Impact of market information on cashew producers in Guinea-Bissau

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Applied Micro Workshop — Mock Job Presentation

November 16th, 2022

Motivation

Primary commodity **prices fluctuate** substantially over time.

- Fluctuations impact many African economies that export them, and often little else.
- In the case of Guinea-Bissau, cashew nuts alone make up 90% of total exports.

Often **producers are less informed** than buyers about market conditions.

- Market information can reduce price uncertainty:
  $\rightarrow$ increasing producers' bargaining power and prices.
- But competition could erode margins for information alone to change prices.

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Of cashews and cash

Nut factories have made a cracking comeback

But farmers are being squeezed

Print edition | Middle East and Africa

Sep 12th 2019 | NAMPULA

Does reducing price uncertainty change producers' sales decisions and prices?

Implement a new market information system in Guinea-Bissau

- Delivering **weekly** information via mobile phones (**voice and text**) to producers.
- Providing news, **prices**, and commercialisation **advice** about raw cashew nuts
- Over **two years** (2020 and 2021) during the trading season.

Method: **two-level cluster randomised trial** across 290 villages, estimating direct and spillover effects (within and across clusters).

Data: 3 rounds of surveys detailing transactions of ∼1900 producers; transaction diaries; administrative data on usage.

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Preview of results: Treated producers sell...

...**at higher prices** relative to control producers, (though only in the second year).

...**more frequently** relative to the control and spillover group, across both years.

...**[illegible]** relative to control producers, only in year 1.

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Why not in 2020? → Between-clusters spillovers.
Why in 2021? → Negotiate better deals.

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...**farther** relative to control producers, across both years.

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Why? → To smooth income given liquidity constraints.

Contributions

Market information, via mobile phones, can change *sales location*
(Jensen, 2007; Aker, 2010; Aker and Mbiti, 2010; Casaburi et al., 2013; Allen, 2014)

Commercialisation decisions influenced by...

- credit/liquidity (Burke et al., 2019; Fink et al., 2020; Albuquerque et al., 2022)
- storage (Aggarwal et al., 2018; Kadjo et al., 2018)
- market power (Casaburi and Reed, 2022; Chatterjee, 2022)

→ we show that **price uncertainty** also affects **sales timing**.

Text-based price information on *domestically* traded commodities has...

- positive effects: (Svensson and Yanagizawa, 2009; Goyal, 2010; Nakasone et al., 2014; Hildebrandt et al., 2021)
- no/mixed effects: (Fafchamps and Minten, 2012; Courtois and Subervie, 2015; Mitra et al., 2018; Camacho and Conover, 2019; Falcao Bergquist et al., 2021)

→ we use **audio-based** messages on an **export commodity** (harder to predict).

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Outline

Motivation

Context and Intervention

Design

Results

Mechanisms

A context where timing matters

Price fluctuations are **exogenous**: Guinea-Bissau is a price-taker in the world market of raw cashew nuts, which make up 90% of its export revenue.

Price fluctuations across and within-seasons are **not well-communicated** to producers.

Sales timing matters: On average 2 offers received and one sale during the trading season (March to July). Difficult to store across seasons. ▸ Details

Spatial arbitrage matters less: Nearly 98% of sales take place in the village.

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A basic motivating framework

Producers have to decide **when and how much** of their stock to sell (in 2 periods).

They receive take-it-or-leave-it offers, which they **accept/reject based on their priors about prices** across periods.

Market information updates producers' **reservation prices** and expectations.

Predictions are ambiguous, depending on **expected price growth**. ▶ Formally

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One of the **best sources of information** on the cashew market worldwide: N'kalô service

N'kalô is a MIS providing information on agricultural markets in 13 countries.

Combines information collected by different market analysts focusing on the main producing countries.

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Content of the weekly messages

We communicate to producers one message per week, with:

- Synthesised and **simplified news** about the national cashew market.

  `Deliveries at the harbour delayed.`

- A **range of** the latest region-specific **farm-gate prices**.

- News about the international cashew market and **advice on whether it is a good time to sell**, based on a simple message describing the likely direction of prices.

Other examples

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- Synthesised and **simplified news** about the national cashew market.
- A **range of** the latest region-specific **farm-gate prices**.

  `Prices in Oio between 350-450 FCFA/kg, 375-450 FCFA/kg in Cacheu.`

- News about the international cashew market and **advice on whether it is a good time to sell**, based on a simple message describing the likely direction of prices.

Other examples

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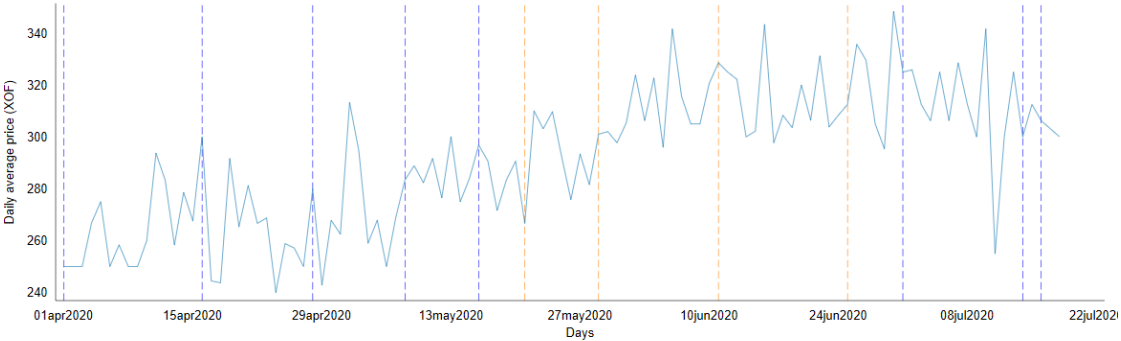
```
We advice to sell at least half of stocks if 400 FCFA /kg is offered,
all if 450 FCFA/kg is offered.
```

▸ Other examples

How reliable was the information?

Number of sales



Bearish message, advising to wait before selling

Bullish message, advising to sell

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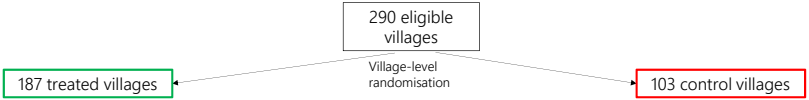
Study design and sample



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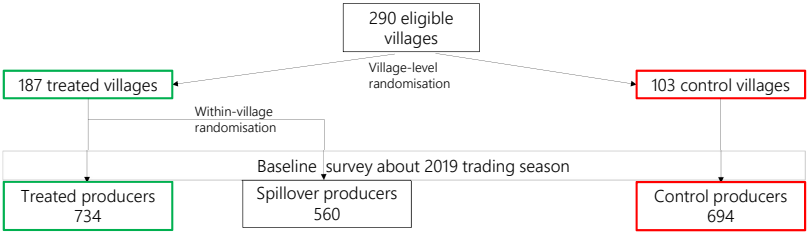

