Got (clean) milk? Governance, Incentives, and Collective Action in Indian Dairy Cooperatives

Manaswini Rao
UC San Diego

Ashish Shenoy
UC Davis ARE

Motivation

Small-scale production is extremely common throughout the developing world.

- 400 million farms of $\leqslant$1 hectare. (Lowder et al. 2016)
- 90% of firms employ $\leqslant$10 workers. (Hsieh & Olken 2014)

Production teams enable access to broader markets.

- Cooperative agriculture
- Farmer-producer corporations
- Self-help groups, etc.

Economic Features of Production Teams

Group-level price signals:

- Bulk production not traceable to individual producers.
- Potential collective action/free riding issues.

Production team embedded in social network:

- Local monitoring and enforcement capacity.
- Potential for elite capture.

Context: Karnataka Milk Federation (KMF)

Aggregates local production for broad distribution:

- Producers organized into village-level cooperatives.
- Cooperative members pour milk together for sale.
- Pay is based on pooled milk.

Large scale of production:

- 2.4 million members in 22,000 villages.
- 2–3 million gallons per day.
- Similar structures exist worldwide.

Experiment: Incentives for Milk Quality

We experimentally provide incentives for lower bacteria.

- Enables higher value-added processing (e.g. yoghurt, milk sweets, etc.).
- Achieved through improved sanitation.
- Incentive applied to pooled (village) cooperative milk.
- Currently no incentive in place.

We randomize information disclosure about payments.

- Limited to local elites or shared publicly.
- Affects bargaining and distribution of surplus.

Results

Incentives improve milk cleanliness.

- 1–2.5% increase in pay over two weeks.
- 81% increase in "high-quality" milk.
- Improvements from both producers and managers.

Publicly announced payments are less effective.

- Treatment effect is half as large.
- 1/3 of managers opt out of payment.
- Managers who opt out have lower social status.

Related Literature

Cooperatives and ag supply chains:

- Banerjee et al. (2001), Wyama (2014), Casaburi & Macchiavello (2015), Mitra et al. (2018), Macchiavello & Miquel-Florensa (2019)

Decentralization and group incentives:

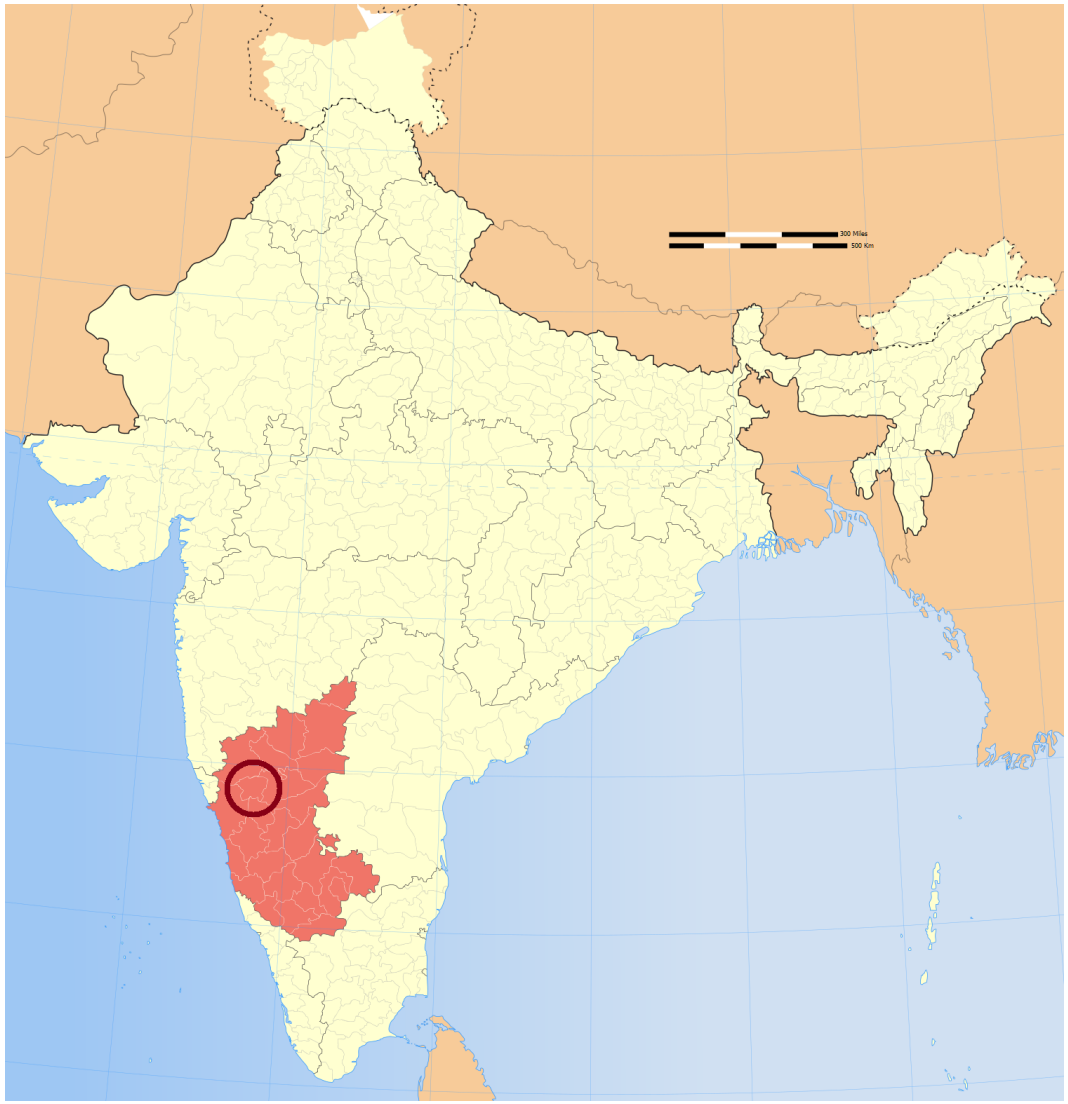
- Marschack (1959), Ostrom (1990), Goyal (2010), Alatas et al. (2012), Bandiera et al. (2013), Hussam et al. (2020)

