The Sustainable Quality Program in the Colombia Coffee Chain

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Motivation

Linking farmers to (international) markets has the potential to increase incomes in rural areas and reduce poverty (WB 2017)

This often requires *quality* upgrading

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$\Longrightarrow$ Challenges along the chain often stifle *quality* upgrading:

Upstream: Input/credit/saving/insurance markets and extension services

- Duflo et al. (2011), Karlan et al. (2014), Bold et al. (2017), Casaburi and Macchiavello (2019) ...

Motivation

Linking farmers to (international) markets has the potential to increase incomes in rural areas and reduce poverty (WB 2017)

This often requires *quality* upgrading

$\Longrightarrow$ Challenges along the chain often stifle *quality* upgrading:

Middle: Side-Selling and Hold-Up at the farm/mill's gates; limited competition

- Antràs and Costinot (2013), Atkin and Donaldson (2015), Macchiavello and Morjaria (2019) ...

Motivation

Linking farmers to (international) markets has the potential to increase incomes in rural areas and reduce poverty (WB 2017)

This often requires *quality* upgrading

$\Longrightarrow$ Challenges along the chain often stifle *quality* upgrading:

Downstream: Lack of demand / Contracting Problems at Export Gate

- Atkin et al. (2017), Antràs and Foley (2015), Macchiavello and Morjaria (2015), Blouin and Macchiavello (2019) ...

Global Buyers Supply-Chain Response

$\Longrightarrow$ Many Global Buyers respond by developing in-house VSS:

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Industry pioneer

NESPRESSO AAA
Started in 2003

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Lift Program

Farmer Support Organisations

Farmer Hub

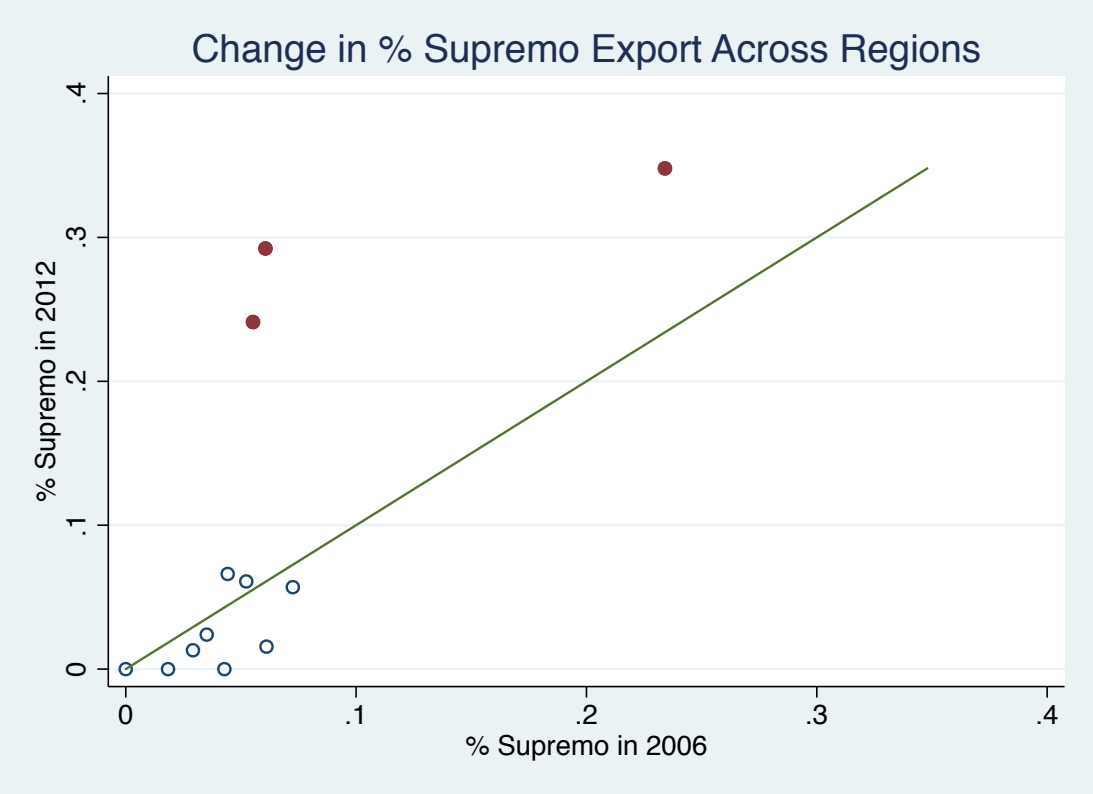
Sustainable Quality Program in Colombia

1. Quality Buyer-Driven Voluntary Sustainability Standard (VSS)
   - Started in 2003
   - Implemented in 36 regions worldwide
   - Coffee Industry flagship program

2. This paper focuses on Colombia:
   - PPP with Federacion Nacional de Cafeteros
   - Focus on Cauca (and Nariño)
     - ★ (80,000+ eligible farmers, 80% of Program Farmers in Colombia)

Export of *Supremo* Quality, by Region

Between 2006 and 2012 Colombia nearly doubled exports of supremo coffee (from 9% to 17%)



$>$ 80% of increase in supremo coffee was exported from Program Regions to the Program

Preview

I. What is the reduced form impact on the supply-side?

DID, Spatial RD

- Farmers invest in plot potential to upgrade quality
- Expansion in Land (intensive and extensive margin)
- Volumes and Quality of production increased

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II. What is the overall welfare impact of the program?

Calibrate a simple model of the value chain

- $\approx$ 30% higher surplus in the Colombian chain
- $\geqslant$ 50% of program surplus goes to farmers

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- $\approx$ 30% higher surplus in the Colombian chain
- $\geqslant$ 50% of program surplus goes to farmers

III. What held quality back?

Counterfactuals + comparison with other VSSs

- Both supply-side and demand-side interventions are important
- Contractual arrangements between buyer and exporter key for farmers welfare

Related literature

- Upgrading (and MNEs):
  - Atkin et al. (2017), Verhoogen (2008), Hasmann et al. (2017), Javorcik (2004), Alfaro-Ureña (2019),...
- Market Structure, Contracts and Trade:
  - Market Structure: Antràs and Costinot (2013), Atkin and Donaldson (2015), Macchiavello and Morjaria (2019)...
  - Contracts: Antràs and Foley (2015), Macchiavello and Morjaria (2015), Blouin and Macchiavello (2019), Cajal-Grossi et al. (2019) ...
- Farmers/informal firms/consumers and Intl' Markets:
  - McCaig and Pavcnick (2018), Pavcnik (2017), ...
- Certifications:
  - Dragusanu and Nunn (2018), De Janvry et al. (2015), Nelson and Pound (2009), Auriol and Miquel-Florensa (2016) ...

Outline of the talk

0 The Sustainable Quality Program
   i) Program at the Export Gate
   ii) Program at the Farm Gate
   iii) Program from Farmer Perspective
   iv) Data

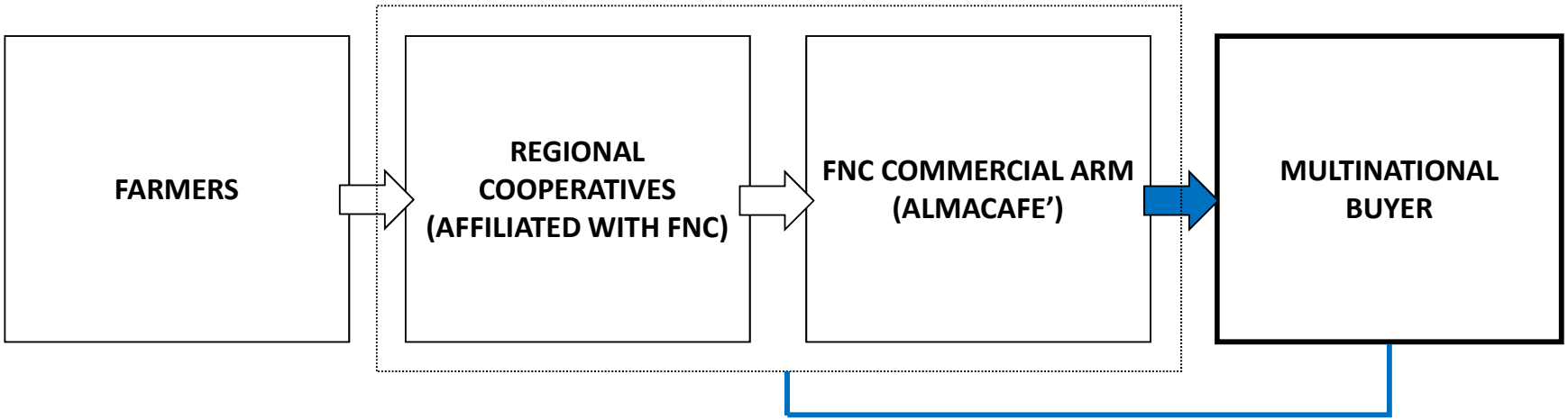
1 Reduced Form Supply Response

2 Framework & Calibration

3 Mechanisms: How did it work?

4 Discussion and Conclusions

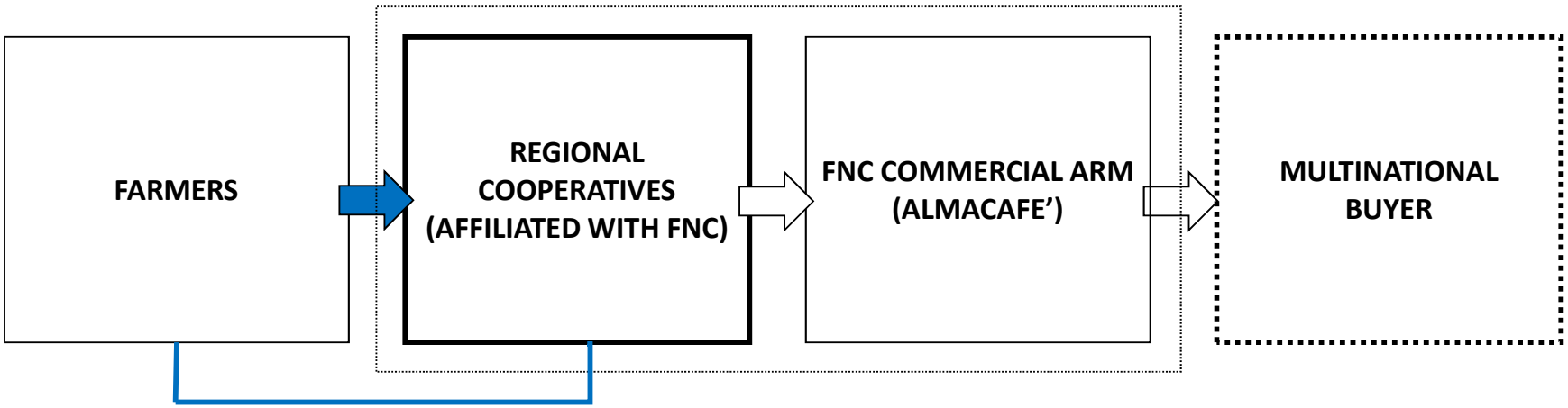
Program Sourcing at the **Export** Gate



$\Rightarrow$ Contract between FNC and Buyer:

1. Export-gate price premium η (**known** and **confirmed** by data analysis)
2. Farm-gate price premium π (**known** and **confirmed** by data analysis)
3. A lump-sum payment to cover implementation costs (**only amount known**)

Program Sourcing at the **Farm** Gate



- Program is a **bundle**:
  - *Supply:* Extension + Training + Support for Renovation
  - *Demand:* Stable Price Premium
    - ★ Premium: COP 40/kg ($\simeq$ 10% over FNC base price (Go))
    - ★ Permanent buying points in all locations

NB No formal contract enforcement with farmers (smallholders)

The Program: Farmers Decision

i. Program identifies region with certain *terroir* conditions

ii. Staggered program roll-out across *veredas* in the region

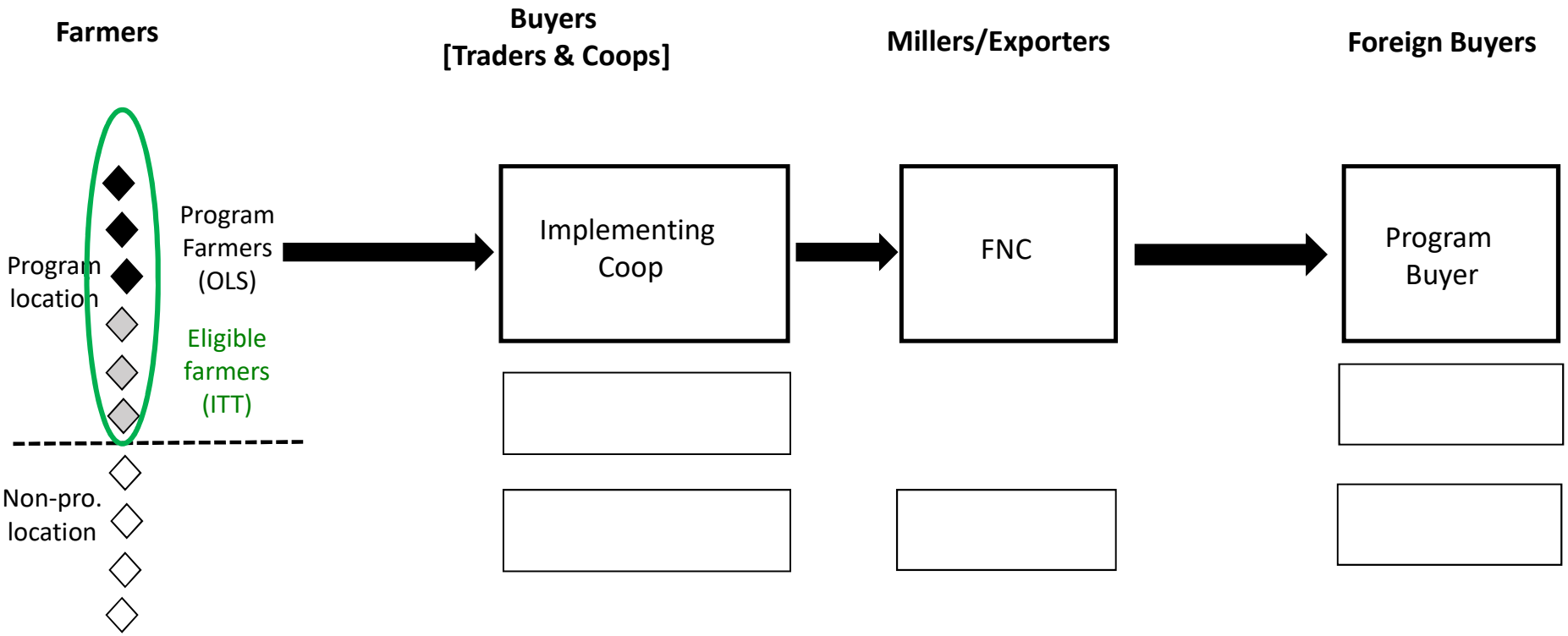
iii. All plots within selected *veredas* are eligible to receive inputs & training

iv. Eligible farmers decide whether to join the program or not (take-up):

Join:
- ⋆ Must meet program requirements (upgrade)
- ⋆ Has the *option* to sell (quality) coffee to program

Not Join:
- ⋆ Can upgrade taking advantage of eligibility
- ⋆ Cannot sell coffee to program

The Coffee Chain & Data



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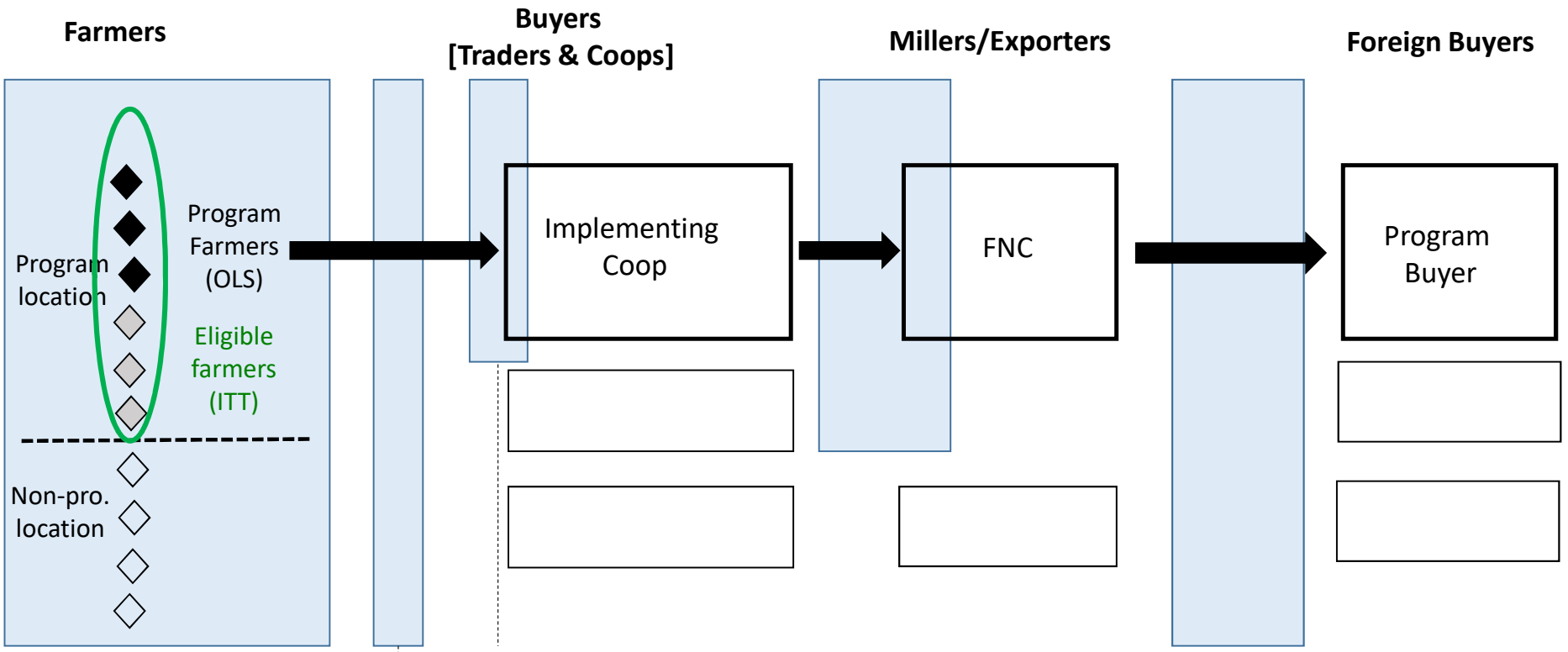


