Decentralized Targeting of Agricultural Credit: Private v. Political Intermediaries

Pushkar Maitra, Sandip Mitra, Dilip Mookherjee and Sujata Visaria

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- Need to explore alternative ways to decentralize: e.g., private intermediaries, NGOs, community management
- We examine private intermediaries as an alternative

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- Local traders/lenders know much about productivity of different farmers from past experience
- They could be incentivized appropriately to reveal this information...
- And restricted/regulated suitably so as to avoid abuse of power (bribery, cronyism)

Agent-Intermediated Lending (AIL) in West Bengal, India

- Our microcredit program provided Individual Liability loans, intermediated by a local agent
- In two potato growing districts of West Bengal, India
- 48 villages allocated randomly to one of two treatments:
  - TRAIL: agent chosen randomly from list of established local trader/lenders
  - GRAIL: agent choice delegated to local government/village council

Role of the Agent

- **Selection:**
  - recommends 30 borrowers from households who own $\leq$ 1.5 acres of cultivable land
  - 10 out of these chosen by lottery to receive offer of a subsidized loan
- Both types of agents: commission = 75% interest paid by recommended clients; penalty for client defaults (loss of upfront deposit)

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- Both types of agents: commission = 75% interest paid by recommended clients; penalty for client defaults (loss of upfront deposit)
- No other formal role for the agent; after borrowers are selected, all subsequent lending and collection implemented by NGO working with us
- However, agent may informally monitor borrowers, remind/pressurize them to repay, help with production or sales advice

Preview of Main Results: Average Treatment Effects

- TRAIL: significant ATEs on potato output (26%), potato profits (41%), farm value added (21%)
- GRAIL: significant ATEs on potato output (23%), but insignificant effects on potato profit (4%) and farm value added (1%)
- TRAIL-GRAIL difference in ATEs on potato profits and farm value added significant at 10% level

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- ATE on unit costs in TRAIL negative (6%), in GRAIL positive (1%); difference is significant at 1%
- Both schemes had similar loan repayment rates (93%); TRAIL loans had higher take-up (81% vs 67%)

Preview of Results, contd.: Explaining ATE Differences

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- Positive selection: In both schemes, recommended borrowers were more productive than non-recommended

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- To what extent can these results be explained by different selection patterns, e.g., with respect to farmer productivity?
- Experimental design combined with "semi-structural" model, used to estimate selection patterns
- Positive selection: In both schemes, recommended borrowers were more productive than non-recommended
- Better selection in TRAIL: TR-recommended borrowers were more productive than GR-recommended
- Evidence is consistent with clientelistic behavior of GRAIL agent, which was absent in TRAIL

Explaining ATE Differences, contd.

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Explaining ATE Differences, contd.

- However, selection differences contributed only a small fraction of overall ATE difference
- 75% of ATE differences are associated with higher treatment effects *conditional on farmer ability* in TRAIL
- We develop and test a model of agent-farmer interactions, to explain these differences in CTEs
- Trade relationship between TRAIL agent and farmers induced sharing of upside and downside risk, and the agent to **help** treated farmers (esp. the most productive) with business advice on how to lower costs
- GRAIL agent by contrast was motivated primarily to reduce default risk, so **monitored** treated farmers (esp. the least productive) and insisted on cultivation practices that raised costs

Related Literature: Targeting

- *Utilizing local community information improves selection* (Bandiera and Rasul (2006), Alatas et al (2012, 2016), Fisman et al (2017), Hussam et al (2017), Berg et al (2018), Debnath and Jain (2018))

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- *Agent Intermediated Loans versus Group Loans*: In similar vein, our previous paper (Maitra et al 2017) compared TRAIL and traditional group-based micro-lending (GBL): selection differences accounted for at least 40% of ATE differences; remaining unexplained

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- *Utilizing local community information improves selection* (Bandiera and Rasul (2006), Alatas et al (2012, 2016), Fisman et al (2017), Hussam et al (2017), Berg et al (2018), Debnath and Jain (2018))
- *Agent Intermediated Loans versus Group Loans*: In similar vein, our previous paper (Maitra et al 2017) compared TRAIL and traditional group-based micro-lending (GBL): selection differences accounted for at least 40% of ATE differences; remaining unexplained
- This paper also finds selection differences between TRAIL and GRAIL, but this turns out to play a small role compared to differences in incentives for respective agents to engage informally with treated farmers
- Hence performance of microcredit (in terms of impacts on borrowers' incomes) could be substantially improved with suitable design of intermediation and loan features

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- Utilizing community members occupying **central** positions in local networks as intervention nodes, to promote take-up and diffusion of loans or new technology (Banerjee et al (2013), Chandrasekhar et al (2018))
- *Which network?* TRAIL/GRAIL can be thought of as selecting nodes of different (economic, political) networks
- Our findings indicate need to understand endogenous impacts on nature of interactions between given pairs, not just who is linked to whom

Road Map

- Experimental Context & Design
- Empirical Results on Outcomes: Average Treatment Effects (ATEs)
- Explaining ATE Differences:
  - Selection; Role of Clientelism
  - Conditional Treatment Effects; Role of Agent Engagement

Experimental Setting

- Focus on potatoes, leading cash crop in West Bengal
- Two leading potato-growing districts: Hugli and West Medinipur
  - TRAIL: 24 villages
  - GRAIL: 24 villages
- Experiment lasted eight 4-month cycles over the period: Sept 2010 - July 2013

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- Experiment lasted eight 4-month cycles over the period: Sept 2010 - July 2013
- Data: Farm survey of 50 households per village, each cycle:
  - 10 treated (Treatment)
  - 10 recommended, not treated farmers (Control 1)
  - 30 non-recommended, with landholding $\leq$ 1.5 acres (Control 2)

Loan Features

- Low interest rate 18% APR (compared to informal interest rates 21-29%, average 25%)
- 4 month duration, timing coincided with potato crop cycle
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- Individual liability; no groups, meetings or savings requirements; doorstep service
- 8 cycles (October 2010-July 2013)
- Dynamic repayment incentives: start with small loans (Rs 2000), fast growth of credit access conditioned on past repayments; termination following repayment less than 50% due
- Partial insurance against village level potato price/yield risk

Household Characteristics and Randomisation Check

	TRAIL (1)	GRAIL (2)	TRAIL-GRAIL (3)
Head: More than Primary School	0.407	0.420	-0.013
	0.015	0.015	
Head: Cultivator	0.441	0.415	0.026
	0.015	0.015	
Head: Labourer	0.340	0.343	-0.003
	0.015	0.015	
Area of house and homestead (Acres)	0.052	0.052	0.000
	0.001	0.002	
Separate toilet in house	0.564	0.608	-0.044
	0.015	0.015	
Landholding (Acres)	0.456	0.443	0.013
	0.013	0.013	
Own a motorized vehicle	0.124	0.126	-0.002
	0.010	0.010	
Own a Savings Bank Account	0.447	0.475	-0.028
	0.015	0.015	
F-test of joint significance (p-value)			0.996