Corruption and elite capture:

- Ferraz and Finan (2008), Kosfeld & Rustagi (2015), Muralidharan et al. (2016), Banerjee et al. (2020)

Outline

Location: Dharwad District, Karnataka, India



Local Supply Chain

Farmer level:

1. Farmers milk cows.
2. Pour milk into village cans.
3. Scope to wash hands, cows, and equipment.

Village level:

1. Density test to detect adulteration.
2. Cans placed on truck for delivery.
3. Scope to wash village collection equipment.

Milk Collection: Milking

Milk Collection: Testing

Milk Collection: Pouring

Milk Collection: Local Sales

Milk Collection: Delivery

Cooperative Governance and Pay Structure

Cooperative members:

- 50–100 members per village.
- Median of 1 cow per member.

Elected president and secretary (10-year terms):

- Secretary oversees milk collection.
- Jointly manage cooperative financial account.
  - KMF pays into cooperative account based on pooled milk.
  - Cooperative pays farmers from this account.
  - In practice: Little transparency about funding.
  - In practice: Surplus rarely returned to farmers.

Board of governors (idiosyncratic terms):

- Nominally oversee cooperative managers.
- Represents communities in village.

Characteristics of Participants: Demographics

	Producers	Directors	Secretary	President
Education	4.4	5.2	10.9	8.3
	(0.7)	(0.3)	(0.3)	(0.5)
Frac. SC/ST	0.29	0.30	0.24	0.08
	(0.02)	(0.03)	(0.06)	(0.04)
Land Owned	6.4	5.4	4.9	14.8
	(0.5)	(2.6)	(0.9)	(2.0)
Monthly Income	11,931	13,256	14,202	19,248
	(693)	(893)	(2,423)	(2,192)
Panchayat		0.06		0.21
		(0.01)		(0.06)
Observations	1,024	406	49	71

Characteristics of Participants: Demographics

	Producers	Directors	Secretary	President
Education	4.4	5.2	10.9	8.3
	(0.7)	(0.3)	(0.3)	(0.5)
Frac. SC/ST	0.29	0.30	0.24	0.08
	(0.02)	(0.03)	(0.06)	(0.04)
Land Owned	6.4	5.4	4.9	14.8
	(0.5)	(2.6)	(0.9)	(2.0)
Monthly Income	11,931	13,256	14,202	19,248
	(693)	(893)	(2,423)	(2,192)
Panchayat		0.06		0.21
		(0.01)		(0.06)
Observations	1,024	406	49	71