Plot Level Panel (2006-16)
All coffee plots in Colombia
(No production / quality)

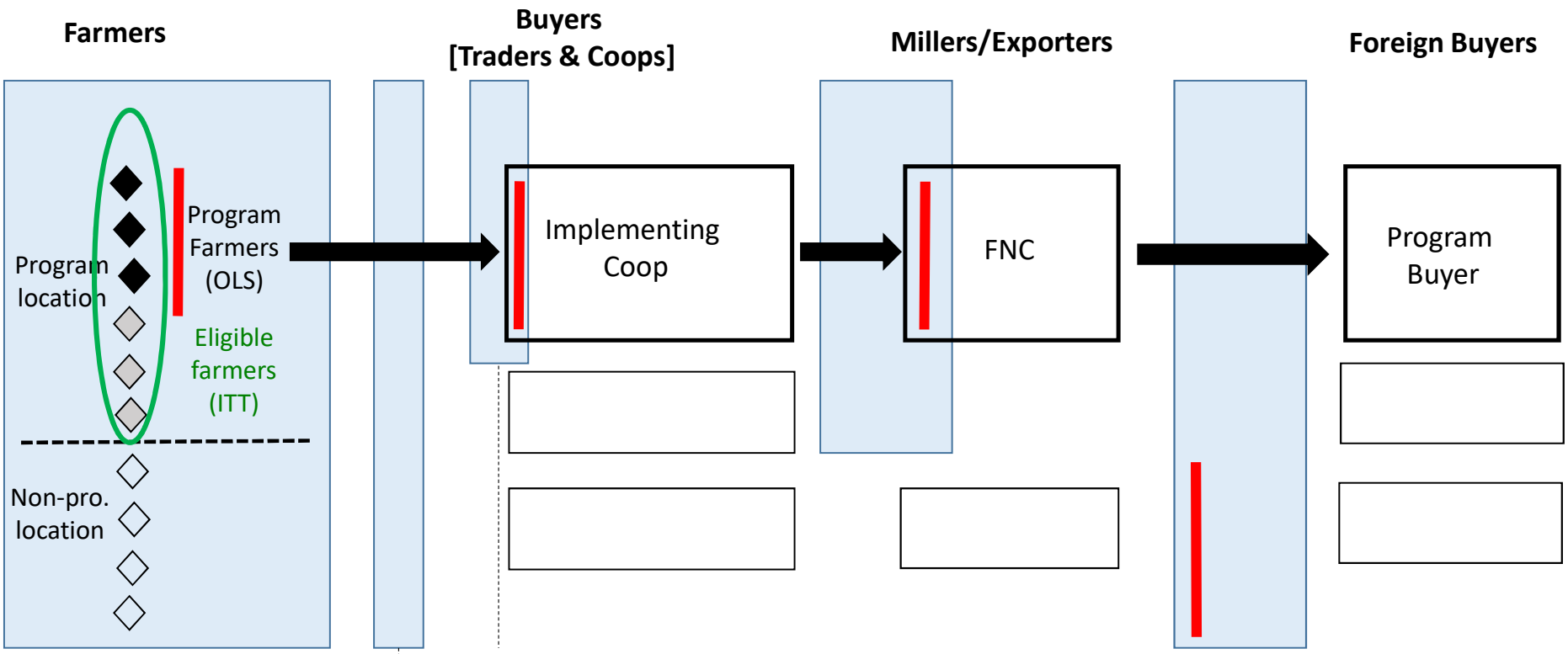
Sales (2013)
All farmers, all buyers

Coop Sourcing (2014-15)
No quality test

FNC Sourcing (2006-16)
From any supplier
With quality test

Exports (2006-16)
All exports
With quality test

The Coffee Chain & Data



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Program Records (?)

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All farmers, all buyers

Coop Sourcing (2014-15)
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From any supplier
With quality test

FNC Processing (2006-16)

Exports (2006-16)
All exports
With quality test

Regional Origin

Outline of the talk

0 The Sustainable Quality Program

1 Reduced Form Supply Response
   i) Program roll-out
   ii) Upgrading investments
   iii) Coffee Quality
   iv) Other outcomes

2 Framework & Calibration

3 Mechanisms: How did it work?

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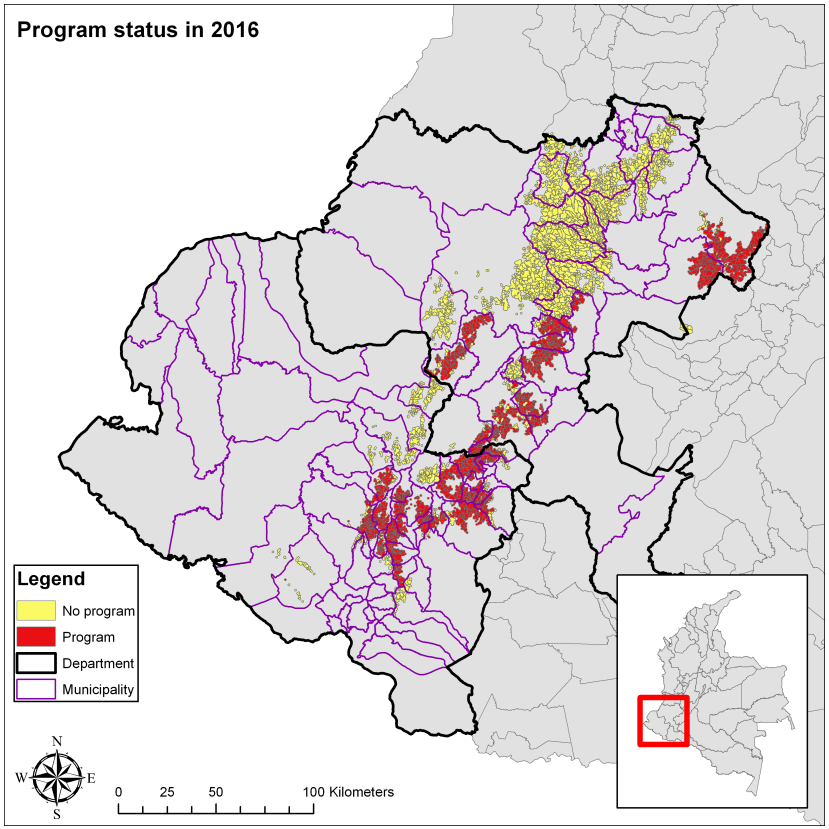
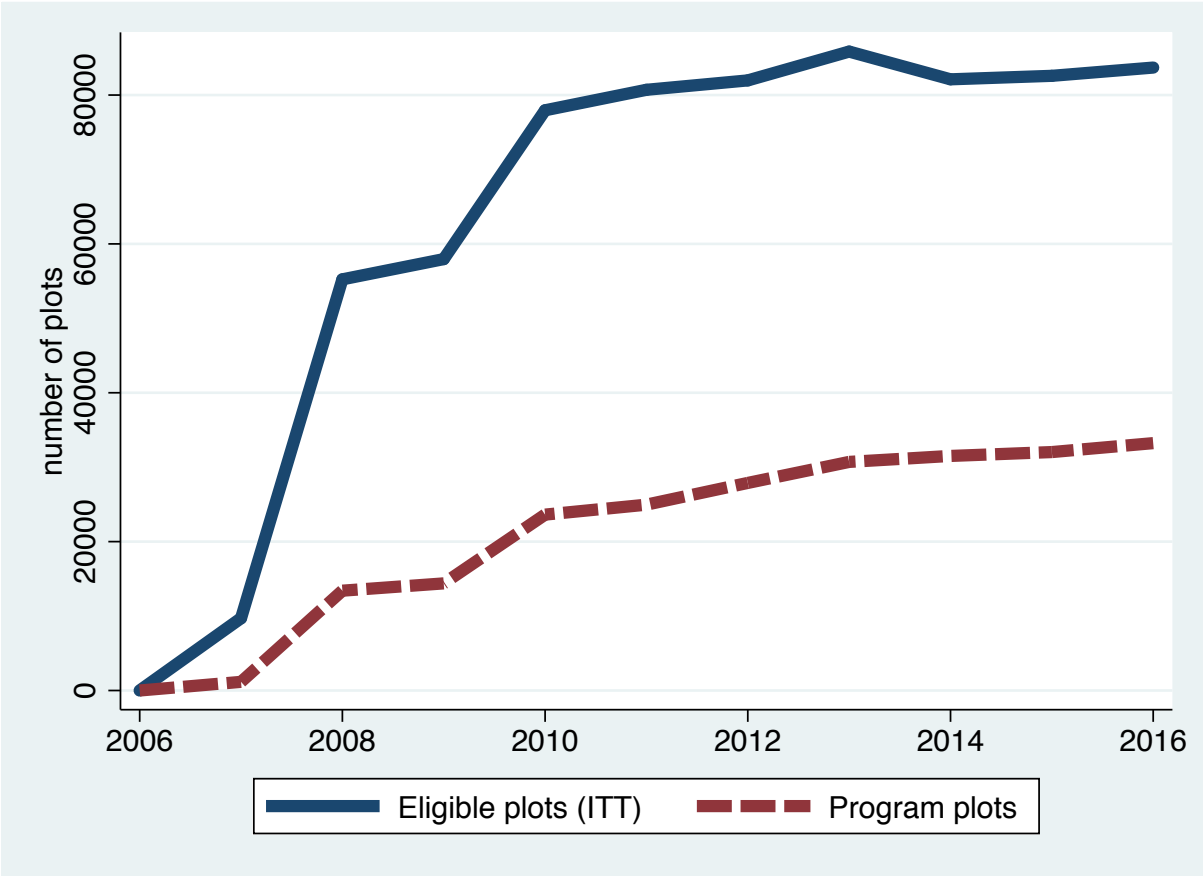
Program Roll-Out and Take-Up



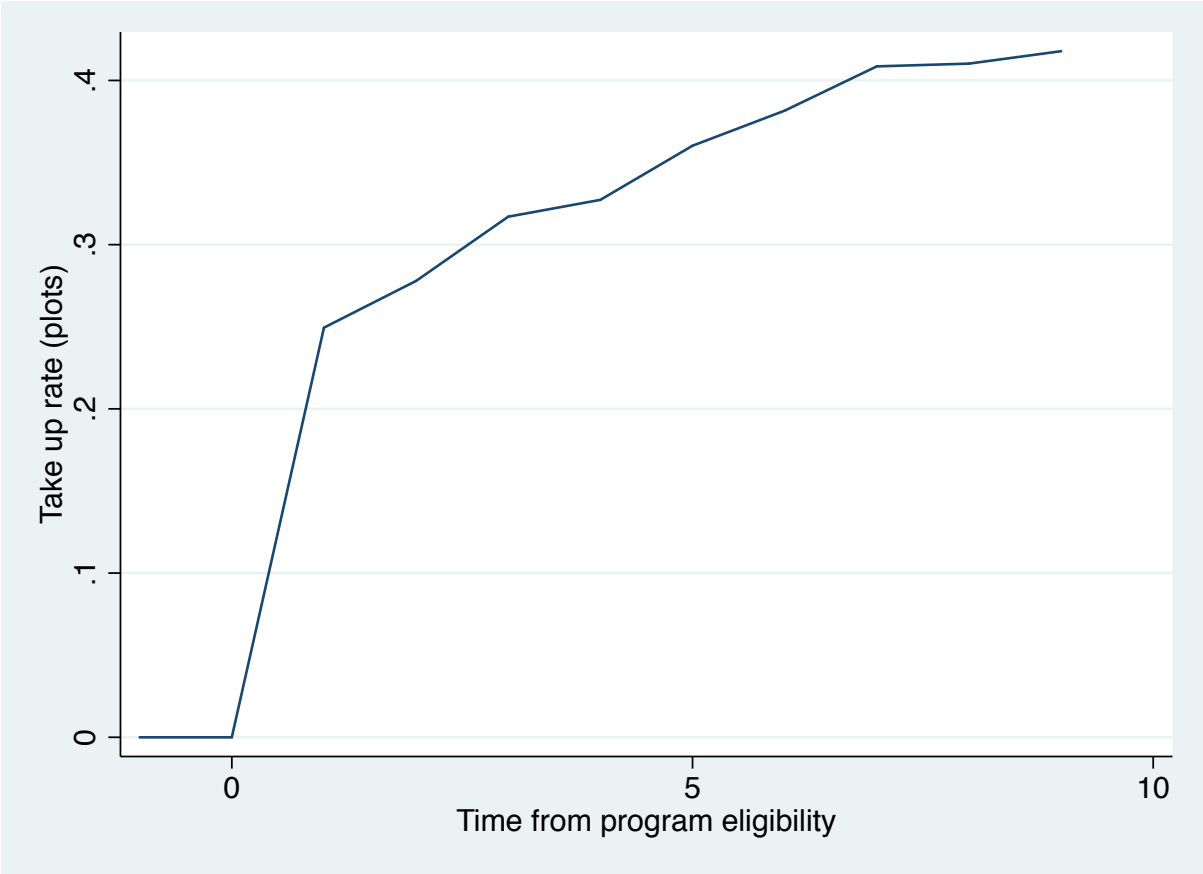
▸ Vereda - Terrain characteristics ▸ Municipality - SocioEconomic characteristics

Program Roll-Out and Take-Up



- Earlier expansion in Nariño, then Cauca
- By 2013 suitable municipalities have almost been saturated

Program Roll-Out and Take-Up



- Speed and likelihood of take-up depend on plot size and quality potential (Go)
- Heterogeneity in take-up rates across municipalities (Go)

Reduced Form: Investment Response

Yearly panel (2006-2016) of all plots in the Program Regions

$$Y_{pvmt} = \beta_0 + \beta_1 \times P_{pvmt} + \gamma_p + \gamma_{mt} + \varepsilon_{pvmt}$$

for plot p in vereda v of municipality m in season t.

- Concerns:
  - *Veredas* Selection
  - Endogenous (timing of) take-up

Reduced Form: Investment Response

Yearly panel (2006-2016) of all plots in the Program Regions

$$Y_{pvmt} = \beta_0 + \beta_1 \times P_{pvmt} + \gamma_p + \gamma_{mt} + \varepsilon_{pvmt}$$

for plot p in vereda v of municipality m in season t.

- Strategy:
  - *Veredas* Selection $\Rightarrow$ DID with plot FE ($+$ spatial RD)
  - Endogenous (timing of) take-up $\Rightarrow$ **ITT** specifications

Reduced Form: Investment Response

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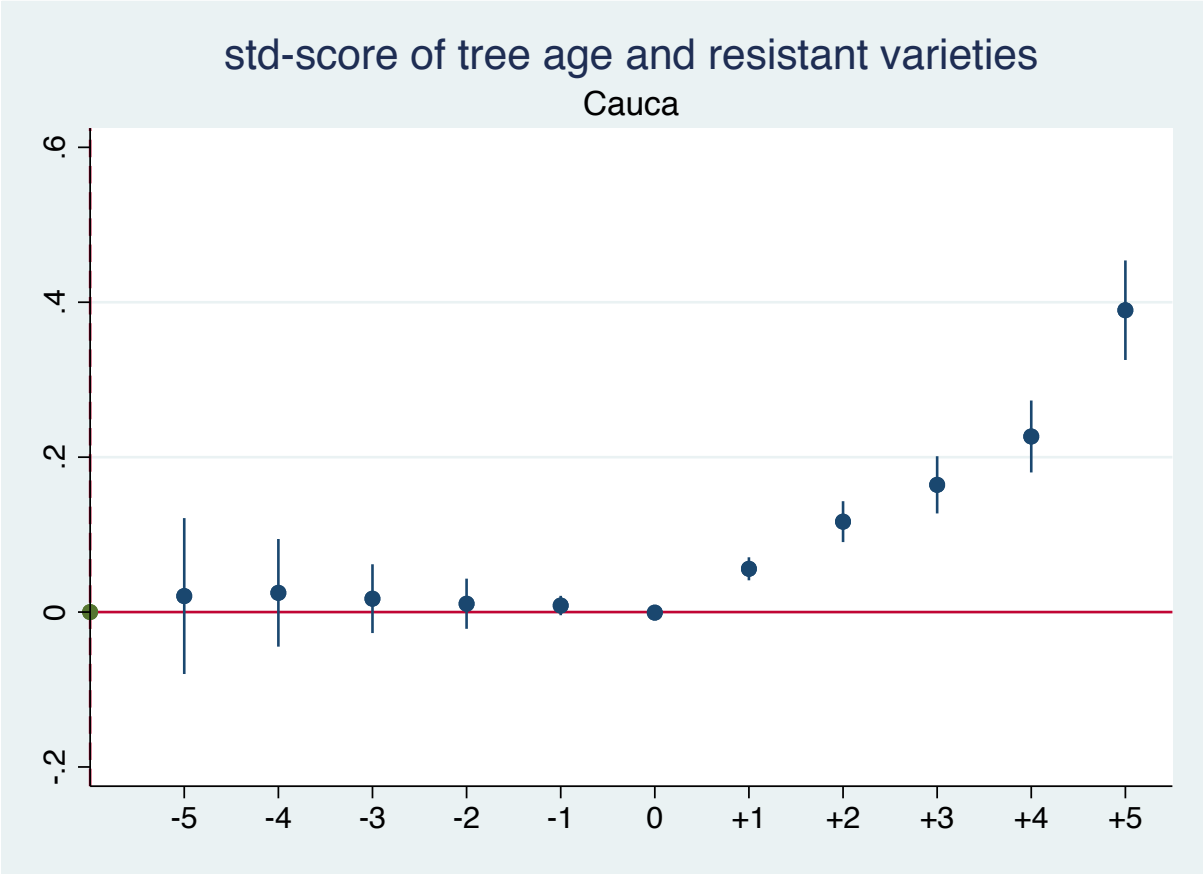