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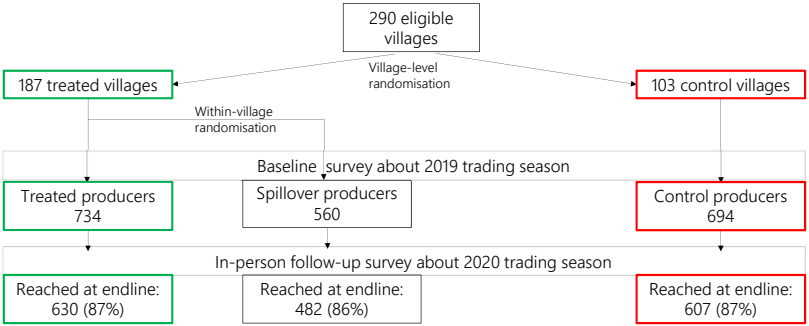

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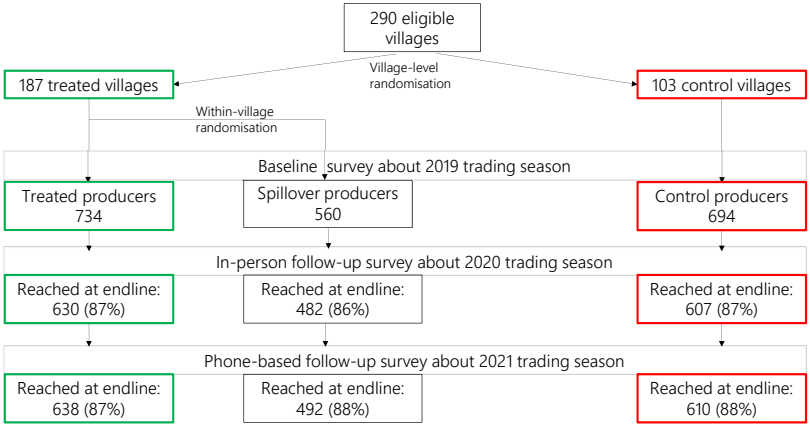

▸ Timeline ▸ Map of villages ▸ Randomisation ▸ Sampling ▸ Attrition and compliance ▸ Descriptives

Estimation

$$y_{iv} = \textit{treatment}_{iv} \cdot \beta + \textit{spillover}_{iv} \cdot \delta + y_{oiv} \cdot \gamma + \alpha_v + \epsilon_{iv} \tag{1}$$

- i and v index individuals, and villages, respectively,
- y_{iv} denotes the outcome of interest measured in the follow-up,
- y_{oiv} denotes the outcome of interest measured in the baseline,
- $\textit{treatment}_{iv}$ denotes individual-level assignment to the treatment group,
- $\textit{spillover}_{iv}$ denotes individual-level assignment to the spillover group in treated villages,
- α_v denotes the randomisation triplet fixed effect,
- ϵ_{iv} is the unobserved variation in the outcome. Errors are clustered at the village-level, the unit of the first randomisation.

https://www.socialscienceregistry.org/trials/4740

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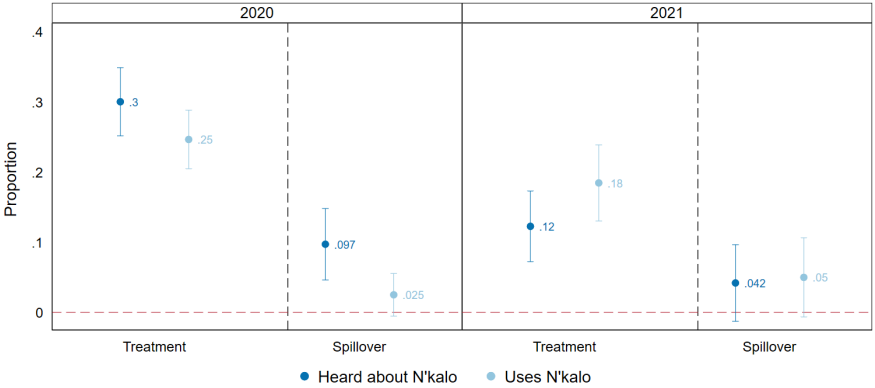
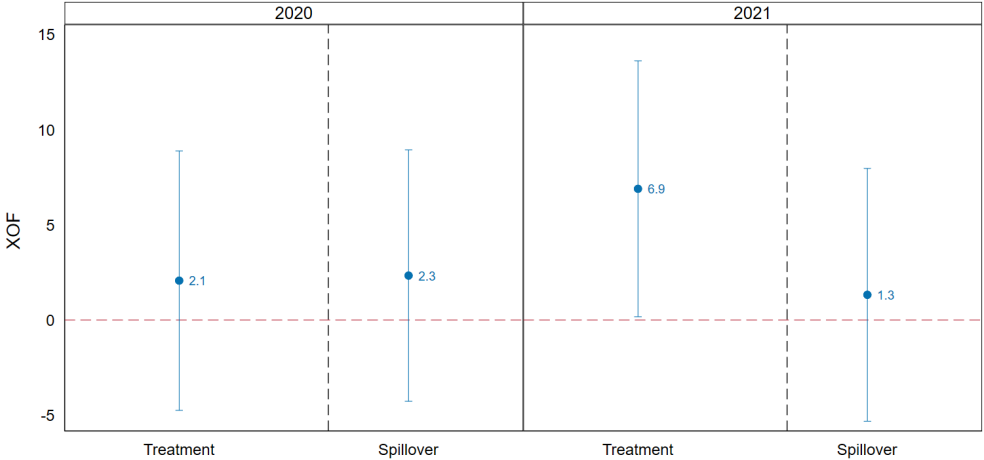
Treated producers engage more with the service



95% confidence intervals displayed
Control mean for: heard about n'kalo is .14 in 2020 and .68 in 2021
Control mean for: uses n'kalo is .02 in 2020 and .43 in 2021