Characteristics of Participants: Demographics

	Producers	Directors	Secretary	President
Education	4.4	5.2	10.9	8.3
	(0.7)	(0.3)	(0.3)	(0.5)
Frac. SC/ST	0.29	0.30	0.24	0.08
	(0.02)	(0.03)	(0.06)	(0.04)
Land Owned	6.4	5.4	4.9	14.8
	(0.5)	(2.6)	(0.9)	(2.0)
Monthly Income	11,931	13,256	14,202	19,248
	(693)	(893)	(2,423)	(2,192)
Panchayat		0.06		0.21
		(0.01)		(0.06)
Observations	1,024	406	49	71

Beliefs of Participants

	Directors	Secretary	President
Social status as reported by:			
Producers	3.1	3.7	3.6
	(0.05)	(0.06)	(0.06)
Directors	3.4	4.1	4.0
	(0.06)	(0.07)	(0.08)
Management quality as reported by:			
Producers	3.0	3.7	3.5
	(0.05)	(0.07)	(0.06)
Directors	3.4	4.4	3.9
	(0.05)	(0.06)	(0.07)
Observations	406	49	71

Beliefs of Participants

	Directors	Secretary	President
Social status as reported by:			
Producers	3.1	3.7	3.6
	(0.05)	(0.06)	(0.06)
Directors	3.4	4.1	4.0
	(0.06)	(0.07)	(0.08)
Management quality as reported by:			
Producers	3.0	3.7	3.5
	(0.05)	(0.07)	(0.06)
Directors	3.4	4.4	3.9
	(0.05)	(0.06)	(0.07)
Observations	406	49	71

Outline

Experimental Interventions

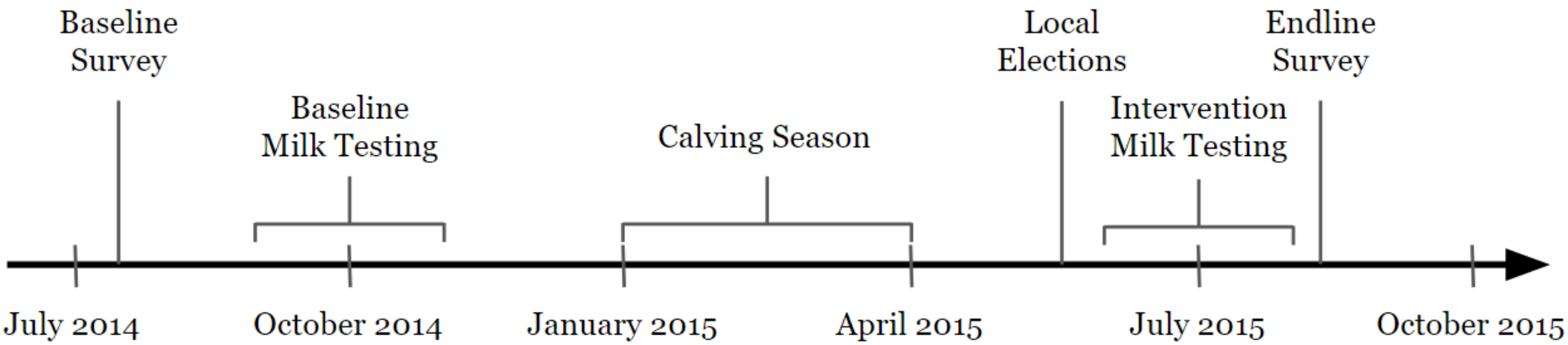
Incentive payment for cleanliness:

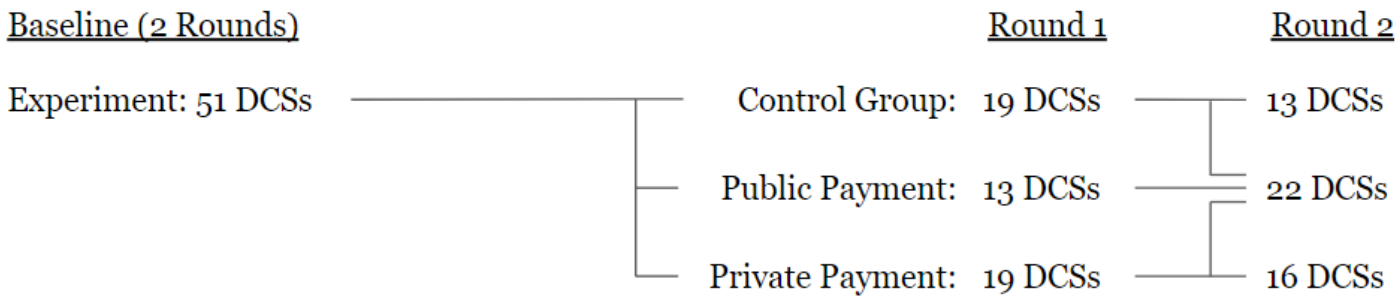
- Control: Milk quality testing only.
- Treatment: Payment for low bacteria.
- Maximum incentive $\sim 2.5\%$ of earnings.