Reduced Form: Investment Response

$$Y_{pvmt} = \beta_0 + \beta_1 \times P_{pvmt} + \gamma_p + \gamma_{mt} + \varepsilon_{pvmt}$$

	(1)	(2)	(3)	(4)
	Standardized Plot Upgrading Score (Tree Age and Share Resistant Varieties)			
	OLS	ITT	Heterogeneity (ITT)	
			Good plots	Other plots
Program Plot	0.1862***			
	(0.009)			
Program Vereda		0.0478**	0.1506***	-0.0213
		(0.020)	(0.034)	(0.022)
Observations	775,263	775,263	196,985	578,278
Number of plots	91,766	91,766	32,060	59,706
Plot FE	Yes	Yes	Yes	Yes
Mun-Year FE	Yes	Yes	Yes	Yes

▸ Parallel trends all regions ▸ Programs ▸ Plot Expansion ▸ Results at the vereda level ▸ Table area

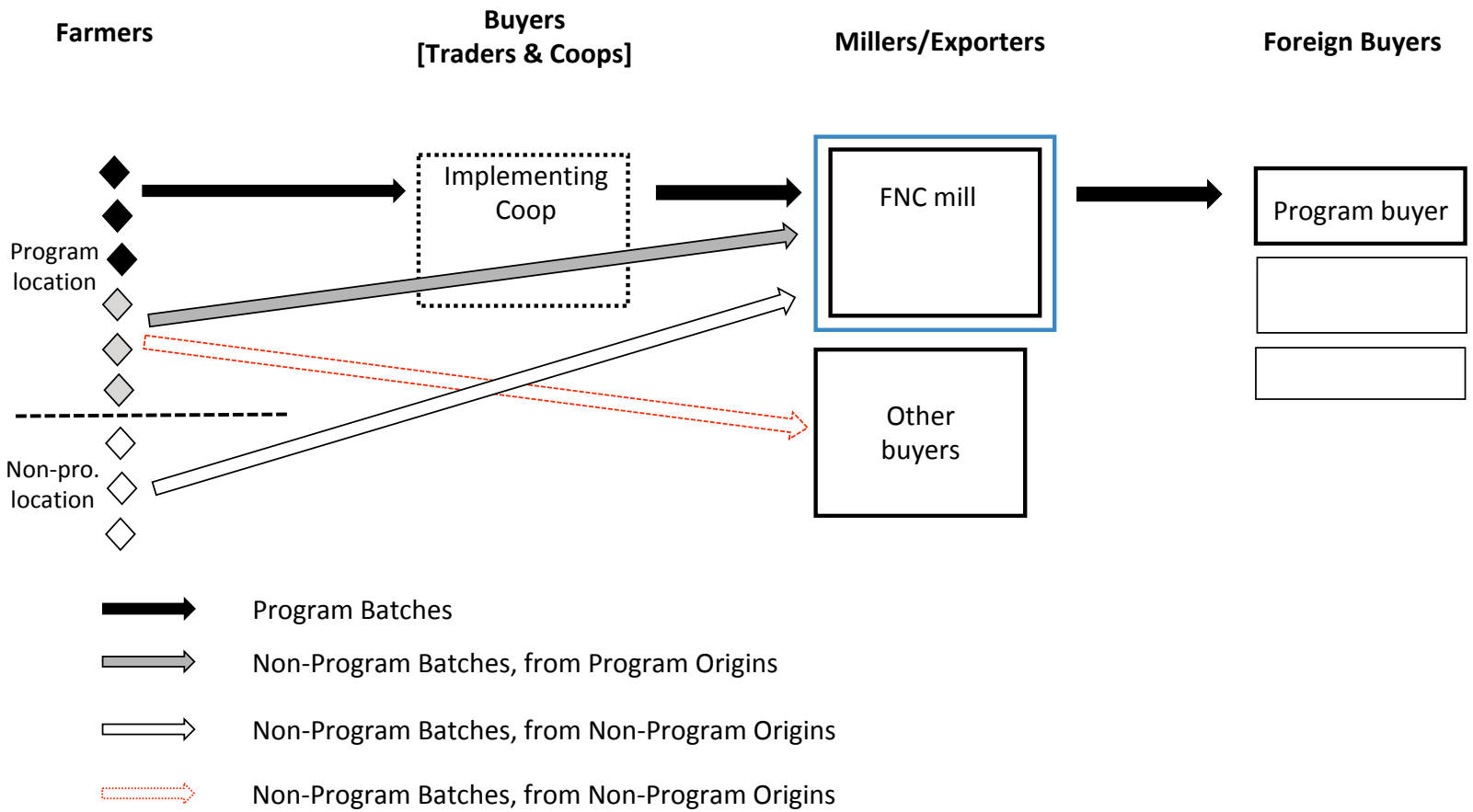
Reduced Form: Quality Response

$\Rightarrow$ Did the program increase quality?

Reduced Form: Quality Response

⇒ Did the program increase quality?

- We observe origin and quality testing of all batches at FNC mills (2006-2016)

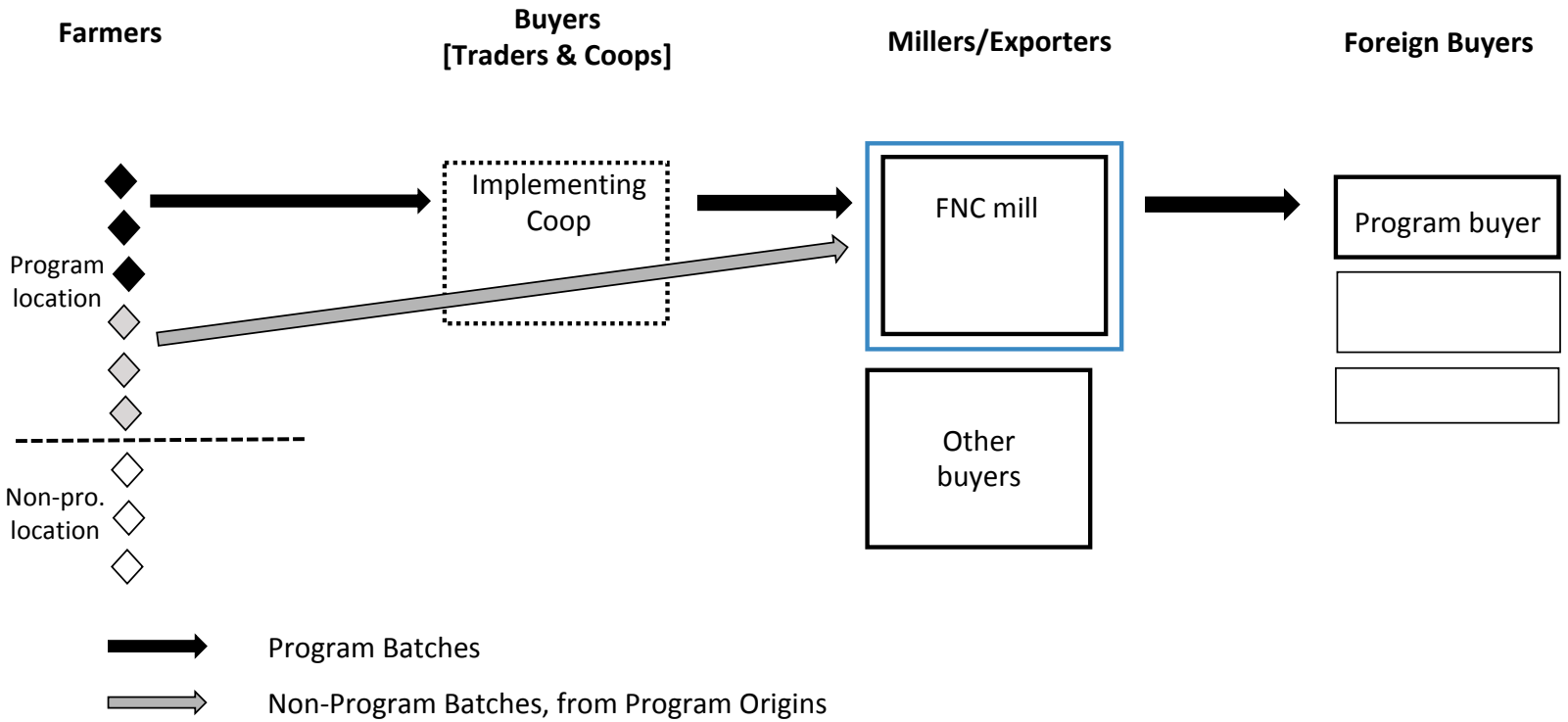


Reduced Form: Quality Response

Q1 Are program batches actually better (OLS)?

$$Q_{bomy} = \beta_0 + \beta_1 \times \text{Program batch}_{bomy} + \gamma_{oym} + \varepsilon_{bomy}$$

where Q_{bomy} denotes a quality outcome of coffee batch b from buying point o in month m of year y.



Reduced Form: Quality Response

	(1) Health beans	(2) Low Quality	(3) Health beans	(4) Low Quality	(5) Health beans	(6) Low Quality	(7) Health beans	(8) Low Quality
	(OLS)		(OLS)		(ITT)		(ITT sorting)	
Program batch	0.0181***	-0.0133***	0.0192***	-0.0140***				
	(0.003)	(0.003)	(0.003)	(0.003)				
Program origin					0.0042***	-0.0083***	0.0021	-0.0090***
					(0.001)	(0.002)	(0.002)	(0.003)
Sample	All	All	All	All	All	All	Non-program	Non-program
Mean dep. var.	93.95%	0.531%	93.95%	0.531%	93.95%	0.531%	93.67%	0.557%
Observations	118,758	118,758	122,897	122,897	122,897	122,897	108,095	108,095
R^2	0.656	0.648	0.482	0.493	0.475	0.488	0.368	0.379
Origin-Month-Year FE	Yes	Yes	No	No	No	No	No	No
Origin - Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (cluster origin and coop-year). *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

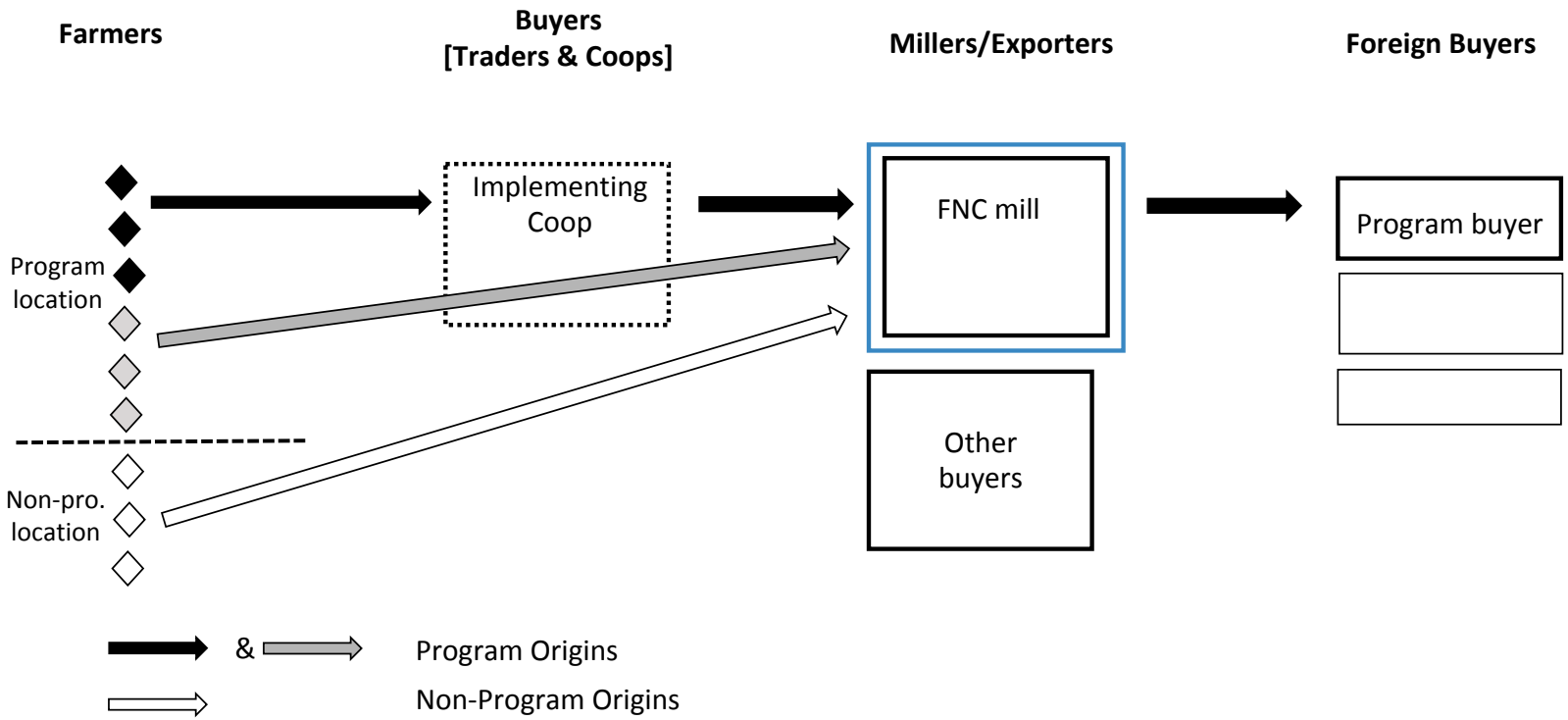
▸ Quality Index

Reduced Form: Quality Response

Q2 Is FNC sourcing better coffee from Program origin (ITT)?

$$Q_{bomy} = \beta_0 + \beta_1 \times \text{Program Origin}_{bomy} + \gamma_{om} + \gamma_{my} + \varepsilon_{bomy}$$

where Q_{bomy} denotes a quality outcome of coffee batch b from buying point o in month m of year y.



Reduced Form: Quality Response

	(1) Health beans (OLS)	(2) Low Quality (OLS)	(3) Health beans (OLS)	(4) Low Quality (OLS)	(5) Health beans (ITT)	(6) Low Quality (ITT)	(7) Health beans (ITT sorting)	(8) Low Quality (ITT sorting)
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Origin-Month-Year FE	Yes	Yes	No	No	No	No	No	No
Origin - Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes

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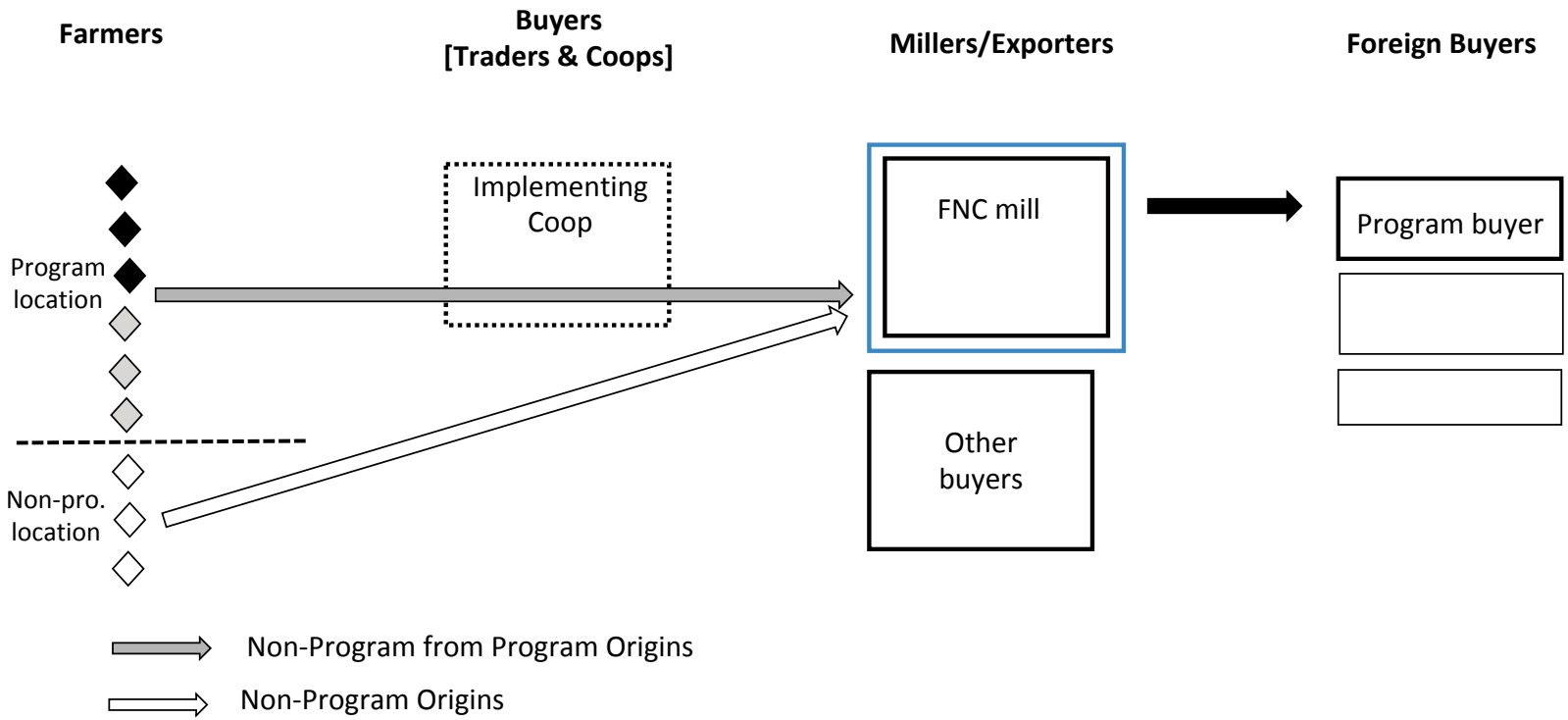
Reduced Form: Quality Response

Q3 Is it purely driven by sorting?

$$Q_{bomy} = \beta_0 + \beta_1 \times \text{Program Origin}_{bomy} + \gamma_{om} + \gamma_{my} + \varepsilon_{bomy}$$

where Q_{bomy} denotes a quality outcome of coffee batch b from buying point o in month m of year y.