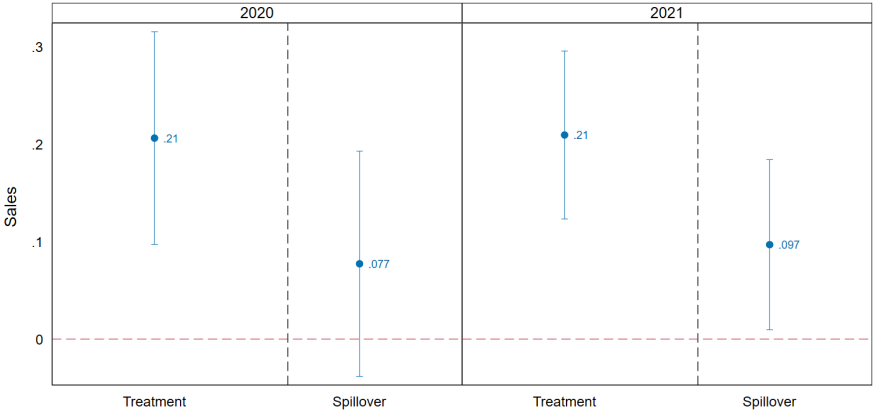
▸ Type of advice

1. Prices increase for treated producers in the second season



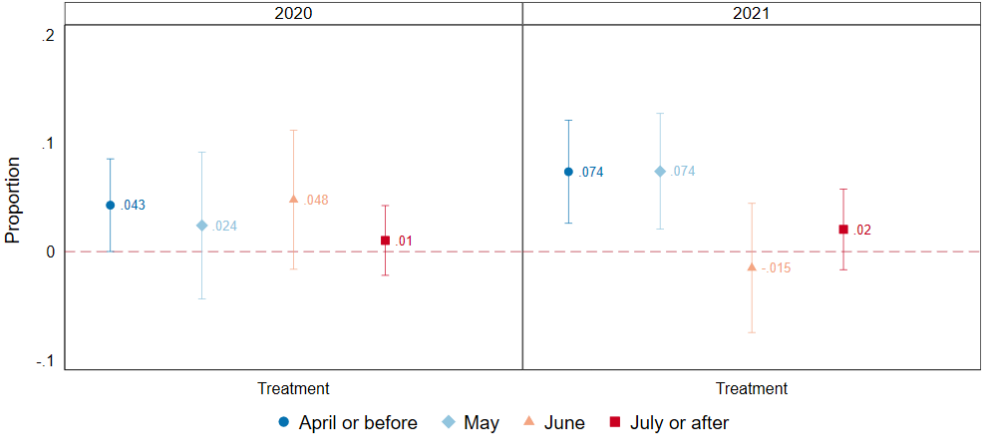
95% confidence intervals displayed
Control mean in 2020 is 296 and 356 in 2021

2. Treated producers sell more frequently



95% confidence intervals displayed
Control mean in 2020 is 1.48 and 1.63 in 2021

2. Treated producers start selling earlier in both trading seasons



95% confidence intervals displayed
Control mean in 2020 is .15 in April or before, .51 in May, .49 in June, .07 after
Control mean in 2021 is .17 in April or before, .49 in May, .64 in June, .12 after

Spillovers
Barter timing

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1. Why did treated producers earn higher prices?

Negotiated higher prices in 2021.

Effect is driven by producers with *larger plantations*.

Pass-through from export to farmgate increases among treated producers.

They switched *buyers*, which may help negotiation.

They changed *sources of market information*.

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2. Why did producers sell more frequently and earlier?

To *reduce risk, smoothen consumption*, following the advice received.

Earlier sales are driven by producers with *fewer assets*.

Expectations about prices decrease, making them more willing to accept offers.

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Mechanisms that we rule out

We rule out that treated producers:

- Changed the *location* of their sales.
- Kept better *records* of their sales.
- Got different *attitudes* towards risk.
- Salience.

So why did we not find a significant increase in prices in 2020 for treated producers?

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Testing for spillovers across villages

We identify between-village spillovers in the style of Miguel and Kremer (2004) and Egger et al. (forthcoming):

$$y_{iv} = \textit{treatment}_{iv} \cdot \beta_1 + \textit{spillover}_{iv} \cdot \delta_1 + y_{oiv} \cdot \gamma_1 \sum_{d=1}^{D} \left(\mathrm{V}^d_{iv\neg v} \cdot \pi^d_1 + \mathrm{TP}^d_{iv\neg v} \cdot \pi^d_2 \right) + \alpha_v + \epsilon_{iv} \tag{2}$$

Controlling for the number of study villages within a radius ($V_{iv\neg v}$), the number of treated producers outside of your village ($\mathrm{TP}^d_{iv\neg v}$) is plausibly random.

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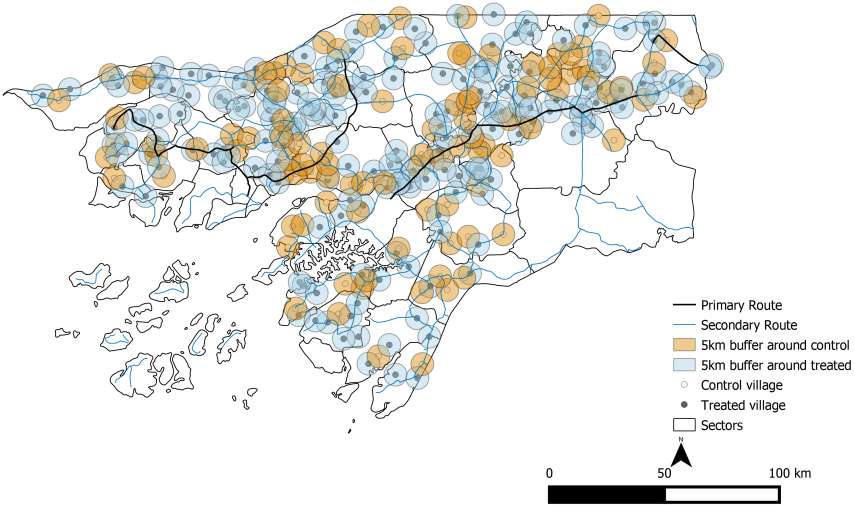
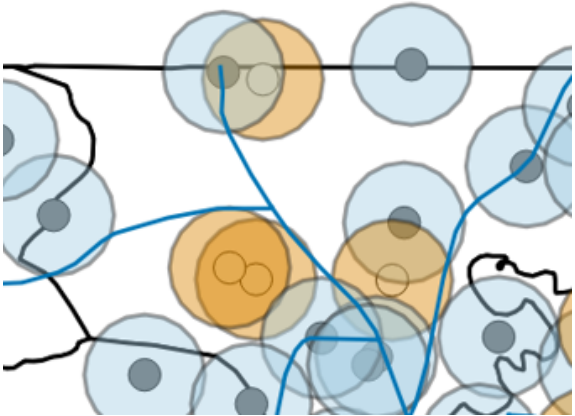
Spatial distribution of treatment intensity



Quasi-random exposure to exogenous treatment

Details

Control village (orange) center-left has no treated villages (blue) within 5km.



Spillovers across clusters can explain why we did not find average increase on prices

	(1) Price 2020	(2) Price 2020	(3) Price 2021	(4) Price 2021
Treatment	2.16		6.3111*	
	(3.37)		(3.4393)	
Spillover	2.49		1.2335	
	(3.27)		(3.3817)	
Treated producers within 0-5km	**2.03***		1.4474	
	(1.20)		(1.0599)	
Villages within 0-5km	-6.22		-0.6599	
	(4.72)		(3.4697)	
Treatment*Treated producers within 0-5km				
Spillover*Treated producers within 0-5km				
# Obs.	1587		1648	
P-value: Treat = Spillover	.918		.1	
P-value (Interaction): Treat = Spillover				
Control group mean	296		365	
Control group st. dev.	104		61	

Notes: OLS estimates of between-village effects, controlling for exogenous spatial treatment intensity. Conley (1999) standard errors are in parentheses, accounting for spatial correlation within a 5km radius. Stars on the coefficient estimates reflect unadjusted *p*-values. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Prices increased in some control villages too

