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Pushkar Maitra, Sandip Mitra,
Dilip Mookherjee and Sujata Visaria

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HKUST Center for Economic Policy
The Hong Kong University of Science and Technology
Clear Water Bay, Kowloon, Hong Kong
T: 3469 3007 E:cep@ust.hk W: cep.hkust.edu.hk

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Authors' contact information

Pushkar Maitra

Department of Economics, Monash University, Clayton Campus, VIC 3800, Australia
Email: Pushkar.Maitra@monash.edu

Sandip Mitra

Sampling and Official Statistics Unit, Indian Statistical Institute, 203 B.T. Road, Kolkata 700108, India
Email: Sandip@isical.ac.in

Dilip Mookherjee

Department of Economics, Boston University, 270 Bay State Road, Boston, MA 02215, USA
Email: dilipm@bu.edu

Sujata Visaria

Department of Economics, Lee Shau Kee Business Building, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong
Email: svisaria@ust.hk

Decentralized Targeting of Agricultural Credit Programs: Private versus Political Intermediaries *

Pushkar Maitra† **Sandip Mitra**‡
Dilip Mookherjee§ **Sujata Visaria**¶

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Abstract

We conduct a field experiment in India comparing two approaches to appointing a local commission agent to select eligible smallholder farmers for a subsidized credit program: a private trader in TRAIL, versus a political appointee in GRAIL. Although both schemes had similar loan take-up and repayments and similar treatment impacts on borrowing and farm output, only TRAIL raised farm profits significantly. This cannot be explained by greater connectedness between TRAIL agents and farmers, or differential patterns of borrower selection. Instead, TRAIL agents increased their interactions with treated farmers, and we argue this helped them procure inputs at lower prices.

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†Pushkar Maitra, Department of Economics, Monash University, Clayton Campus, VIC 3800, Australia. Pushkar.Maitra@monash.edu.

‡Sandip Mitra, Sampling and Official Statistics Unit, Indian Statistical Institute, 203 B.T. Road, Kolkata 700108, India. Sandip@isical.ac.in.

§Dilip Mookherjee, Department of Economics, Boston University, 270 Bay State Road, Boston, MA 02215, USA. dilipm@bu.edu.

¶Sujata Visaria, Department of Economics, Lee Shau Kee Business Building, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong. svisaria@ust.hk.

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1 Introduction

Many public programs in developing countries are being implemented at the local level. Increasingly, communities monitor service providers and decide how to target recipients, and local governments deliver development and welfare programs. This move toward decentralized program delivery rests on the presumption that local providers recognize beneficiary merit and need, and are more accountable to the beneficiary population than distant officials. Indeed, several recent papers find that community networks and connections can effectively target beneficiaries, diffuse information and increase program take-up (Bandiera and Rasul 2006; Alatas et al. 2012, 2016; Fisman et al. 2017; Hussam et al. 2018; Berg et al. 2018; Beaman and Magruder 2012; Debnath and Jain 2018; Beaman et al. 2018; Banerjee et al. 2013; Chandrasekhar et al. 2018).

However in some contexts, delegated programs have displayed an anti-poor bias and a misallocation of benefits, such as when local community agents target those they have personal connections to, or when local elites influence beneficiary selection (Deserranno et al. 2018; Bandiera et al. 2020; Vera-Cossio 2018; Banerjee et al. 2019).[1] This raises the question of how to choose agents, what responsibilities to delegate and how to suitably incentivize them. To reduce the risk of elite capture, programs could restrict eligibility to individuals with low assets, income or consumption. Similarly, they could offer agents

[1]For broader overviews of the evidence on elite capture and clientelism in decentralized programs, see World Development Report (2004); Mansuri and Rao (2013); Mookherjee (2015); Bardhan and Mookherjee (2020).

commissions that depend on performance indicators specifically designed to disincentivize collusion or mis-targeting. We argue however, that even with such safeguards in place, the decision of which kind of agent to appoint is an important element of program design. Village residents participate in many different networks in different spheres of their lives: economic, social and political. The nodal agents of these networks are experts in different domains, and can have different motivations. Accordingly, the effectiveness of the intervention could depend on which nodal agent is appointed.

During 2010-2013 we conducted an experiment in 48 randomly selected villages in West Bengal, India to evaluate the effectiveness of appointing nodal agents to intermediate a subsidized rural credit program for smallholder farmers. In this agent-intermediated lending (AIL) program, the task of borrower selection was delegated to specifically appointed local intermediaries. The program sought to leverage the agents' specialized information and connections with village residents. In the Trader-Agent Intermediated Lending (or TRAIL) scheme implemented in 24 randomly selected villages, the intermediary was a nodal agent in the village economic network. Specifically, he was local private trader-lender with extensive trading experience in the village. In the Gram Panchayat Agent Intermediated Lending (or GRAIL) scheme implemented in another 24 randomly selected villages, the intermediary belonged to the political network, and was chosen by the elected local government (locally known as the Gram Panchayat or GP).[2]

[2]In Maitra et al. (2017) we compared the TRAIL scheme with a traditional group-based lending (GBL) scheme and found that superior borrower selection explained about 40% of the larger increase in farm value-added in the TRAIL scheme.

Thus TRAIL and GRAIL agents had different occupations, belonged to different networks, and possibly had different motivations for participating in the AIL scheme. The GRAIL scheme resembles political decentralization, where program implementation is delegated to the local government. Accordingly it could be vulnerable to political distortions such as elite capture or clientelism. The TRAIL scheme represents a different kind of decentralization, where a development program is delegated to a private agent. Compared to a political appointee, a private trader-lender with extensive business connections in the village may be better informed of farmers' productivity and reliability, and have weaker political motives, if any. On the other hand, however, the TRAIL agent could exercise market power by manipulating input prices or output prices when they transact with treated farmers (Floro and Ray 1997; Mitra et al. 2018).

The AIL program had in-built safeguards against the kind of mis-targeting documented in recent experiments in Uganda and Thailand (Bandiera et al. 2020; Vera-Cossio 2018). The agents had no control over the interest rate, duration or other terms of the loan. They were incentivised through commissions equal to 75% of the interest payments made by the borrowers they had recommended.[3] To ensure that loans were targeted to smallholder farmers, agents could only recommend households that owned less than 1.5 acres of cultivable land. Once the agent had recommended borrowers, they had no further formal role in the scheme. An independent MFI that we collaborated

[3]Our model in Maitra et al. (2017) explains how this reduces the risk of collusion, and motivates the agent to recommend high productivity borrowers.

with, interacted directly with a random subset of recommended individuals, and both disbursed the loans and collected repayment.

Interest rates were below the informal market rate. Borrowers posted no collateral. They were individually liable for their loans. Loan cycles and durations were synchronized with crop seasons so as to facilitate planting, and easy repayment upon harvest. Repayment amounts were reduced if the village faced a yield or output price shock. The initial loan size of Rs.2000 was roughly equal to 40% of the average amount that sample households borrowed from informal sources. Conditional on adequate repayment, credit limits increased by 33% in each successive loan cycle, thus providing dynamic incentives to repay.

A priori, it is hard to predict how the method of appointing agents might affect the outcomes of the AIL program. The experiment allows us to evaluate this question. Importantly, the research design allows us also to shed light on the mechanisms driving the results. Of the 30 households that the agent recommended, a subset of 10 were randomly selected to receive the loans. In addition to these, we also survey households that were recommended by the agent but not selected to receive the loan, as well as a random sample of households that were not recommended. This permits us to estimate selection patterns by examining households that did not receive the loans, and comparing those that were and were not recommended. It also allows us to estimate treatment effects conditional on selection, by examining households that were recommended and comparing those that did and did not receive the loans.

We find that loan take-up rates were high in both schemes, although at 94% the take-up was significantly higher in the TRAIL scheme than in the GRAIL (87%). Default rates were equally low (7%) in both schemes. Treated households in both schemes increased their borrowing, cultivated area and crop output significantly, by similar extents. However, it was only in the TRAIL scheme that farmers saw an increase in profits from the major cash crop, aggregate farm profits and household income. This is because of a larger treatment effect on unit cost of production for GRAIL farmers.

Since the agent's formal role was limited to recommending borrowers, one might expect that the different impacts of the two schemes are explained by differences in the types of borrowers who were selected. Indeed, network relationships do explain borrower selection patterns: TRAIL agents were more likely to select farmers that had borrowed from them in the past, while the GRAIL agent was more likely to recommend borrowers who shared his social identity or supported his political party.[4]

Whether these selection differences can explain the differences in the treatment effects of the two schemes, depends on how the selected farmers differed in underlying farming ability, access to markets and credit. Whereas market access can be measured directly by examining the input prices that farmers pay, credit access and farming ability are latent and can only be inferred indirectly

[4] We do not find clear differences in the likelihood of targeting poor households: households selected by the TRAIL agent have lower landholding but greater education and better quality housing. In Maitra et al. (2019) we compare the distributive impacts of the two schemes. We find that the TRAIL scheme increased Atkinson measures of household welfare by significantly more than the GRAIL scheme. This result holds across a wide range of parameters of inequality aversion.

by developing and then testing theoretical predictions in the data. Viewing the data through the lens of two different models with different assumptions about returns to scale, credit constraints and multidimensional farmer types, we argue that the estimated ATE differences are unlikely to be due to differences in borrower selection. Recommended households in the two schemes do not differ significantly in acreage, crop output, value added or profit. The only exception is that recommended households in the TRAIL scheme paid higher factor prices and incurred significantly higher unit costs of production than those in the GRAIL scheme.

Note also that our empirical results suggest that the main reason why the effect on farm income differ, was the different impacts on unit costs of potato cultivation. Thus, in contrast to many recent studies that argue that beneficiary selection explains differential outcomes among microcredit borrowers (Beaman et al. 2020; Hussam et al. 2018; Banerjee et al. 2019), we find that it is mainly differential treatment effects, conditional on borrower selection, that are responsible for the superior outcome of the TRAIL scheme . In other words, treated TRAIL households earned larger profits than GRAIL households, despite having similar productivity and in fact producing at higher unit cost at baseline, and despite being offered loans with identical features. Since the two schemes differed only in the type of agent, this suggests the true underlying reason was in differential treatment effects on agent assistance to farmers.