Reduced Form: Quality Response

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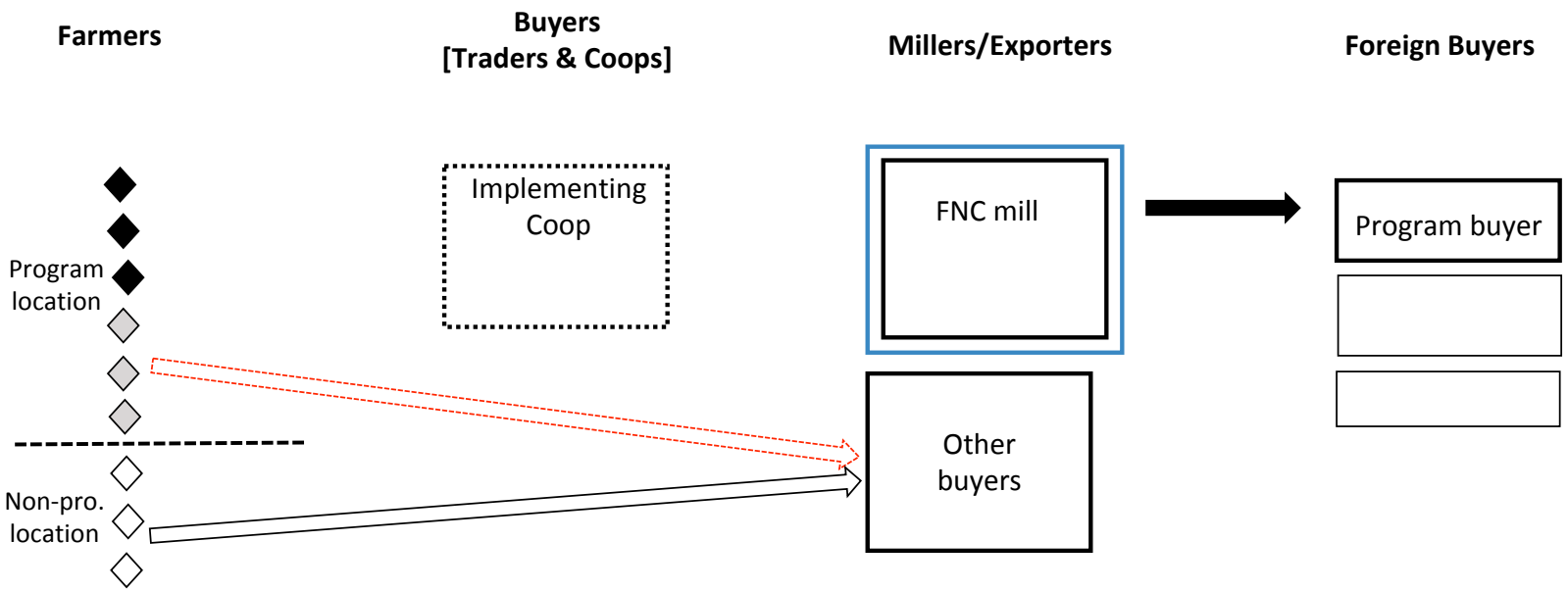
Origin-Month-Year FE	Yes	Yes	No	No	No	No	No	No
Origin - Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (cluster origin and coop-year). *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

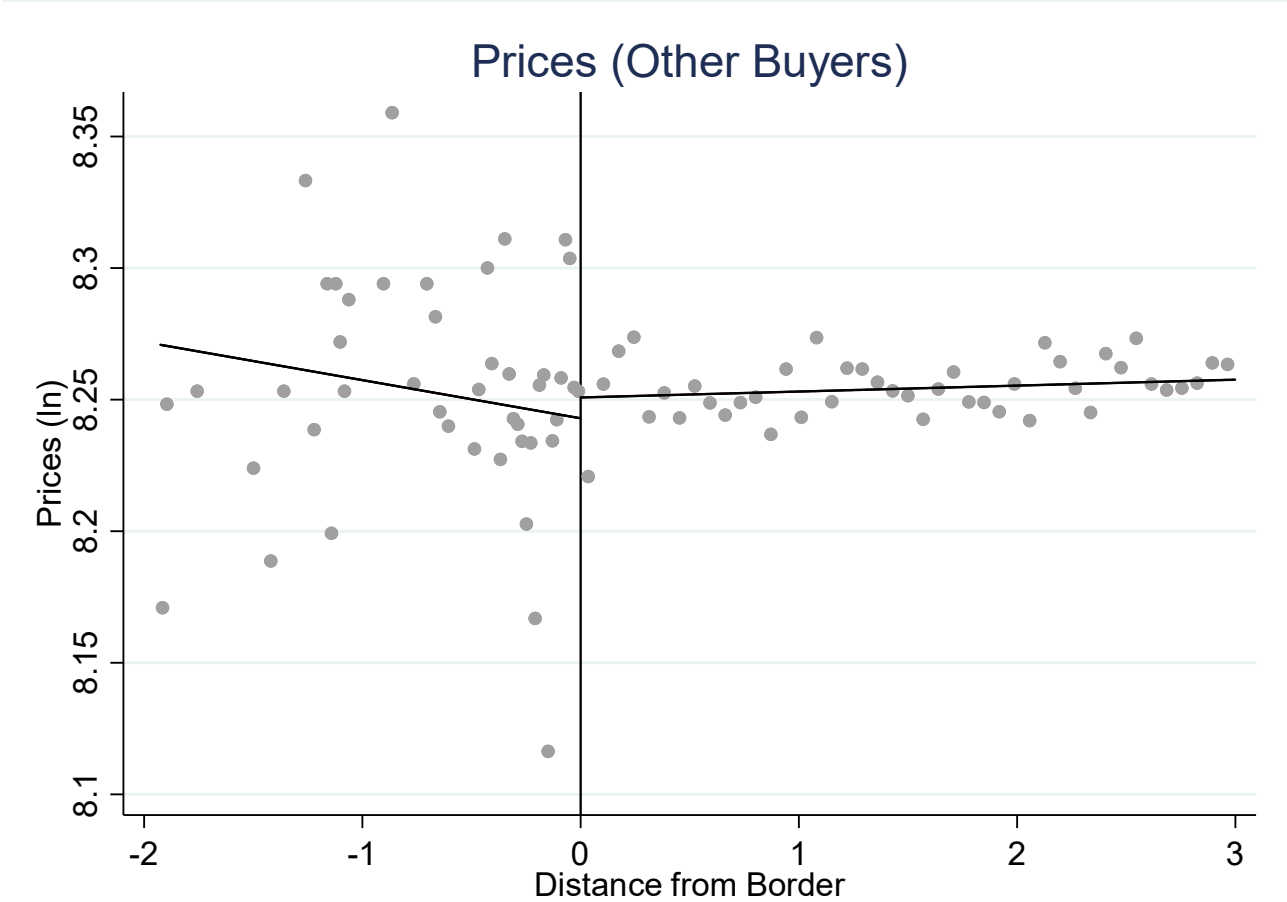
Reduced Form: Quality Response

Q4 What about sorting to other buyers?

- Challenge: we do not observe quality sold to other buyers
- **Approach A**: prices of all coffee transactions (only for 2013)
- **Approach B**: look at export quality



Approach A: Sorting and Prices from Other Buyers



- Under sorting sales to non-program buyers in program origins (by program farmers) should fetch lower prices
- RDD around program borders to overcome selection into different localities
- Caveat: due to El Niño & La Niña 2013 was a bad year for quality

▸ Density ▸ Elevation ▸ RDD Map ▸ RDD Validity

Approach A: Sorting and Prices from Other Buyers

- Higher prices from the cooperative and no difference in prices from other buyers
- No negative spillovers:
  - Non-program farmers in Program Veredas Link to table
  - Results at the vereda level Link to table

	(1)	(2)	(3)	(4)	(5)	(6)
	ln price - all buyers		**ln price - Cooperative**		**ln price - Other buyers**	
	(OLS)	(ITT)	(OLS)	(ITT)	(OLS)	(ITT)
Program Farmer	0.0359***		0.0345***		0.0016	
	(0.002)		(0.003)		(0.003)	
Program Vereda		0.0105*		0.0194**		-0.0102
		(0.005)		(0.008)		(0.007)
Observations	5,211	5,211	4,375	4,375	2,303	2,303
R^2	0.266	0.204	0.201	0.168	0.222	0.222
Border FE	Yes	Yes	Yes	Yes	Yes	Yes
Border Distance	Yes	Yes	Yes	Yes	Yes	Yes

Approach B: DID at Export Gate

$$S_{ry} = \beta_0 + \beta_1 \times PR_{ry} + \gamma_r + \gamma_y + \varepsilon_{ry}$$

where r is region and y is year

Dependent variable: % Exported as Supremo Coffee

	(1)	(2)	(3)	(4)
Program Region × Post	0.126***	0.152**	0.136***	0.162**
	(0.041)	(0.074)	(0.036)	(0.065)
Sample	FNC	FNC	All	All
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Region Trend	No	Yes	No	Yes

- **Approach B**: look at export quality
  - If sorting to other buyers, DID estimates should be sensitive to include non-FNC sales

Reduced Form: Other Outcomes

- We use the 2013 sales data + RDD to investigate other outcomes:

$$Y_{fmvb} = \alpha + \beta_1 \times P_{fmv} + \gamma_b + X_{fmvb} + \varepsilon_{fmvb}$$

- Sales (Go)
  - Increased sales to Program implementer ($\downarrow$ side-selling)
- Upgrading (Go)
  - Qualitatively Confirm DID results ($\uparrow$ investments)
- Production (Go)
  - Used in calibration ($\uparrow$ production)
- Spillover (Go)
  - No evidence

Reduced Form: Sales

- Contract between the program and farmers can not be enforced:
  - Farmers could be concerned that buyer doesn't pay announced price premium
  - Farmers could be concerned that buyer reneges on promise to buy all supply of suitable quality

$\Rightarrow$ (Sales data not ideal since quality was very poor in 2013)

- Transaction data from coop (2015/16) confirm:
  a) 10% announced price premium (Go);
  b) Program buys $>$ 90% of Program farmers production (Go)

Outline of the talk

0 The Sustainable Quality Program

1 Reduced Form Supply Response

2 Framework & Calibration
   i) Model
   ii) Assumptions
   iii) Empirical Strategy
   iv) Results

3 Mechanisms: How did it work?

4 Discussion and Conclusions

II. Framework

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- A perfectly competitive market for standard quality
  - Price for standard coffee in competitive international market p_w
  - Domestic farm-gate price $p = p_w/(1+\tau)$
  - Unit production cost $c < p$

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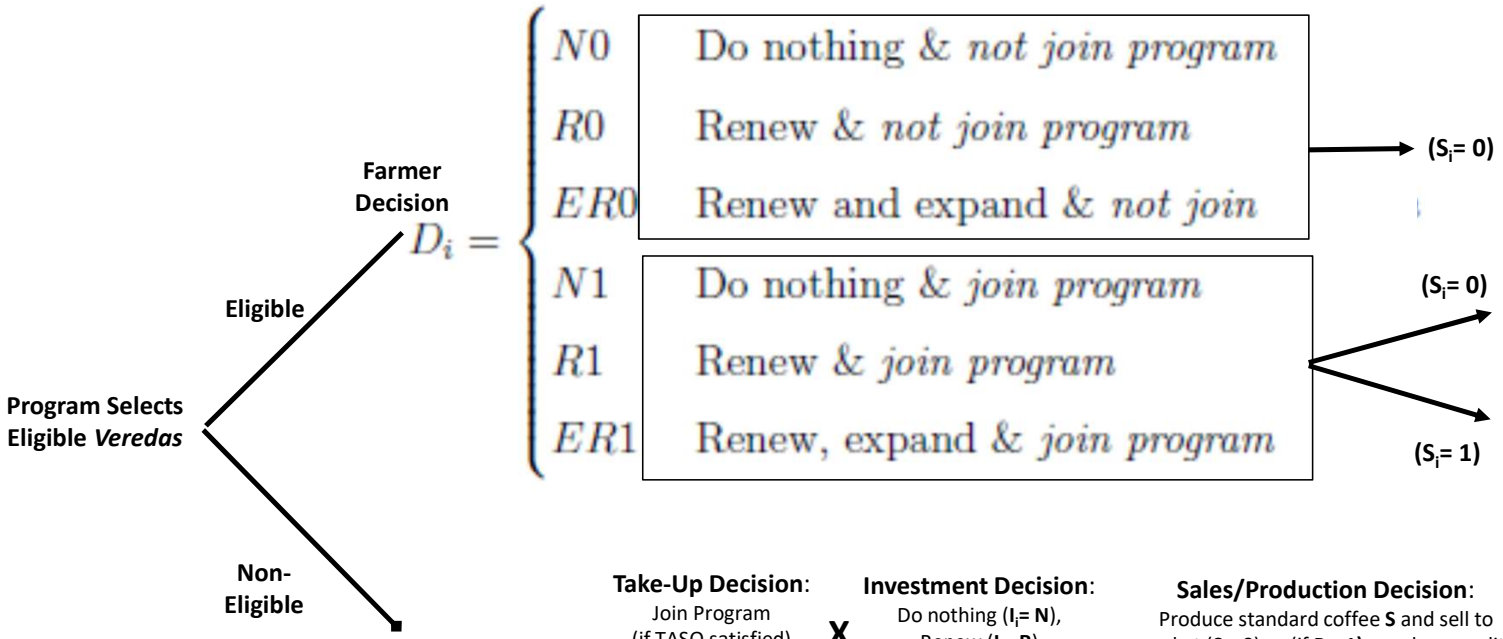
- A perfectly competitive market for standard quality
  - Price for standard coffee in competitive international market p_w
  - Domestic farm-gate price $p = p_w/(1+\tau)$
  - Unit production cost $c < p$

- A monopsonist buyer willing to pay a quality price premium $(1+\eta)\,p^w$
  - To produce high quality farmer incurs fixed (F_i) and variable cost (γ)
  - International buyer sources through a program implementer (FNC)
  - Program implementer pays farmers quality premium $p^Q = (1+\pi)p$

II. Framework: Remarks

- Market Structure Assumptions:
  1. Treat FNC and coop as a single vertically integrated exporter
     - ★ No double-marginalization on program sales (▸ Go)
  2. Identical transport/processing costs τ
     - ★ (w.i.p., new data)
  3. Perfectly competitive standard quality market
     - ★ Guarantia de Compra $+$ no spillover / g.e. effects on prices
  4. No other buyer of quality coffee
     - ★ Low baseline level $+$ no sorting $+$ no side-selling ($+$ w.i.p., new data)

Farmers Decision



i. Program identifies region with certain *terroir* conditions

ii. All plots within selected *veredas* are eligible to receive inputs & training

iii. Eligible farmers decide whether to join the program or not (take-up):

Join: has the *option* to sell (quality) coffee to program

Not Join: can upgrade but cannot sell to program

II. Framework: Farmer choices

- Eligible farmer decides whether to invest in her plot and/or join the program

$$D_i = \begin{cases} \mathbf{I_P} = 0 \begin{cases} N0 & \text{Do nothing \& } \textit{not join program} \\ R0 & \text{Renew \& } \textit{not join program} \\ ER0 & \text{Renew and expand \& } \textit{not join program} \end{cases} \\ \mathbf{I_P} = 1 \begin{cases} N1 & \text{Do nothing and } \textit{join program} \\ R1 & \text{Renew \& } \textit{join program} \\ ER1 & \text{Renew, expand \& } \textit{join program} \end{cases} \end{cases}$$

$\Rightarrow$ Benefit:

- Increase in production: $Q_i^D = (1 + \omega_d) x Q_i$
- If join: option to sell to program at $p^Q = (1 + \pi) \times p$
- The option is valued α

$\Rightarrow$ Cost:

- Fixed cost F_i^D
- Additional variable cost γ to produce quality
  - ★ γ is neither *farmer* nor *decision* specific

II. Framework: Farmer choices

- Eligible farmer decides whether to invest in her plot and/or join the program

$\Rightarrow$ Benefit:

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$\Rightarrow$ Cost:

  - Fixed cost F_i^D
  - Additional variable cost γ to produce quality

- Farmer chooses D_i that maximizes

$$D_i \in argmax_D$$

$$\{W_i^D = (1 + \mathbf{I_P}\alpha)[(1 + \mathbf{I_P}\pi)p^S - (1 + \mathbf{I_P}\gamma)c^S)] \times (1 + \mathbf{I_D} \times \omega^D)Q_i - F_i^D\}$$

II. Framework: Program Objective Function

- *Program Implementer Profits* **P***:*

$$\mathbf{P} = \mathbf{Q}^{Q} \times ((1+\eta)p^{W} - (1+\pi)p^{S} - \tau p^{W})$$

- Farm gate premium π is set to

$$\pi \in \arg\max \lambda \mathbf{P} + (1-\lambda) \int_{Q} \int_{F} \mathbf{I_D} W_i^D d\Omega() d\Phi()$$

$$s.t. \begin{cases} ((1+\pi) \times p - (1+\gamma) \times c) \geq (p-c) & (FarmerIC) \\ \mathbf{Q}^{Q} = \mathbf{Q}^{Q}(\pi) & (FarmerPC) \end{cases}$$

λ :

- A reduced-form representation of buyer contract with FNC
- Resale price maintenance, CSR (with limited transfers), ...