	(1) Price 2020	(2) Price 2020	(3) Price 2021	(4) Price 2021
Treatment	2.16	7.09*	6.3111*	7.5468*
	(3.37)	(4.08)	(3.4393)	(4.4743)
Spillover	2.49	6.92*	1.2335	3.0616
	(3.27)	(4.01)	(3.3817)	(4.0472)
Treated producers within 0-5km	**2.03***	**3.96*****	1.4474	2.1029
	(1.20)	**(1.41)**	(1.0599)	(1.4671)
Villages within 0-5km	-6.22	-6.11	-0.6599	-0.6312
	(4.72)	(4.62)	(3.4697)	(3.4488)
Treatment*Treated producers within 0-5km		-2.90**		-0.7645
		(1.36)		(1.5700)
Spillover*Treated producers within 0-5km		-2.59*		-1.0853
		(1.42)		(1.5510)
# Obs.	1587	1587	1648	1648
P-value: Treat = Spillover	.918	.966	.1	.231
P-value (Interaction): Treat = Spillover		.742		.767
Control group mean	296	296	365	365
Control group st. dev.	104	104	61	61

Notes: OLS estimates of between-village effects, controlling for exogenous spatial treatment intensity. Conley (1999) standard errors are in parentheses, accounting for spatial correlation within a 5km radius. Stars on the coefficient estimates reflect unadjusted ***p***-values. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Conclusion...in a nutshell

Our positive effects on prices suggest that buyers's side is not fully competitive. Better informed producers can earn some small margins.

We show that price uncertainty can affect producers' choice of *when* to sell.

- Treated producers sell earlier, more frequently, to smooth their intertemporal revenue and reduce risk.

First study delivering commercialisation advice using *audio-based messages*, overcoming shortcomings of previous (SMS-based) market information systems.

- We complement expansion of digital provision of agronomic extension services. (Fabregas et al., 2019; Cole and Fernando, 2021)

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Thank you !

This research was carried out with technical and financial support from the

Partnership for Economic Policy (PEP)

partnership for economic policy pep

Funded by: Private Enterprise Development in Low-Income Countries

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

WILLIAM + FLORA Hewlett Foundation

Global Affairs Canada Affaires mondiales Canada

www.pep-net.org https://pedl.cepr.org/

Outline

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Design details

Extra results

Discussion

Setup

A **framework** by Mitra et al. (2018) to conceptualise the intertemporal decision problem faced by producers and **to motivate the experiment**:

Two-period model with one producer (F) and a trader (T), who buys from producer and resells at export price (x_t).

Producers only know that $x_t \in [\underline{x}, \overline{x}]$.

Risk-averse producers decides how much to sell in either period, with $q_2 = 1 - q_1$ and outside option $M(x_t)$, choosing q_1 to maximise:

$$W(q_1 p_1) + \delta W(p_2(1 - q_1)) \tag{3}$$

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Solving the model without any information

Solving by backwards induction, **T will offer the expected reservation price** in the second period: $p_2^* = E(M(x_2)|p_1)$

In the first period, F chooses q_1^* satisfying the FOC:

$$p_1 W'(p_1 q_1) = \delta p_2^* W'(p_2^*(1 - q_1)) \tag{4}$$

The supply function is $q_1 = q_1^*(p_1, p_2^*)$ for the first period over the range $p_1 \geq E[M(x_1)]$ and $q_1 = 0$ otherwise.

The **relationship between q_1^* and p_1 depends on the curvature of W**. For example, if wealth effects dominate, a higher price in the first period is associated with a lower amount sold in the same period.

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Introducing market information

Market information is a binary signal σ_t that **updates producers' beliefs about the (export) price distribution.**

If $\sigma_t = L$ the producer expects $x_t \in [\underline{x}, \hat{x}]$.
If $\sigma_t = H$ the producer expects $x_t \in [\underline{x}, \overline{x}]$.

Farmgate price in each period depends on the signal p_t^k such that $p_t^L < p_t^* < p_t^H$.

The optimal q_1 satisfies the following FOC:

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where after observing the signal $k \in \{L, H\}$ the producer believes that the price will be high with probability α_k^H.

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Ambiguous predictions with market information

Predictions depend on interplay of beliefs, preferences, and signals.

Suppose that in the first period the signal is low. Then F's choice satisfies:

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In this case, informed producers are more likely to sell than uninformed ones in the first period, as $p_1^L < p_1^*$, and smooth revenue across the two periods.

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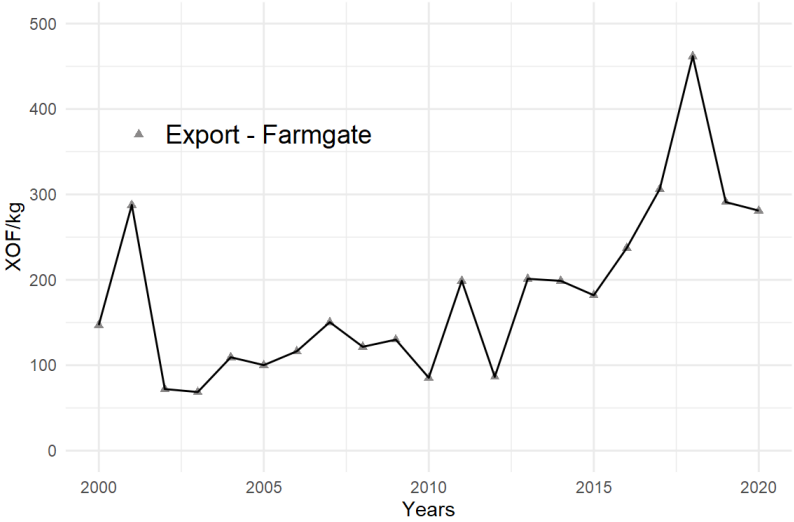
Conceptual framework