Consistent with this, we find evidence of positive treatment effects on farmers' reports of conversations with their agents. Both TRAIL and GRAIL agents had more conversations with Treatment than Control 1 households about credit and different aspects of agriculture. Specifically, in line with their expertise in business matters, TRAIL agents were significantly more likely to speak with the farmers about agricultural harvest and sales: the chance that their conversation was about these matters increased from 17% for Control 1 households to 69% for Treatment households. For GRAIL agents the corresponding likelihood increased from 12% to only 28%. It is possible that similar differences in conversations about input procurement helped treated households in the TRAIL scheme procure inputs at lower prices. Indeed, we find that the treatment effect on factor price indices was 20% lower in the TRAIL scheme. This likely explains the discrepant impacts on unit cultivation costs.

These results suggest the key difference between the TRAIL and GRAIL schemes lay in the different domains of expertise and informal network relationships of the agents, not in the number of pre-existing links that TRAIL and GRAIL agents had with village farmers. Moreover, in the TRAIL scheme the agents increased the frequency of interactions and emphasized different content in their interactions with farmers they were already linked to. As a result, treated farmers in the TRAIL scheme may have benefited more from their agent's expertise and lowered input procurement prices by more than those in the GRAIL scheme. This suggests that even when the intermediaries' formal task is limited to selecting beneficiaries, their subsequent, even if informal, engagement with these beneficiaries can be consequential.[5]

[5]The idea that agents' influence can extend beyond selection echoes Heath (2018)'s ar-

Our results are broadly consistent with the main conclusion of Bandiera et al. (2020) that differences in "social structure", incorporating differences in agent types and their corresponding motivations, can significantly influence the ultimate welfare impacts of decentralized development interventions. Moreover, our results suggest that it is possible to design microcredit schemes so as to avoid the anti-poor biases and misallocation found in many recent policy experiments. We demonstrate that by carefully aligning their incentives and motivation, private intermediaries can be employed to delivery programs successfully so as to significantly increase farm incomes, while ensuring that loans are repaid.[6] In particular, this can dominate delegation to local governments or their political representatives.

The paper is organized as follows. In Section 2 we describe the two loan intervention schemes that we will analyse in this paper. Section 3 describes our data. Section 4 presents the estimates of the average treatment effects of the two schemes on borrower outcomes, while Section 5 provides evidence on their financial performance. Section 6 discusses a possible selection-based mechanism, which we then show is inconsistent with the empirical evidence. Section 7 discusses our preferred explanation. Section 8 concludes the paper.

gument that referred new recruits are more productive because the referring worker can weaken their limited liability constraints and reduce their shirking.

[6]Following recommendations by experts appointed by the Reserve Bank of India, there has been a move to engage private "business correspondents" to deliver banking services in rural areas (Kishore 2012; RBI 2011, 2013). However the literature provides little guidance on how to select or incentivize these correspondents.

2 Context and Intervention Design

The TRAIL and GRAIL interventions were designed to facilitate the cultivation of potatoes, the predominant high-return cash crop in the districts of Hugli and West Medinipur in West Bengal. However large cultivation costs constrain the extent to which farmers can plant potatoes; the principal alternatives include paddy, sesame and vegetables (see Maitra et al. 2017, Table 2). The experiment was carried out in 48 randomly selected villages, each at least 8 kilometres apart from the others, and belonging to the jurisdiction of different local government councils (or GPs).[7] Panel A of Table 1 presents descriptive statistics for the sample villages.[8] As column 3 shows, we do not find significant differences in village size, number of potato cultivators in the village or the number of potato cultivators in the different landholding categories across the two treatment arms.

The credit scheme was implemented by a microfinance institution based in Kolkata. In each of the 24 villages in the TRAIL arm, our field team drew up a list of local traders who had at least 50 clients, or had been operating in the village for longer than 3 years. One name was randomly drawn from this list, and offered the position of agent for the scheme. In all cases, the first trader we approached accepted the contract. In the GRAIL arm the field team requested

[7]Gram Panchayats (GPs) have 8-15 representatives directly elected every five years from a group of villages. In West Bengal village council elections, candidates typically declare an affiliation with a state-level political party.

[8]Panel A of Table 1 uses data from a 2007 houselisting exercise that we carried out in 46 of these 48 villages for a different project (see Mitra et al. 2018), well before the credit interventions began. In 2010, political violence prevented us from working in 2 villages from the 2007 sample; we do not have houselisting data for the 2 replacement villages.

the gram panchayat to recommend for the agent's position persons who had lived in the village for at least 3 years, were personally familiar with farmers in the village and had a good local reputation. One randomly drawn person from this list was offered the position of GRAIL agent.[9] West Bengal has a long history of cadre-based mobilization of voters through political rallies and campaigns. Local political party workers are often instrumental in identifying beneficiaries for government programs and delivering benefits.

In each village, the agent was asked to recommend as potential borrowers 30 residents who owned no more than 1.5 acres of land. The field team conducted a lottery in the office of the local government to draw the names of 10 individuals from this list.[10] Selected individuals were then offered the loans. In what follows we refer to them as Treatment households.

The first loans (of Rs.2000) were disbursed during the planting season for potatoes in October–November 2010. Borrowers were individually liable for repaying their loans in a single lumpsum with 6 percent interest four months later. Loans became progressively larger in subsequent cycles, conditional on successful repayment. In cycle 2, the borrower was eligible to borrow 133% of the principal amount repaid at the end of cycle 1. Loan sizes grew in each subsequent cycle according to the same rule, so that in cycle 8 the maximum loan size could have been Rs.8300. Only borrowers who repaid at least 50% of

[9] One individual refused to participate for religious reasons; he was replaced by a second randomly chosen individual from the list.

[10] Our field team kept the list of recommended individuals confidential, so as to avoid any spillover effects on informal credit access or other relationships, for recommended households that were not randomly assigned to receive the loan.

principal due were allowed to borrow again in the next cycle. So as to avoid pressurizing borrowers to sell their harvest prematurely to repay their loan, farmers could repay in the form of potato "bonds". In this case the repaid amount was calculated at the prevailing price of the bonds.[11]

At the beginning of cycle 1, the agent put down a deposit of Rs.50 per borrower, which was returned to him if his borrower survived in the program for two years. At end of each loan cycle, the agent received a commission equal to 75% of the interest paid by all borrowers whom he had recommended. This high commission rate was meant to incentivize him to select productive borrowers who would repay the loan, and to discourage him from colluding with potential borrowers. If more than one-half of his recommended borrowers defaulted on their loans, the agent was terminated and earned no further commissions. At the end of two years, all surviving agents received a refund of their deposit as well as a paid holiday to a seaside resort. These formal incentives were likely supplemented by informal motivations: in conversations during our field visits, some TRAIL agents remarked that they expected the scheme to increase their prominence in the village, or to boost their business. GRAIL agents may also have viewed the scheme as an extension of government anti-poverty programs, or as a means to increase the popularity of their political party.

There was very little MFI penetration in this area in 2010, and our partner MFI had not operated in any of these villages before. The MFI's role was

[11]Farmers can store their harvested crop in cold storages for a maximum of 11 months. Potato "bonds" are receipts from the cold store facility that are traded between farmers and traders.

limited to loan transactions with Treatment households. They did not screen borrowers in any way, check how they used the loans, or monitor them.[12] The loans were funded by an external grant held by the principal investigators of this project.

3 Data and Descriptive Statistics

Every four months during 2010-2103, we conducted detailed crop and credit surveys with 50 households in each of the 48 sample villages. In each village, all 10 Treatment households were included in our sample. Of the 20 households that the agent had recommended but did not receive the loan, we surveyed a random subset of 10 households. We refer to these as Control 1 households. We also included 30 additional households randomly chosen from those the agent did not recommended. We call these the Control 2 households. The same person in each household answered the survey in each round. There was no attrition in the sample over the eight survey cycles.

3.1 Pre-intervention Differences in Observable Characteristics

Panel B of Table 1 presents summary statistics for selected household-level characteristics for the complete sample. We see in column 1 that the av-

[12] A loan module in our household surveys allowed us to collect detailed information about each households' borrowing and loan utilization.

erage household in our sample owned 0.45 acres of land. Most households were occupied in agricultural cultivation or labour. In the average household the oldest male member was about 48 years old and had not studied beyond primary school. In columns 2 and 4 we see these statistics for Control 1 households, separately in TRAIL and GRAIL villages. Columns 3 and 4 show differences between Treatment and Control 1 households within each treatment arm: these are always statistically insignificant. The F-statistics at the bottom of the table indicate that both in the TRAIL and the GRAIL schemes, these household characteristics do not jointly explain whether a recommended household was assigned to receive the AIL loan.

3.2 Agent Characteristics in TRAIL and GRAIL

Table 2 presents data about the TRAIL and GRAIL agents. Nearly all TRAIL agents reported owning a shop or a business. In contrast, only 29% of GRAIL agents reported business as their main occupation: instead 38% were agriculturalists, 12% held government jobs and 20% report being engaged in other occupations. Both TRAIL and GRAIL agents owned more land than the average sample household, and had higher education levels. However among them, TRAIL agents were wealthier and reported larger weekly incomes, but GRAIL agents were more likely to have studied beyond primary school. GRAIL agents were also significantly more involved in civil society and politics: 30% were members of a village organization, 17% were political party workers, and 13% had been members of the local government. None of the TRAIL agents were directly involved in politics in this way.

3.3 Pre-Intervention Engagement with the Agent

Table 3 provides additional evidence about the nature of connections that the agents had with village residents. In our surveys, we asked households to tell us if they knew the agent in their village, if they met him often, and if they had any economic or social connections with him. We present data from the first round of surveys conducted in December 2010, thus describing pre-existing relationships at the time the study began. We also use data from the household and agent surveys to identify whether the agent and sample households belonged to the same occupation or social group.[13]

The agents were well-known in their villages: both in TRAIL and GRAIL villages, more than 90 percent of sample households reported knowing the agent, and conditional on knowing him, nearly all said they met him at least once a week.[14] As we saw before, the TRAIL agent was almost always a trader, and so naturally his occupation did not overlap with sample households who were mainly cultivators or labourers. However GRAIL agents were more likely to be cultivators themselves. Nearly all sample households belonged to the

[13]Political connections between the agent and sample households can only be inferred in GRAIL villages. In 2013, households participated in a straw poll and indicated their preferred political party. If they supported the same party that was in majority control of the gram panchayat in 2010, then we infer that they support the same party that the GRAIL agent belonged to.

[14]The estimation sample consists of all sample households that owned at most 1.5 acres of land. We report weighted means, where each Treatment and Control 1 household is assigned a weight of $\frac{30}{N}$ and each Control 2 household is assigned a weight of $\frac{N-30}{N}$. N is the total number of households in the village.

same religion as the GRAIL agent, and nearly two-thirds reported the same caste category.