Identification

1. $F_i^D = G^D(X_i) + e_i$ with e_i EV Type I with shape σ
   $\rightarrow$ Farmer's decision can be represented by a multinomial logit

2. Identification Strategy:
   - σ *is* identified from investment decisions of *non-takers*
   - once σ is known, α *is* identified from take-up in 'excess' of what implied by π, γ and ω alone

3. Remarks:
   - Model is over-identified (relevant constraints are imposed)
   - Model of binary take-up decision similar insights but precludes counterfactuals on α
   - Estimates anchored to take-up + price premia along chain $\rightarrow$ robust to c, p^w, γ ...

II. Framework - Calibration

	Estimates		
ω	Increases in volumes		Table + (w.i.p., new data)
	ω^P	25%	
	ω^U	12%	
	ω^E	38%	
π	Program farm gate price premium	10%	known + Table
η	Program FOB price premium	20%	known + Table
η^W	Supremo export gate premium	10%	Table
	Directly observed from the data		
Q_i	Farm size distribution	1000 Kg/Ha.	
p_w	FOB price for standard coffee	3.75 USD/Kg	
p	Farm gate price for standard coffee	2.7 USD/Kg	
τ	Transport / Processing costs	0.4	
	Information from agronomists		
c	Variable cost for standard coffee	0.68 USD/Kg	(w.i.p., new data)
γ	Additional program variable cost	16.7%	(w.i.p., new data)

II. Framework - Results

Parameters	
λ (estimated)	**0.695**
	[0.685,0.705]
α (estimated)	**0.21**
	[0.185,0.215]
ω (observed)	25%*
η (observed)	19%*
Outcomes	
π (observed)	10%*
% Quality	**59%**
Take-Up (T=1)	41%
△ Farmers Π T=1	17%
△ Farmers W	19%
△ Chain Surplus	**33%**
% Surplus Farmers	**56%**

▸ Robustness ▸ Full Table

Outline of the talk

0 The Sustainable Quality Program

1 Reduced Form Supply Response

2 Framework & Calibration

3 Mechanisms: How did it work?
   i) Remarks
   ii) Demand & Supply (counterfactuals)
   iii) Comparison with other VSSs
   iv) External Validity

4 Discussion and Conclusions

Remarks

- Program might have alleviated at least *a* market failure
  - (Marginal) benefit of producing quality at export gate: $\approx 37.5c$
    - ★ $10\% \times 3.75\$ \approx 37.5c$
  - Marginal cost of producing quality: $\leq 27c$
    - ★ Program price premium gives an upper bound $10\% \times 2.7\$ \approx 27c$
    - ★ Marginal cost of producing quality $16.7\% \times 0.68\$ \approx 11.4c$

Remarks

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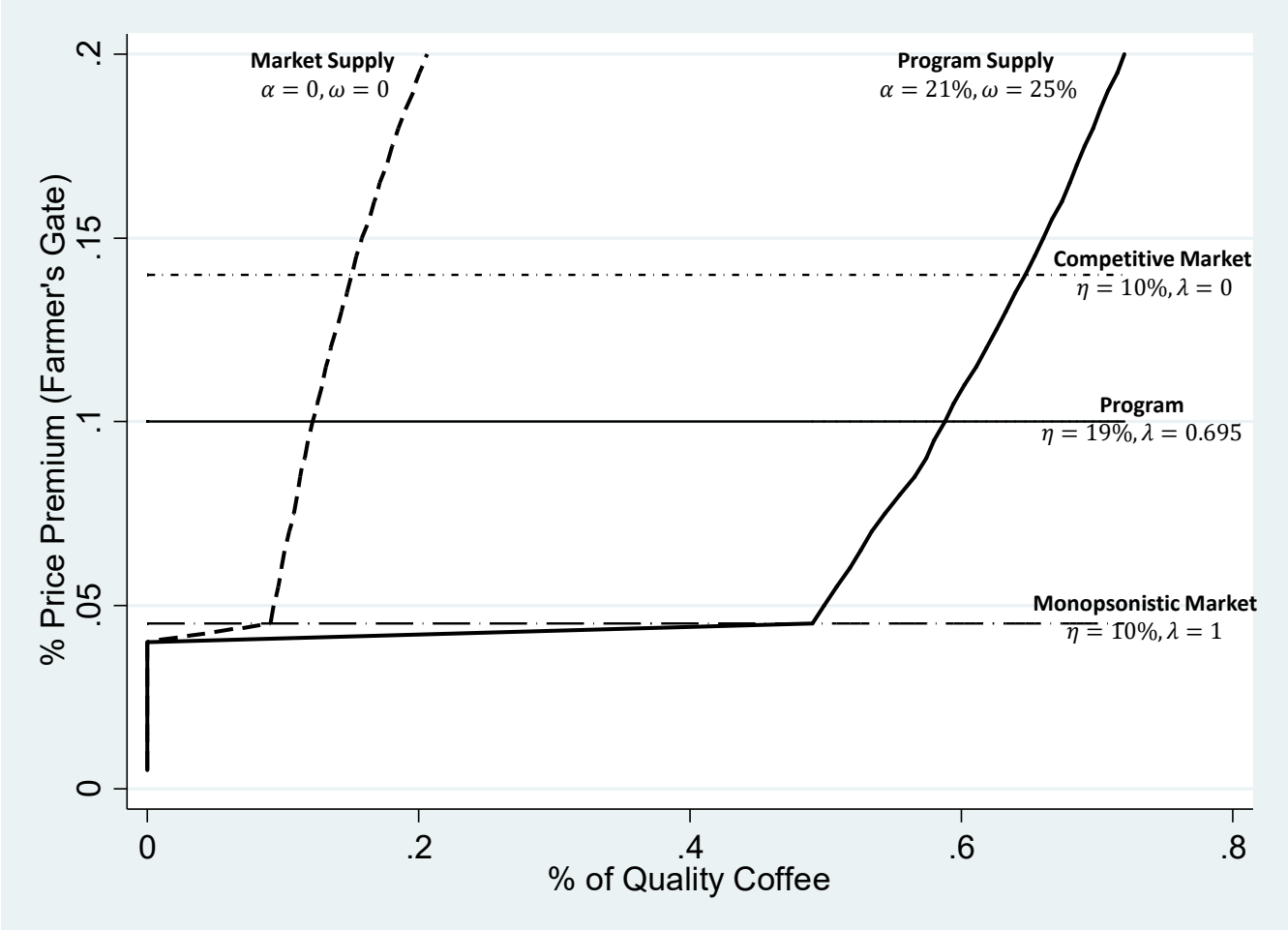
    - ★ Marginal cost of producing quality $16.7\% \times 0.68\$ \approx 11.4c$
- Program unlikely to have fully restored efficiency in the chain
  - Perfect contract enforcement would fully remove double marginalization:
    - ★ Farm gate premium would be $10\% \times 3.75\$ \approx 37.5c \Rightarrow (\pi \approx 15\%)$
  - A possible explanation: constraints on lump-sum to FNC
    - ★ potentially consistent with PPP with FNC and dynamic disbursement

Counterfactuals: Demand and Supply



- At the farm gate the program shifted both:
  - S: increasing production (ω) and luring farmers in through (α)
  - D: export gate premium (η) and transferring more of that to farmers (λ)

Counterfactuals: Full Table

Panel A: Calibration & Counterfactuals

	Baseline Estimates	**Counterfactuals**								
		Supply Side			*Demand Side*			*Market Structure*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Parameters		ω=0	α=0	ω=0 α=0	λ=1	η=0.1	λ=1 & η=0.1	Monopsonist	Monopsonist + Enforceable Contracts	Competitive Market
λ (estimated)	**0.695** [0.685,0.705]	0.695	0.695	0.695	1	0.695	1	1	1	0
α (estimated)	**0.21** [0.185,0.215]	0.21	0	0	0.21	0.21	0.21	0	0	0
ω (observed)	25%*	0%	25%	0%	25%	25%	25%	0%	0%	0%
η (observed)	19%*	19%	19%	19%	19%	10%	10%	10%	10%	10%
Outcomes										
π (observed)	10%*	14%	13.5%	16%	4.5^{+}%	4.5^{+}%	4.5^{+}%	4.5^{+}%	0.5%	14%
% Quality	**59%**	35%	38%	17%	49%	48%	48%	9%	7%	15%
Take-Up (T=1)	41%	28%	28%	16%	34%	34%	34%	11%	9%	15%
$\triangle$ Farmers Π T=1	17%	12%	32%	23%	14%	14%	14%	17%	16%	21%
$\triangle$ Farmers W	19%	9%	9%	4%	13%	13%	13%	2%	1.5%	4%
$\triangle$ Chain Surplus	**33%**	15%	17%	6%	29%	20%	20%	3%	2.5%	4%
% Surplus Farmers	**56%**	61%	53%	62%	46%	66%	66%	62%	54%	100%

Comparison with other VSS

$\Rightarrow$ Compare with other programs:

- That provide inputs and training (Environmental label)
- That aim to solve price transmission issues (Social label)

Comparison with other VSS

⇒ Compare with other programs:

- That provide inputs and training (Environmental label)
- That aim to solve price transmission issues (Social label)

	(1) Farm Gate	(2)	(3) Mill Gate	(4)	(5)	(6) Export Gate	(7)
	Price (ln)	Price (ln)		Quality	Price (ln)		Quality
Program	0.0946***	0.0660***	0.0462***	0.1244***	0.1976***	0.1896***	1.1367***
	(0.009)	(0.004)	(0.003)	(0.025)	(0.012)	(0.014)	(0.039)
Environmental label	0.0080	0.0317***	0.0021	0.0078	0.0473***	0.0427***	-0.1056***
	(0.007)	(0.003)	(0.004)	(0.018)	(0.006)	(0.006)	(0.024)
Social label		0.0149***	-0.0134***	-0.0837***	0.0902***	0.0662***	-0.1016***
		(0.004)	(0.004)	(0.032)	(0.006)	(0.007)	(0.024)
Sample		All	Non-standard	Non-standard	All	Non-standard	Non-standard
Observations	28,323	213,252	122,481	69,092	52,847	23,111	26,417
R^2	0.783	0.930	0.938	0.467	0.910	0.904	0.462
Farmer FE	Yes						
Mill sale conditions		Yes	Yes	Yes			
Contract conditions					Yes	Yes	Yes

Notes: Robust standard errors in parentheses (cluster buying point column 1, cluster origin-year columns 204 and cluster year-month-destination columns 5-7). *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Unit of observation: Column 1 farmer-program, Columns 2 to 4 a coffee batch entering the mill, Columns 5 to 7 a batch at the export gate. Time period is 2006-2013.

External Validity

- Program is the flagship buyer-driven VSSs in coffee
  - Other global companies have similar programs
  - Similar programs are being implemented in other chains
- In Colombia the Program was implemented in multiple regions
  - In one region the program is implemented by a private exporter
  - Our data coverage not ideal to explore *heterogeneity*
- The Program is implemented in multiple countries (w.i.p., new data)
  - Central and South America: similar structure, typically with private exporters
  - East Africa: Program mostly supports NGO-managed extension/training
    - ⋆ Weaker exporters: harder to guarantee reliability, traceability and enforce farm gate premium

    → Colombia as a model to aim for

Conclusions

Comprehensive analysis of a buyer-driven quality-upgrading program

1. Evidence suggests that the program
   - Incentivized (larger) farmers to invest and upgrade farm
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   - Takers welfare increased substantially, no negative spillover on non-takers
   - Farmers keep substantial share of surplus

Conclusions

Comprehensive analysis of a buyer-driven quality-upgrading program

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   - Incentivized (larger) farmers to invest and upgrade farm
   - Quantity, Quality and Prices increased
2. Welfare Evaluation
   - Takers welfare increased substantially, no negative spillover on non-takers
   - Farmers keep substantial share of surplus
3. Mechanisms
   - Both supply-side and demand-side component of the bundle are important
   - Contractual arrangements btw exporter and global buyer impact farmers welfare

Thank You!

Terrain conditions comparison across Veredas

	Not-Program Ver.		**Program Ver.**		T-test Difference
	N	Mean/SE	N	Mean/SE	(1)-(2)
Agro-climatically attainable yield 1961-90, kg DW/ha	410	1038.800 (22.018)	350	995.740 (22.580)	43.060
Altitude (mean), metres	410	1727.627 (27.244)	350	1902.465 (24.881)	-174.838***
Altitude (std), metres	410	157.524 (5.697)	350	185.562 (5.327)	-28.038***
Slope (mean), degrees	410	16.039 (0.359)	350	19.398 (0.249)	-3.360***
Slope (std), degrees	410	6.429 (0.111)	350	7.273 (0.105)	-0.843***
Terrain ruggedness index (mean)	410	76.315 (1.724)	350	91.700 (1.223)	-15.385***
Terrain ruggedness index (std)	410	27.281 (0.645)	350	31.405 (0.645)	-4.124***
Agro-climatically attainable yield 1961-90, kg DW/ha	286	1036.185 (21.875)	312	1070.715 (22.898)	-34.529
Altitude (mean), metres	306	1794.774 (31.394)	335	1874.720 (29.756)	-79.945*
Altitude (std), metres	299	154.820 (6.164)	342	171.118 (5.042)	-16.299**
Slope (mean), degrees	301	16.541 (0.408)	340	18.300 (0.285)	-1.759***
Slope (std), degrees	302	6.444 (0.119)	339	7.009 (0.101)	-0.565***
Terrain ruggedness index (mean)	299	77.883 (1.894)	342	86.955 (1.380)	-9.072***
Terrain ruggedness index (std)	301	26.796 (0.628)	340	30.072 (0.602)	-3.276***

Municipalities comparison

	(1) *Non-program*		(2) *Program*		*T-test*
	N	Mean/SE	N	Mean/SE	(1)-(2)
Official Area (Km^2)	36	455.250	33	374.788	80.462
		(89.469)		(63.005)	
Altitude	36	1747.139	33	1683.727	63.412
		(124.334)		(112.956)	
Distance to district capital	36	53.229	33	53.062	0.167
		(4.365)		(3.585)	
Rurality Index (Rural/ Total Population)	36	0.750	33	0.767	-0.017
		(0.031)		(0.029)	
Poverty Index (SISBEN)	36	93.295	32	97.587	-4.292
		(2.721)		(0.430)	
Land Gini Index	36	0.769	32	0.739	0.029
		(0.015)		(0.013)	
Land Gini Index (Ownership)	36	0.754	32	0.716	0.037**
		(0.013)		(0.009)	
Literacy rate in 2005	36	84.589	32	85.435	-0.847
		(1.842)		(0.794)	
Index of soil agricultural suitability	35	2.895	32	2.393	0.502
		(0.277)		(0.176)	
Coffee cultivation 1997 (thsds. hectares)	32	1.484	29	1.181	0.303
		(0.307)		(0.155)	
Presence of coca cultivation	36	0.944	33	0.879	0.066
		(0.222)		(0.212)	
Presence indigenous population (1535-1540)	36	0.361	33	0.758	-0.396***
		(0.081)		(0.076)	
Spanish ocupied land (1510 - 1561)	36	0.361	33	0.273	0.088
		(0.081)		(0.079)	
Presence of land conflics (1901 - 1917)	36	0.056	33	0.061	-0.005
		(0.039)		(0.042)	
Presence of land conflicts (1918 - 1931)	36	0.083	33	0.121	-0.038
		(0.047)		(0.058)	
Violence 1948 to 1953	36	0.139	33	0.061	0.078
		(0.058)		(0.042)	
Presence of ELN	36	0.194	33	0.152	0.043
		(0.078)		(0.063)	
Presence of FARC	36	1.167	33	0.424	0.742***
		(0.146)		(0.115)	
Guerrilla Massacres	32	0.125	29	0.069	0.056
		(0.059)		(0.048)	
Paramilitary Massacres	32	0.875	29	0.172	0.703**
		(0.317)		(0.100)	

Plot outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	plot score - Program mun.		plot score - Program veredas		plot score - Heterogeneity	
	OLS	ITT	OLS	ITT	ITT Good	ITT Other
Program plot	0.1699***		0.1700***			
	(0.010)		(0.009)			
Program vereda		0.0608**		0.0277**	0.1434***	0.0098
		(0.026)		(0.011)	(0.023)	(0.012)
Observations	737,405	737,405	719,105	719,105	172,834	546,271
Number plots	93,885	93,885	91,367	91,367	32,271	59,096
Plot FE	Yes	Yes	Yes	Yes	Yes	Yes
Mun-Year FE	Yes	Yes	–	–	–	–
Year FE	–	–	Yes	Yes	Yes	Yes

Robust standard errors (cluster vereda) in parentheses. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15 Time period is 2006 to 2016. Unit of observation is plot-year.

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Plot expansion

	(1)	(2)	(3)	(4)	(5)	(6)
	In planted area			**Plot exit**		
Program plot (takers)	0.0695***		0.0875***	-0.0549***		-0.0688***
	(0.004)		(0.007)	(0.002)		(0.006)
Will be takers			0.0392***			-0.0497***
			(0.007)			(0.006)
Never takers eligible			0.0040			0.0107*
			(0.006)			(0.006)
Program vereda		0.0180***			-0.0061	
		(0.007)			(0.006)	
Observations	737,405	737,405	737,405	737,405	737,405	737,405
Number of plots	93,885	93,885	93,885	93,885	93,885	93,885
Plot and Mun-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors (cluster vereda) in parentheses. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15 Time period is 2006 to 2016. Unit of observation is plot-year.