Design details

Extra results

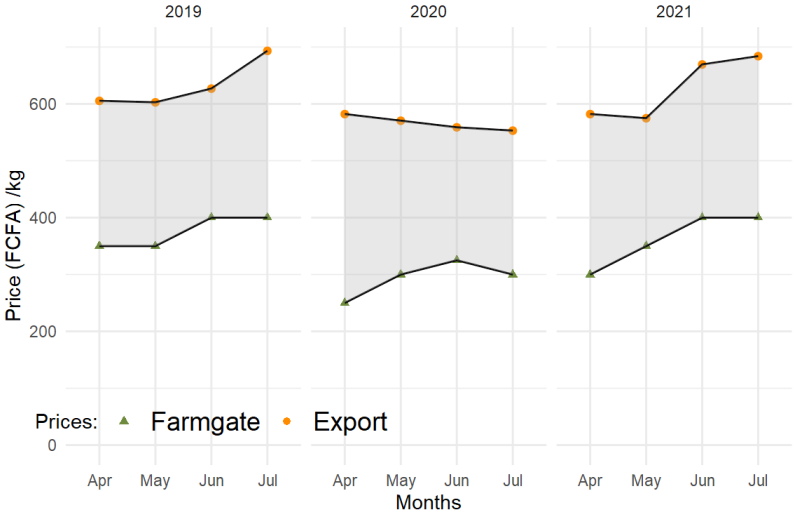
Discussion

Margins vary *across* seasons



Prices vary both *within* the same season and *across* seasons

By regions



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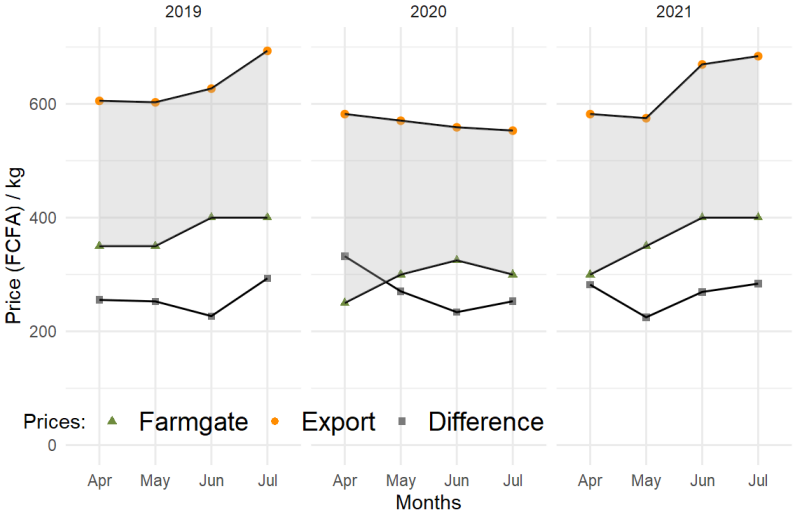
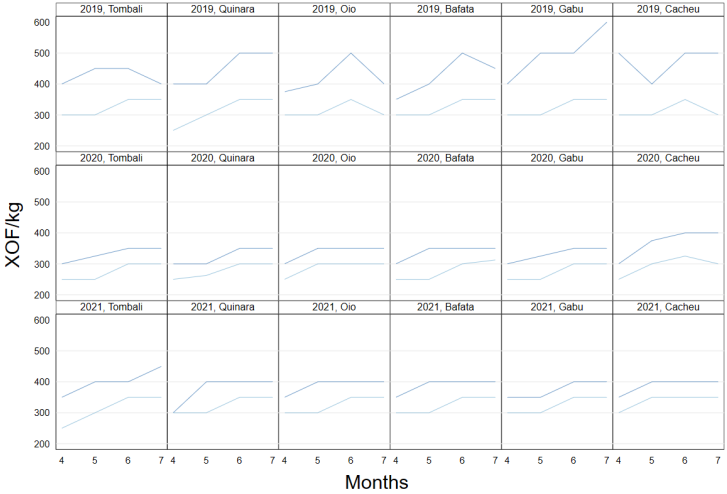
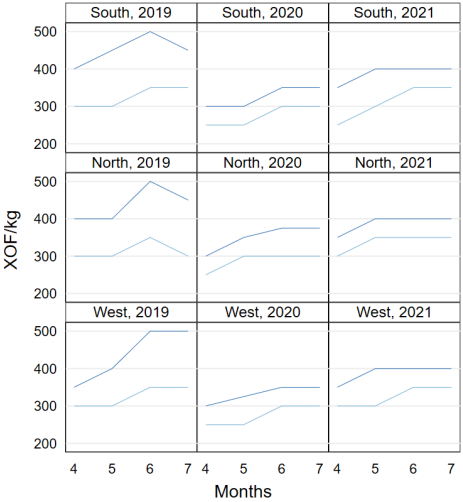


Price variation *within* seasons and across regions



Interquartile range by geographic zones across years

Price variation *within* seasons and across zones



Interquartile range by geographic zones

Sampling

Sampling Frame 2009 national census, with geo-coded villages.

Eligible villages: with over 10 households in 2009.

Village sampling Randomly select 290 villages across 6 regions (out of 8).

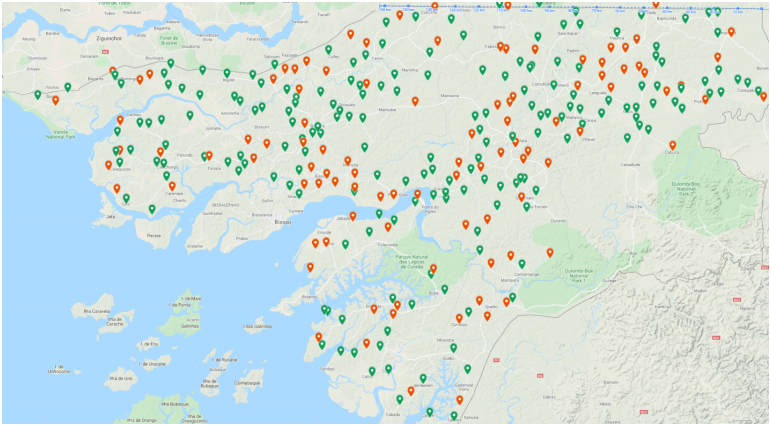
We **maximized the minimum distance between any two villages**, covering as much area as possible within the regions.

Eligible households: every household that owns a cashew plantation and a working mobile phone.

Household sampling: Randomly select 7 producers from a list with all producers, obtained from the village chief.

Villages by treatment status

Green points are treated villages, red points are control ones.


Ziguinchor
Bissau
Bissorã
Farim
Bafatá
Gabú
Bissau
Bissau
Bissau

Randomisation

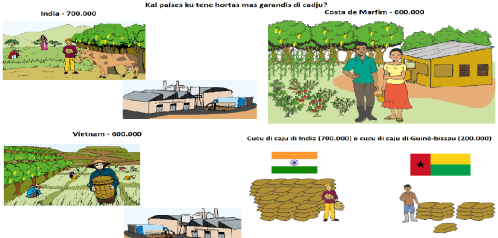
For village-level stratification, we follow Fafchamps and Minten (2012):

We use an algorithm to distribute villages into **triplets of most similar villages** within regions: 2 randomly allocated to treatment and 1 to control.

For within-village randomisation:

On-site lottery: Once selected producers complete the baseline surveys, an on-the-spot within-village lottery (drawing two kinds of beads from a bag) among interviewed producers randomly determines 4 treated and 3 non-treated households in "treated villages".