However TRAIL agents had stronger economic links: in the TRAIL villages 11-20% of households reported that the agent was an important source of credit, inputs or employment, or an important trader of their produce. In line with this, one-third of the sample households had purchased inputs from the agent, and 15% had borrowed from him in the three years prior to the start of our study. GRAIL agents were significantly less likely to have engaged with sample households in this way.

We infer that although both agent types knew village residents well, the nature of their interactions differed: GRAIL agents might have interacted more in the social and political spheres, whereas TRAIL agents predominantly had economic relationships with sample households.

4 Estimating Treatment and Selection Effects

We aggregate the data from the four-monthly surveys into a household-year level dataset. This contains information for three consecutive years about annual borrowing for agricultural and non-agricultural purposes, acreage planted with potatoes, potato output, sales, revenues, production costs, value-added and imputed profits.[15]

[15] Farmers often store some of their potato harvest and sell it at different points in the year. We track the harvested potatoes over multiple survey rounds in order to calculate the sales revenues and align them with the costs of production, transport and sales.

To examine the impact of the schemes on household outcomes, we run regressions according to the following specification:

$$\begin{aligned} y_{ivt} = \beta_0 &+ \beta_1 \text{TRAIL}_v + \beta_2(\text{TRAIL}_v \times \text{Control 1}_{iv}) + \beta_3(\text{TRAIL}_v \times \text{Treatment}_{iv}) \\ &+ \beta_4(\text{GRAIL}_v \times \text{Control 1}_{iv}) + \beta_5(\text{GRAIL}_v \times \text{Treatment}_{iv}) \\ &+ \gamma \mathbf{X}_{ivt} + I(\text{Year}_t) + \varepsilon_{ivt} \end{aligned} \tag{1}$$

Here y_{ivt} denotes the outcome variable of interest for household i in village v at time t. The dummy variables TRAIL_v and GRAIL_v take value 1 if the household belongs to a TRAIL or GRAIL village respectively, and similarly the variables Treatment_{iv} and Control 1_{iv} are self-explanatory. The omitted category is the Control 2 households in GRAIL villages.

Since only a random subset of the recommended household were offered the loans, the difference in the outcomes of the Treatment and Control 1 households is an estimate of the average treatment effect of the loan, conditional on being recommended to participate in the scheme. Accordingly, the conditional average treatment effect of the TRAIL scheme is estimated as $\hat{\beta}_3 - \hat{\beta}_2$ and of the GRAIL scheme is estimated as $\hat{\beta}_5 - \hat{\beta}_4$.[16]

Neither Control 1 nor Control 2 households received the AIL loans, although Control 1 households were recommended by the agents. Since only 10 households in each village received the loans, it is unlikely that the schemes generated general equilibrium effects, therefore the difference in the outcomes of the

[16] All households that were randomly drawn to receive the loan are assigned a value of 1 for the Treatment dummy variable, therefore these are intent-to-treat estimates.

Control 1 and Control 2 households tells us how the recommended households differ from the non-recommended. Specifically, the coefficient $\hat{\beta}_2$ estimates the TRAIL selection effect and $\hat{\beta}_4$ estimates the GRAIL selection effect. The set $\mathbf{X}_{ivt}$ contains measures of the household's landholding, religion and caste, and the age, education and occupation of the oldest male in the household. $I(\text{Year}_t)$ denotes two year dummies. Standard errors are clustered at the village level.

4.1 Treatment Effects on Agricultural Borrowing and Informal Interest Rates

As we see in column 1 of Table 4, Treatment households in both schemes significantly increased their borrowing: TRAIL Treatment households borrowed Rs.2868 (or 137%) more, and GRAIL Treatment households borrowed a very similar Rs.2754 (or 143%) more than Control 1 households. The point estimates on non-program agricultural borrowing are small and statistically insignificant (column 2), indicating that program loans did not crowd out agricultural loans from other sources. We conjecture this was because farmers were reluctant to disrupt their traditional informal credit relationships for a new intervention.

4.2 Treatment Effects on Potato Cultivation

Table 5 shows that in both schemes, this increased borrowing translated into large and statistically significant effects on potato cultivation. In both TRAIL and GRAIL villages, the effect is concentrated on the intensive margin. TRAIL treatment households planted 0.09 additional acres with potatoes (27%, column 1) and harvested 950 kilograms more (26%, column 2). GRAIL treatment households,planted an additional 0.07 acres (23%, column 1) and benefited from a 24% increase in potato output (column 2).

In column 5 we see that the average TRAIL Treatment household earned an additional Rs.3900 in potato sales revenue (27%). Their total cost of production increased by Rs.1846 (or 22% more, column 4), so that on net, value-added increased by Rs.2060 (or 36% more, column 6). When we subtract the imputed cost of family labor employed in potato farming, this works out to a statistically significant Rs.1907 or 40% increase in profit (column 7).[17]

Sales revenues also increased for the average GRAIL Treatment household although the point estimate is smaller at Rs.2504 (19%).[18] Their cost of production increased by 28 percent, so that there is no change in their value-added or imputed profits.[19]

[17]To calculate the shadow cost of family labour, we price the family labor time for male, female and child labor spent on the crop at the median wage for hired labor of that type in that year, crop and village.

[18]TRAIL borrowers also experienced a smaller decline in output price than GRAIL borrowers did (0.6% instead of 3.6%), although this difference is not statistically significant (p-value=0.37). We collected quantity and price data for each potato sale by sample households. If farmers held potatoes for self-consumption, we impute the sales revenue by pricing that quantity at the median sale price in the village.

[19]We find qualitatively similar results when we run equation (1) without controlling for

Thus while borrowers in both schemes increased potato acreage and output, only TRAIL borrowers increased their profits. The difference between the TRAIL and GRAIL treatment effects on imputed profits is statistically significant at 10% (column 7). This difference in outcomes is driven by different effects on unit costs of production: the input cost per acre of cultivation decreased by 6% for TRAIL Treatment households, whereas the point estimate for GRAIL Treatment households is an increase of 1.2%. The difference is statistically significant ($p - value < 0.05$).

In Figure 1 we examine whether the average treatment effects varied over the three years of the program. If the magnitude of treatment effects increased over time this may suggest that TRAIL households learned how to convert the loans into increased profits. The data do not suggest learning. We find that in all three years, the average treatment effects on potato acreage and output were positive and statistically significant, in both schemes. However profits increased in the TRAIL scheme in all three years, and were never statistically significant in the GRAIL scheme. Similarly, the treatment effects on input costs per acre were negative and statistically significant in the TRAIL scheme in all three years, but never in the GRAIL scheme. In Year 3, the input cost per kilogram of potato output was also negative and statistically significant in the TRAIL scheme.

$\mathbf{X_{ivt}}$. See Tables A1 and A2.

4.3 Treatment Effects on Farm Incomes

In Table 6 column 1, we estimate average treatment effects on a measure of farm income, aggregating the profits from the four major crops grown in this area.[20] The results indicate that farm profits of TRAIL treatment households increased by a statistically significant 28%, whereas GRAIL treatment households had a non-significant increase of 3.8%. Note also that in each scheme, the treatment impacts on potato profits account for a large fraction of the impact on farm income (79% for the TRAIL scheme and 65% for the GRAIL). For this reason, when we investigate underlying mechanisms we will focus only on the data related to potato cultivation.

In column 2, we estimate effects on non-agricultural income, which is calculated as the sum of rental, sales, labour and business income. Possibly due to measurement error, the point estimates are very imprecise. We have no evidence that non-agricultural incomes increased as a result of either scheme. Finally, column 3 shows that TRAIL households' aggregate income increased by 9.1%, whereas it decreased by 9% for GRAIL treatment households; this difference between TRAIL and GRAIL households is statistically significant at the 10% level.[21]

[20]The average treatment effects for paddy, sesame and vegetables are available upon request.

[21]Figure 1 also presents the year-specific average treatment effects on aggregate farm profits. The treatment effects are positive and statistically significant in the TRAIL scheme in all three years. The effects in the GRAIL scheme are never statistically significant.

5 Loan Performance

In Table 7 we examine loan take-up and repayment rates. In column 1, the dependent variable is the likelihood that a household eligible to borrow in any given cycle actually took the loan. As discussed, initial eligibility to borrow was determined through a random draw from the pool of recommended borrowers; in subsequent cycles the household remained eligible to borrow if it had repaid at least 50% of its previous loan. The sample means in Panel A show that TRAIL Treatment households borrowed in 94% of the instances they were eligible to borrow. GRAIL Treatment households borrowed in a significantly lower 87% of instances (column 1). This difference holds even in Panel B when control for cycle fixed effects and observable borrower characteristics using the regression:

$$y_{hvt} = \alpha_0 + \alpha_1 \text{GRAIL}_v + \gamma \mathbf{X}_t + \varepsilon_{hvt} \tag{2}$$

We define a loan to be in default if any part of the repayment amount remained unpaid on the due date. In both schemes, on average 7% of loans were in default per cycle (Panel A, column 2). The regression result in Panel B confirms that there is no difference in default rates in the two schemes.

6 Can the Results by Explained by Selection?

To recap, we have found that assigned borrowers in both schemes were highly likely to accept the program loans, although take-up was slightly lower in the GRAIL scheme. Repayment rates were similarly high in both schemes. Treated borrowers increased their potato acreage, harvests, and sales revenue by similar magnitudes in the two schemes. The main difference was in the impact on cultivation costs. Unit costs fell for Treatment households in the TRAIL scheme but did not change in the GRAIL scheme. As a result only the TRAIL scheme generated increases in farm profits.

We now explore the extent whether this can be explained differential selection of beneficiaries in the two schemes. For example, TRAIL agents might have recommended more productive farmers, or households skilled at sourcing inputs at lower prices.

To begin with, in Table 8 we examine whether network linkages with farmers help predict recommendation patterns by TRAIL and GRAIL agents. Specifically, we run two separated regressions for the TRAIL and GRAIL schemes, with the following specification:

$$R_{iv} = \xi_0 + \xi_1 L_{iv} + \xi_2 Z_{iv} + \epsilon_{iv} \tag{3}$$

The estimation sample consists of Control 1 and Control 2 households. The dependent variable R_{iv} takes the value 1 if household i in village v is recommended by the agent but not selected to receive a loan, and 0 if it is not recommended. The explanatory variables include economic, social and political links between household i in village v and the AIL agent in that village (L_{iv}) and a set of household characteristics (Z_{iv}).