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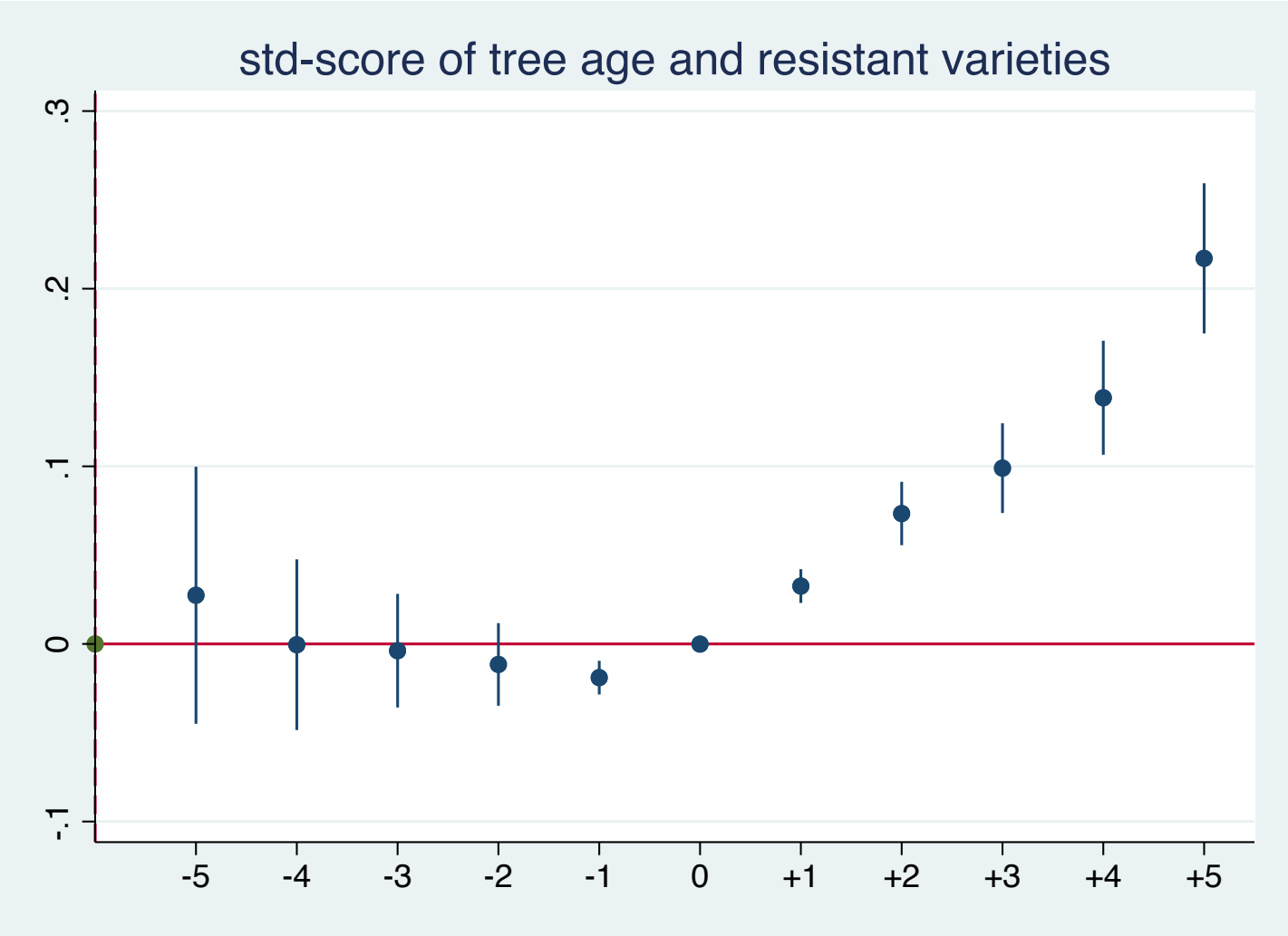
Parallel trends Plot Index



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Plot analysis at Vereda level

	(1) ln Coffee area	(2) Plot exit	(3) Number farmers	(4) Number plots
Program vereda	0.0911***	-0.0169***	3.0003***	3.5383***
	(0.023)	(0.005)	(0.630)	(0.826)
Observations	21,538	21,538	21,538	21,538
Number of veredas	2,086	2,086	2,086	2,086
Vereda FE	Yes	Yes	Yes	Yes
Mun-Year FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses (cluster municipality). *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Time period is 2006 to 2016. Unit of observation is vereda-year. The variable "program vereda" takes value 1 after the vereda becomes eligible by the program.

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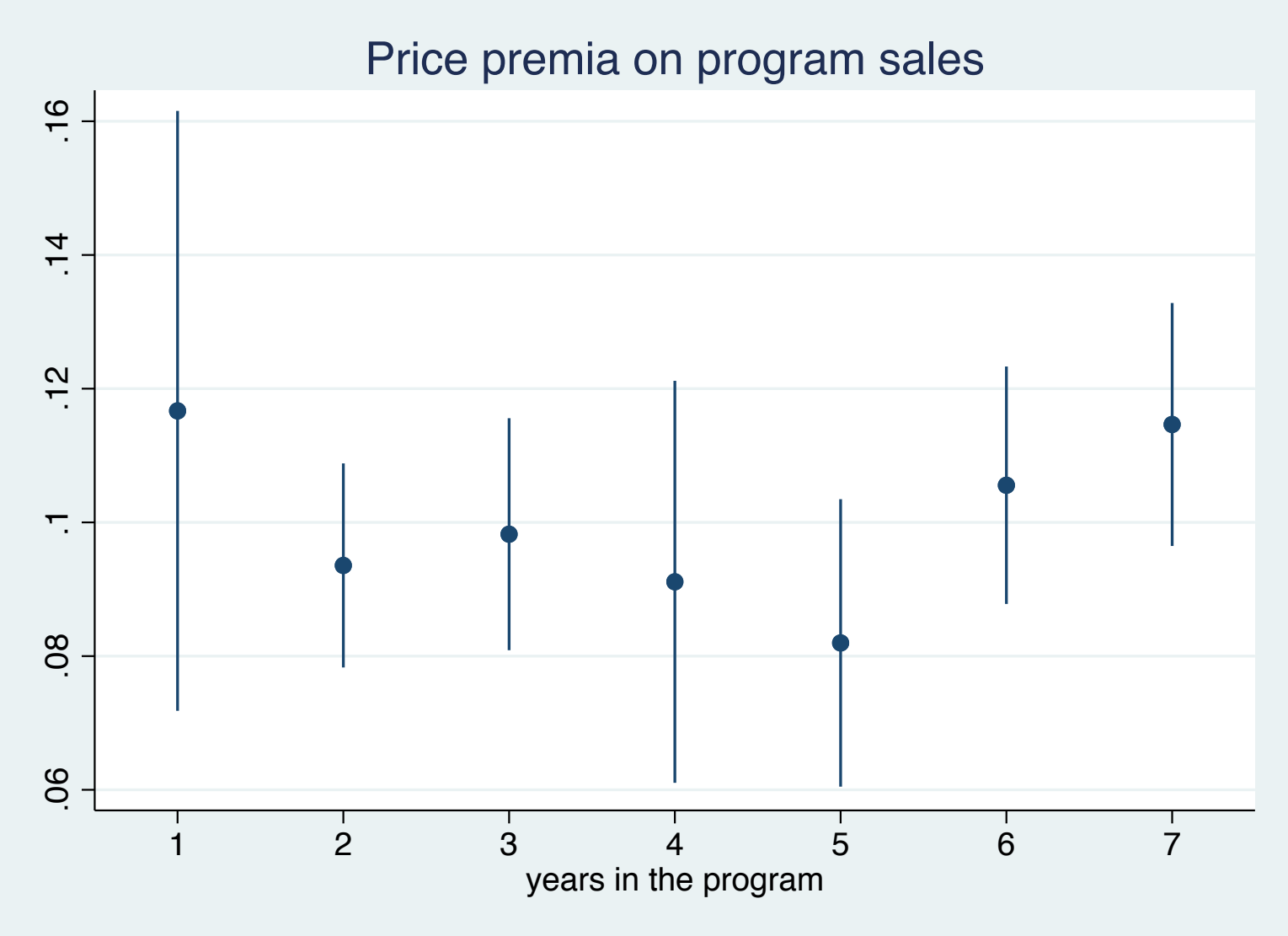
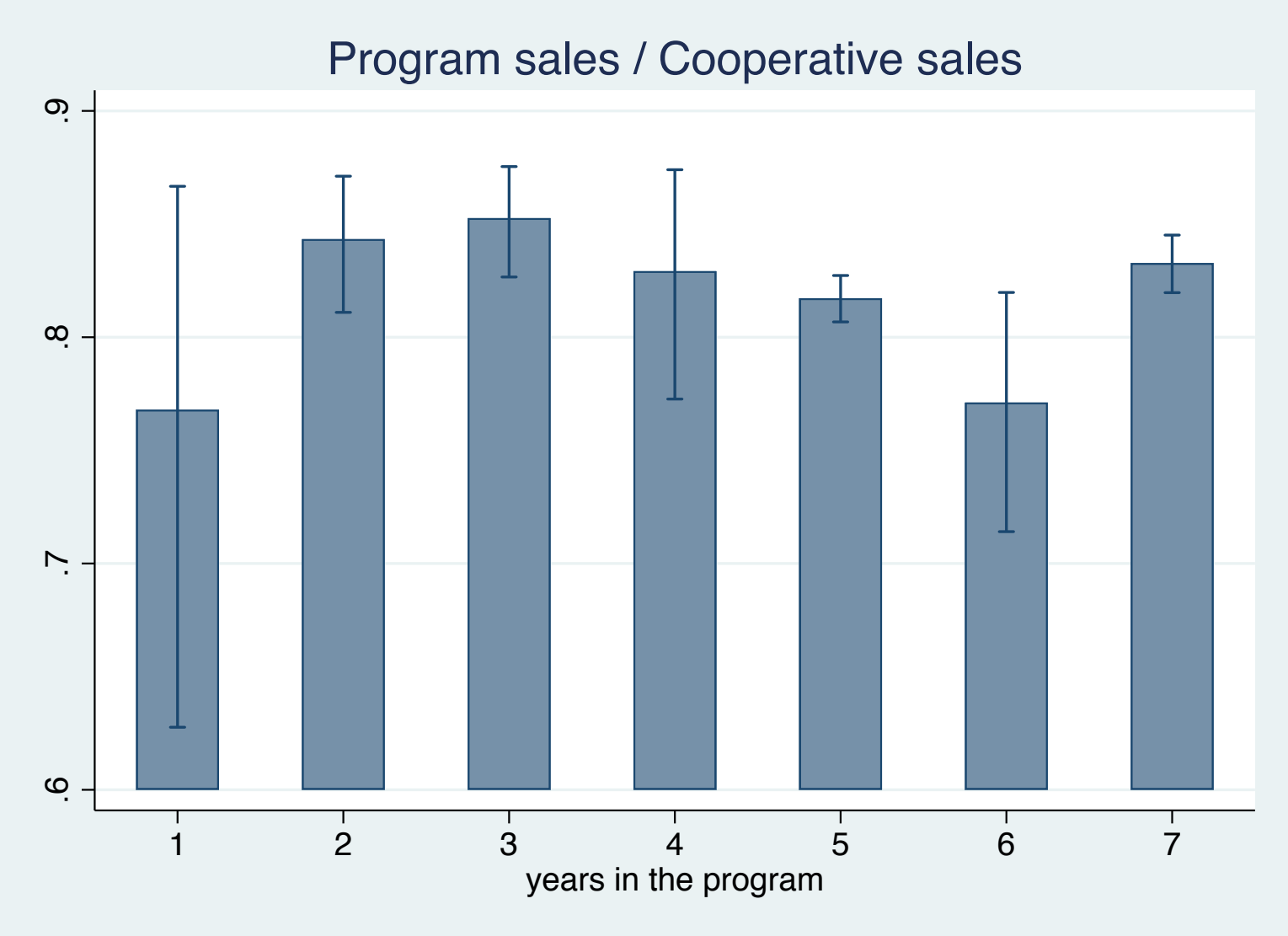
Program price premium – by farmer program tenure



Share sold to program – by farmer program tenure



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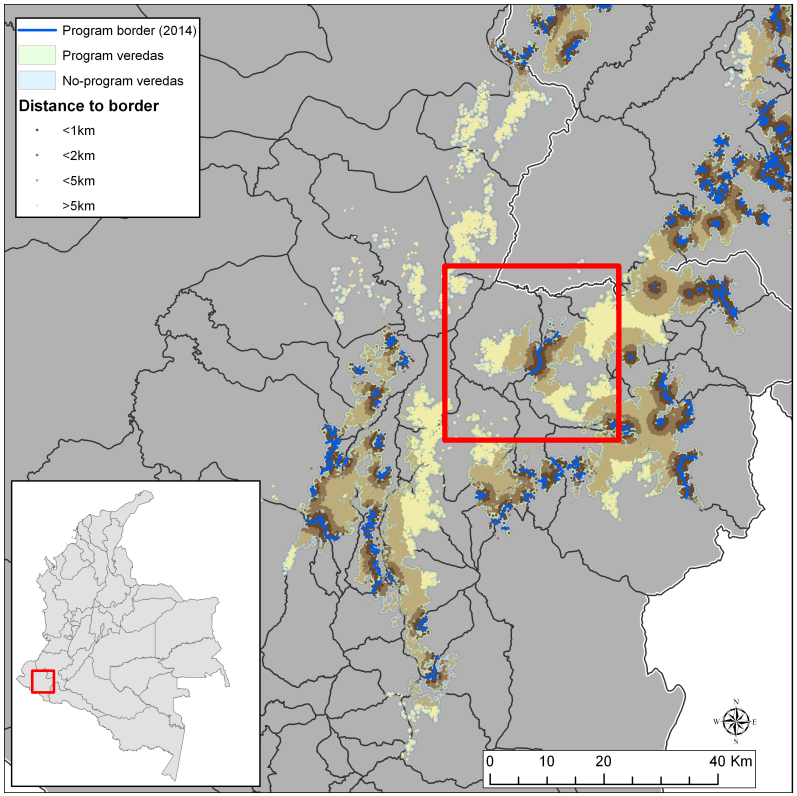
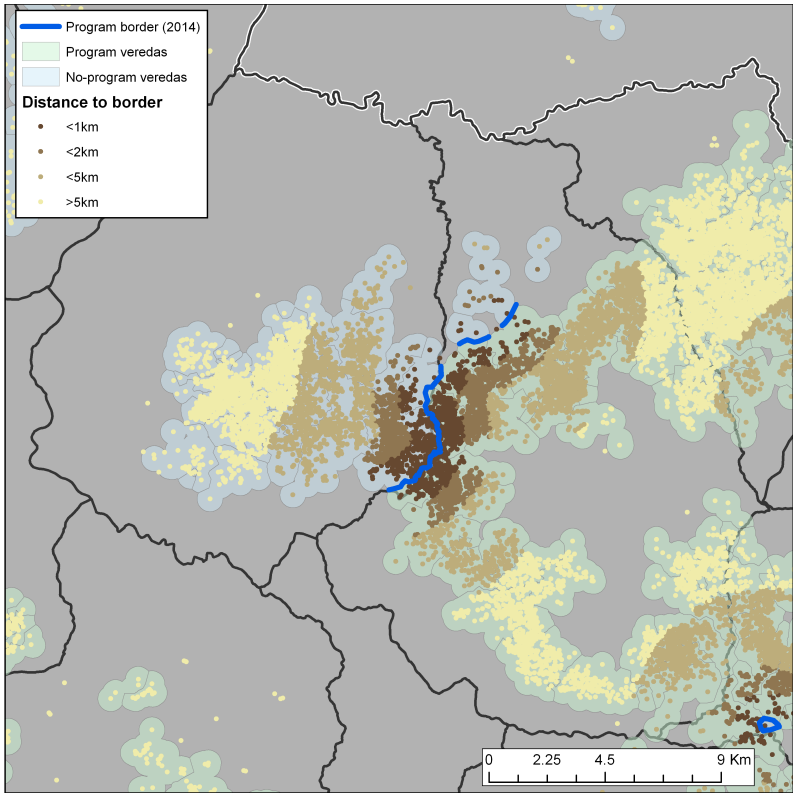
RDD - Borders map





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RDD - Farmer comparison

	(1) In total area	(2) % shade	(3) Number of plots	(4) Plot ownership	(5) Altitude	(6) Longitude	(7) Latitude
Program vereda	0.0808*	0.0121	0.0198	0.0204	17.7989	205.5652	39.0170
	(0.047)	(0.015)	(0.049)	(0.024)	(14.248)	(151.962)	(170.989)
Observations	5,770	5,770	5,770	5,770	5,770	5,770	5,770
R^2	0.178	0.166	0.128	0.208	0.750	0.996	0.995
Border FE, 1k border	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors (cluster municipality) in parentheses *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Unit of observation is a farmer.

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Farmer spillovers

	(1) ln price (all)	(2) ln price (coop)	(3) ln price (other buyers)	(4) Sells to Coop	(5) Sells to other	(6) Share sold to coop	(7) land	(8) density	(9) age
Program farmer	0.0306***	0.0383***	-0.0092	0.2389***	-0.0902+	0.2200***	0.6643***	333.6023***	-3.7587***
	(0.005)	(0.007)	(0.007)	(0.060)	(0.058)	(0.055)	(0.106)	(103.725)	(1.437)
Will enter program	-0.0067	0.0040	-0.0141	0.0434	-0.0201	0.0665	0.3832***	272.4185**	-4.1674***
	(0.007)	(0.010)	(0.009)	(0.064)	(0.062)	(0.058)	(0.119)	(113.760)	(1.475)
Eligible not in program	-0.0052	0.0039	-0.0106	0.0602	-0.0127	0.0616	0.0350	257.3459**	-0.6891
	(0.005)	(0.007)	(0.007)	(0.060)	(0.057)	(0.054)	(0.105)	(102.263)	(1.429)
Observations	5,211	4,375	2,303	5,211	5,211	5,211	5,209	5,211	5,211
R^2	0.266	0.201	0.222	0.208	0.213	0.279	0.197	0.112	0.197
Border FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Border Distance	yes	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses, cluster locality.*** p<0.01, ** p<0.05, * p<0.1, + p<0.15

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Farmer spillovers - Vereda level

	(1) ln price (all)	(2) ln price (coop)	(3) ln price (private)	(4) Share coop.	(5) Number other buyers
Program vereda	0.0242***	0.0261***	0.0071**	0.1290***	-0.0013
	(0.003)	(0.005)	(0.003)	(0.033)	(0.033)
Observations	2,217	2,170	1,979	2,217	1,982
R^2	0.534	0.376	0.300	0.372	0.367
Municipality FE	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors (cluster municipality) in parentheses *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Unit of observation is a vereda.