Face-to-face training after baseline with treated producers



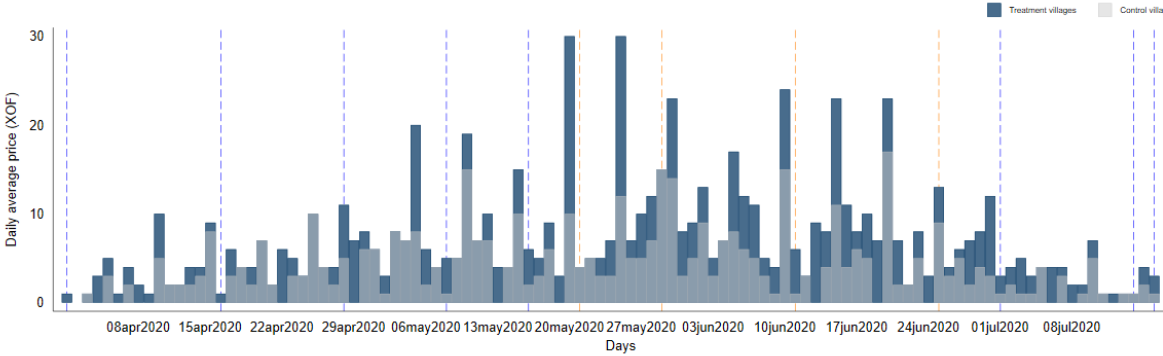
Example of SMS

```
Opening of the cashew season
postponed because of coronavirus.
Dry your nuts well to keep quality.
Advice is to wait to sell until
confusion is over.
```

Example of push-call

This is André from n'kalô to give you the last news of the cashew market. The demand for cashew is increasing all over the country as factories in India and Vietnam have re-opened. Prices at farm-gate are between 300 and 375 FCFA/kg around Biombo and Bissora, between 250 and 325 FCFA/kg in Bafata and Gabu and reach 300 to 400 FCFA/kg in Bonco close to the border with Senegal. As demand is growing prices are expected to go up, so we advise not to sell before the price reaches 375 FCFA/kg. N'kalô wishes you a very good week.

Number of sales recorded in diaries



Timeline of the study

Nov-Dec 2019: Baseline (in-person) survey and training of treated producers.

Apr-Aug 2020: Information dissemination.

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Economic relevance

Raw cashew nuts account for 90 percent of Guinea-Bissau's export revenue and about 25 percent of GDP. More than 80 percent of production goes into exports.

Sales of raw **cashews are the main source of income for 80 percent** of producers. Median annual revenue from raw cashew sales was around 800 EUR in 2019.

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Sample descriptives (*baseline*)

On average, respondents have 43 years and 4 years of formal education. 5% are women.

30% of respondents could read a sentence without difficulties.

Plot size is 3ha on average.

56% of respondents rely on family and friends for marketing advice. Only 6% of respondents belong to a producer cooperative.

Each village has around 30 producers per village (36 households/village) and 3 local buyers. 13 household members / household.

30% of respondents report difficulties with storage.

32% of respondents report having a fixed buyer.

Back

Rice exchanges

14 percent of total production is exchanged for rice

35 percent of producers took up a loan before the start of the trading season in 2019, and 85 percent of these loans were in-kind (rice).

- 53 percent of cash loans were repaid using cashew nuts
- 80 percent of the in-kind loans were repaid with cashew nuts.

Balance: Demographic characteristics

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover	(5) Max pairwise st. diff.
1 if female	0.05	0.00	-0.00	0.00	0.02
	(0.23)	(0.01)	(0.01)	(0.01)	1985
	1985	[0.95]	[1.00]	[0.99]	
Age	43.47	-1.06	-1.11	0.05	0.06
	(14.96)	(0.79)	(0.77)	(0.75)	1988
	1988	[0.37]	[0.46]	[0.99]	
Household size	13.40	0.57	1.02*	-0.45	0.08
	(7.88)	(0.54)	(0.57)	(0.41)	1988
	1988	[0.44]	[0.34]	[0.85]	
Years of education	3.89	0.01	-0.10	0.11	0.04
	(3.77)	(0.23)	(0.23)	(0.18)	1988
	1988	[0.95]	[1.00]	[0.97]	
1 if Kriol is the most spoken language at home	0.21	-0.01	-0.01	0.00	0.05
	(0.41)	(0.02)	(0.02)	(0.02)	1988
	1988	[0.89]	[1.00]	[0.99]	
1 if cashew is the main source of income	0.79	0.02	0.00	0.02	0.06
	(0.41)	(0.02)	(0.02)	(0.02)	1988
	1988	[0.44]	[1.00]	[0.85]	
1 if faces storage limitations	0.27	0.06**	0.02	0.04*	0.15
	(0.45)	(0.03)	(0.02)	(0.02)	1988
	1988	[0.05]*	[0.89]	[0.85]	
Minimum age of trees	3.32	-0.06	0.08	-0.14	0.06
	(3.43)	(0.17)	(0.20)	(0.20)	1966
	1966	[0.89]	[1.00]	[0.97]	
Max age of trees	17.23	-0.20	0.04	-0.25	0.04
	(8.41)	(0.47)	(0.48)	(0.48)	1868
	1868	[0.89]	[1.00]	[0.99]	
1 if trees were plagued	0.69	-0.03	-0.01	-0.03	0.08
	(0.46)	(0.03)	(0.03)	(0.03)	1980
	1980	[0.37]	[1.00]	[0.85]	
1 if sells other crops	0.65	0.09***	0.10***	-0.01	0.21
	(0.48)	(0.02)	(0.02)	(0.02)	1988
	1988	[0.00]***	[0.00]***	[0.99]	
Index of trust (Anderson 2008)	-0.00	0.07	0.07	-0.00	0.05
	(1.00)	(0.05)	(0.05)	(0.06)	1988
	1988	[0.37]	[0.55]	[0.99]	

Notes. Coefficient of treatment and spillover at baseline (columns 2-3). Column 3 tests for differences in parameters obtained in previous two columns. Column 4 reports the standardised pairwise maximum difference between mean across all study groups. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted *p*-values. *q*-values reported in brackets. * denotes significance at 10 pct., ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations.

Balance: Producer characteristics

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover	(5) Max pairwise st. diff.
Desired reference price	1042.00	-16.38	14.87	-31.25	0.09
	(297.53)	(16.78)	(22.31)	(23.25)	1988
	1988	[0.38]	[0.68]	[0.42]	
Minimum price at which sold most cashew in the last 3 years	318.64	-5.68	-1.93	-3.75	0.06
	(88.85)	(4.22)	(4.70)	(4.40)	1988
	1988	[0.25]	[0.68]	[0.67]	
1 if delayed sales because expected price to raise	0.72	0.00	-0.01	0.02	0.04
	(0.45)	(0.02)	(0.02)	(0.03)	1984
	1984	[0.82]	[0.68]	[0.67]	
Number of potential buyers that made offers	2.68	0.19*	0.05	0.13	0.16
	(1.71)	(0.10)	(0.10)	(0.10)	1981
	1981	[0.13]	[0.68]	[0.42]	
1 if thinks that the reference price is important in marketing	0.36	0.03	0.03	0.01	0.07
	(0.48)	(0.02)	(0.03)	(0.03)	1987
	1987	[0.25]	[0.68]	[0.79]	
Number of producers that shared price offers with imputations	4.91	0.60***	0.74**	-0.13	0.11
	(5.79)	(0.29)	(0.34)	(0.39)	1863
	1863	[0.13]	[0.11]	[0.79]	
Number of producers informed of an offer received with imputations	5.95	0.81***	1.72***	-0.91*	0.20
	(6.86)	(0.35)	(0.48)	(0.53)	1878
	1878	[0.13]	[0.00]***	[0.42]	

Notes: Coefficient of treatment and spillover at baseline (columns 2-3). Column 3 tests for differences in parameters obtained in previous two columns. Column 4 reports the standardised pairwise maximum difference between mean across all study groups. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted ***p***-values. ***q***-values reported in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations.