Disclosure of incentive payments:

- Private: Payment disclosed to managers only.
- Public: Payment disclosed to cooperative members.

Timeline of Experiment





Milk Testing

Each round of milk testing (2 baseline, 2 intervention):

1. Announce a 2-week window in which we might test.
2. Arrive on a random day during collection.
3. Take a sample of milk from a pooled can.
4. Take a swab from another can.
5. Put in icebox and send to lab.
6. Return within two days to deliver payment.

Regression Specification

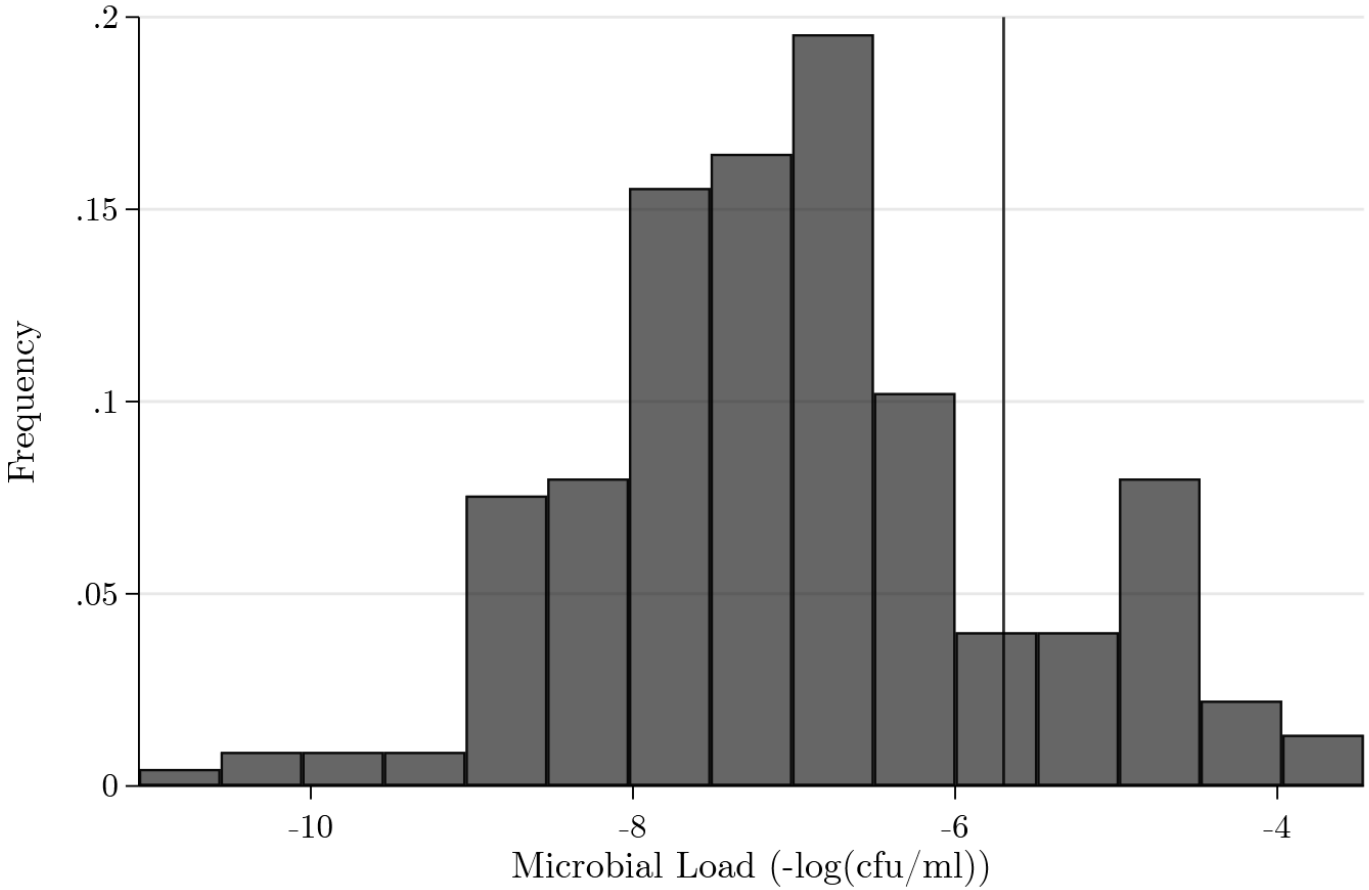
Difference-in-differences:

$$Y_{ijt} = \beta^{Pr} T_{jt}^{Pr} + \beta^{Pu} T_{jt}^{Pu} + \gamma_j + \delta_t + \epsilon_{ijt}$$

for cooperative j at time t.

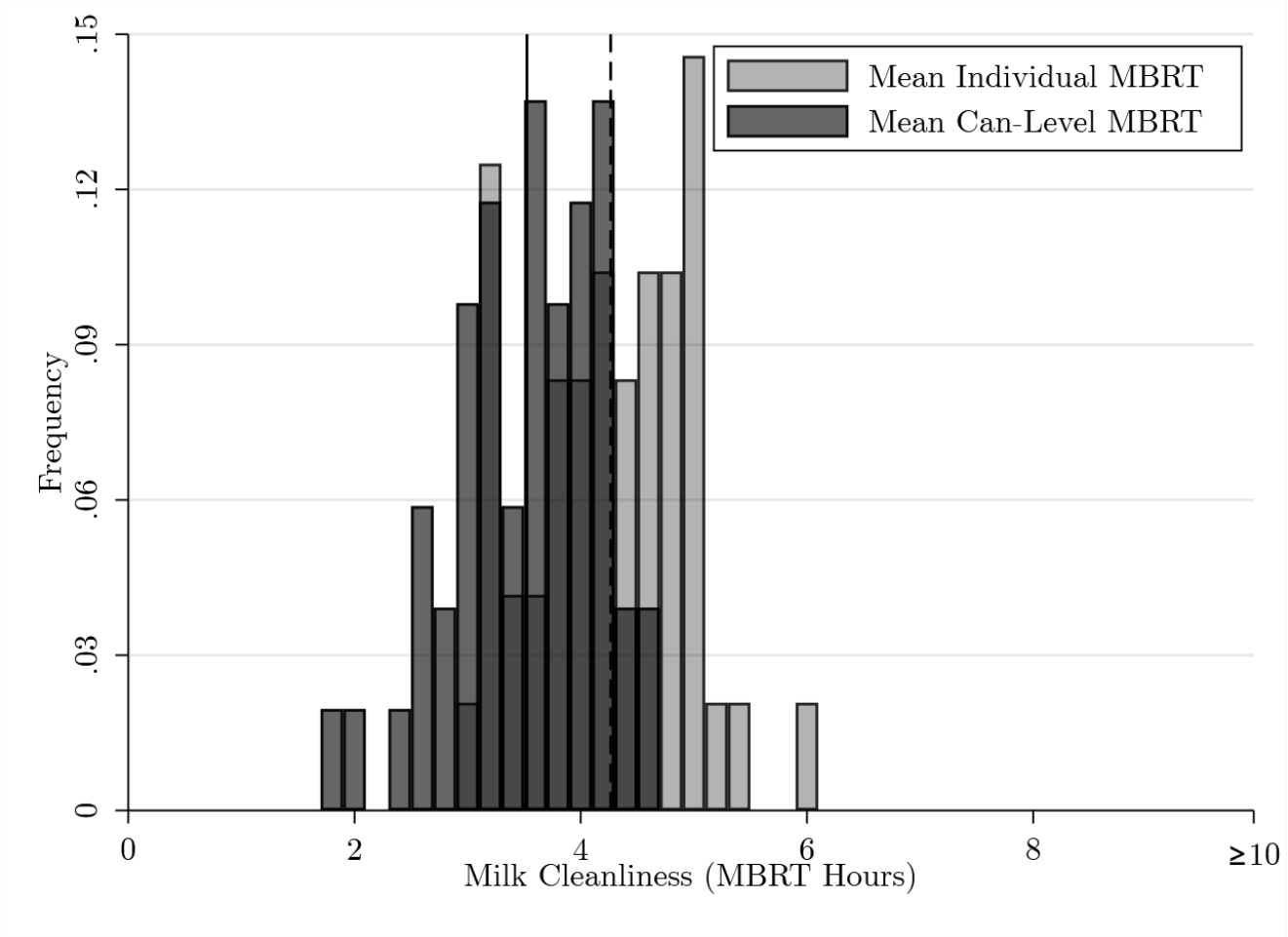
- Can-level regressions for milk testing.
- Individual-level regression for survey outcomes.
- Simple difference for endline-only outcomes.