Back

Participation in FNC programs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Individual program		**Technical program**		**Credit program**		**ID program**	
Program farmer	0.0284***		-0.0364***		0.0043		-0.0872***	
	(0.003)		(0.004)		(0.006)		(0.002)	
Program vereda		-0.0002		0.0026		0.0148		-0.0058
		(0.007)		(0.005)		(0.009)		(0.004)
Mean dep. var.	0.9482		0.9391		0.6163		0.9241	
Observations	632,270	632,270	632,270	632,270	632,270	632,270	632,270	632,270
Number of Farmers	115,767	115,767	115,767	115,767	115,767	115,767	115,767	115,767
Farmer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mun-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses (cluster vereda) *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Unit of observation farmer-year, time period 2007-2012.
Dependent variable is a dummy that takes value 1 if the farmer participated in a program in a given year. The *"Individual program"* dummy takes value 1 when the farmer had a one-to-one activity with the extension services. *"ID program"* refers to the FNC program to ensure all farmers had an ID that allowed them to do monetary transactions with the cooperative and keep track of the programs they are involved and their benefits.

Back

Along the chain - Export prices

→ Program batches receive higher prices at port:

	(1)	(2)	(3)	(4)
		ln price per Kg. - excelso		
Program batch	0.1917***	0.1987***	0.1076***	0.0886***
	(0.020)	(0.024)	(0.029)	(0.028)
Regions	All	Program	Program	Program
Product	All	All	High gran.	High gran.
Quality controls	No	No	No	Yes
Observations	53,675	13,705	4,001	4,001
R^2	0.905	0.908	0.905	0.915
Contract conditions	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Origin - Year FE	Yes	Yes	Yes	Yes
Contract conditions	Yes	Yes	Yes	Yes

Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1, + p<0.15

→ No evidence of double-marginalization at the mill ▸ Prices at mill

▸ Back

Price premium at the processing stage

	(1)	(2)	(3)	(4)	(5)
			ln price per Kg. - pergamino		
Program batch	0.0629***	0.0460***	0.0463***	0.0452***	0.0383***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)
Sample	All	Non-standard	N-S. Region	N-S. R. coop	N-S. R. coop
Quality control	No	No	No	No	Yes
Observations	213,252	122,481	44,808	27,455	26,238
R^2	0.929	0.938	0.950	0.933	0.944
Quantity control	Yes	Yes	Yes	Yes	Yes
Punto de compra - Year FE	Yes	Yes	Yes	Yes	Yes
Mill FE	Yes	Yes	Yes	Yes	Yes
Coop FE	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses (cluster Location-year). *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Unit of observation is a transaction, a coffee batch entering the mill. *Non-standard* coffee are all transactions where the product is not denoted as standard. Region refers to the districts where the program is implemented. Quality controls include bean characteristics and taza tests. The *quality index* is the z-score of grams of healthy beans in sample and the negative of the grams of beans with broca and qualifying as pasilla (subproduct) in sample. Index time span is 2009-2014, and sample is restricted to this time period for Columns (4) and (5).

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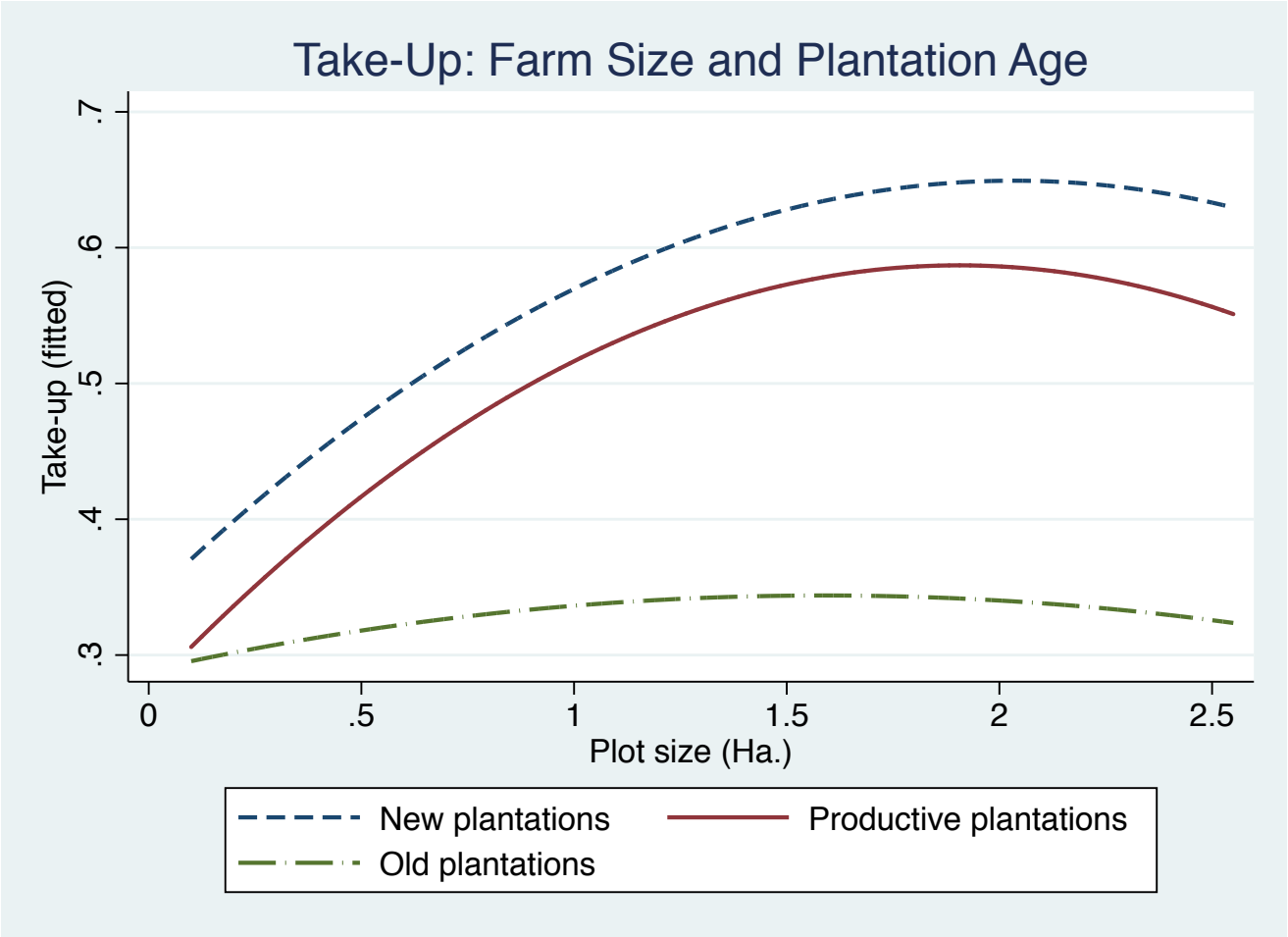
Estimating Fixed costs

F_i: Log-Normal $\mu_{im} = \alpha_m + \theta_{a_i}(q_i)^2$ and σ

- ML estimation from Take-Up decision
  - Heterogeneity by Municipality m (Go)
  - Take-up, size and plantation age (Go)
- From estimates $\rightarrow$ Simulated Fixed Costs to numerically solve model (and run conunterfactuals)
  - Simulated Fixed Costs
  - Model fit (Go)

back

Take-up heterogeneity - Age and size



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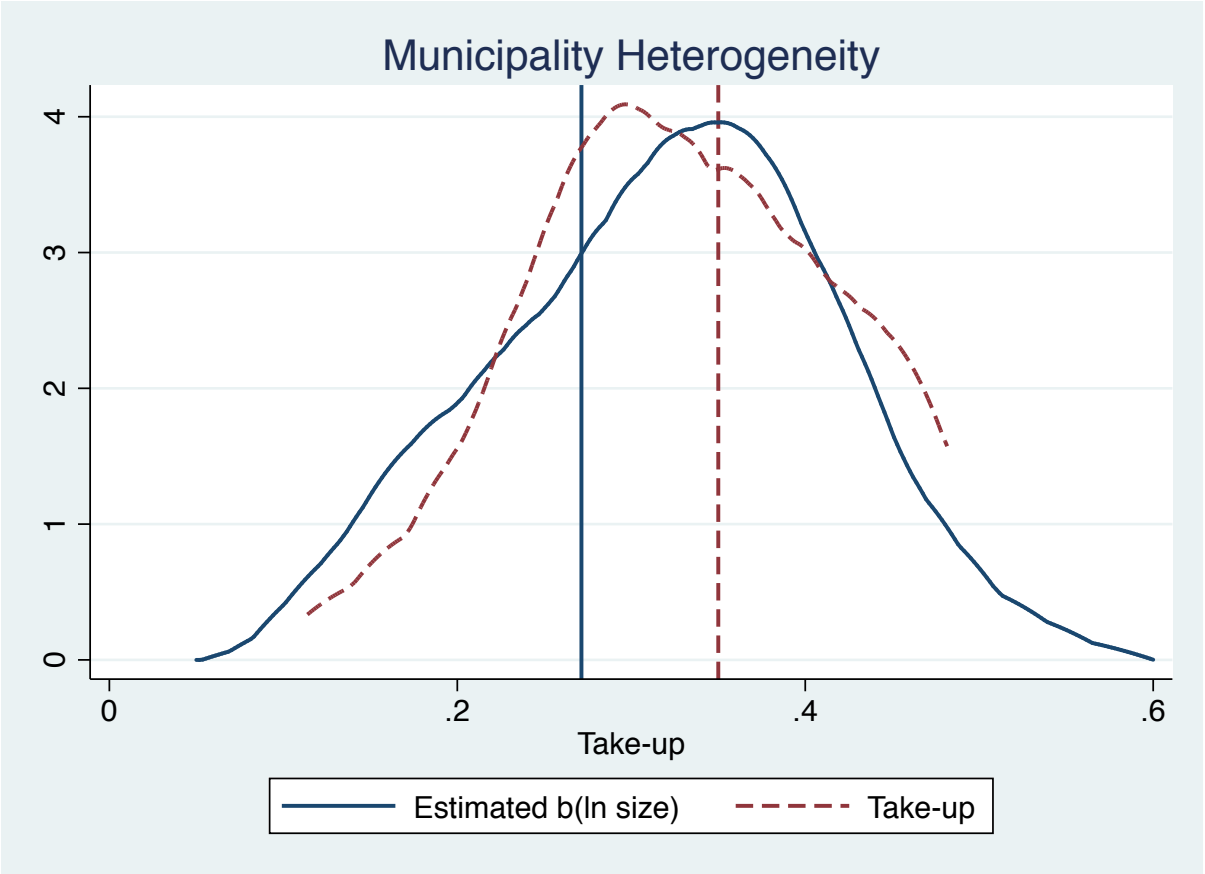
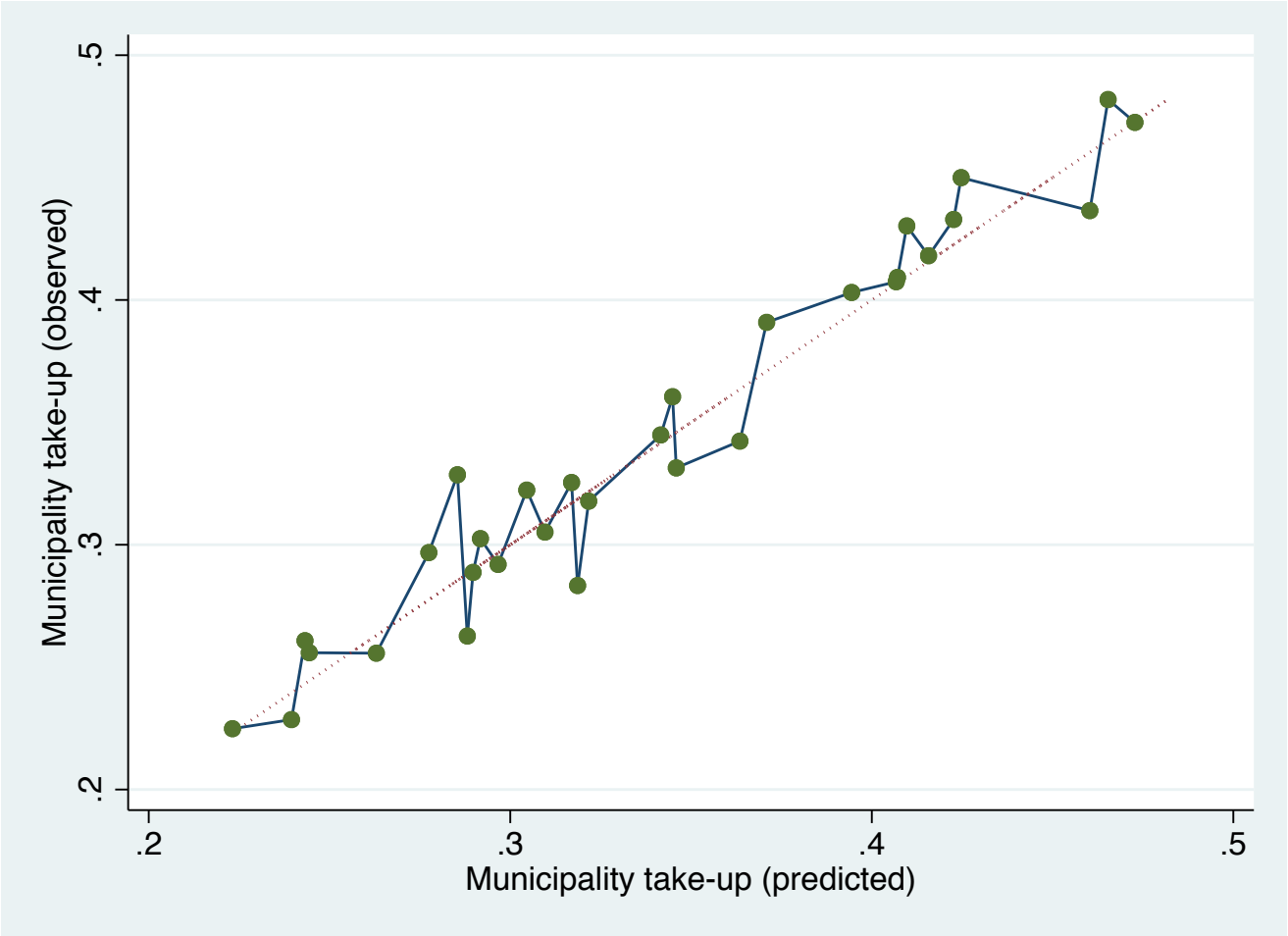
Take-up heterogeneity - Municipality



The figure reports the distribution of take-up rates across municipalities and the municipality specific estimated β_{land} in the regression Take up$_{pm} = \alpha + \beta_{land} * \text{Land Size}_{pm} + \beta_{age} * \text{Age}_{pm} + \epsilon_{pm}$ for each program municipality.

