and they would not know that someone recommended the offer specifically to them."

Figure S11: Safety pamphlet: Front-side

موبائل بینکنگ کےاستعمال کے ساتھ محفوظ طریقے سے بچت کریں۔

موبائل بینکنگ کے استعمال کے ذریعے محفوظ طریقے سے بچت کیسے کی جا سکتی ہے اس کے بارے میں معلومات یہاں ہیں

1. ایک قابل اعتماد اکاؤنٹ کھولیں جیسے کہ آسان موبائل اکاؤنٹ: آسان موبائل اکاؤنٹ اسٹیٹ بینک آف پاکستان (SBP) اور پاکستان ٹیلی کمیونیکیشن اتھارٹی (PTA) کا ایک اقدام ہے جو موبائل بینکنگ اکاؤنٹس کو تیز، آسان، محفوظ اور سستے طریقے سے کھولنے میں سہولت فراہم کرتا ہے۔ آسان موبائل اکاؤنٹ کھولنے کے لیے #2262* ڈائل کریں۔ موبائل بینک اکاؤنٹس جاز (JAZZ) یا ٹیلی نار(TELENOR) یا یوفون (UFONE) سمز پر #786* ڈائل کرکے یا ایپلیکیشن کے ذریعے بھی کھولے جاسکتے ہیں۔

2. **اپنے پن کی حفاظت کریں:** آسانی سے اندازہ لگانے والے نمبر ہرگز استعمال نہ کریں۔ اپنا پن دوسروں کے ساتھ شیئر نہ کریں۔

3. **نامعلوم نمبروں سے کالز یا ایس ایم ایس SMS کا جواب نہ دیں:** سروس فراہم کرنے والے ٹول فری نمبر **(0800 xxxxx*)** یا شارٹ کوڈ نمبر جیسے **4444 (جاز کیس/ Jazzcash)** یا **3737** (ایزی پیسہ / Easypaisa) استعمال کریں گے۔

4. **جعل سازی سے بچیں:** ایسے اسکیمرز (جعل سازوں) کے ساتھ مشغول نہ ہوں جو "غلط نمبر" پر پیغام بھیجنے یا رقم بھیجنے کا دعوی کرتے ہیں،اور کہتے ہیں کہ آپ نے "لاٹری" جیت لی ہے، یا آپ کو غیر تصدیق شدہ مالیاتی سروسز استعمال کرنے کی ترغیب دیتے ہیں۔ جب شک ہو تو اس پمفلٹ کی پشت پر منظور شدہ اور ممنوعہ خدمات کی فہرست دیکھیں

5. **اپنی بینک سٹیٹمنٹ چیک کریں اور کسی بھی مسئلے کی اطلاع دیں:** آسان موبائل اکاؤنٹ کے صارفین #2262* ڈائل کرکے منی اسٹیٹمنٹ کو منتخب کرسکتے ہیں۔دوسرے صارفین #786* ڈائل کرکے اکاؤنٹ اسٹیٹمنٹ منتخب کرسکتے ہیں یا اپنی موبائل بینکنگ ایپلیکیشن استعمال کرسکتے ہیں۔ اگر کوئی مشکل پریشانی ہو تو اپنے بینک کی ہیلپ لائن یا اسٹیٹ بینک آف پاکستان کے کنزیومر پروٹیکشن ڈیپارٹمنٹ سے رابطہ کریں۔ ہیلپ لائنز کے لیے اس پمفلٹ کے پچھلے حصے سے رجوع کریں۔

Figure S12: Safety pamphlet: Front-side (English translation)

Keeping your money safe with mobile banking

Here is information on how one can keep their money safe with mobile banking:

1. **Open a reliable account such as the Asaan Mobile Account (AMA)**: The AMA is a State Bank of Pakistan (SBP) and Pakistan Telecommunication Authority (PTA) initiative to facilitate the swift, easy, safe, and affordable opening of mobile banking accounts. Dial *2262# to open an AMA. Mobile bank accounts can also be opened by dialing *786# on Jazz, Telenor, or Ufone sims or via apps.
2. **Protect your PIN**: Do not use easily guessable numbers. Do not share your PIN with others.
3. **Do not respond to calls or SMSs from unknown numbers**: Service providers will use a toll-free number (*0800 xxxxx) or a short-code number such as 4444 (JazzCash) or 3737 (EasyPaisa).
4. **Avoid common scams:** Do not engage with strangers who claim to have messaged or sent money to the "wrong number", say you have won a "lottery", or encourage you to use unauthorized financial services. When in doubt, refer to the list of approved and banned services on the back of this pamphlet.
5. **Check your banking statement and report any issues:** AMA users can dial *2262# and select Mini Statement. Other users can dial *786# and select Account Statement or use their mobile banking app. If there are discrepancies, contact your bank helpline or the State Bank of Pakistan's Consumer Protection Department. Refer to the back of this pamphlet for helplines.

Figure S13: Safety pamphlet: Back-side

اسٹیٹ بینک آف پاکستان کے منظورشدہ مالیاتی ادارے	اسٹیٹ بینک آف پاکستان کے غیر منظورشدہ ادارے
(Allied Bank) الائیڈ بینک	OctaFX
(Askari Bank) عسکری بینک	(Easy Forex)ایزی فاریکس
(Bank Alfalah) بینک الفلاح	(Bitcoin)بٹ کوائن
(Bank Of Punjab) بینک آف پنجاب	(Litecoin)لائٹ کوائن
(CMPECC) سی ایم پی ای سی سی	(Pakcoin)پاک کوائن
(Easypaisa) ایزی پیسہ	(OneCoin)ون کوائن
(Finja)فنجا	(DasCoin)ڈاس کوائن
(Jazzcash)جاز کیش	(Binance)بائننس
(JS Bank)جے ایس بینک	(Pay Diamond)پے ڈائمنڈ
	دیگر ورچوئل کرنسیاں/ سکے/ ٹوکنز (Other Virtual Currencies/Coin/Tokens)
(Konnect By HBL)کنیکٹ بذریعہ ایچ بی ایل	
(MCB Bank)ایم سی بی بینک	
(Meezan Bank)میزان بینک	
(NayaPay)نیا پے	
(Sadatech)سدائیک	
(UBL)یونائیٹڈ بینک لمیٹڈ	
(U Microfinance Bank)یو مائیکرو فنانس بینک	
(U Bank/UPaisa)یو بینک / یوپیسا	

مالیاتی خدمت فراہم کرنے والے ادارے	ہیلپ لائن	شکایت کا اندراج
جاز کیش (Jazzcash)	جاز صارفین: 4444 دیگر: 444-124-111-042	یو ایس ایس ڈی : #11*6*786* ای میل : complaints@mobilinkbank.com
ایزی پیسہ(Easypaisa)	ٹیلی نار صارفین کے لیے: 3737 دیگر: 737-003-111-042	ای میل : complaints@telenorbank.pk
ایم سی بی بینک(MCB)	فون: 622-000-111-042	ای میل : info@mcb.com.pk
یو بی ایل(UBL)	فون: 021-32446949	ای میل : customer.services@ubl.com.pk
جے ایس بینک(JS)	فون: -321-654-111-021	ای میل : CCU.helpdesk@jsbl.com
یو بینک / یوپیسا(U Bank/U Paisa)	یوفون صارفین کے لیے: 7777 دیگر: 265-282-111-051	ای میل : complaints@ubank.com.pk
HBL Konnect	فون: -111-425-111-042	ویب سائٹ: https://www.hbl.com/customer-assistance/complaint-form
اسٹیٹ بینک آف پاکستان کا کنزیومر پروٹیکشن ڈیپارٹمنٹ	فون: 0092-21-111-727-273 ای میل cpd.helpdesk@sbp.org.pk	ویب سائٹ: https://bankingmohtasib.gov.pk/website/CompliantForm.aspx

