

1. Introduction and background

Recent protests by farmers across different parts of the developing world have brought into sharp focus the distressing plight of agriculture. Low crop prices feature prominently among protesting farmers' concerns. Most smallholders sell their crops to private intermediaries, who charge markups as high as 100%, causing large farmgate-market price gaps (Mitra et al. 2018). An increasingly prominent view in the literature attributes these gaps to trader market power, finding little price pass-through from markets to farmers (Bergquist 2017, Mitra et al. 2018). Yet it offers few clues as to the possible source of traders' market power—finding no effect on prices of providing price information (Mitra et al. 2018, Hildebrandt et al. 2015), connecting farmers to online marketplaces (Newman et al. 2019, Kumar 2016), or introducing inventory credit (Casaburi, Glennerster & Suri 2013). A contrasting view contends that large farmgate-market price gaps reflect costs for traders' valuable services (Dillen & Dambro 2017).

Whether traders wield market power and if yes how to supplant it remain open questions. This project proposes a new solution. It posits that traders render useful services but wield market power in their provision, enabling them to extract surplus from farmers. For example, traders provide farmers with credit (20-50% of loans) and insurance against price risk (Maitra et al. 2019, Casaburi & Macchiavello 2019). Liquidity constraints among prospective traders would then limit entry and manifest as market power in the credit market. Similarly, poor linkages to multiple wholesale markets would prevent effective mitigation against price risk and manifest as market power in the insurance market. Both constraints are empirically important—with Casaburi & Reed (2019) finding that liquidity binds, and Casaburi, Glennerster & Suri (2013) finding high search costs. Indeed, most traders operate in a single market (Bergquist 2017).

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Farmers would be unwilling to relinquish existing traders' services because they are unable to find credible substitutes. However, increasing competition in the provision of these services would reallocate surplus to farmers and even increase competition among existing traders. This project asks:

(i) Which services provided by traders have most value for farmers? Understanding what lends value to trading relationships is the first step in creating credible substitutes. A real-stakes willingness-to-sell survey will estimate the value of credit, insurance, and dynamic guarantees—individually and in combination. It will additionally estimate costs of switching away from current traders even if a new one provides all these services, revealing the importance of more amorphous relational considerations.

(ii) Can alleviating barriers to the provision of the highest-value services spur new trader entry? Based on (i), the project will consider credit and/or market linkage constraints.

(iii) Does the entry of new traders affect farmgate prices and farmers' bargaining power in existing trading relationships (intensive margin gains)? Does it additionally foster extensive margin gains by enabling more lucrative crop choice with now-better market access?

2. Methodology and research approach

This proposal has 2 components. A first elicits farmers' willingness-to-sell (WTS) to a new trader in an incentive-compatible manner, to estimate the value of current trader services and switching costs. A second leverages information on the highest-value services to alleviate barriers to their provision among prospective traders. Farmers will be randomized (stratified by switching costs) into receiving the option to sell to new traders, with 80% power to pick up ensuing effects on prices.

Project results will inform the design of a larger RCT exploring extensive margin gains

and the best remedy for tackling root causes of market power in interlinked contracts (specifically, whether interventions should aim to increase competition in the trader market, or directly in the credit/insurance markets to maximize farmer surplus). See appendix 3 for details. The low-cost WTS survey provides early indication of whether credit/insurance and dynamic guarantees in them actually have value over vanilla, non-interlinked trading.

The empirical setting is the vegetable supply chain in India, where over 70% of farmers are smallholders (NSSO 2013) and sell at the farmgate to the same trader every year (Mitra et al. 2018). Between 50-75% of the wholesale value accrues post-farmgate (Maitra et al. 2019). While prior studies focus on grain markets, vegetables offer a particularly salient context for the posed questions. The time-sensitive nature of the crop creates the opportunity to provide value via timely advance payments and aggregation. High perishability implies sales must happen as soon as produce reaches a given market; combined with uncertainty about the quantity arriving at a given market on a given day, this creates the opportunity to create value via price insurance. The high cost plus high return nature of the crop creates the opportunity to provide value via guaranteed market access over time. Potential barriers to the provision of any of these services create the prospect for market power.