In line with previous work, the determinants of selection likelihood vary with network connections between the households and the agent in their village. TRAIL agents were significantly more likely to recommend households who had borrowed from them in the past. In contrast, GRAIL agents were significantly more likely to recommend households that belonged to their religion or caste, or supported their political party.[22]

How do the characteristics of recommended borrowers differ by the type of agent? With respect to observable measures of wealth or economic status, the results are mixed. The GRAIL agents recommended households with lower education levels and worse quality housing, but TRAIL agents recommended households with smaller landholdings.[23] Based on this evidence, it is unclear which scheme favored poorer households. We explore this issue in greater detail in our companion paper Maitra et al. (2019) on the distributive impacts of these programs.

Do these differences indicate misallocation of program loans, and explain the estimated differences in average treatment effects? The answer depends on how they translate into differences in farm productivity or cost-effectiveness, which affect farm production, input costs, and profits. Many of these characteristics are not directly observable. Therefore, in what follows, we develop a theoretical model of farmers' cultivation choices and profits and how they vary with innate traits such as total factor productivity and cost-effectiveness. This allows

[22] As we see in columns (1) and (3) in Table 8, these results hold irrespective of whether or not we control for household characteristics and wealth.

[23] Again, both these results hold irrespective of whether for not we control for economic, social and political links. See specifications 2 and 3 in Table 8.

us to back out differences in these unobservable traits from observable farm outcomes. To focus on the role of selection *per se*, we assume in this section that the innate traits are themselves affected by the program.

6.1 Model A: Decreasing Returns Technology, Efficient Informal Credit Allocation

Assume that farmers vary along two dimensions: farming ability and cost-effectiveness. The ability of farmer i, denoted by TFP a_i, is the result of access to observable factors such as land, farm implements, soil quality, household size and education, as well as unobservable factors such as farming acumen. To simplify the analysis, we assume that farm production requires a single variable factor input, l. More cost-effective farmers can source this input at a lower price w_i.[24] Cost-effectiveness is an observed trait, while farming ability is not.

Farmers produce according to the strictly increasing and concave production function $f(\cdot)$. This function satisfies the regularity condition (RC) which states that $\frac{-f''}{f'}$ is non-increasing in l.[25] The price of farm output is normalized to unity.[26]

[24]This model is closely related to that in Maitra et al. (2017). It extends that model by including cost-effectiveness as an additional dimension of farmer heterogeneity, but abstracts from product risk.

[25]This condition prevents $f'(l)$ from decreasing "too fast" in l and so restricts the extent to which the production function exhibits diminishing returns. It is satisfied by most standard functional forms such as constant elasticity or exponential functions.

[26]Equivalently, interpret a_i as the revenue productivity, the product of the output price and TFP.

Farmers finance cultivation by borrowing from informal moneylenders. We assume that the informal credit market is efficient and there is no limit on credit access.[27] Moneylenders face a common cost of capital ρ, and compete *a la* Bertrand.[28]

Accordingly, farm profits for farmer i can be written as

$$\Pi_i = a_i f(l_i) - \rho w_i l_i \tag{4}$$

A farmer who does not receive the subsidized loan will borrow from the informal lender and choose scale of cultivation l_i^c so that

$$f'(l_i^c) = \frac{\rho}{\gamma_i} \tag{5}$$

where $\gamma_i \equiv \frac{a_i}{w_i}$ is a measure of total factor productivity adjusted for factor prices (ATFP). This allows us to reformulate the agent's two dimensional type as (γ_i, w_i), a combination of ATFP and cost-effectiveness.

From condition (5) we see that a farmer with higher productivity (adjusted for factor price) has larger returns to expanding cultivation. Therefore, scale of cultivation $l^c(\gamma_i)$ is a strictly increasing function of ATFP alone. Control farmers with higher ATFP borrow more and cultivate on a larger scale. Hence we can compare the ATFP of different control farmers by comparing their

[27] For example, borrowers face large reputational costs for non-repayment and so there is no strategic default.

[28] If farmers self-finance their cultivation, we can think of ρ as the opportunity cost of their capital.

cultivated areas. Cost-effectiveness can be inferred from directly observed factor prices that the farmer pays.

Consider next how farmer traits would affect the treatment effects of the loans on farm profits. Assume a farmer of type (γ_i, w_i) who receives the AIL loan at the subsidized interest rate $r < \rho$ uses it to increase cultivation scale by the amount l_i^t, but does not adjust his level of informal borrowing, and that the size limit of the AIL is not binding. Then, his cultivation scale would satisfy the condition:

$$f'(l_i^c + l_i^t) = \frac{r}{\gamma_i} \tag{6}$$

The treatment effect on output is given by $w_i\gamma_i[f((l_i^c + l_i^t) - f(l_i^c)]$, and on profit is given by $w_i[\gamma_i[f((l_i^c + l_i^t) - f(l_i^c)] - rl_i^t]$.

The following Proposition describes how treatment effects vary with ATFP and cost-effectiveness of selected (Control 1) borrowers. The proof is provided in the Appendix.

Proposition 1 *In Model A:*

(a) The treatment effect on the scale of cultivation is increasing in ATFP γ_i (holding w_i fixed), and is independent of w_i (holding γ_i fixed). The treatment effect on output and profit are increasing in each trait (γ_i, w_i) holding the other fixed.

(b) Suppose the production function has constant elasticity. Then the treatment effect on cultivation cost per unit of output is independent of (γ_i, w_i).

Part (a) states that treatment effects on output and profit are rising in each trait (γ_i, w_i), holding the other fixed. This is because the regularity condition RC limits the extent of concavity of the production function, and ensures that treatment effects on output and profit are rising in ATFP, holding w_i fixed. In other words, higher ATFP implies that control farmers produce more and earn more profit, and also that their output and profit increase by more if they receive the program loan.

The other part of (a) states that output and profit treatment effects are decreasing in cost-effectiveness, holding ATFP fixed. This may seem paradoxical, but note the qualification that ATFP is held fixed. If the factor price increases while ATFP is fixed, then productivity and factor price are scaled up by the same amount. This corresponds to a higher output and profit, while leaving scale of cultivation unchanged.[29]

Part (b) states that if the production function is CES, the treatment effect on cost per unit of output is independent of the farmer's type $(\gamma_i,\, w_i)$. This is a straightforward implication of the proportionality of (ATFP-weighted) average and marginal products, and noting that the first-order conditions in equations (5) and (6) imply that ATFP-weighted marginal products are equal for all control farmers, and all treated farmers, irrespective of farmer traits.

Using this model, a comparison of Control 1 farmers in the TRAIL and GRAIL

[29]One interpretation could be that factor prices reflect unobservable input quality, which raises productivity by at least the same proportion as it increases the factor price. Then lower cost-effectiveness corresponds to higher quality inputs, which raises output and profit. Note however, we do not observe input quality in our data and so cannot provide direct evidence for this interpretation.

schemes can tell us whether selection differences can explain the differences in average treatment effects. Accordingly, in Table 9 we estimate the following regression on Control 1 households in TRAIL and GRAIL villages:

$$y_{ivt} = \eta_0 + \eta_1 \text{TRAIL}_v + \lambda \mathbf{X}_{ivt} + I(\text{Year}_t) + \varepsilon_{ivt} \tag{7}$$

where y_{ivt} denotes the outcome variable of interest for household i in village v at time t. The dummy variable TRAIL_v takes value 1 if the household resides in a TRAIL village, and 0 if it is from a GRAIL village.

Column 1 Table 9 presents the mean value of the variable of interest for Control 1 households in GRAIL villages, and column 2 presents the coefficient on the TRAIL dummy. In the first row, the TRAIL coefficient for agricultural borrowing is Rs. 915, but not statistically significantly different from zero. This is also true for acreage devoted to potato cultivation. Recalling part (a) of Proposition 1, there is no clear evidence of superior ATFP selection in the TRAIL scheme.

Turning next to selection differences in cost-effectiveness, we see that selected farmers in TRAIL paid significantly higher factor prices. We compute indices of factor prices as the ratio of the weighted average of input prices paid by Control 1 households in a given year in the TRAIL villages and the GRAIL villages. In the first row, the index is weighted by the mean input quantities purchased by GRAIL Control 1 households. In the second row it is weighted by input quantities purchased by TRAIL Control 1 households. As we see in the bottom two rows of Table 9, we reject the null hypothesis that the indices were equal to 1. So we have clear evidence that the TRAIL agent selected farmers who paid **higher** input prices!

Again, this may seem paradoxical, but not so when cost-effectiveness represents low quality inputs. Since farmers with closer links to the TRAIL agent might have access to superior business advice, one can interpret this as reflecting quality variations in inputs.[30]

Now consider the predictions for average treatment effects of the schemes. If we interpret the empirical results in Table 9 as showing that recommended farmers in the TRAIL scheme have weakly higher ATFP, then we would infer from Model A that they should produce more output and earn more profit than recommended farmers in the GRAIL scheme. Indeed, the point estimates in Table 9 suggest that TRAIL Control 1 households produce more output and earn larger farm profit, although these differences are not statistically significant. However potato value-added and imputed profits have negative point estimates (also not statistically significant).

If instead we infer from Table 9 that the TRAIL agent recommended farmers with the same ATFP and lower cost-effectiveness than the GRAIL agent, then part (a) of Proposition 1 predicts a larger ATE in the TRAIL scheme for both output and profit. What we have seen in Table 5 is that TRAIL treated farmers' output increased by the same amount as the GRAIL treated farmers,

[30]Farmers in our sample villages often express concern about adulterated or low quality fertilizer and seeds. It is possible that the TRAIL agent helped treated farmers procure higher quality inputs from trustworthy sources, at a higher price. However note once again, we did not collect data on input quality.

but their profits increased by more. Part (b) predicts an identical positive treatment impact on unit cost. This prediction does not match the data, irrespective of whether we use cost per acre or cost per unit of output. Hence, according to Model A, selection differences in innate traits can explain some of the observed ATE results, while they fail to explain others.

Recall that Model A assumed that farmers produced according to a diminishing returns function, and that the informal credit market was efficient. As a result selection differences could only arise along the dimensions of farm productivity or cost-effectiveness. If instead the credit market was imperfect, then borrowers' wealth levels could determine their access to credit. It is plausible in such a scenario that the TRAIL agents recommended higher-wealth borrowers who were not as credit-constrained. If the production function had increasing returns to scale, this would cause larger average treatment effects on output and profits for TRAIL borrowers. In what follows, we develop an alternative model that examines this possibility.