Scope for Improvement



14% of cans meet USDA processing requirement.

Scope for Improvement



Pooled milk is 0.5 std. devs. worse than individual milk.

Outline

Summary of Results

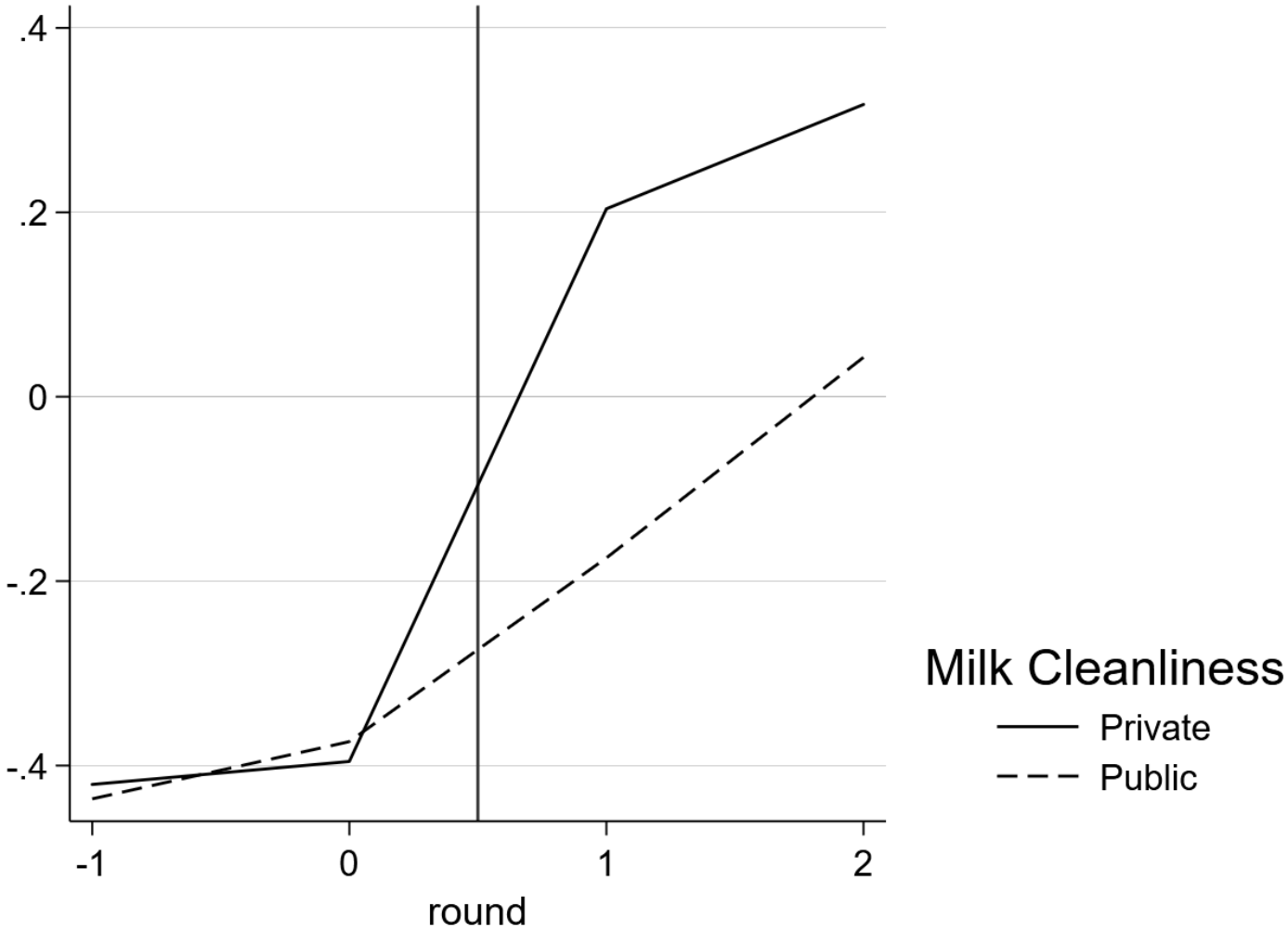
Incentives improve cleanliness.