Baseline: Selected Crop Characteristics

	Sesame (1)	Paddy (2)	Potatoes (3)
Cultivate the crop (%)	0.49	0.69	0.64
Acreage (acres)	0.45	0.69	0.49
Production Cost	335	2985	7556
Revenue (Rs)	3423	8095	21298
Value added (Rs)	2720	3787	9215
Value added per acre (Rs/acre)	6348	6568	17779

Large trader middleman margins in potato (at least 30-40% of wholesale price)

Baseline Credit Details (Crop Loans)

Source	Proportion Loans	Interest APR	Duration Days	Proportion Collateralized
Traders/Lenders	0.66	25	122	0.01
Family/Friends	0.02	23	183	0.07
MFI	0.02	34	272	0.01
Cooperatives	0.25	16	327	0.78
Banks	0.05	12	324	0.83

Lenders earn negligible profits (their cost of capital = 20-24%)

Agent Characteristics

	GRAIL (1)	TRAIL (2)	Difference (3)
Occupation: Cultivator	0.375	0.042	0.33***
	(0.101)	(0.042)	(0.109)
Occupation: Shop/business	0.208	0.958	-0.667***
	(0.095)	(0.042)	(0.104)
Occupation: Other	0.417	0.000	0.125*
	(0.690)	(0.000)	(0.690)
Owned agricultural land	2.63	3.29	-0.667**
	(0.198)	(0.244)	(0.314)
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)

Agent-Farmer Relationships: Control 1 Farmers, Baseline

	Mean TRAIL (1)	Mean GRAIL (2)	Difference (3=1–2)
Had economic relationship with agent	0.490	0.247	0.243***
(loans, crop sales, input purchases, employment)	(0.018)	(0.015)	
Agent was one of the 2 most important economic relationships	0.133	0.029	0.104***
	(0.012)	(0.006)	
Agent and hh same caste/religion	0.470	0.627	-0.158***
	(0.018)	(0.017)	
Household knew agent	0.910	0.924	-0.013
	(0.010)	(0.009)	
Household met agent at least once a week	0.982	0.987	-0.005
	(0.005)	(0.004)	
Agent invited household on special occasions	0.335	0.286	0.049**
	(0.017)	(0.016)	

Average Treatment Effects

$$
\begin{aligned}
y_{ivt} = \quad & \beta_0 + \beta_1 \text{TRAIL}_v + \beta_2(\text{TRAIL}_v \times \text{Treatment}_{iv}) + \beta_3(\text{TRAIL}_v \times \text{Control 1}_{iv}) \\
+ \quad & \beta_4(\text{GRAIL}_v \times \text{Treatment}_{iv}) + \beta_5(\text{GRAIL}_v \times \text{Control 1}_{iv}) \\
+ \quad & \gamma\, \mathbf{X}_{iv} + T_t + \varepsilon_{ivt}
\end{aligned}
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- Conditional treatment effects (ITT estimates), *conditional on selection*: Difference between Treatment and Control 1:
  - TRAIL: $\beta_2 - \beta_3$
  - GRAIL: $\beta_4 - \beta_5$

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  - GRAIL: $\beta_4 - \beta_5$
- Selection effects: Difference between Control 1 and Control 2:
  - TRAIL: $\beta_3 - \beta_1$
  - GRAIL: β_5

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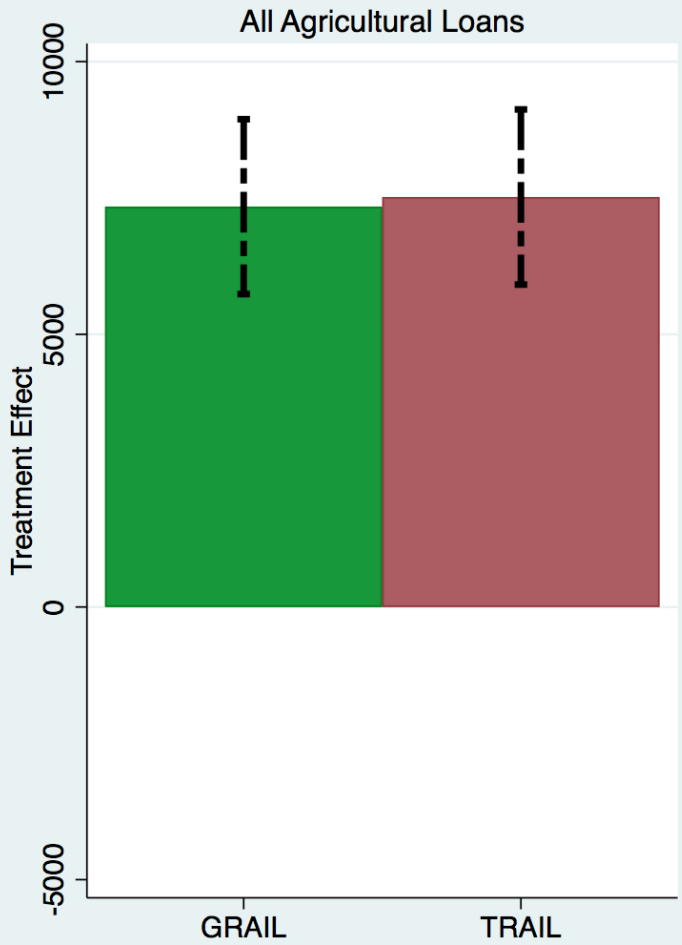
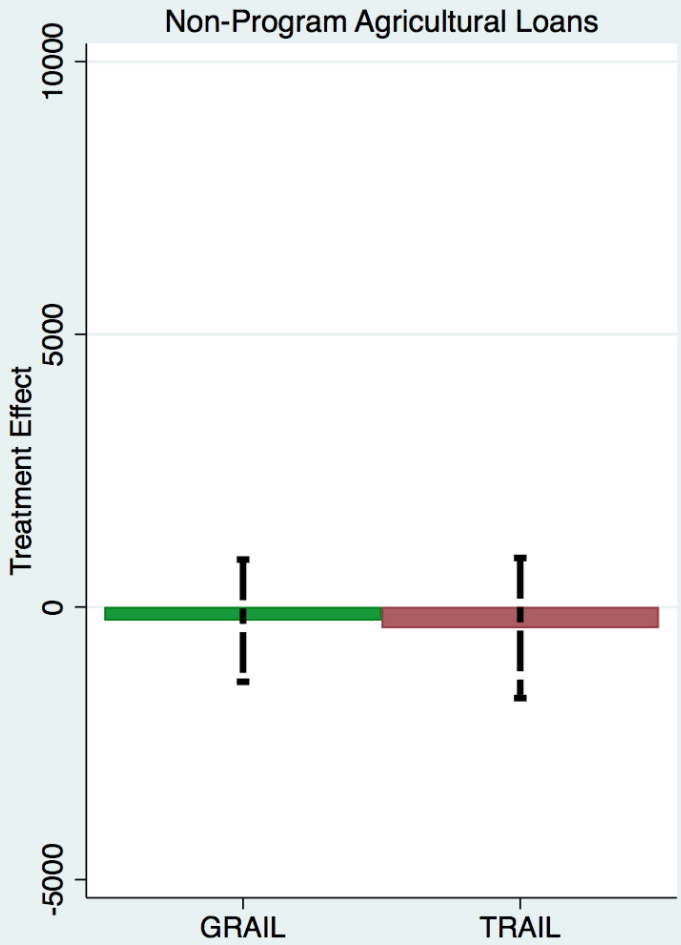
  - GRAIL: $\beta_4 - \beta_5$
- Selection effects: Difference between Control 1 and Control 2:
  - TRAIL: $\beta_3 - \beta_1$
  - GRAIL: β_5
- Controls for age, education, occupation of oldest male, land owned, year dummies, price information intervention
- Standard errors clustered at the hamlet level to account for spatial correlation