6.2 Model B: Increasing Returns and Credit Rationing

We now allow increasing returns to scale and credit rationing, implying the allocation of credit is inefficient. Farmers now vary along three different dimensions: farm productivity (TFP a_i), cost-effectiveness (measured inversely by factor price w_i) and access to credit (C_i). The production function has increasing returns to scale ($f'' > 0$) over the relevant range, and for control farmers, cultivation scale is determined by credit access. As in Model A, we assume that borrowers repay loans.

A farmer who can only borrow from informal lenders pays input price w_i and cultivates at scale l_i. Given credit access C_i and a binding credit constraint, he cultivates at the scale given by

$$l_i^c = \frac{\chi_i}{\rho} \tag{8}$$

where $\chi_i \equiv \frac{C_i}{w_i}$ denotes credit access adjusted for factor prices (adjusted credit access, or ACA). Equivalently, a farmer can be represented by three characteristics: ATFP, cost-effectiveness and credit access (γ_i, w_i, χ_i). The farmer's scale of borrowing equals $w_i\chi_i$, output is $w_i\gamma_i f(\frac{\chi_i}{\rho})$, and profits:

$$\Pi_i^c = w_i[\gamma_i f(\frac{\chi_i}{\rho}) - \chi_i]. \tag{9}$$

It follows that within the control group, the scale of cultivation is proportional to χ_i, borrowing is proportional to $w_i\chi_i$, and both output and profit are increasing in each argument w_i, γ_i, χ_i holding the other two fixed.

The AIL scheme increased credit access for all treated households by a uniform amount L. Since the interest rate r on program loans is lower than the informal interest rate, and production follows increasing returns, a rationed treated farmer would expand his cultivation scale up to the point where the augmented credit limit $C_i + L$ was binding.

Hence area cultivated would expand by $\frac{L}{rw_i}$, output by $w_i\gamma_i\{f(\frac{\chi_i}{\rho}+\frac{L}{rw_i})-f(\frac{\chi_i}{\rho})\}$

and profits by

$$w_i[\gamma_i\{f(\frac{\chi_i}{\rho}+\frac{L}{rw_i})-f(\frac{\chi_i}{\rho})\}]-L. \tag{10}$$

The increasing returns to scale technology ensures that treatment effects on output and profit increase in ACA (χ_i). They also increase in ATFP γ_i, for obvious reasons. However, Model B differs from Model A in that the treatment effects on output and profit are *increasing* in cost-effectiveness, since this allows the farmer to expand the scale of cultivation by more. Summarizing, we have:

Proposition 2 *In Model B:*

(a) The treatment effect on borrowing does not vary across borrowers of different types. The treatment effect on cultivation scale is decreasing in w_i.

(b) The treatment effect on output is decreasing in w_i, and increasing in each argument γ_i, χ_i holding the other fixed. The treatment effect on profit equals the treatment effect on output minus a constant (L).

Model B predicts that if Control 1 farmers in TRAIL were less credit-constrained, then they should have borrowed significantly more than their GRAIL counterparts. However as discussed in Section 6.1, Table 9 showed no significant differences in the cultivation scale of households selected in the two schemes. Thus we lack clear evidence that credit access differed between TRAIL and GRAIL borrowers.

We have also seen earlier that selected TRAIL farmers clearly paid higher input prices, and so part (a) predicts that the treatment effects on scale of cultivation should be smaller in the TRAIL scheme. Instead, in column 1 of Table 5 we saw that the ATE on acreage was larger in TRAIL, although the difference in ATEs in the two schemes was not statistically significant.

Moreover, the second part of (b) predicts that the TRAIL and GRAIL treatment effects on output differ by the same amount as the treatment effects on profits. Instead, we saw in Table 5 that the treatment effect on profits was substantively larger in the TRAIL than in the GRAIL scheme, whereas the treatment effect on output was quantitatively similar and not statistically different. Thus Model B also cannot satisfactorialy explain our empirical results.

7 A Possible Explanation

If the larger average treatment effects in the TRAIL scheme cannot be explained by superior borrower selection by TRAIL agents, they must be the result of larger treatment effects for TRAIL borrowers, *conditional* on selection. In particular, the data suggest that in the TRAIL scheme, treated farmers lowered their unit costs of production to an extent that GRAIL farmers did not. This could have been the result of access to advice by agents with different expertise and motivations. Recall that the agents' commissions depended on their treated borrowers' repayment of loans, which may have motivated them to devote more attention to supervising or helping them. The differential expertise of the two kinds of agents may then have had different consequences for the productivity and factor price impacts on treated farmers. Alternatively, the motivations of the TRAIL and GRAIL agents may differ. The TRAIL agent could be motivated by the prospect of increased procurement of outputs of the treated farmers which they could re-sell in their capacity as middlemen in the potato supply chain. Acting on behalf of the local government, GRAIL agents might have been motivated to help low-income farmers increase their incomes in order to achieve poverty reduction goals. Alternatively, they may have seen this as an opportunity to increase support for their political party.[31]

We utilize evidence about conversations that sample households reported having with the agent about four different topics: cultivation, harvest, sales and credit. We aggregate this data across the three surveys in each year to compute an annual count of conversations on each subject. In Table 10 we present average treatment effects estimated using a variant of equation (1), where the dependent variables are the number of conversations on matters relating to agriculture (the sum of conversations about cultivation, harvest and sales (column 1), and credit (column 2), and the fraction of all agricultural conversations that were about cultivation (column 3) and sales (column 4). Columns 1 and 2 show that both TRAIL and GRAIL Treatment households had significantly more conversations on both agriculture and credit matters than their Control 1 counterparts.

Column 3 shows that in both schemes there was a switch in favour of discussing agricultural sales, within conversations about agriculture. However this change

[31] In an earlier version of this paper we provided an explicit model of these differences in agent motivations, and derived predictions for the time the agent devoted to advising and monitoring farmers, that varied with farmer productivity. Although the empirical patterns aligned with these theoretical predictions, our tests were underpowered.

was more pronounced in TRAIL: whereas Control 1 households only discussed sales in 17% of their conversations about agriculture with the agent, Treatment households discussed sales in 69% of these conversations. In contrast the fraction increased from 12% to only 17% in the GRAIL scheme. This difference in average treatment effects between TRAIL and GRAIL schemes is statistically significant (p-value=0.02).

More discussions about sales could either be a reflection of Treatment households transacting more output with the TRAIL agent, or of more advice from the TRAIL agent about where and when to sell the harvested crop, which may help the farmer realize a higher sale price for their output. Recall from Table 5 that the treatment effect on the potato sale price realized in TRAIL was larger than in GRAIL by about 4%, but the difference was not statistically significant. On the other hand, the treatment effect on unit cost of production per acre was significantly lower in the TRAIL scheme. This could have been the result of the TRAIL agent's procurement advice at the time of planting.

Unfortunately we do not know if farmers and agents specifically discussed input procurement. However, we can examine the likely consequences of such conversations, by directly examining the input prices that households paid. In Table 11 we see that there are significantly larger average treatment effects on both factor price indices in the GRAIL scheme than in the TRAIL scheme: GRAIL farmers' input prices increased by about 20% more than TRAIL farmers' (p-value of difference < 0.10). This is consistent with the TRAIL agent helping treated farmers procure inputs at lower costs. In turn this could explain the negative and statistically significant treatment effects on input costs per acre in the TRAIL scheme. As we saw in Table 5, this appears to be the primary channel driving the TRAIL borrowers' significant increases in profits.

8 Concluding Comments

This paper finds evidence that trader-agent-intermediated lending (or TRAIL) where private traders were appointed as intermediaries, resulted in significant positive impacts on borrower production and farm incomes. When instead the local village council appointed the intermediary (in gram panchayat agent-intermediated lending or GRAIL), production increased to a similar extent, but farm incomes were unchanged. The data suggest these differences are driven by different impacts on cultivation costs. Specifically, the TRAIL scheme enabled treated farmers to source lower-cost inputs and incur lower unit costs of production than in the GRAIL scheme.

We argued that it is difficult to explain these outcomes as the result of differences in the extent to which the two types of agents were connected with village members, or the way in which they selected beneficiaries. While the architecture of pre-existing local network connections may have influenced which particular farmers were selected, it cannot explain the impacts on their profits or incomes. Instead, the data suggest that differences in the nature of links (economic, rather than social or political), in the frequency and nature of interactions with treated farmers, and in expertise and motivations of the respective agent determined the different outcomes of the two schemes. The private trader may have directed treated farmers to lower-cost or higher quality input sources, either simply due to his greater expertise in this domain, or because he was motivated to help increase their output, with a corresponding increase in his own trading profits. Thus what really seemed to matter was the endogenous impact on *how* the agent connected with the farmers. The salience of business expertise of the intermediary which helped farmers procure at lower cost is also a novel feature of our experiment, in contrast to the typical focus on farm productivity and access to technical knowledge.