- Private incentives work better than public incentives.

Public incentives: some secretaries opt out of payment.

- Explains some of private/public difference.
- Primarily weaker cooperative management.
- Continue to allow milk testing.

Event Study by Treatment Assignment



Effects on Milk Cleanliness

	Index	Index	SPC	MBRT
Private Incentive	0.64*	0.63**	0.47	0.36
	(0.35)	(0.31)	(0.32)	(0.22)
	[0.1]			
Public Incentive	0.32	0.39	0.38	0.17
	(0.32)	(0.29)	(0.32)	(0.18)
	[0.32]			
Control Mean	0.06	0.06	6.83	3.44
R-Squared	0.08			
Observations	204	204	204	204
DS-Lasso		X	X	X

81% increase in milk suitable for processing.

Margins of Adjustment

Cooperative managers:

- Anecdotal: Secretaries seen washing cans.

Cooperative members:

- Increased beliefs about others' cleanliness.
- True even among those who don't know about experiment or payments.

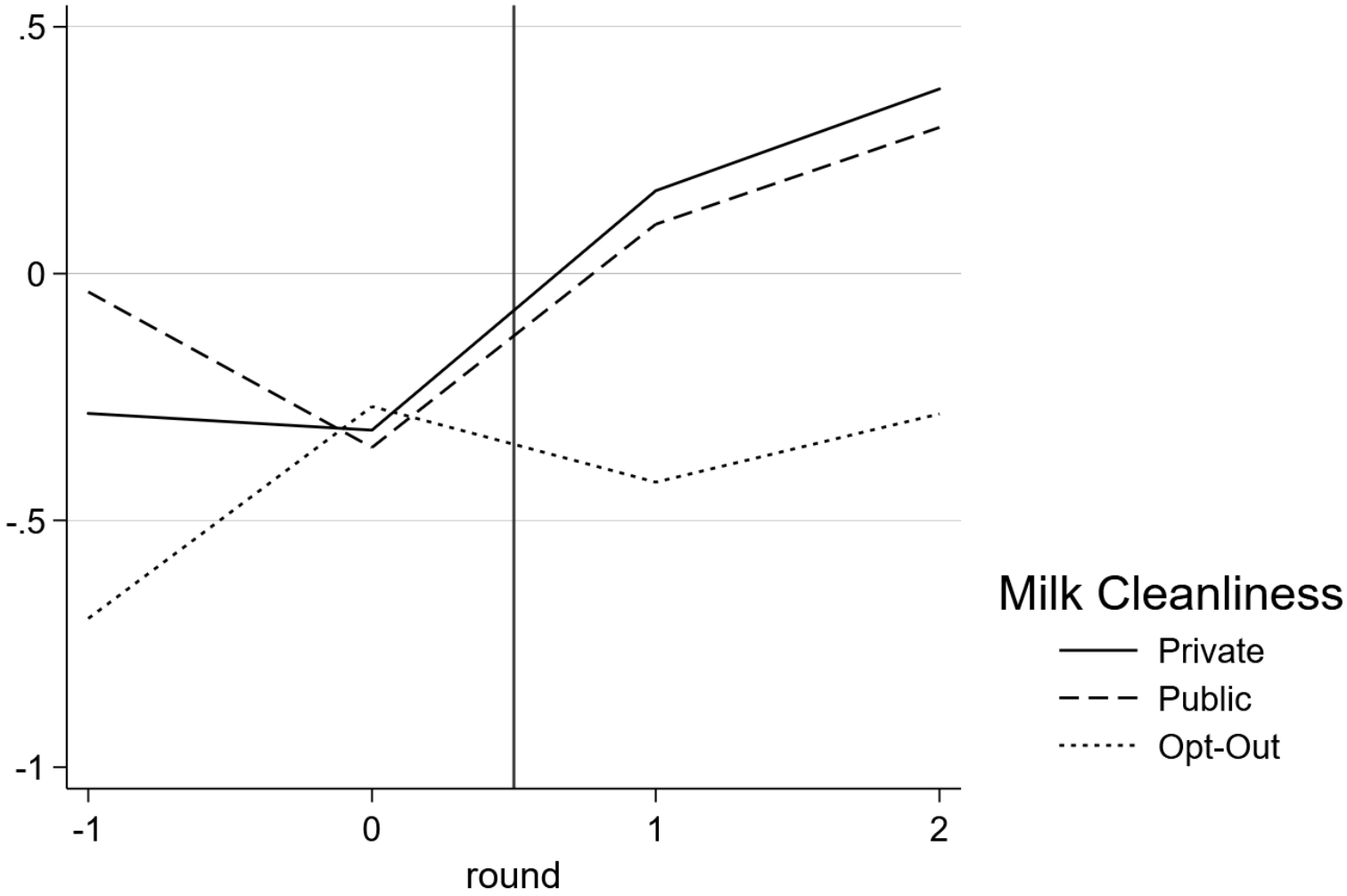
Effects on Cleanliness Beliefs

	Know about Payments	Received Bonus	Believe Secy. Clean	Believe Prod Clean
Private Incentive	0.01	0.01	-0.26**	0.45***
	(0.011)	(0.09)	(0.12)	(0.11)
	[1.0]	[0.84]	[0.01]	[0.0]
Public Incentive	0.16***	0.03	-0.08	0.30**
	(0.04)	(0.07)	(0.08)	(0.12)
	[0.03]	[0.47]	[0.6]	[0.0]
Control Mean	0.008	0.81	4.53	4.31
R-Squared	0.08	0.48	0.03	0.06
Observations	982	2,006	1,990	1,918
Simple Difference	X			

Public Incentive Managers Opt Out of Payment

	Payment Round 1	Payment Round 2	Opted Out Round 2
Private Incentive	121.1	98.3	0
	(106.9)	(82.7)	
	[0.33]	[0.26]	
Public Incentive	-0.405	16.78	0.32***
	(85.4)	(81.1)	(0.10)
	[1.0]	[0.85]	[0.0]
Control Mean	715.8	676.9	0
R-Squared	0.05	0.05	0.21
Observations	153	153	51

Event Study by Treated Status



Opt-Out Cooperatives Have Weaker Management

	Treated	Opted Out	Difference
Frac. Directors Known	0.27	0.24	-0.03
	(0.03)	(0.0)	(0.0)
Directors Meetings	1.66	1.27	-0.39 ***
	(0.05)	(0.16)	(0.10)
Dirs. Powerful	3.2	2.7	-0.42 ***
(farmer opinion)	(0.05)	(0.15)	(0.06)
Dirs. Management	3.1	2.7	-0.32 ***
(farmer opinion)	(0.07)	(0.15)	(0.07)