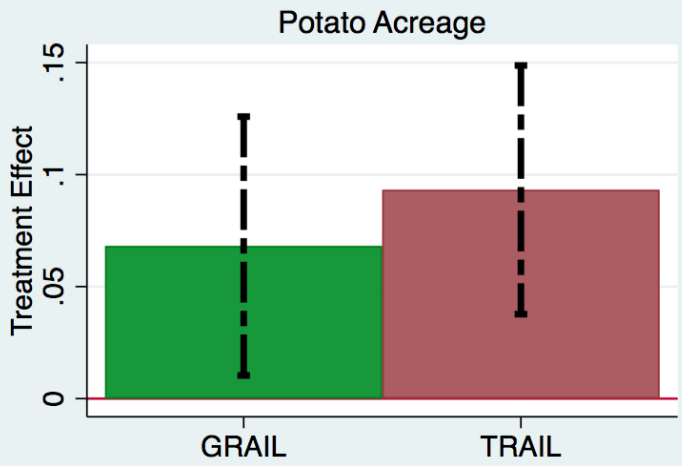
Average Treatment Effects: Amount Borrowed

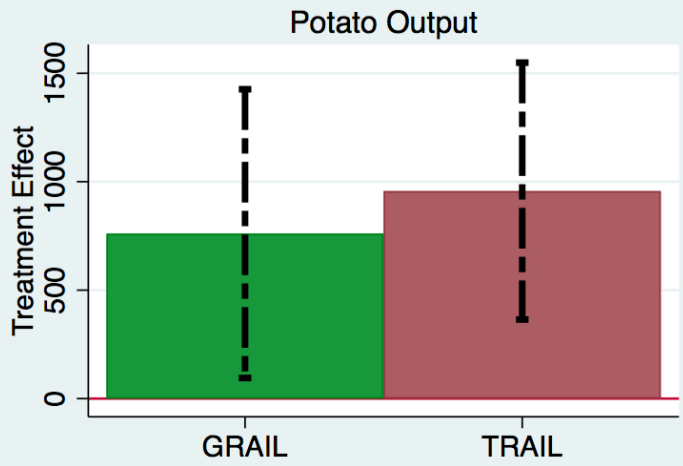


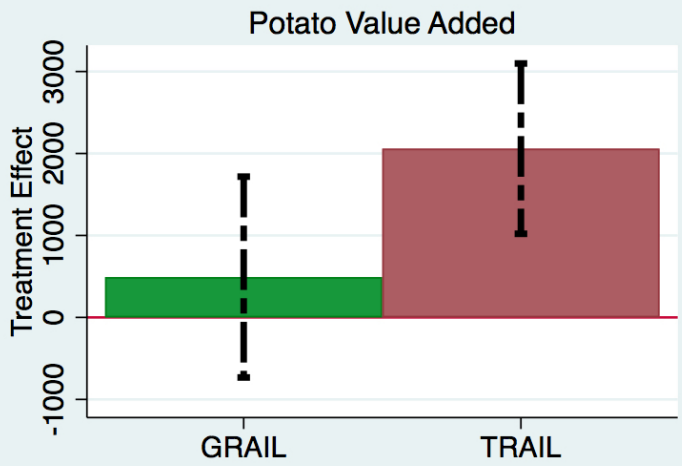


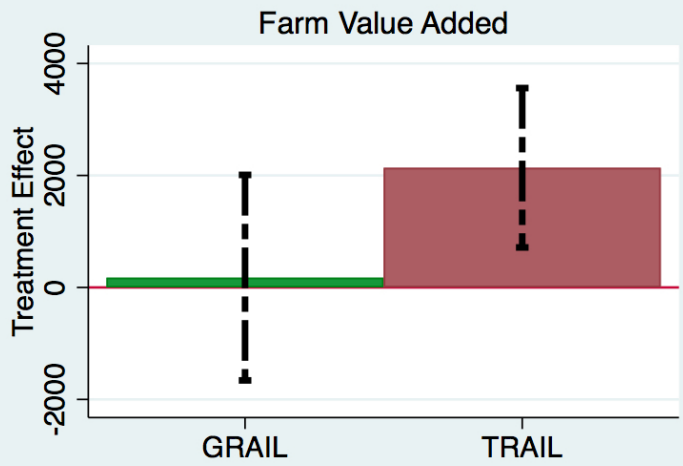
Lines denote 95% CI.