I. Identifying high-value trader services

A modified Becker Degroot Marschack (BDM) exercise will elicit the price at which farmers are willing to sell to a new trader instead of to their existing trader under a variety of {service, duration} combinations. This reported price must lie between the market price (minus transport costs) and the farmgate price offered by existing traders in that village. A random price will then be drawn from within these bounds, with farmers given the option to sell at a new trader's price offer iff (i) their reported price lies below this lottery-drawn price AND (ii) below the new

trader's price offer. The new trader's price offer is ex-ante unknown. Farmers will be told that one of their choices will be picked for implementation, i.e. that there are real stakes associated with their responses. Truth telling is incentive-compatible. More details of price determination are discussed after part II below. Prior studies have employed BDM exercises to assess farmers' valuation of insurance products (Cole et al. 2016) and advisory services (Cole & Fernando 2016) in India. Services considered here will include:

1. **Aggregation:** At minimum a trader aggregates and transports to nearby wholesale markets. Farmers will report the price at which they are willing to sell to a new trader at the farmgate.

2. **Aggregation + advance payments:** Traders offer advance payments to alleviate farmers' liquidity constraints at harvest time. Farmers will report the price at which they are willing to sell to a new trader offering advance payments. Comparing 1 & 2 yields the value of advance payments.

3. **Aggregation - insurance against price risk:** Vegetables are perishable and must be sold at the market if transported. Farmers may be averse to sinking the cost of transportation only to find an unfavorable price. Traders are able to guarantee a price at the farmgate on account of having connections to multiple markets in the upstream supply chain. In contrast to 1, where prices are guaranteed at the farmgate, the survey will offer rental space on a truck going to a specific destination, with farmers receiving whatever wholesale price prevails there minus transport and time costs. Comparing 1 & 3 yields the value of insurance.

4. **Aggregation + Advance payments - insurance against price risk.**

Farmers will additionally report prices at which they are WTS when the above services are guaranteed over different durations, which refer to the number of vegetable pickings (20 per

season up to 10 seasons). This will reveal the importance of dynamic incentives. The difference between prices offered by their current trader and a new trader who provides the same set of services (guaranteed over time) will reveal switching costs associated with components *excluding* these service, for e.g. due to relational considerations. The sample size is 500 farmers across 25 villages.

II. Facilitating entry of new traders

Armed with knowledge of which services appear key in adding value to farmers, I will pilot strategies to facilitate the entry of new traders in their provision. A local NGO will help identify young, entrepreneurial individuals from study areas. They will be offered the prospect of entry through the alleviation of two constraints, subject to revision based on the above exercise. The first is credit: traders often make advance payments to alleviate farmers' liquidity constraints at harvest time (roughly amounting to \$50-80 per farmer per picking). They need enough liquidity to be able to make this payment for 20+ farmers, so as to fill a truck to capacity for transport to a market. They additionally incur transportation costs. The project will provide the requisite liquidity to potential entrants for the first/first two pickings, following which they should have enough cash-on-hand to make the payments themselves.

The second constraint is absence of market linkages: prospective traders may not know where or to whom to on-sell produce. Existing traders typically have contacts across multiple wholesale markets, enabling them to get the best prices and offer effective price insurance. The pilot will connect prospective traders to commission agents across nearby wholesale markets through contacts of staff at the implementing partner.

Illustration of randomization & price determination

Farmers will first be stratified based on the WTS exercise into insurance value x credit value x switching cost bins. Within each stratum half will be assigned to treatment—i.e., given the opportunity to sell to a new trader—and half to control (not given the opportunity to sell). Leveraging rich information on value of services for members of each stratum, those in the treated group will receive a contract only offering services they actually value and not those they value less, as illustrated in the figure below. This is intended to maximize value-for-money in easing credit constraints, by not offering it to those for whom it has little value in the trading relationship. The contract will dynamically guarantee purchases over 20 pickings (1 season).

	Credit value: Low	Credit value: High
Insurance value: Low	T: Aggregation w/o insurance C	T: Credit + Aggregation w/o insurance Control
Insurance value: High	T: Aggregation w/ insurance Control	T: Credit + Aggregation w/ insurance Control

Price determination: New traders will be told the current trader price, wholesale market price, and transportation costs. They will be asked to pick a price offer for treated farmers for the selected set of services, knowing that sales only happen if the offer price exceeds WTS. As per the modified BDM exercise, a random price will be drawn between the market price minus transport costs and current-trader price (with probability ensuring 50-50 T-C within strata). Farmers will be given the option to sell at the new trader's price offer iff their reported WTS price lies below this lottery-drawn price AND below the new trader's price offer. The proposed design accomplishes three objectives:

- (i) Enables understanding how entry affects prices through a natural price-setting mechanism, wherein there is uncertainty on the farmer side about how high a price a new trader is willing to offer, and uncertainty on the trader side that prevents 1st degree price discrimination.