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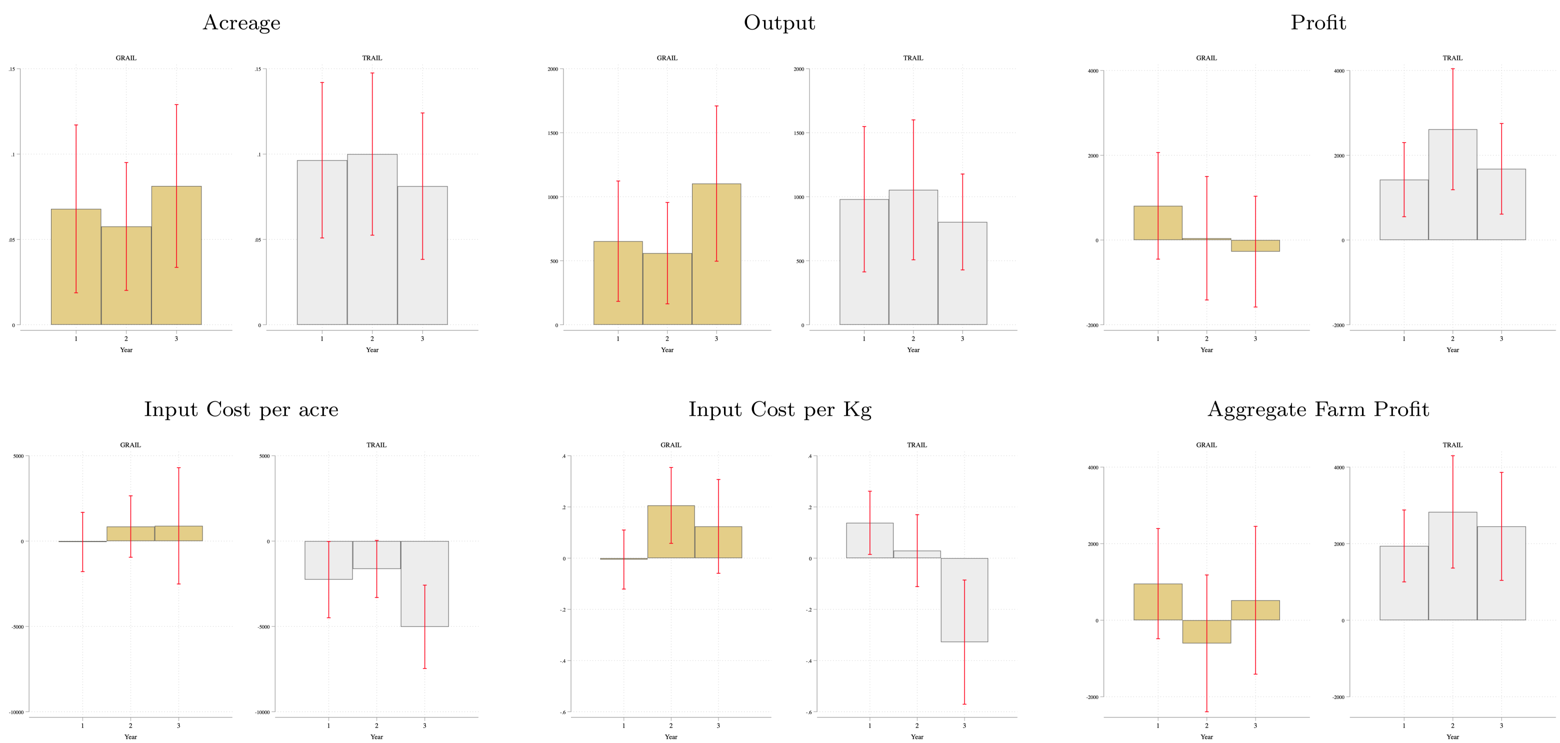
Figure 1: Year Specific Average Treatment Effects.



Notes: Estimates Average Treatment effects by year presented (regression specification given by equation (1)) and 90% confidence interval presented. Acreage, output, profit, input cost per acre and input cost per Kg refer to acreage in potato cultivation, potato output, imputed profit, input cost per acre and input cost per Kg of output in potato cultivation respectively. Aggregate Profit refers to aggregate farm profit, computed as the sum of imputed profit for the four major crops grown in this region: potatoes, paddy, sesame and vegetables.

Table 1: Descriptive Statistics

Panel A: Village Characteristics

	TRAIL (1)	GRAIL (2)	TRAIL — GRAIL (3)
Number of Households	276.04	252.21	23.83
	(201.59)	(238.36)	
Number of Potato Cultivators	164.63	160.75	3.88
	(130.30)	(168.39)	
Of which:			
Landless	15.96	27.96	-12.00
	(18.98)	(75.63)	
Own 0 − 1.25 acres	113.88	99.67	14.21
	(103.22)	(78.00)	
Own 1.25 − 2.50 acres	25.58	24.63	0.96
	(16.27)	(25.20)	
Own 2.50 − 5.00 acres	10.88	12.83	-1.96
	(7.39)	(17.11)	
Own 5.00 − 12.50 acres	1.38	1.17	0.21
	(1.79)	(1.95)	
Own more than 12.50 acres	0.00	0.04	-0.04
	(0.00)	(0.20)	

Panel B: Household Characteristics

	All	TRAIL		GRAIL	
		Control 1	Treatment–Control 1	Control 1	Treatment–Control 1
	(1)	(2)	(3)	(4)	(5)
Landholding	0.457	0.454	-0.017	0.451	0.063
	(0.009)	(0.025)	(0.078)	(0.026)	(0.068)
Non Hindu	0.173	0.171	-0.027	0.140	0.060
	(0.008)	(0.025)	(0.060)	(0.023)	(0.039)
Low Caste	0.376	0.389	-0.020	0.353	0.001
	(0.011)	(0.032)	(0.068)	(0.031)	(0.046)
Age of Oldest Male	47.498	47.145	-0.002	47.970	0.000
	(0.283)	(0.773)	(0.002)	(0.757)	(0.003)
Schooling of Oldest Male:	0.430	0.470	0.006	0.366	0.098
More than Primary School	(0.011)	(0.033)	(0.060)	(0.031)	(0.053)
Occupation of Oldest Male: Cultivation	0.756	0.825	0.022	0.813	-0.017
	(0.009)	(0.025)	(0.053)	(0.026)	(0.078)
Occupation of Oldest Male: Labour	0.519	0.551	-0.006	0.570	-0.033
	(0.011)	(0.033)	(0.056)	(0.032)	(0.049)
Joint Test F-statistic			0.49		1.51
p-value			*0.83*		*0.21*
Sample Size	2081		460		454

Notes: Panel A uses data from the house listing exercise we carried out in 2007. Since 2 of the villages from the 2007 sample had to be replaced due to political violence, Panel A uses a sample of 46 villages. In Panel B, Column 1 presents means for all sample households. This includes Treatment, Control 1 and Control 2 households across all 48 villages. Note that only Control 2 households that owned no more than 1.5 acres of land are included in the estimation sample. By construction, all Treatment and Control 1 households own less than or equal to 1.5 acres. Occupation includes main or secondary occupation. Standard errors in parentheses.

Table 2: Agent Characteristics

	GRAIL (1)	**TRAIL** (2)	**Difference** (3)
Male	1.00	0.958	0.042
	(0.00)	(0.042)	(0.042)
SC/ST	0.208	0.083	0.125
	(0.085)	(0.058)	(0.102)
Non-Hindu	0.125	0.083	0.042
	(0.069)	(0.058)	(0.090)
General caste	0.667	0.833	-0.167
	(0.098)	(0.078)	(0.125)
Primary Occupation: Cultivator	0.375	0.042	0.33
	(0.101)	(0.042)	(0.109)
Primary Occupation: Shop/business	0.292	0.958	-0.667
	(0.095)	(0.042)	(0.104)
Primary Occupation: Government Job	0.125	0.000	0.125
	(0.069)	(0.000)	(0.069)
Primary Occupation: Other	0.208	0.000	0.208
	(0.085)	(0.000)	(0.085)
Owns agricultural land	2.63	3.29	-0.667
	(0.198)	(0.244)	(0.314)
Total owned land	4.08	5.04	-0.958
	(0.248)	(0.292)	(0.383)
Has *pucca* house	0.375	0.458	-0.083
	(0.101)	(0.104)	(0.145)
Educated above primary school	0.958	0.792	0.167
	(0.042)	(0.085)	(0.094)
Weekly income (Rupees)	1102.895	1668.75	-565.855
	(138.99)	(278.16)	(336.78)
Village society member	0.292	0.083	0.208
	(0.095)	(0.058)	(0.111)
Party hierarchy member	0.167	0.000	0.167
	(0.078)	(0.00)	(0.079)
Panchayat member	0.125	0.000	0.125
	(0.069)	(0.00)	(0.069)
Self/family ran for village head	0.083	0.000	0.083
	(0.058)	(0.00)	(0.058)

Notes: Sample consists of 24 agents in TRAIL villages and 24 agents in GRAIL villages. Standard errors are in parentheses.

Table 3: Pre-Intervention Social and Economic Engagement with the Agent

	TRAIL (1)	GRAIL (2)	Difference (3)	p-value (4)
Networks: Agent and Household belong to				
Same Occupation	0.014	0.287	-0.272	*0.000*
	(0.004)	(0.014)		
Same Caste Category	0.575	0.654	-0.079	*0.002*
	(0.015)	(0.015)		
Same Religion	0.796	0.950	-0.154	*0.000*
	(0.013)	(0.007)		
Same Political Party		0.313		
		(0.014)		
Relationship with Agent				
Household knows Agent	0.905	0.911	-0.006	*0.692*
	(0.009)	(0.009)		
Household meets Agent at least once a week†	0.978	0.984	-0.007	*0.415*
	(0.005)	(0.004)		
Household member invited by Agent on special occasions†	0.325	0.295	0.030	*0.224*
	(0.015)	(0.015)		
Agent is one of the two most important				
Money Lenders	0.169	0.087	0.082	*0.000*
	(0.012)	(0.009)		
Input suppliers	0.184	0.077	0.107	*0.000*
	(0.012)	(0.008)		
Output buyers	0.185	0.024	0.162	*0.000*
	(0.012)	(0.005)		
Employers	0.114	0.077	0.037	*0.016*
	(0.010)	(0.008)		
In the past 3 years household has				
Bought from Agent	0.331	0.047	0.283	*0.000*
	(0.015)	(0.007)		
Borrowed from Agent	0.153	0.052	0.101	*0.000*
	(0.011)	(0.007)		
Worked for Agent	0.102	0.093	0.009	*0.548*
	(0.009)	(0.009)		

Notes: The TRAIL agent was a randomly selected trader in the village. The GRAIL agent was selected by the local government. Recommended households include Treatment and Control 1 households. Non-recommended households include Control 2 households. Sample restricted to all households with 1.5 acres of land in TRAIL and GRAIL villages.†: Conditional on knowing the agent. Weighted averages over Treatment, Control 1 and Control 2 households are presented. Treatment and Control 1 households are assigned a weight of $\frac{30}{N}$, where as Control 2 households are assigned a weight of $\frac{N-30}{N}$, where N is the total number of households in the village. p-value of the TRAIL v GRAIL difference presented in itatics.

Table 4: Average Treatment Effects on Agricultural Borrowing

	All Loans (Rs.)	Non-Program Loans (Rs.)
	(1)	(2)
TRAIL		
Treatment Effect	2873	-448.5
	(727.2)	(634.8)
	0.000	*0.480*
FDR Sharpened q	[0.001]	[0.471]
Mean Control 1	5226	5226
% Effect	54.98	-8.58
GRAIL		
Treatment Effect	2754	-104.9
	(526.2)	(551.3)
	0.000	*0.849*
FDR Sharpened q	[0.001]	[0.849]
Mean Control 1	4330	4330
% Effect	63.60	-2.42
Difference TRAIL v GRAIL		
$p - value$	*0.894*	*0.684*
Sample Size	6,159	6,156

Notes: Treatment effects are computed from regressions that follow equation (1) in the text and are run on household-year level data for all sample households in TRAIL and GRAIL villages with at most 1.5 acres of land. Sample restricted to cycles 1, 4 and 7 (the potato planting cycles). Regressions also control for the religion and caste of the household, age, educational attainment and occupation of the eldest male member of the household, household's landholding, a set of year dummies and an information village dummy. % Effect: Treatment effect as a percentage of the mean of the relevant Control 1 group. †: Non-Program loans refer to loans from sources other than the TRAIL or GRAIL schemes. The FDR sharpened q values computed using the procedure in Anderson (2008) are in square brackets.