Average Treatment Effects: Potato Cultivation, Income

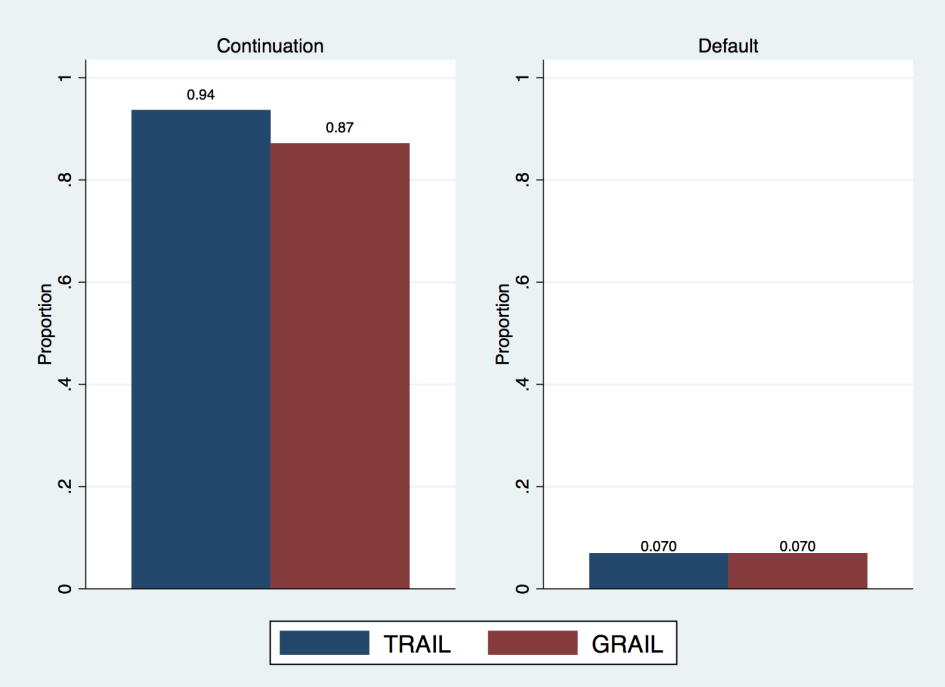








Takeup, Default Rates



Difference (TRAIL–GRAIL): 0.065*** (Continuation); 0.000 (Default)

Panel B: Regression Results

	Continuation (1)	Default (2)
GRAIL	-0.066 ***	0.005
	(0.011)	(0.010)
R^2	0.08	0.06
Sample Size	2667	2422

Estimating, Understanding Role of Selection Differences

- Assume farmers vary in ability θ drawn from some distribution
- TFP A rising, unit cost c falling in θ
- Farmer i in village v, year t selects scale of (potato) cultivation/loan size $l = l^c_{ivt}$ to maximize

$$P_{vt} A_i \frac{l^{1-\alpha}}{1-\alpha} - \rho_{vt} c_i l - F$$

(A_i: TFP, c_i: unit cost; P_{vt}: village yield shock, ρ_{vt} cost of informal credit, F fixed cost)

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$$\log l^c_{ivt} = \frac{1}{\alpha} \log \frac{A_i}{c_i} + \frac{1}{\alpha}[P_{vt} - \rho_{vt}]$$

(provided $\theta_i \geq \underline{\theta}_{vt}$; similar expression for log output)

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- Ability measure: Farmer fixed effect in farm panel regression for scale of potato cultivation/output with village-year dummies
- 30% of control group did not grow potatoes: can only get upper bound

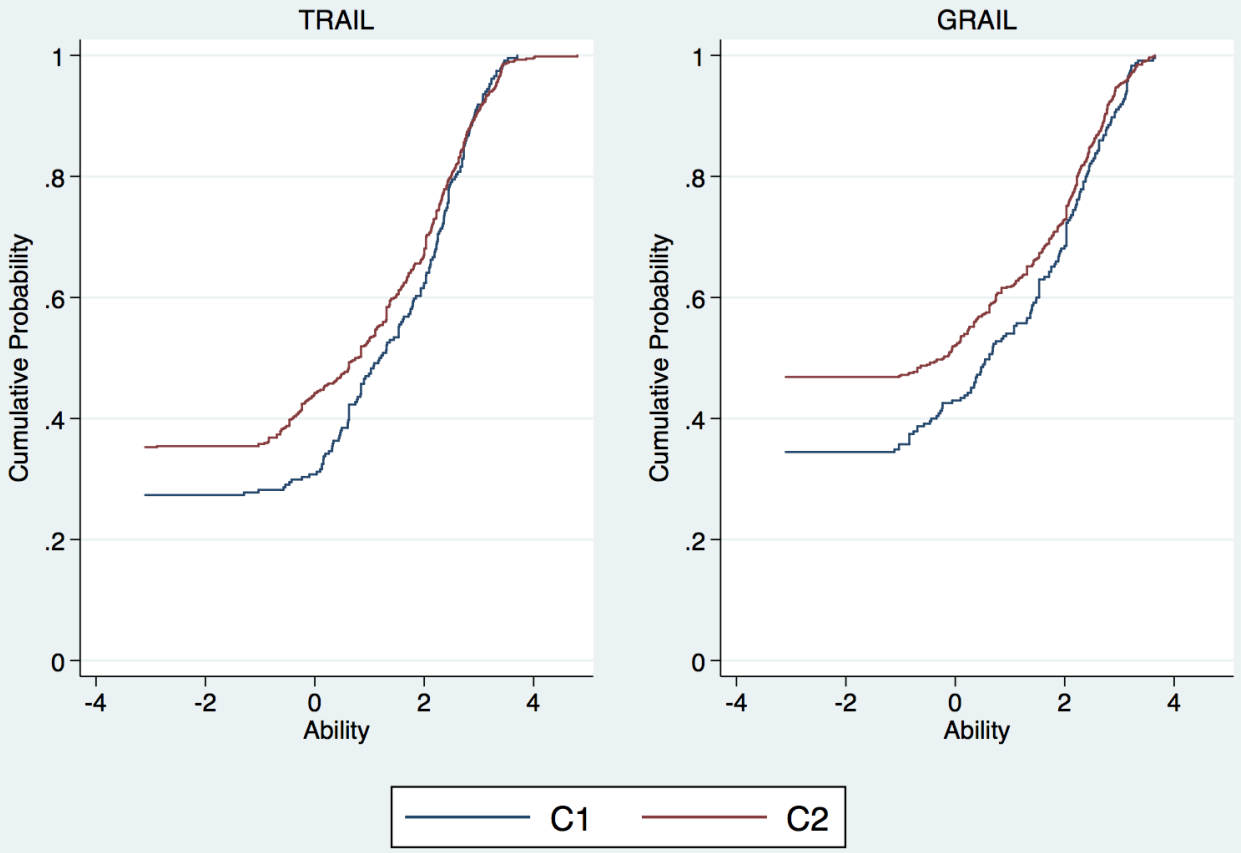
Ability Heterogeneity

- Inter-quartile (75-25) range: log area cultivated 3-4:1, corresponds to 1.5-2:1 for $\frac{A}{c}$ assuming $\alpha \geq 0.5$
- Only small fraction of this variation can be predicted on the basis of observable HH characteristics: regression R-sq is 0.18, rises to 0.2 in LASSO

▸ Ability Regression

- Potentially explains why formal lenders external to the village find it difficult to target more productive farmers
- And why local community members may be better informed than external lenders