Balance: Village characteristics

	Control (1) *Mean* (SD) Total obs.	(2) Treatment
Number of cashew producers in the village	33.87	-0.67
	(23.49)	(2.83)
	288	[0.81]
Number of cashew buyers in the village	2.90	1.14***
	(2.58)	(0.41)
	287	[0.05]*
Road distance in km to nearest sector capital	25.59	1.02
	(23.70)	(2.65)
	290	[0.81]
Road distance in km to nearest region capital	51.48	-0.85
	(33.51)	(2.96)
	290	[0.81]
Road distance in km to the capital	162.30	4.15
	(69.26)	(4.60)
	290	[0.59]
Distance in km to the nearest primary road	20.16	2.35
	(17.17)	(1.60)
	290	[0.38]
Distance in km to the nearest secondary road	3.19	0.53
	(2.85)	(0.32)
	290	[0.38]
Distance in km to the nearest road	2.74	0.30
	(2.40)	(0.28)
	290	[0.58]

Notes: Coefficient of village-level treatment at baseline (columns 2). Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the village. All models control for the randomisation triplet fixed-effects. Standard errors are in parentheses and are robust. Stars on the coefficient estimates reflect unadjusted p-values. q-values reported in brackets. * denotes significance at 10 pct., ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations.

Balance: Main outcomes

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover	(5) Max pairwise st. diff.
Price per sale per kg	395.89	-3.66	1.35	-5.01	0.05
	(96.24)	(5.51)	(5.60)	(4.75)	1968
	1968	[0.73]	[0.81]	[0.56]	
Value of all sales and exchanges	525563.79	35895.89	24851.78	11044.11	0.03
	(921998.28)	(44423.03)	(43333.93)	(29750.44)	1978
	1978	[0.68]	[0.77]	[0.84]	
Value of all sales	486696.38	14815.85	15806.13	-990.28	0.01
	(912168.16)	(43992.64)	(43245.56)	(28614.91)	1984
	1984	[0.80]	[0.77]	[0.97]	
Value of exchanges	38130.25	220023.34***	107071.90*	113211.43**	0.22
	(83549.96)	(6769.25)	(5951.64)	(5656.60)	1982
	1982	[0.02]**	[0.40]	[0.29]	
Total quantity sold	1206.35	54.39	36.52	17.87	0.01
	(1855.65)	(96.73)	(94.05)	(66.13)	1984
	1984	[0.75]	[0.77]	[0.85]	
Number of sales	1.62	0.01	0.07	-0.05	0.08
	(0.81)	(0.04)	(0.05)	(0.04)	1988
	1988	[0.80]	[0.40]	[0.56]	
1 if exchanged cashew for rice	0.30	0.04	0.02	0.02	0.15
	(0.46)	(0.03)	(0.03)	(0.02)	1985
	1985	[0.34]	[0.77]	[0.56]	
Total quantity exchanged	113.66	57.26***	25.75	31.51**	0.21
	(247.43)	(19.08)	(17.06)	(15.94)	1982
	1982	[0.02]**	[0.40]	[0.29]	
Share of quantity sold over quantity exchanged and sold	0.90	-0.02	-0.01	-0.02	0.13
	(0.20)	(0.01)	(0.01)	(0.01)	1979
	1979	[0.34]	[0.77]	[0.47]	
1 if borrowed money or rice	0.35	-0.00	0.04	-0.05*	0.10
	(0.48)	(0.03)	(0.03)	(0.03)	1987
	1987	[0.92]	[0.40]	[0.29]	
Implicit price of loans per kg of cashews	356.61	-11.98	-19.76	7.77	0.18
	(101.18)	(11.23)	(12.33)	(12.43)	516
	516	[0.62]	[0.40]	[0.76]	
Total quantity paid for loans	45.23	17.69*	8.85	8.85	0.10
	(126.18)	(9.09)	(7.27)	(9.30)	1987
	1987	[0.23]	[0.42]	[0.58]	
Share of quantity sold over quantity exchanged and paid in loans	0.94	-0.01	-0.01	0.00	0.03
	(0.15)	(0.01)	(0.01)	(0.01)	1983
	1983	[0.68]	[0.40]	[0.76]	

Notes: Coefficient of treatment and spillover at baseline (columns 2-3). Column 3 tests for differences in parameters obtained in previous two columns. Column 4 reports the standardised pairwise maximum difference between mean across all study groups. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted p-values. q-values reported in

Balance: Secondary outcomes

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover	(5) Max pairwise st. diff.
1 if delayed sales because expected price to raise	0.72	0.00	-0.01	0.02	0.04
	(0.45)	(0.02)	(0.02)	(0.03)	1984
	1984	[0.90]	[0.87]	[0.83]	
1 if sped up sales because expected price to drop	0.30	-0.01	-0.01	-0.00	0.00
	(0.46)	(0.03)	(0.03)	(0.03)	1978
	1978	[0.90]	[0.93]	[0.99]	
1 if sold most to local buyer	0.37	0.00	0.02	-0.02	0.06
	(0.48)	(0.03)	(0.03)	(0.03)	1984
	1984	[0.95]	[0.87]	[0.94]	
1 if sold most to itinerant buyer	0.55	-0.00	-0.02	0.02	0.04
	(0.50)	(0.03)	(0.03)	(0.03)	1984
	1984	[0.99]	[0.87]	[0.83]	
1 if sold most directly to a market	0.06	0.00	0.01	-0.00	0.03
	(0.24)	(0.01)	(0.01)	(0.01)	1984
	1984	[0.90]	[0.87]	[0.97]	
1 if sold to or close to Senegal	0.00	-0.00	-0.00	0.00	0.05
	(0.07)	(0.00)	(0.00)	(0.00)	1988
	1988	[0.90]	[0.87]	[0.97]	
1 if sold cashews in April 2019 or before	0.20	-0.02	-0.00	-0.02	0.06
	(0.40)	(0.02)	(0.02)	(0.02)	1854
	1854	[0.88]	[0.93]	[0.78]	
1 if sold cashews in May 2019	0.50	0.01	0.07**	-0.06**	0.14
	(0.50)	(0.03)	(0.03)	(0.03)	1854
	1854	[0.90]	[0.28]	[0.42]	
1 if sold cashews in June 2019	0.55	0.04*	0.01	0.04	0.11
	(0.50)	(0.02)	(0.03)	(0.03)	1854
	1854	[0.83]	[0.93]	[0.69]	
1 if sold cashews in July 2019 or later	0.19	-0.01	-0.00	-0.00	0.06
	(0.39)	(0.02)	(0.02)	(0.02)	1854
	1854	[0.90]	[0.93]	[0.98]	
Total quantity produced	1477.87	147.53	58.96	88.57	0.07
	(1997.03)	(108.25)	(102.99)	(77.61)	1912
	1912	[0.88]	[0.87]	[0.70]	
1 if lost cashew post-harvest	0.06	-0.01	0.02	-0.03**	0.13
	(0.24)	(0.01)	(0.01)	(0.02)	1988
	1988	[0.90]	[0.87]	[0.42]	
Quantity lost post-harvest	2.46	-0.85	1.10	-1.94*	0.13
	(15.04)	(0.75)	(1.13)	(1.07)	1986
	1986	[0.88]	[0.87]	[0.51]	

Notes: Coefficient of treatment and spillover at baseline (columns 2-3). Column 3 tests for differences in parameters obtained in previous two columns. Column 4 reports the standardised pairwise maximum difference between mean across all study groups. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted p-values. q-values reported in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations.