▸ back ▸ back

Model fit: Municipality



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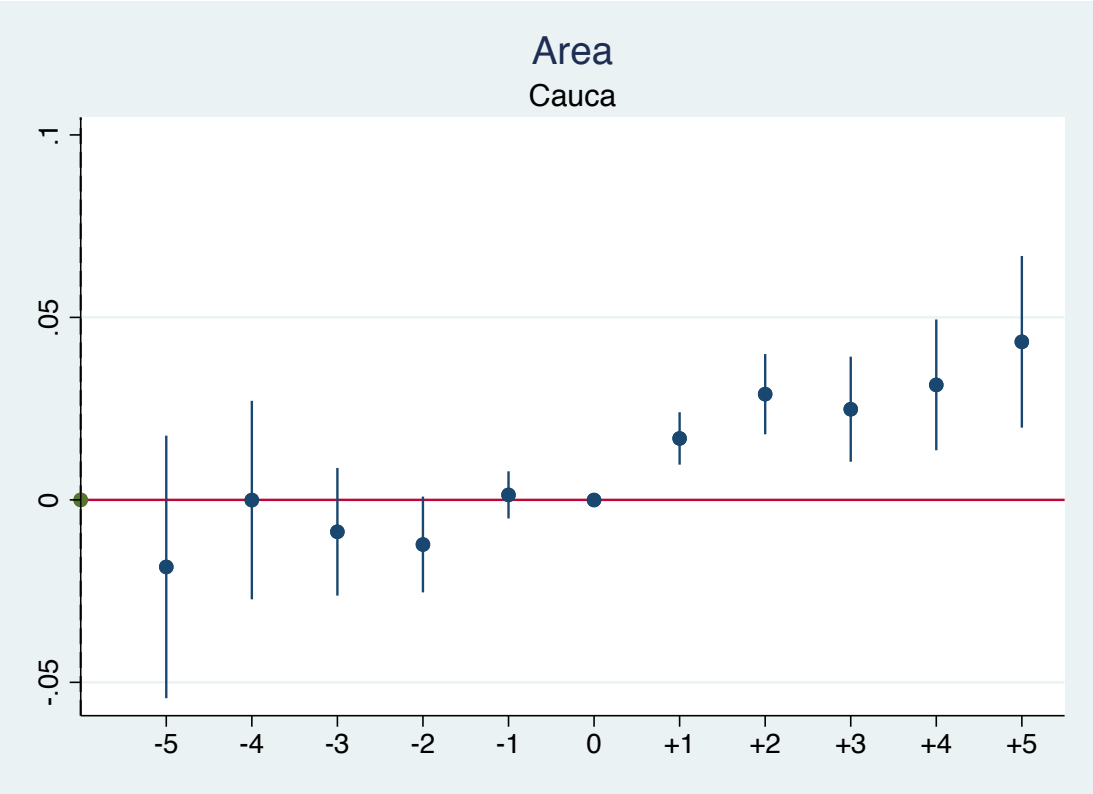
Plot Expansion

- Dependent variable: ln of plot area planted with coffee



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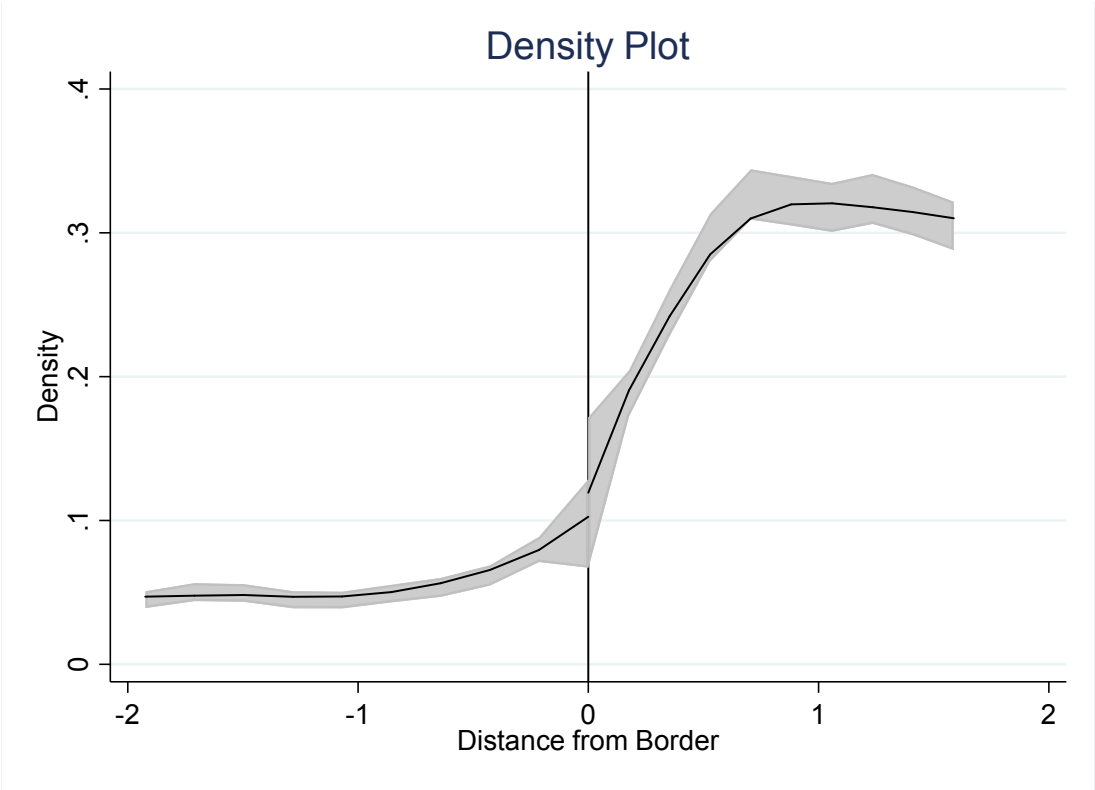
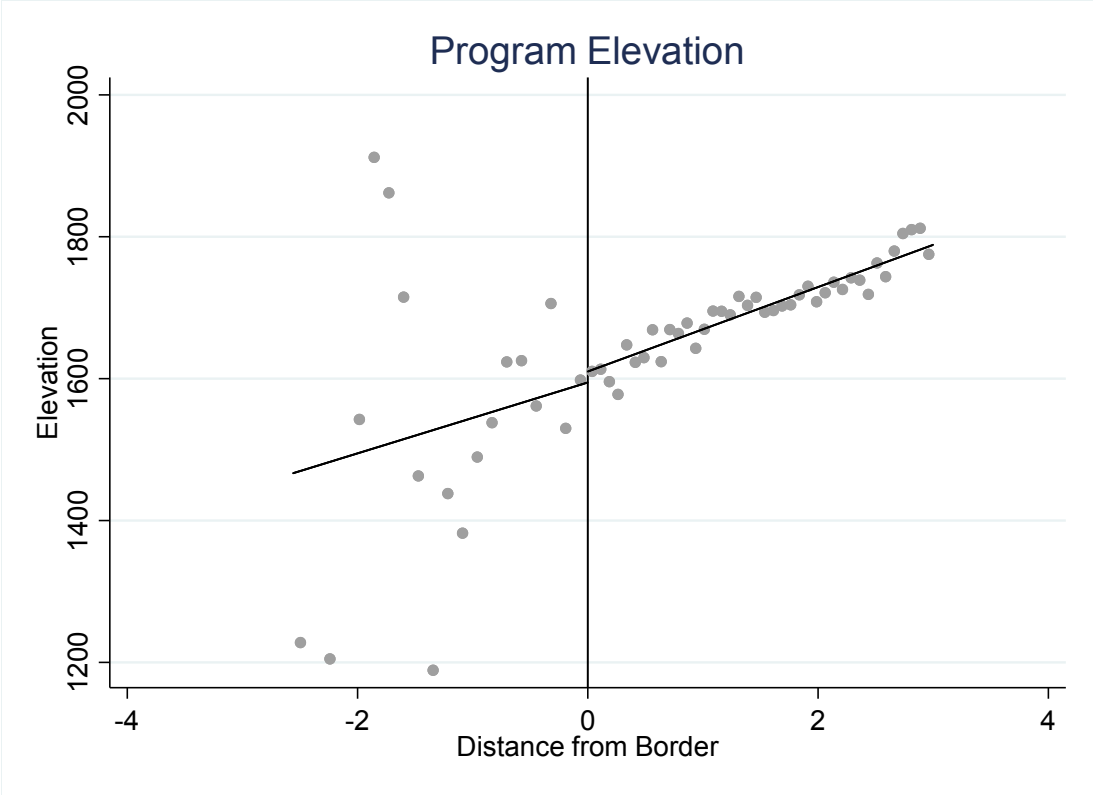
RDD: Continuous Density



	Epanechnikov (p=2)	Epanechnikov (p=1)	Epanechnikov (p=3)	Uniform (p=2)	Triangular (p=2)
P-value	0.49	0.84	0.80	0.97	0.29

Back

RDD: Continuous Density



	Epanechnikov	Uniform	Triangular
β	20.146	33.098	10.72
P-value	0.76	0.644	0.873

Back

RDD: Plot Upgrading

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Land with Coffee			**Plot density**			**Average tree age**		
	(OLS)	(ITT)	(IV)	(OLS)	(ITT)	(IV)	(OLS)	(ITT)	(IV)
Program Farmer	0.5840***		0.7017***	81.3034***		664.0923***	-2.6267***		-4.5678**
	(0.031)		(0.264)	(29.715)		(256.551)	(0.283)		(1.937)
Program Vereda		0.3068***			290.5656***			-1.9986	
		(0.106)			(101.782)			(1.405)	
Observations	5,209	5,209	5,209	5,211	5,211	5,211	5,211	5,211	5,211
R^2	0.192	0.129	0.189	0.111	0.111	0.031	0.188	0.164	0.174
Border FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border Distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, cluster location. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

(▸ Back)

RDD: Sales Patterns

- ▷ Farmers more likely to sell to coop – and less to other buyers
- ▷ ... and sell bigger share of their produce to the cooperative

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Sells to coop			Sells to other buyers			Share sold to Cooperative		
	(OLS)	(ITT)	(IV)	(OLS)	(ITT)	(IV)	(OLS)	(ITT)	(IV)
Program Farmer	0.1826***		0.3167***	-0.0769***		-0.1063	0.1595***		0.2990***
	(0.016)		(0.089)	(0.016)		(0.118)	(0.015)		(0.092)
Program Vereda		0.1386**			-0.0465			0.1308**	
		(0.058)			(0.057)			(0.053)	
Observations	5,211	5,211	5,211	5,211	5,211	5,211	5,211	5,211	5,211
R^2	0.207	0.153	0.177	0.213	0.208	0.212	0.279	0.245	0.251
Border FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border Distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, cluster location. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

(▸ Back)

Program Price Premium

Strategy: Program sales (2015-2016) for one of the Cooperatives implementing the program

$$ln(P_{fsoy}) = \beta_0 + \beta_1 \times P_{sfy} + \gamma_{oy} + \gamma_f + \varepsilon_{fsmy}$$

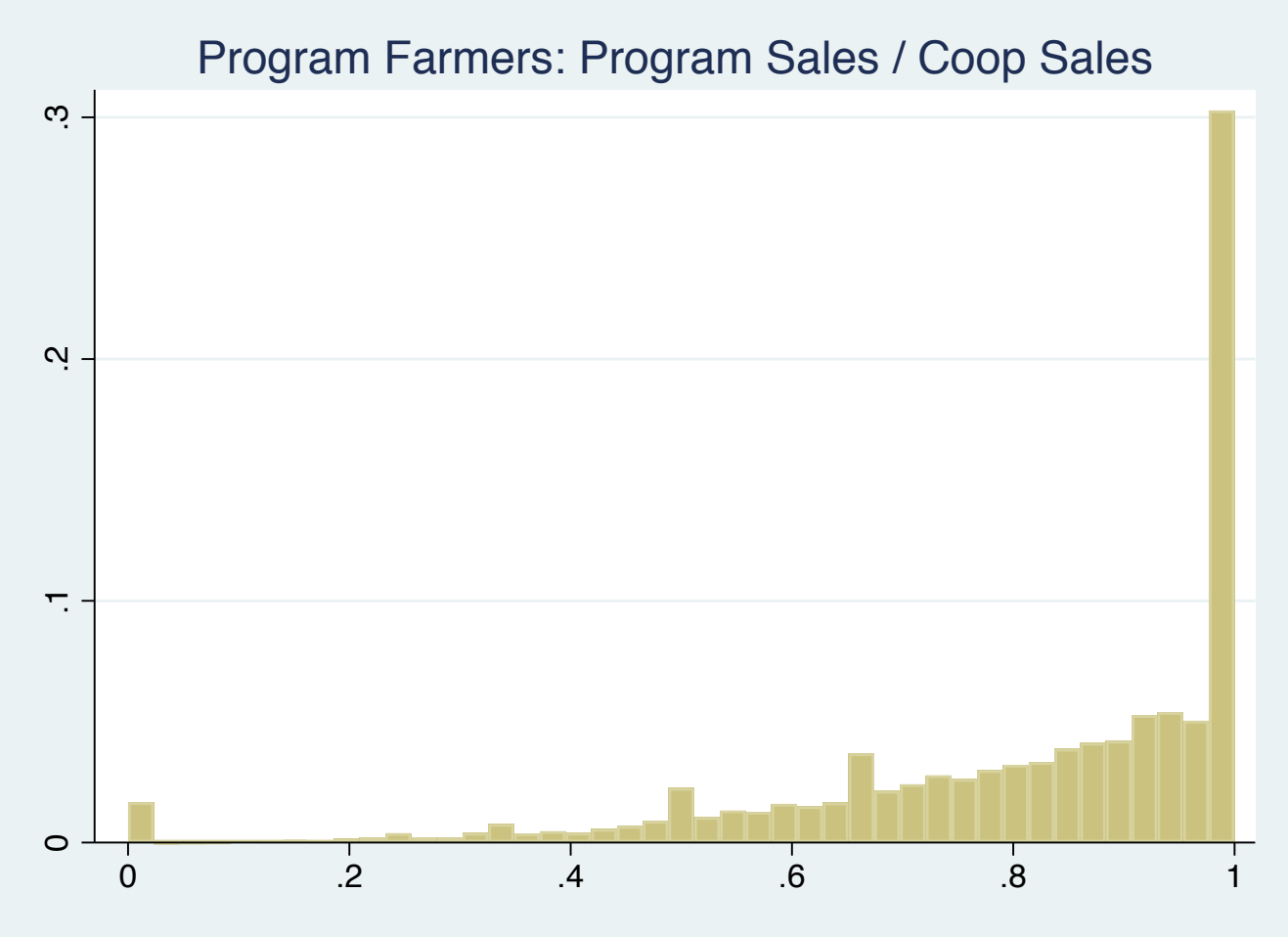
: farmer f, program s, buying point (origin) o in season y

	(1)	(2)	(3)	(4)
	ln price per kg.			
Program sales	0.0968***	0.0960***	0.0962***	0.0591**
	(0.008)	(0.009)	(0.012)	(0.023)
Sale types included	All	All	All	Non-standard
Observations	28,323	28,323	28,323	22,969
Location-Year FE	Yes	Yes	Yes	Yes
Farmer FE	No	Yes	–	–
Farmer-Year FE	–	–	Yes	Yes

▸ Tenure in the program ▸ Back

(No) Hold-Up

- Program buys around 80% of the program farmers deliveries to the program implementer.



▸ Tenure in the program ▸ Back

Program Sourcing at the **Farm**'s Gate

- Program farmers sell program batches to local FNC-Affiliated Cooperative
- Permanent buying points in all locations
- Premium: COP 40/kg ($\simeq$ 10% over daily FNC price for standard quality)

Standard coffee

Program Premium

(Back)

RDD: Production and Upgrading

Table: **Other Outcomes: Production and Upgrading**

	(1)	(2)	(3)	(4)	(5)
	Quantity Produced (log)			**Plot Upgrade Index**	**ln Land Under Coffee**
Program Farmer	0.6205***				
	(0.054)				
Program Vereda		0.1358***		0.1060**	0.0494**
		(0.048)		(0.043)	(0.023)
Expand			0.3831***		
			(0.089)		
Renew			0.1337+		
			(0.085)		
Observations	5,829	5,829	790	8157	8157
Farmer controls	Yes	Yes	Yes	N.A.	N.A.
Border FE	Yes	Yes	No	Yes	Yes
Border Distance	1Km	1Km	N.A.	1Km	1Km
Vereda FE	N.A.	N.A	Yes	N.A	N.A
Takers only	N.A.	N.A.	Yes	N.A.	N.A.

(▸ Back)

Calibration: Robustness

	Baseline	**ROBUSTNESS**							
	γ=0.167, c=0.68, τ=1.4, pw=3.75	γ=0.20	γ=0.225	c=0.75	c=1.02	τ=1.5	τ=1.6	pw=3.25	pw=4.25
λ (estimated)	0.695	0.705	0.71	0.71	0.745	0.725	0.765	0.71	0.685
α (estimated)	21%	23%	24%	22%	24%	22%	22%	22%	22%
π (observed)	10%	10%	10%	10%	10%	10%	10%	10%	10%
% Quality	59%	59%	59%	59%	59%	59%	59%	59%	59%
Take-Up (T=1)	41%	41%	41%	41%	41%	41%	41%	41%	41%
$\triangle$ Farmers T=1	17%	16%	15%	17%	16%	17%	17%	17%	18%
$\triangle$ Farmers W	19%	18%	18%	18%	18%	18%	18%	18%	18%
$\triangle$ Chain Surplus	33%	33%	33%	33%	36%	35%	37%	34%	32%
% Surplus Farmers	56%	56%	56%	55%	52%	53%	50%	55%	57%

(▸ Back)

Full Table

Panel A: Calibration & Counterfactuals

	Baseline Estimates	**Counterfactuals**								
		Supply Side			*Demand Side*			*Market Structure*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Parameters		ω=0	α=0	ω=0 α=0	λ=1	η=0.1	λ=1 & η=0.1	Monopsonist	Monopsonist + Enforceable Contracts	Competitive Market
λ (estimated)	**0.695** [0.685,0.705]	0.695	0.695	0.695	1	0.695	1	1	1	0
α (estimated)	**0.21** [0.185,0.215]	0.21	0	0	0.21	0.21	0.21	0	0	0
ω (observed)	25%*	0%	25%	0%	25%	25%	25%	0%	0%	0%
η (observed)	19%*	19%	19%	19%	19%	10%	10%	10%	10%	10%
Outcomes										
π (observed)	10%*	14%	13.5%	16%	4.5^{+}%	4.5^{+}%	4.5^{+}%	4.5^{+}%	0.5%	14%
% Quality	**59%**	35%	38%	17%	49%	48%	48%	9%	7%	15%
Take-Up (T=1)	41%	28%	28%	16%	34%	34%	34%	11%	9%	15%
△ Farmers Π T=1	17%	12%	32%	23%	14%	14%	14%	17%	16%	21%
△ Farmers W	19%	9%	9%	4%	13%	13%	13%	2%	1.5%	4%
△ Chain Surplus	**33%**	15%	17%	6%	29%	20%	20%	3%	2.5%	4%
% Surplus Farmers	**56%**	61%	53%	62%	46%	66%	66%	62%	54%	100%

Panel B: Fit

	Take-Up (P = 1)	**% in D | (P = 1)**			**% in D | (P = 0)**		
		Nothing	Upgrade	Expand & Upgrade	Nothing	Upgrade	Expand & Upgrade
Data	39%	36%	42%	21%	63%	24%	13%
Model	41%	32%	45%	23%	64%	23%	13%

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Reduced Form: Quality Response

Dependent variable: Batch quality index				
	(1) (OLS)	(2) (OLS)	(3) (ITT)	(4) (ITT sorting)
Program batch	0.4218***	0.4045***		
	(0.046)	(0.050)		
Program origin			0.2230***	0.1765***
			(0.049)	(0.055)
Sample	All	All	All	non-program
Observations	123,089	123,089	123,089	108,135
R^2	0.469	0.650	0.360	0.348
Origin - Month- Year FE	No	Yes	No	No
Origin - Year FE	Yes	– –	No	No
Origin - Month FE	Yes	– –	Yes	Yes
Year-Month FE	Yes	– –	Yes	Yes

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