Ability of Selected v. Non-Selected: TRAIL and GRAIL

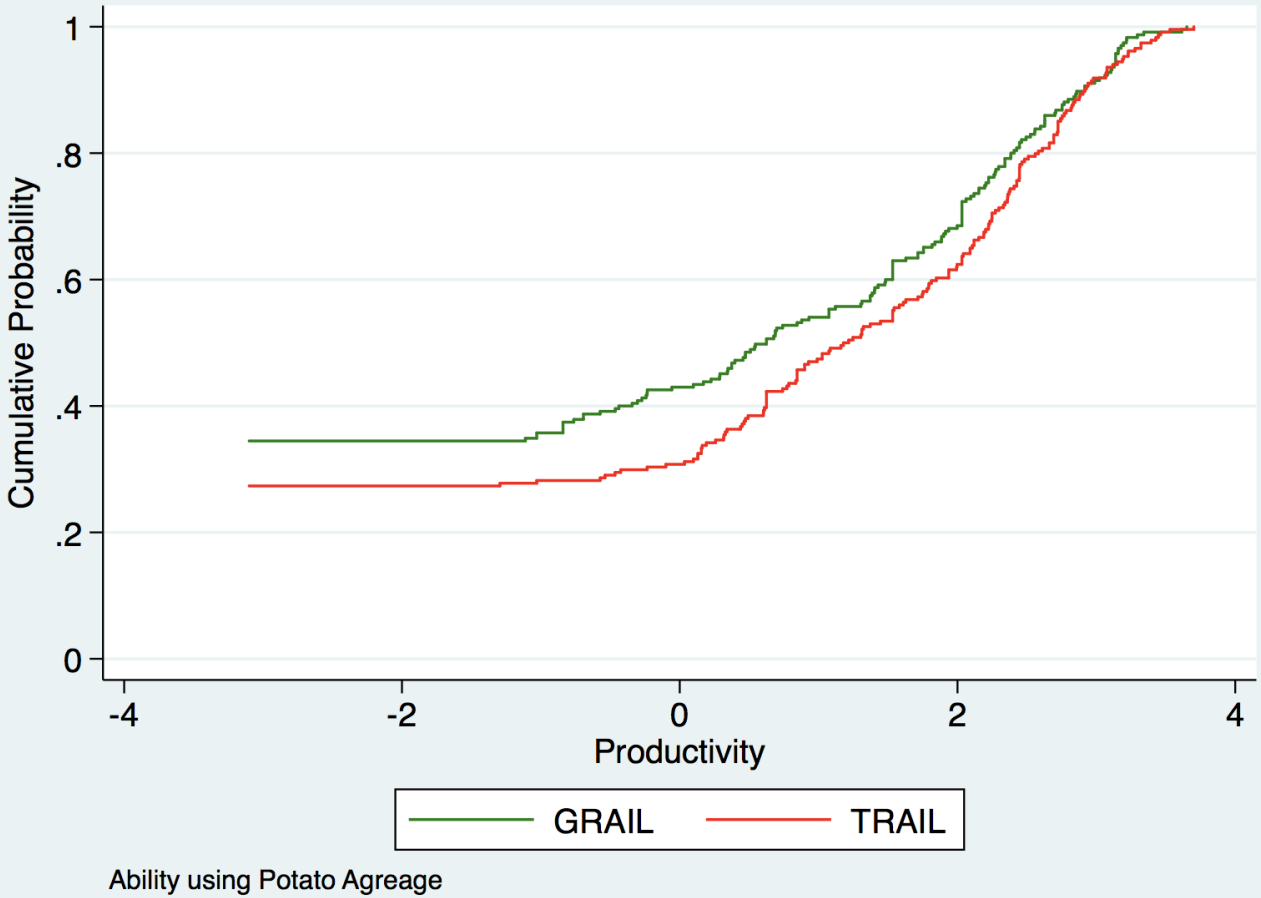


Ability using Potato Acreage

K-S Test

	p-value [bstrap prop. sign.]
TRAIL:	.005 [0.87]
GRAIL:	.011 [0.83]

Comparing Selection (C1) between TRAIL and GRAIL



K-S Test
p-value [bstrap prop. sign.]
.061 [0.74]

Conditional Treatment Effects

- We cannot use the same method to estimate ability of Treated farmers, since their cultivation scale, TFP and costs of farmers would be affected by treatment
- *Order-Preserving Assumption (OPA):* rank order of area cultivated or output is unaffected by treatments (analogous to Athey-Imbens (2006))

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- We can then rank Treated farmers by cultivation scale/output: assign to Treated farmers the counterfactual productivity estimate for the farmer at the same rank in the Control 1 productivity distribution
- For 30% of farmers who did not cultivate potatoes, we only have upper bound of productivity estimate. Pool them into Bin 1.
- For potato cultivators we have a continuous estimate. Classify into Bins 2 and 3: below and above median among cultivators

Explaining Selection Differences: Role of Clientelism

- An important reason for superior selection in TRAIL: more non-cultivators (Bin 1) were selected by GRAIL agent
- Possible role of political clientelism? Incentive of GRAIL agent to 'buy votes', esp. from poorer households?
- We test by examining CTEs on how households voted in a straw poll we conducted in 2013 at the end of the experiment:

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- Were Treated households more likely to vote for the incumbent party compared with Control 1 households in the same ability bin?
- Answer is yes; selection effect also positive but these were in concentrated in Bins 2 and 3 (*select loyalists who are more able; and swing voters who are less able*) ▸ Voting Effects

Explaining Selection Differences: Role of Clientelism

- An important reason for superior selection in TRAIL: more non-cultivators (Bin 1) were selected by GRAIL agent
- Possible role of political clientelism? Incentive of GRAIL agent to 'buy votes', esp. from poorer households?
- We test by examining CTEs on how households voted in a straw poll we conducted in 2013 at the end of the experiment:
- Were Treated households more likely to vote for the incumbent party compared with Control 1 households in the same ability bin?
- Answer is yes; selection effect also positive but these were in concentrated in Bins 2 and 3 (*select loyalists who are more able; and swing voters who are less able*) ▸ Voting Effects
- Swing voter effect appears in more competitive constituencies

Role of Selection in Explaining ATE Differences

- How important is selection in explaining ATE differences between TRAIL and GRAIL?
- As against possible differences in Conditional Treatment Effects (CTEs)?
- The experiment may have changed the way agents engaged with borrowers, resulting in changes in productivity and costs for a farmer *with the same underlying ability*
- CTE differences were large, for each bin ▸ CTE Differences
- Decomposition exercise: calculate role of selection versus CTE effects ▸ ATE Decomposition