(ii) Ensures truth telling is still incentive compatible for farmers, enabling estimation of true value of services & switching costs. Farmers will only be told that the lottery-price from BDM is probabilistic, not that the probability distribution is drawn to ensure 50-50 T-C composition.

(iii) It leaves all farmers weakly and some strictly better off than before by credibly improving their outside option.

Since study farmers will comprise on average 5-10% of a village and new traders can offer a contract of their choosing to non-study farmers I do not anticipate that being restricted to offering a fixed set of services to treatment and no service to control farmers will pose a deterrent to entry. Alleviation of credit-related liquidity constraints will be limited to being for study farmers (for power).

Research Outcomes, Sample Size, Power

Value of services provided & switching costs: Estimated values of dynamic guarantees, advance payments, price insurance, and their combinations will reveal which of traders' many services are key to the resilience of trading relationships. We will also learn the magnitude of switching costs—e.g. as stemming from personal, long-lasting relationships—even after main services are supplied by an alternate entity. This is currently unknown, but crucial to whether existing traders can be practically replaced.

Prices: among those who switch as well as those who do not switch over to new selling arrangements. In the latter case there might be renegotiation with current traders due to better outside options; if yes, this will enable estimating the bargaining parameter in existing trader relationships—i.e., the magnitude of market power. I will also consider heterogeneity by switching costs. I will track prices and entity of buyer over 3 seasons via phone surveys.

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Sample size: 500 farmers from 25 villages. This was chosen to have 80% power to pick up an effect on prices between 10%-15%. Details of the power calc simulation are in appendix 2.

3. **Timeline and budget**

Feb-April, 2020: identifying prospective traders.

April, 2020: farmer willingness-to-sell surveys.

May-June, 2020: implementation (vegetable season)

July-September, 2020: analyzing data + designing subsequent RCT + fostering partnerships for larger RCT briefly described in appendix 3.

A budget with detailed explanations is attached.

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References

- [1] Kaushik Basu. Disneyland monopoly, interlinkage and usurious interest rates. *Journal of Public Economics*, 34(1):1–17, 1987.
- [2] Lauren Falcao Bergquist. Pass-through, competition, and entry in agricultural markets: Experimental evidence from kenya. UC Berkeley Mimeo- graph, 2017.
- [3] Lorenzo Casaburi, Rachel Glennerster, and Tavneet Suri. Rural roads and intermediated trade: Regression discontinuity evidence from sierra leone. Available at SSRN 2161643, 2013.
- [4] Lorenzo Casaburi, Rachel Glennerster, Tavneet Suri, and Sullay Kamara. Providing collateral and improving product market access for smallholder farmers. a randomised evaluation of inventory credit in sierra leone. 3ie Impact Evaluation Report, 14, 2014.
- [5] Lorenzo Casaburi and Rocco Macchiavello. Demand and supply of infre- quent payments as a commitment device: evidence from kenya. *American Economic Review*, 109(2):523–55, 2019.
- [6] Lorenzo Casaburi and Tristan F Reed. Competition in agricultural markets: An experimental approach. 2019.
- [7] Shawn Cole, A Nilesh Fernando, Daniel Stein, Jeremy Tobacman, Har- vard Business, and I Wharton. Field comparisons of incentive-compatible preference elicitation techniques. 2016.
- [8] Shawn Allen Cole and A Fernando. Mobile-izing agricultural advice: Tech- nology adoption, diffusion and sustainability. Harvard Business School Fi- nance Working Paper, (13- 047), 2016.
- [9] Brian Dillon and Chelsey Dambro. How competitive are crop markets in sub-saharan africa? *American Journal of Agricultural Economics*, 99(5):1344–1361, 2017.
- [10] Nicole Hildebrandt, Yaw Nyarko, Giorgia Romagnoli, and Emilia Sol- dani. Price information, inter-village networks, and bargaining spillovers: Experimental evidence from ghana. Preliminary draft). Retrieved from http://sites. bu. edu/neudc/files/2014/10/paper_345. pdf, 2015.
- [11] Richa Kumar. Rethinking revolutions: Soyabean, choupals, and the chang- ing countryside in Central India. Oxford University Press, 2016.
- [12] Rocco Macchiavello and Pepita Miquel-Florensia. Buyer-driven upgrading in gvcs: The sustainable quality program in colombia. 2019.
- [13] Rocco Macchiavello and Ameet Morjaria. Competition and relational con- tracts: evidence from rwanda’s coffee mills. Buffett Institute Global Poverty Research Lab Working Paper, (17-

103), 2019. 1

[14] Pushkar Maitra, Sandip Mitra, Dilip Mookherjee, and Sujata Visaria. De-centralized targeting of agricultural credit programs: Private versus political intermediaries. Mimeograph, 2019.