Table 5: Average Treatment Effects on Potato Cultivation

	Acreage (Acres) (1)	Production (Kg) (2)	Cost of Production (Rs.) (3)	Price (Rs.) (4)	Revenue (Rs.) (5)	Value Added (Rs.) (6)	Imputed profit (Rs.) (7)	Input Cost per Acre (Rs.) (8)	Input Cost per Kg (Rs.) (9)
TRAIL									
Treatment	0.0925	946	1845	-0.0301	3897	2059	1906	-2911	-0.0451
	(0.0247)	(256.3)	(648.5)	(0.0913)	(1099)	(559.9)	(544.4)	(900.7)	(0.0652)
p-value TRAIL	*0.001*	*0.001*	*0.007*	*0.743*	*0.001*	*0.001*	*0.001*	*0.002*	*0.493*
FDR Sharpened q-value	[0.003]	[0.003]	[0.004]	[0.262]	[0.003]	[0.003]	[0.003]	[0.003]	[0.197]
Mean Control 1	0.336	3646	8482	4.627	14285	5732	4734	49077	2.434
% Effect	27.530	25.946	21.752	-0.651	27.280	35.921	40.262	-5.931	-1.853
GRAIL									
Treatment	0.0689	771.7	2009	-0.176	2504	493.7	191.4	551.2	0.106
	(0.0243)	(273.5)	(624.7)	(0.136)	(1060)	(676.8)	(652.8)	(1092)	(0.0626)
	0.007	*0.007*	*0.002*	*0.203*	*0.022*	*0.469*	*0.771*	*0.616*	*0.0976*
FDR Sharpened q-value	[0.015]	[0.015]	[0.011]	[0.17]	[0.028]	[0.307]	[0.409]	[0.377]	[0.089]
Mean Control 1	0.296	3237	7071	4.800	12965	5828	4942	47511	2.351
% Effect	23.277	23.840	28.412	-3.667	19.314	8.471	3.873	1.160	4.509
Difference TRAIL v GRAIL									
$p - value$	*0.508*	*0.652*	*0.859*	*0.370*	*0.377*	*0.0854*	*0.0523*	*0.0186*	*0.104*
Sample Size	6,150	6,150	6,150	3,818	6,150	6,150	6,150	4,038	4,007

Notes: Treatment effects are computed from regressions that follow equation (1) in the text and are run on household-year level data for all sample households in TRAIL and GRAIL villages with at most 1.5 acres of land. The dependent variable in column 1 takes the value of 1 if the household cultivated potato in that year, 0 otherwise. The dependent variables in columns 2—8 take the actual value reported by the household if it did, or take the value zero if it did not cultivate potatoes in that year. In column 9, households that did not cultivate potatoes in a year are dropped from the estimating sample. Regressions also control for the religion and caste of the household, age, educational attainment and occupation of the eldest male member of the household, household's landholding, a set of year dummies and an information village dummy. % Effect: Treatment effect as a percentage of the mean of the relevant Control 1 group. Imputed profit = Value Added – shadow cost of labour. Standard errors in parentheses are clustered at the village level. p-values are in italics. The FDR sharpened q values computed using the procedure in Anderson (2008) are in square brackets.

Table 6: Average Treatment Effects on Farm Profit, Non Agricultural Income and Total Household Income

	Aggregate Farm Profit	Non Agricultural Income	Total Household Income
	(1)	(2)	(3)
TRAIL	2406	1436	3843
	(597.2)	(3077)	(2872)
	0.000	*0.643*	*0.187*
FDR Sharpened q	[0.001]	[0.390]	[0.231]
Mean Control 1	8564	33618	42182
% Effect TRAIL	28.09	4.27	9.11
GRAIL	290.3	-4313	-4023
	(768)	(2950)	(3254)
	0.707	*0.150*	*0.222*
FDR Sharpened q	[0.5]	[0.5]	[0.5]
Mean Control 1	7580	37171	44751
% Effect GRAIL	3.83	-11.60	-8.99
Difference TRAIL v GRAIL			
$p-value$	*0.0380*	*0.183*	*0.0735*
Sample Size	6,150	6,150	6,150

Notes: Treatment effects are computed from regressions that follow equation (1) in the text and are run on household-year level data for all sample households in TRAIL and GRAIL villages with at most 1.5 acres of land. Regressions also control for the religion and caste of the household, age, educational attainment and occupation of the eldest male member of the household, household's landholding, a set of year dummies and an information village dummy. % Effect: Treatment effect as a percentage of the mean of the relevant Control 1 group. Standard errors in parentheses are clustered at the village level. p-values are in italics. The FDR sharpened q values computed using the procedure in Anderson (2008) are in square brackets.

Table 7: Loan Performance

	Take-up (1)	**Default** (2)
Panel A: Sample Means		
TRAIL	0.937	0.070
	(0.006)	(0.007)
GRAIL	0.872	0.070
	(0.009)	(0.008)
Difference p-value	*0.000*	*0.987*
Panel B: Regression Results		
GRAIL	-0.066	0.005
	(0.011)	(0.010)
	0.000	*0.619*
R^2	0.08	0.05
Sample Size	2667	2422

Notes: The sample consists of household-cycle level observations of Treatment households in TRAIL and GRAIL villages with at most 1.5 acres of landholding. The dependent variable in column 1 takes value 1 if the household took the program loan in the particular cycle, provided the household was eligible for the loan in that cycle. The dependent variable in column 2 takes value 1 if a borrowing household fails to fully repay the amount due on the loan taken in that cycle on the due date. The regression specification In Panel B is given by equation (2). Regressions also control for landholding, religion and caste of the household and age and educational attainment of the oldest male in the household. Robust standard errors presented in parenthesis. p-values are presented in italics.

Table 8: Likelihood of Recommendation: Observable Characteristics

	Specification 1		Specification 2		Specification 3	
	TRAIL (1)	GRAIL (2)	TRAIL (3)	GRAIL (4)	TRAIL (5)	GRAIL (6)
Economic Links:						
Bought from agent	-0.031	0.107			-0.025	0.121
	(0.042)	(0.076)			(0.044)	(0.079)
	0.469	0.170			0.578	0.140
Borrowed from agent	0.170***	0.008			0.149***	0.005
	(0.032)	(0.109)			(0.033)	(0.107)
	0.000	0.943			0.000	0.964
Worked for agent	0.064	0.003			0.030	-0.017
	(0.070)	(0.042)			(0.073)	(0.042)
	0.370	0.941			0.685	0.695
Social and Political Links:						
Same Occupation	-0.003	0.057			-0.007	0.042
	(0.032)	(0.043)			(0.041)	(0.044)
	0.919	0.201			0.864	0.350
Same Caste	0.009	0.033			-0.030	0.040
	(0.038)	(0.029)			(0.057)	(0.040)
	0.815	0.268			0.600	0.322
Same Religion	0.063	0.151***			0.063	0.187***
	(0.042)	(0.045)			(0.091)	(0.048)
	0.149	0.003			0.499	0.001
Same Political Party		0.070*				0.074**
		(0.035)				(0.033)
		0.055				0.032
Household Characteristics:						
Non Hindu			-0.059	-0.047	-0.004	0.008
			(0.045)	(0.034)	(0.099)	(0.028)
			0.205	0.176	0.971	0.778
Male headed household			0.251***	0.081	0.222***	0.067
			(0.056)	(0.101)	(0.055)	(0.097)
			0.000	0.432	0.001	0.495
High Caste			0.034	0.039	0.056	0.007
			(0.042)	(0.031)	(0.068)	(0.035)
			0.433	0.222	0.419	0.841
Household Size			0.005	0.006	0.005	0.005
			(0.010)	(0.007)	(0.010)	(0.007)
			0.589	0.364	0.640	0.446
Age of Oldest Male			-0.003	-0.000	-0.002	-0.000
			(0.002)	(0.001)	(0.002)	(0.001)
			0.124	0.903	0.186	0.830
Education of Oldest Male: Primary			0.051	-0.062**	0.053	-0.060**
			(0.045)	(0.027)	(0.043)	(0.028)
			0.267	0.028	0.233	0.039
Household Wealth:						
Spline Landholding $\leq$ Median			0.326*	0.199	0.300	0.147

Continued ...

Likelihood of Recommendation: Observable Characteristics (Continued)

	Specification 1		Specification 2		Specification 3	
	TRAIL	GRAIL	TRAIL	GRAIL	TRAIL	GRAIL
	(1)	(2)	(3)	(4)	(5)	(6)
			(0.181)	(0.162)	(0.180)	(0.165)
			0.085	0.232	0.108	0.380
Spline Landholding > Median			-0.493**	-0.217	-0.478**	-0.150
			(0.225)	(0.203)	(0.228)	(0.214)
			0.039	0.297	0.047	0.490
Pucca (brick) house			-0.081*	-0.064*	-0.072	-0.074**
			(0.041)	(0.034)	(0.045)	(0.035)
			0.059	0.073	0.122	0.048
Constant	0.209***	0.075*	0.097	0.172**	0.031	-0.027
	(0.043)	(0.042)	(0.110)	(0.066)	(0.134)	(0.084)
	0.000	0.090	0.390	0.015	0.816	0.756
Sample Size	797	822	787	804	787	804

Notes: Dependent variable is recommended by the agent. Sample restricted to Control 1 and Control 2 households with at most 1.5 acres of land in the TRAIL and GRAIL villages. OLS regression results presented. Specification 1 includes only Economics and Political Links; Specification 2 includes only Household Characteristics and Household Wealth and finally Specification 3 is the complete specification. Robust standard errors presented in parenthesis. p-values are presented in italics.