Explaining CTE Differences: Trader-Farmer Contracting Model

- The paper develops a theoretical model of borrower-trader interactions via interlinked credit-cum-marketing contracts, to explain CTE differences
- Traders can engage with borrower either to:
  - *monitor* in order to reduce default risk
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- Monitoring lowers risk, and lowers productivity (raises costs)
- Help raises productivity/crop price, lowers costs
- TRAIL agent has no incentive to monitor; positive incentive to help, higher for treated farmers (motivated by prospect of higher crop sales through the agent, raising middleman profits)
- GRAIL agent has incentive to monitor (to reduce default risk) esp. poorer borrowers; no incentive/capacity to help

Testing the Model

- We test predictions of the model:
  - Default rates for Bin 1 fall in GRAIL, compared with TRAIL (higher monitoring of Bin 1 in GRAIL) ▸ Control 1 Default Rates ▸ Treated Default Rates
  - CTEs on Agent-Farmer Interactions ▸ CTEs Agent Engagement
  - Higher CTEs on Unit Cost Reduction in TRAIL ▸ CTE Unit Costs

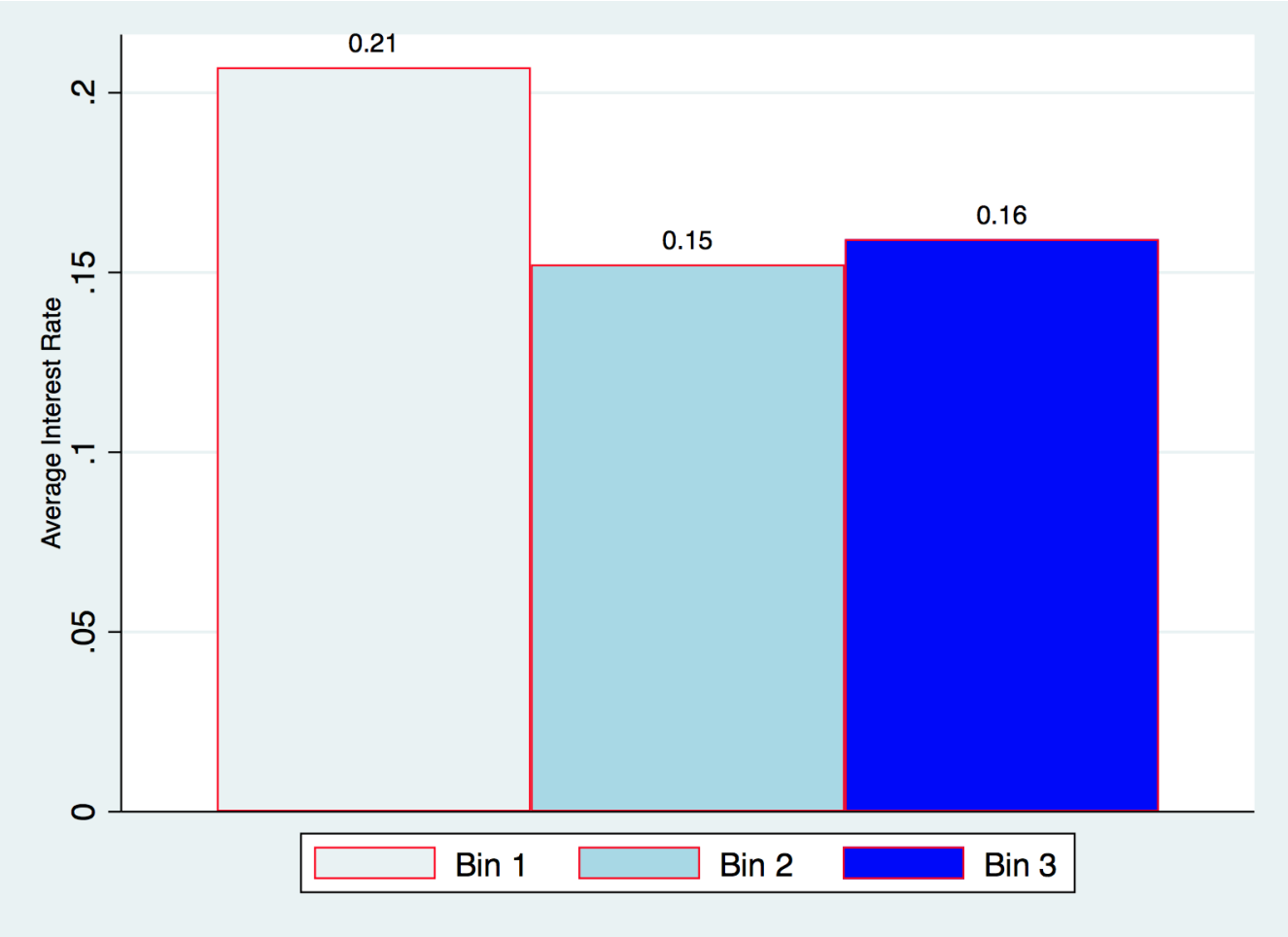
Summary

- Higher ATEs on potato/farm income in TRAIL, negligible effects in GRAIL
- Evidence of selection of less productive farmers in GRAIL, possibly owing to clientelism
- But most of the ATE difference is driven by differences in conditional treatment effects
- Suggests important (informal) role played by agent engagement with borrowers (monitoring/help)
- Better performance of TRAIL w.r.t. selection and engagement, possibly explained by absence of political motives, and better aligned economic incentives (equity-holder rather than debt)