Figure S14: Safety pamphlet: Back-side (English translation)

State Bank of Pakistan Approved	**State Bank of Pakistan Banned**
Allied Bank, Askari Bank, Bank Alfalah, Bank of Punjab, CMPECC, EasyPaisa, Finja, JazzCash, JS Bank, Konnect by HBL, MCB Bank, Meezan Bank, NayaPay, Sadatech, United Bank Limited (UBL), U Microfinance Bank (U Bank/UPaisa)	OctaFX, Easy Forex, Bitcoin, Litecoin, Pakcoin, OneCoin, DasCoin, Binance, Pay Diamond, Other Virtual Currencies/Coins/Tokens

Financial Service Provider	**Helpline**	**Complaint registration**
JazzCash	Jazz users: 4444 Others: 042-111-124-444	USSD: *786*6*11# Email: complaints@mobilinkbank.com
EasyPaisa	For Telenor users: 3737 Others: 042-111-003-737	Email: complaints@telenorbank.pk
MCB Bank	Phone: 042-111-000-622	Email: info@mcb.com.pk
UBL	Phone: 021-32446949	Email: customer.services@ubl.com.pk
JS bank	Phone: 021-111-654-321	Email: CCU.helpdesk@jsbl.com
U Bank/UPaisa	For Ufone users: 7777 Others: 051-111-282-265	Email: complaints@ubank.com.pk
Konnect by HBL	Phone: 042-111-425-111	Website: https://www.hbl.com/customer-assistance/complaint-form
State Bank of Pakistan's Consumer Protection Department	Phone: 0092-21-111-727-273 E-mail: cpd.helpdesk@sbp.org.pk	Website: https://bankingmohtasib.gov.pk/website/CompliantForm.aspx

S.3.10.2 Treatment group #1: Revealed Sender, Hidden Targeting

For the senders in Revealed Sender, Hidden Targeting, field officers read to sender: "If you recommend any pamphlets and I visit [Receiver Name] for your recommendation, I would tell [Receiver Name] that [Sender Name] recommended that I give the pamphlets to one of their co-villagers and say that we, Gallup Pakistan, randomly selected [Receiver Name] specifically. Therefore, they would know that it was you specifically who recommended the pamphlets, but they would not know that you recommended the pamphlets specifically to them."

S.3.10.3 Treatment group #2: Hidden Sender, Revealed Targeting

For the senders in Hidden Sender, Revealed Targeting, field officers read: "If you recommend any pamphlets and I visit [Receiver Name] for your recommendation, I would tell [Receiver Name] that another co-villager recommended that I give the pamphlets to [Receiver Name], specifically. Therefore, they would not know that it was you specifically who recommended the pamphlets, but they would know that someone recommended the pamphlets specifically to them."

S.3.10.4 Treatment group #3: Revealed Sender, Revealed Targeting

For the senders in the control group, field officers read to sender: "If you recommend any pamphlets and I visit [Receiver Name] for your recommendation, I would tell [Receiver Name] that [Sender Name] recommended that I offer these pamphlets to [Receiver Name], specifically. Therefore, they would know that it was you specifically who recommended the pamphlets and they would know that you recommended the pamphlets specifically to them."

S.3.11 Comprehension checks

After the field officer describes the recommendation environment, they ask three comprehension check questions. The first question checks whether the sender is aware that choosing no pamphlets means that their name and their decision will not be mentioned to the receiver. The next two questions check their understanding of whether their identity and/or their targeting of the receiver will be revealed along with a pamphlet recommendation fits with their assigned treatment group. If the respondent does not correctly answer all three questions, the field officer repeats the key instructions and re-asks the questions. When asking the questions for the second time, the field officer does not move forward until the respondent is able to give the correct answer.