Table 9: Selection Effects

	Mean GRAIL C1 (1)	Additional Effect TRAIL (2)	p-value (3)	Sample Size (4)
Agricultural Borrowing				
All Borrowing	4330	915.30	*0.355*	1,392
		(979.93)		
Potato Cultivation				
Acreage	0.296	0.038	*0.442*	1,392
		(0.049)		
Production	3237	402.25	*0.476*	1,392
		(559.23)		
Cost of Production	7071	1,384.18	*0.280*	1,392
		(1,265.31)		
Price	4.80	-0.15	*0.254*	904
		(0.13)		
Revenue	12965	1,298.61	*0.565*	1,392
		(2,240.85)		
Value Added	5828	-84.87	*0.939*	1,392
		(1,098.97)		
Imputed Profit	4942	-214.02	*0.831*	1,392
		(996.38)		
Input cost per acre	47511	1,195.98	*0.487*	959
		(1,708.00)		
Input cost per kg	2.351	0.043	*0.702*	951
		(0.11)		
Farm Profit, Non-Agricultural Income and Household Income				
Aggregate Farm Profit	7580	1,073.87	*0.368*	1,392
		(1,181.68)		
Non-Agricultural Income	37171	-4,246.43	*0.256*	1,392
		(3,695.77)		
Household Income	44751	-3,172.56	*0.386*	1,392
		(3,623.67)		
Input Price Index†:				
TRAIL v. GRAIL index (GRAIL weights)		1.41	*0.030*	
		(0.179)		
TRAIL v. GRAIL index (TRAIL weights)		1.40	*0.031*	
		(0.18)		

Notes: Estimating equation given by equation (7). Regressions run on household-year level data for all Control 1 households in TRAIL and GRAIL villages. Regressions also control for the religion and caste of the household, age, educational attainment and occupation of the eldest male member of the household, household's landholding, a set of year dummies and an information village dummy. †: p-value of Input Price index = 1, where input price indices are defined as $\frac{P^{TR} \times Q^{GR}}{P^{GR} \times Q^{GR}}$ (GRAIL weights), and $\frac{P^{TR} \times Q^{TR}}{P^{GR} \times Q^{TR}}$ (TRAIL weights).

Table 10: Interaction with Agent. Average Treatment Effects

	Conversations relating to		Proportion of Conversations relating to	
	Agriculture	Credit	Cultivation	Sales
	(1)	(2)	(3)	(4)
TRAIL				
Treatment Effect	0.0594	0.310	-0.458	0.419
	(0.0279)	(0.00318)	(0.149)	(0.137)
	0.039	*0.000*	*0.001*	*0.004*
Mean Control 1	0.0242	0.00712	0.583	0.167
GRAIL				
Treatment Effect	0.233	0.289	-0.218	0.0415
	(0.116)	(0.00245)	(0.183)	(0.125)
	0.0498	*0.000*	*0.059*	*0.636*
Mean Control 1	0.0213	0.00426	0.375	0.125
Difference TRAIL v GRAIL				
p-value	*0.152*	*0.715*	*0.159*	*0.0202*
Sample Size	6,156	6,156	173	173

Notes: Agricultural interaction defined by the number of conversations with the agent or trader in the three days prior to the survey aggregated over the year, on matters relating to cultivation, harvest and sales. Proportion of conversations relating to cultivation and sales (columns 3 and 4) are computed the the number of conversations relating to cultivation and sales, as a proportion of the total number of conversations relating to agriculture. Estimating sample includes all sample households in TRAIL and GRAIL villages with atmost 1.5 acres of land. OLS regression results presented. Standard errors in parenthesis clustered at the village level. p-values are in italics.

Table 11: Index of Factor Prices: Treatment Effects

	TRAIL	GRAIL	TRAIL v GRAIL Difference (p-value)
	(1)	(2)	(3)
Laspeyre's Index			
Treatment/Control 1	1.025	1.221	*0.063*
	(0.116)	(0.118)	
Paasche's Index			
Treatment/Control 1	1.060	1.278	*0.044*
	(0.120)	(0.122)	

Notes:
Laspeyre's Index for Treatment/Control 1 defined as $\frac{P^T \times Q^{C1}}{P^{C1} \times Q^{C1}}$.
Paasche's Index for Treatment /Control 1 defined as $\frac{P^T \times Q^T}{P^{C1} \times Q^T}$.
Q^T and Q^{C1} denote the quantity indices for Treatment and Control 1 households respectively. We present the estimated coefficient of the TRAIL dummy from a regression of the (input) price index on TRAIL dummy and year and district fixed effects.

Appendix

Proof of Proposition 1

To prove (a) for scale of cultivation, use (5) and (6) to obtain $l_i^t = g(\frac{r}{\gamma_i}) - g(\frac{\rho}{\gamma_i})$ where $g \equiv f'^{-1}$. Hence the slope of l_i^t with respect to γ_i equals $g'(\frac{\rho}{\gamma_i})\frac{\rho}{\gamma_i^2} - g'(\frac{r}{\gamma_i})\frac{r}{\gamma_i^2}$. Since RC implies that $xg'(x)$ is increasing in x, it follows that l_i^t is increasing in γ_i.

Next we show the treatment effect on output is increasing in γ_i. We claim that $\gamma_i f'(l_i^c + l) \geq \gamma_j f'(l_j^c + l)$ for any $l \geq 0$. To establish this, first use RC to infer that $\frac{f'(l_i^c+l)}{f'(l_j^c+l)}$ is nondecreasing in l. Hence $\frac{f'(l_i^c+l)}{f'(l_j^c+l)} \geq \frac{f'(l_i^c)}{f'(l_j^c)} = \frac{\gamma_j}{\gamma_i}$, establishing the claim. Combining this with $l_i^t \geq l_j^t$ shown above, it follows that $\gamma_i[f(l_i^c + l_i^t) - f(l_i^c)] \geq \gamma_j[f(l_j^c + l_j^t) - f(l_j^c)]$.

Finally we show profit treatment effects are also rising in γ_i. Observe that a treated type i could have chosen a program loan of size l_j^t instead of l_i^t. So by revealed preference: $\gamma_i f(l_i^c + l_i^t) - rl_i^t \geq \gamma_i f(l_i^c + l_j^t) - rl_j^t$. Hence

$$\begin{aligned}
\gamma_i[f(l_i^c + l_i^t) - f(l_i^c)] - rl_i^t &\geq \gamma_i f(l_i^c + l_j^t) - rl_j^t - \gamma_i f(l_i^c) \\
&= \gamma_i[f(l_i^c + l_j^t) - f(l_i^c)] - rl_j^t \\
&\geq \gamma_j[f(l_j^c + l_j^t) - f(l_j^c)] - rl_j^t
\end{aligned}$$

where the last inequality uses the claim shown above.

The proofs of remaining parts have been sketched in the text, so are not included here. ■

Proof of Proposition 2

Proof: (a) and (b) are obvious, as is the result that treatment effect on output and profit differ by a constant. From (10) these treatment effects are increasing in γ_i. Since the credit limits are binding they are also increasing in χ_i. They are decreasing in w_i because the slope of (10) with respect to w_i

equals $\gamma_i[f(\frac{\chi_i}{\rho}+\frac{L}{rw_i})-f(\frac{\chi_i}{\rho})]-f'(\frac{\chi_i}{\rho}+\frac{L}{rw_i})\frac{L}{rw_i}] < 0$, since $f(\frac{\chi_i}{\rho}+\frac{L}{rw_i})-f(\frac{\chi_i}{\rho}) < f'(\frac{\chi_i}{\rho}+\frac{L}{rw_i})\frac{L}{rw_i}$ by the Mean Value Theorem and $f" > 0$. ■

Table A1: Average Treatment Effects in Potato Cultivation. No Additional Controls

	Acreage (Acres) (1)	Production (Kg) (2)	Cost of Production (Rs.) (3)	Price (Rs.) (4)	Revenue (Rs.) (5)	Value Added (Rs.) (6)	Imputed profit (Rs.) (7)	Input Cost per Acre (Rs.) (8)
Treatment Effects								
TRAIL	0.0925	946	1845	-0.0301	3897	2059	1906	-2911
	(0.0247)	(256.3)	(648.5)	(0.0913)	(1099)	(559.9)	(544.4)	(900.7)
	0.001	*0.001*	*0.007*	*0.743*	*0.001*	*0.001*	*0.001*	*0.002*
Mean Control 1	0.336	3646	8482	4.627	14285	5732	4734	49077
% Effect	27.53	25.95	21.75	-0.65	27.28	35.92	40.26	-5.93
GRAIL	0.0689	771.7	2009	-0.176	2504	493.7	191.4	551.2
	(0.0243)	(273.5)	(624.7)	(0.136)	(1060)	(676.8)	(652.8)	(1092)
	0.007	*0.007*	*0.002*	*0.203*	*0.022*	*0.469*	*0.771*	*0.616*
Mean Control 1	0.296	3237	7071	4.800	12965	5828	4942	47511
% Effect	23.28	23.84	28.41	-3.67	19.31	8.47	3.87	1.16
Difference: TRAIL v. GRAIL (p-value)								
ATE	*0.508*	*0.652*	*0.859*	*0.370*	*0.377*	*0.0854*	*0.0523*	*0.0186*
Sample Size	6,150	6,150	6,150	3,818	6,150	6,150	6,150	4,038

Notes: Treatment effects are computed from regressions that follow equation (1) in the text and are run on household-year level data for all sample households in TRAIL and GRAIL villages with at most 1.5 acres of land. The dependent variable in column 1 takes the value of 1 if the household cultivated potato in that year, 0 otherwise. The dependent variables in columns 1—7 take the actual value reported by the household if it did, or take the value zero if it did not cultivate potatoes in that year. In column 9, households that did not cultivate potatoes in a year are dropped from the estimating sample. Regressions also control a set of year dummies and an information village dummy. % Effect: Treatment effect as a percentage of the mean of the relevant Control 1 group. Imputed profit = Value Added – shadow cost of labour. Standard errors in parentheses are clustered at the village level. p-values are in italics.

Table A2: Average Treatment and Selection Effects on Farm Profit, Non Agricultural Income and Total Household Income

	Aggregate Farm Profit	Non Agricultural Income	Total Household Income
	(1)	(2)	(3)
Treatment Effects			
TRAIL	2406	1436	3843
	(597.2)	(3077)	(2872)
	0.000	*0.643*	*0.187*
Mean Control 1	8564	33618	42182
% Effect	28.09	4.27	9.11
GRAIL	290.3	-4313	-4023
	(768)	(2950)	(3254)
	0.707	*0.150*	*0.222*
Mean Control 1	7580	37171	44751
% Effect	3.83	-11.60	-8.99
Difference TRAIL v GRAIL (p-value)			
ATE	*0.038*	*0.183*	*0.074*
Sample Size	6,150	6,150	6,150

Notes: Treatment and Selection effects are computed from regressions that follow equation (1) in the text and are run on household-year level data for all sample households in TRAIL and GRAIL villages with at most 1.5 acres of land. Regressions also control for a set of year dummies and an information village dummy. % Effect: Treatment effect as a percentage of the mean of the relevant Control 1 group. Standard errors in parentheses are clustered at the village level. p-values are in italics.