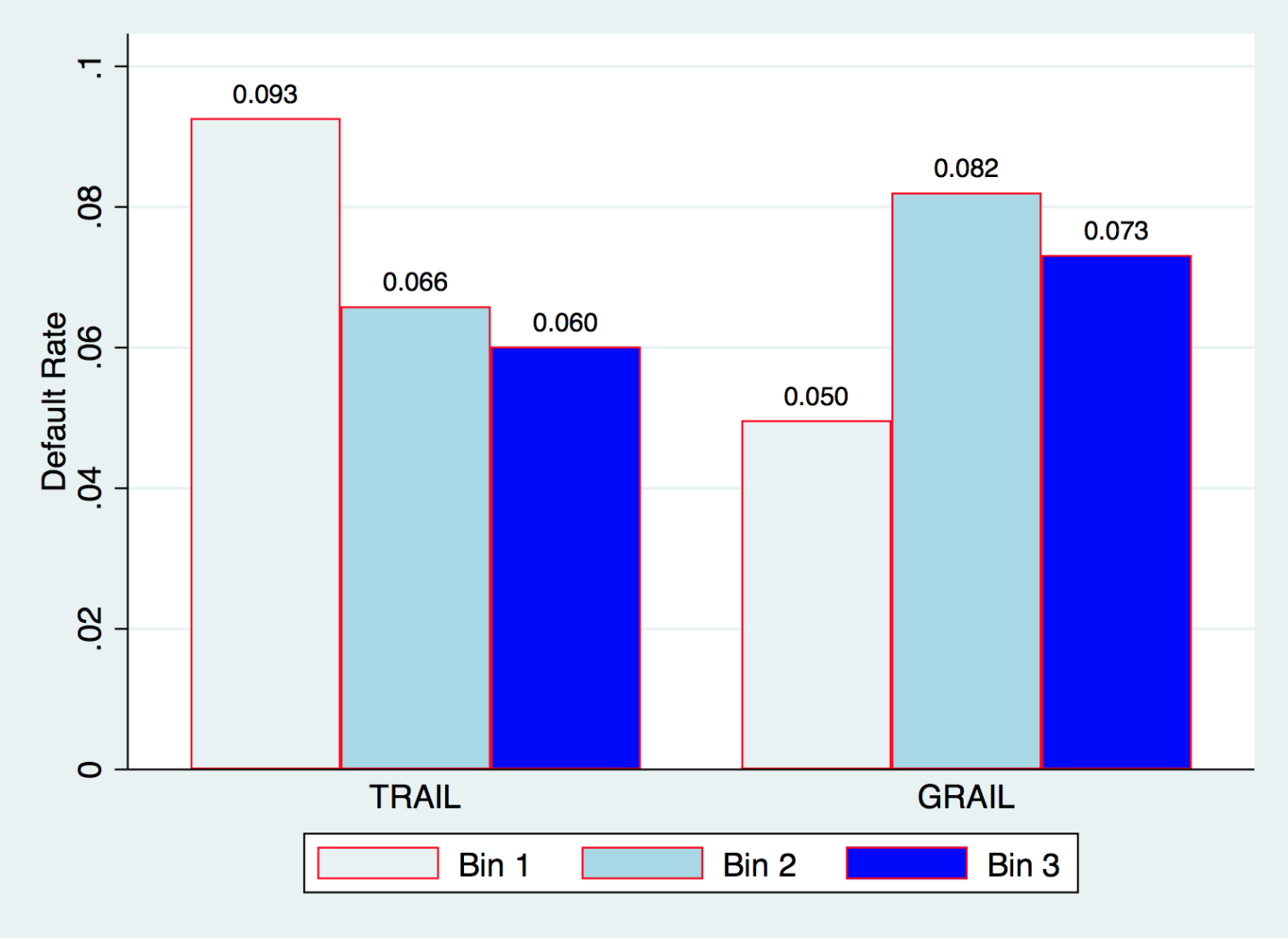
Treatment Effects on Voting Patterns in Poll

	TRAIL (1)	GRAIL (2)	TRAIL (3)	GRAIL (4)
Treatment Effect	0.0241	0.0782**		
	(0.0496)	(0.0340)		
Treatment Effect: Bin 1			0.0915	0.130†
			(0.0868)	(0.0697)
Treatment Effect: Bin 2			-0.0741	0.0309
			(0.0805)	(0.0702)
Treatment Effect: Bin 3			0.0568	0.0135
			(0.0564)	(0.0743)
Selection Effect	-0.0649	0.0825**		
	(0.0447)	(0.0369)		
Selection Effect: Bin 1			-0.133	0.0217
			(0.0610)	(0.0580)
Selection Effect: Bin 2			-0.0291	0.117†
			(0.0738)	(0.0664)
Selection Effect: Bin 3			-0.0343	0.105†
			(0.0594)	(0.0718)
Sample Size	1,011	1,026	1,021	1,044

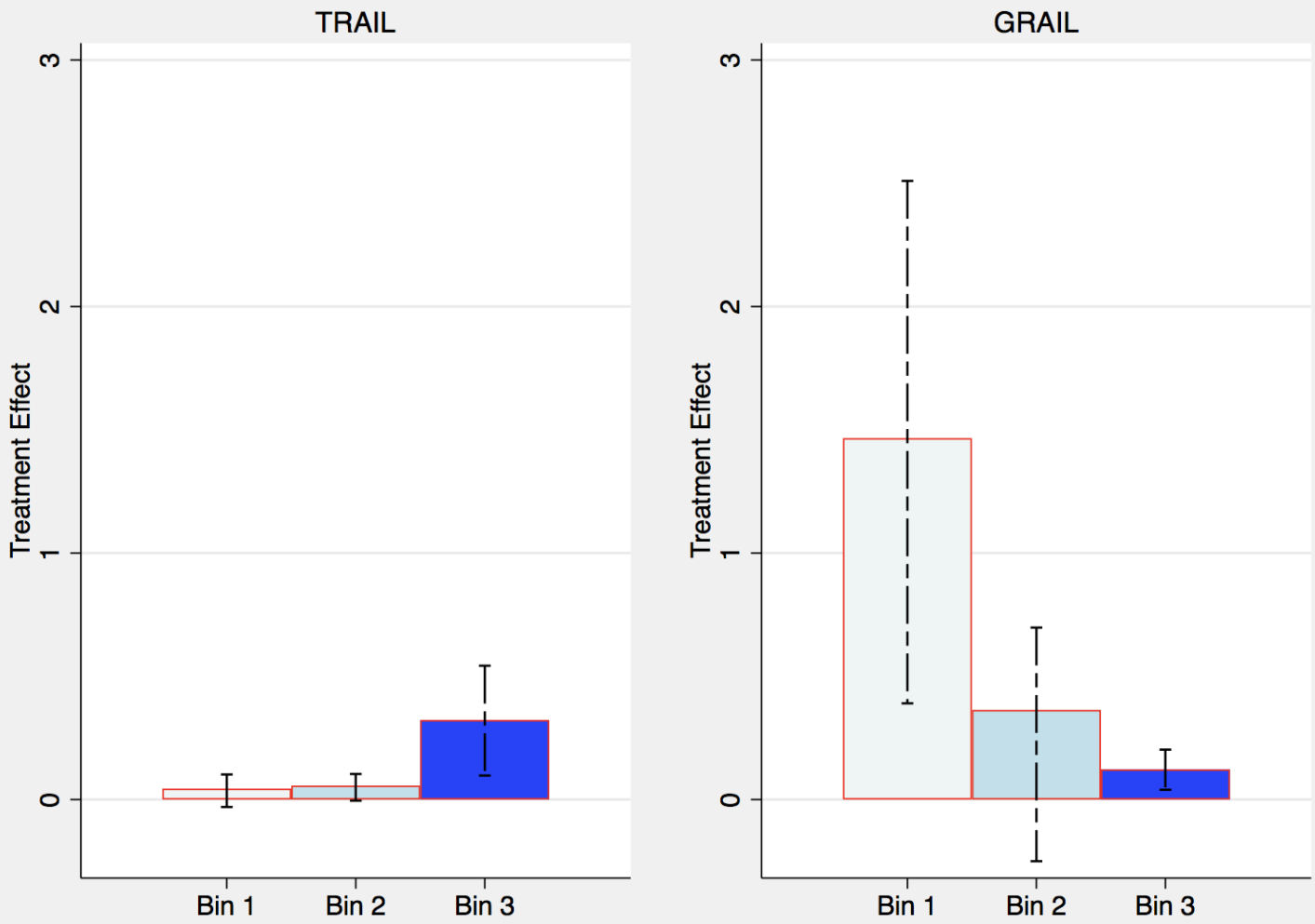
Evidence: Informal Interest Rates, Control Group