Secy. Powerful	3.7	3.5	-0.20 **
(farmer opinion)	(0.09)	(0.22)	(0.10)
Secy. Management	3.6	3.5	-0.1
(farmer opinion)	(0.13)	(0.11)	(0.11)
Num. Villages	15	7	
Joint Test (F-Stat)			10.94

Outline

Local Capacity to Address Collective Action

Village cooperatives can internally solve collective action.

- We provided a small incentive which led to large gains.
- Evidence of collective action within village.

Response relies on buy-in form elites.

- Control over financial information matters.
- Some managers choose to opt out.
- Why forego "free" income to cooperative?

Conceptual Framework for Elite Capture

Setup of model:

- One manager, one worker in production team.
- Fixed sharing rule for surplus from production.
- Manager can hide a portion of output from worker.

Results:

- Manager would prefer to hide some output.
- Equilibrium is suboptimal.
- Cost of full disclosure is higher for weaker managers.

Statements from Opt-Out Managers

"Farmers will regularly start expecting payments."

"Farmers [will be] angry about why the monetary reward is going to the [cooperative] when they were the ones who produced the milk."

Costs of Information Disclosure

1. We are bad communicators.
   - Farmers expect to be paid more than we deliver.
   - Disappointment must be managed by cooperative management.
2. Disclosure threatens information rents.
   - Managers control information about cooperative surplus.
   - Our public disclosure threatens their control.
   - It is safer to opt out instead.

Conclusion

- At the margin, cooperatives can internally solve collective action when faced with group incentives.
  - 1% larger incentive leads to 81% improvement in quality.
- Elites may block productive opportunities if they constrain elite power.
  - Tradeoff between achieving policy goals and limiting elite capture.
- Cautionary lesson for policies that limit rent extraction but rely on elites for implementation.
  - E.g. electronic payments, audits, etc.

Thank you!

shenoy@ucdavis.edu