[15] Sandip Mitra, Dilip Mookherjee, Maximo Torero, and Sujata Visaria. Asymmetric information and middleman margins: An experiment with indian potato farmers. *Review of Economics and Statistics*, 100(1):1–13, 2018.

[16] Neil Newman, Lauren Falcao Bergquist, Nicole Immorlica, Kevin Leyton-Brown, Brendan Lucier, Craig McIntosh, John Quinn, and Richard Sseibuule. Designing and evolving an electronic agricultural marketplace in uganda. In *Proceedings of the 1st ACM SIGCAS Conference on Computing and Sustainable Societies*, page 14. ACM, 2018.

[17] Walter Y Oi. A disneyland dilemma: Two-part tariffs for a mickey mouse monopoly. *The Quarterly Journal of Economics*, 85(1):77–96, 1971.

[18] National Sample Survey Organization. Situation assessment of farmers, 2013.

Appendix 1: Partner organizations

JPAL South Asia is the survey partner. Precision Agriculture for Development (PAD) is the implementing partner and is providing access to their farmer database: they work with over 450,000 smallholder farmers, of which 40,000 grow vegetables. To identify prospective, trustworthy traders I will work in partnership with a local NGO like the Agha Khan Rural Support Program (AKRSP). They are one of PAD's partner organizations and have substantial presence in both Gujarat & Odisha.

For the subsequent RCT, which will study how entry affects farmer outcomes, I intend to partner with a large retailer or startup that would benefit from access to a network of local aggregators. I am in conversation with both Big Basket (a large online retailer in India) and the Kisan Network (an aggregator startup), who would be interested in such a network. A third prospective partner is DeHaat (also an aggregator startup). In the larger RCT I will also partner

with PAD to cross-randomize access to ICT advisory services alongside new trader entry, to gauge if this inspires shifts into high-value vegetable crops (extensive-margin gains).

Appendix 2: Power calculation simulations

Mean price: Rs.20/kg; standard deviation: Rs.10/kg (based on observations during scoping)

Switching costs are unknown: I speculate for the power calculation exercise that the mean is Rs. 5/kg, with standard deviation Rs. 2.5/kg. This would correspondingly reduce prices paid by current traders by these amounts.

- For given sample size (I tried 400-600):
- Assign treatment stratified by switching costs (2 strata split by median switching cost; 50% in T and 50% in C).
- Assign predicted treatment effects with new traders: varying between 14-20% for those with low switching costs; and 5-10% for those with high switching costs
- Reject the null of no effect if treatment is significant at $\alpha=0.05$.
- Simulate 1000 times; power is the share of these simulations that reject the null of no effect.

A sample of 500 yields power 80% to pick up effects of 10% on those with low switching costs and 14% on those with high switching costs. There is additionally 60% power to pick up heterogeneous effects by switching cost when split by median. However, I anticipate more strata and thus higher power to pick up heterogeneous effects with more splits.

Appendix 3: Plan for larger RCT

Results from this project will be shared with potential partners for scale-up to study (i) extensive margin gains on crop choice and (ii) the root cause of market power in interlinked contracts. Potential partners include large retailers and aggregators who would want to directly purchase

from a network of new local traders at the village level. On (i) the larger RCT will, in collaboration with PAD, explore whether better market access combined with better information on how to grow vegetables can enable extensive margin shifts into more lucrative crops.

On (ii) it will arbitrate between two hypotheses for why traders possess market power in interlinked contracts. The first is that monopsony enables offering dynamic incentives that help satisfy farmers' IC constraint and resolve market failures in credit and insurance markets. This nonetheless yields trader monopoly in these allied markets and extraction of surplus until the outside option via interlinkage (Basu 1987). In this case the optimal solution is to improve farmers' outside option by enabling outsiders to provide interlinked contracts and creating more competition in the trader market (as in the current project). The second hypothesis is that monopoly in resolving credit/insurance market failures enables monopsony and extraction of surplus through interlinkage. The optimal solution to reallocate surplus to farmers in this case entails creating more competition in these allied markets.