Evidence: TRAIL, GRAIL Default Rates



Evidence: CTEs on Agent Engagement Reported by Borrower



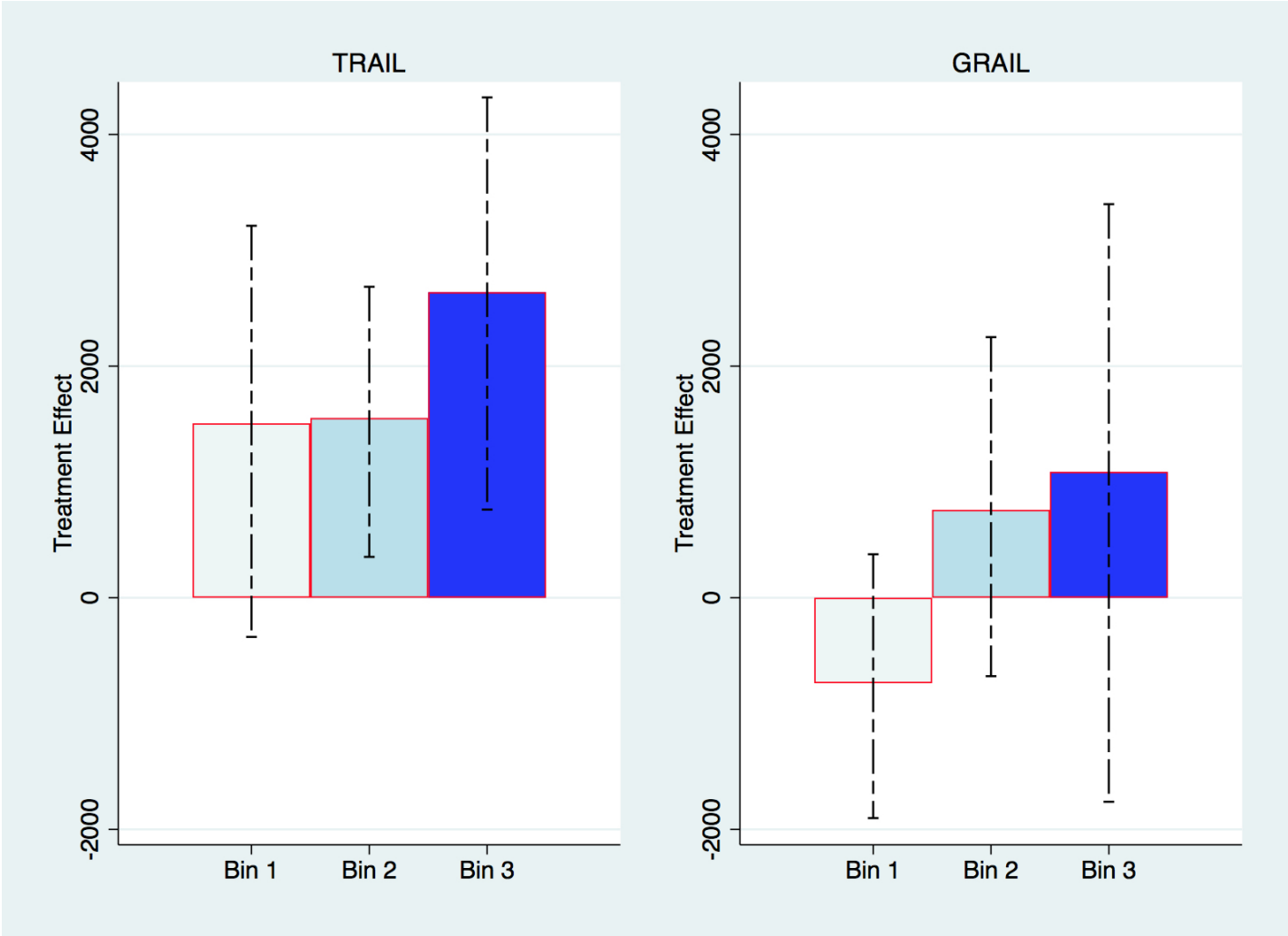
Evidence: CTEs on Unit Costs (Rs/acre)

	TRAIL	GRAIL	Difference
ATE	-2908***	554	3462**
	(1015)	(1098)	(1499)
CTE Bin 1	-1701	6788†	-8469
	(5217)	(2949)	(5981)
CTE Bin 2	-2320	-1881	-439
	(1624)	(1708)	(2374)
CTE Bin 3	-3737†	1552	-5290†
	(1334)	(1561)	(2061)

Ability Variation with Observable Characteristics

	Farmer FE (1)
Landholding	1.559***
	(0.491)
Non Hindu	-0.999**
	(0.429)
Low caste	-1.005***
	(0.278)
Female-Headed Household	-1.443**
	(0.568)
Age of Oldest Male	-0.004
	(0.011)
Oldest Male Completed Primary School	0.146
	(0.287)
Constant	0.469
	(0.672)
Sample Size	464
R-squared	0.184

Conditional Treatment Effects: Farm Value Added



Decomposition of ATE Differences: TRAIL v. GRAIL

	w_{TR}	w_{GR}	Diff	TRAIL TE	GRAIL TE	TRAIL - GRAIL	$(w_{TR} - w_{GR}) \times$ TRAIL	$w_{GR} \times$ (TRAIL-GRAIL)
Bin 1	0.27	0.34	-0.07	1040.4	30.4	1010.1	-74.1	348.2
Bin 2	0.33	0.33	0.00	1561.2	551.2	1010.0	-4.5	335.2
Bin 3	0.40	0.32	0.07	2834.1	1291.4	1542.6	209.8	498.9
ATE				2059.2	492.4	1566.8		
% of ATE due to Selection								8.38
% of ATE due to CTE								75.46