Attrition and compliance

At follow-up response rate is 86%, balanced across treatment arms. ▸ Attrition

53% of treated producers received at least 8 SMS messages or robocalls ▸ Compliance

Attrition

	Control (1) Mean (SD)	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover	(5) Max pairwise st. diff. Total obs.
1 if attrited at endline	0.13	0.01	0.00	0.00	0.05
	(0.33)	(0.02)	(0.02)	(0.02)	1988
		[0.66]	[0.80]	[0.90]	
1 if attrited at follow-up	0.12	0.00	-0.01	0.01	0.03
	(0.33)	(0.02)	(0.02)	(0.02)	1988
	1988	[0.81]	[0.80]	[0.90]	

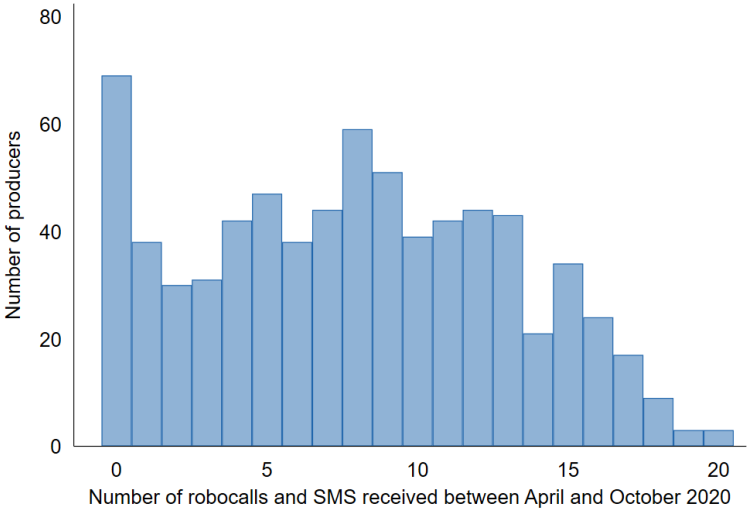
Notes: Coefficient of treatment and spillover at baseline (Columns 2-3). Column 4 tests for differences in parameters obtained in previous two columns. Column 5 reports the standardised pairwise maximum difference between mean across all study groups. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for randomization triplet fixed-effects. Standard errors are in parentheses and are clustered at the village-level. Asterisks on the coefficient estimates reflect unadjusted p-values. p-values reported in brackets. Significance levels: *10%, **5%, and ***1%. Column 1 displays the control mean, standard deviation, and total number of observations.

Compliance

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
1 if received at least 8 messages in 2020 (Take-up)	0.00	0.53***	0.00	0.53***
	(0.00)	(0.02)	(0.01)	(0.03)
	1719	[0.00]***	[0.90]	[0.00]***
1 if listened to at least 8 messages in 2021 (Take-up)	0.06	0.15***	-0.02	0.16***
	(0.24)	(0.02)	(0.01)	(0.02)
	1988	[0.00]***	[0.27]	[0.00]***

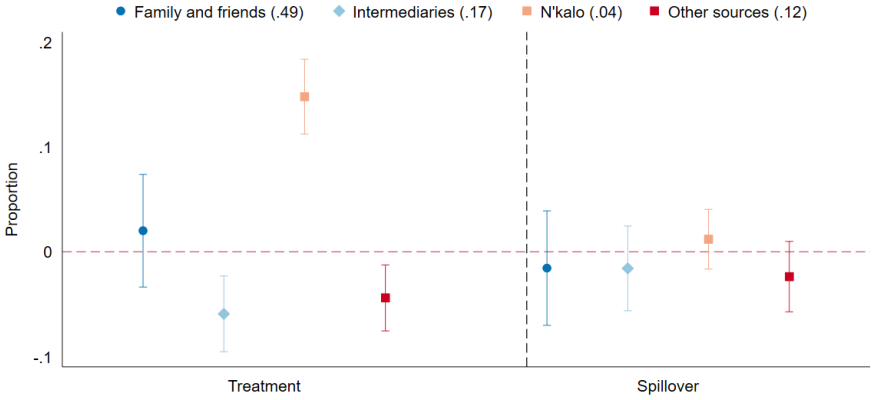
Notes: Coefficient of treatment and spillover at endline (Columns 2-3). Column 4 tests for differences in parameters obtained in previous two columns. Outcome variable listed on the left. The unit of observation is the individual producer. All models control for randomization triplet fixed-effects. Standard errors are in parentheses and are clustered at the village-level. Asterisks on the coefficient estimates reflect unadjusted p-values. Minimum p-values reported in brackets. Significance levels: *10%, **5%, and ***1%. Column 1 displays the control mean, standard deviation, and total number of observations.

Messages received



728 treated producers

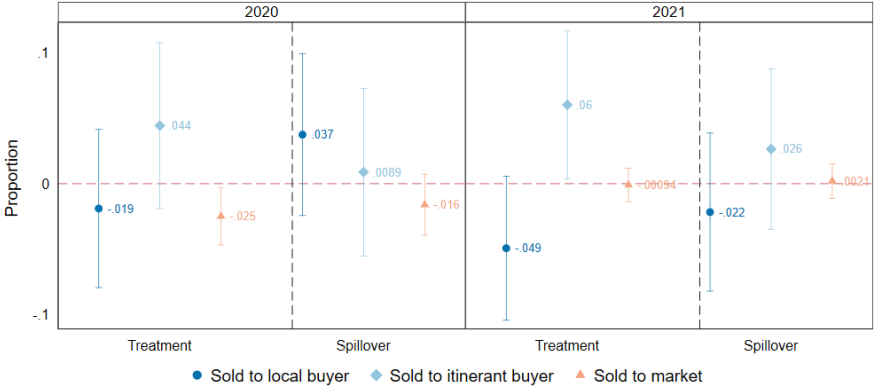
Treated producers follow less the advice of intermediaries or other agents



95% confidence intervals displayed
Control mean in parentheses

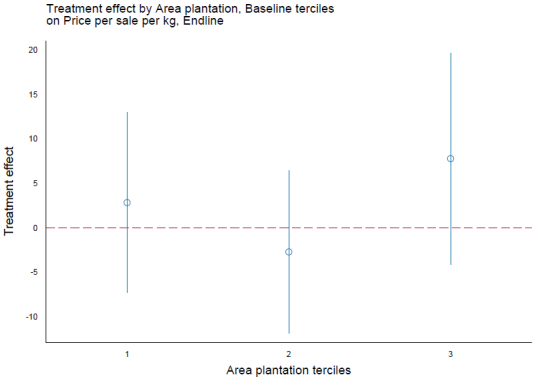
Back

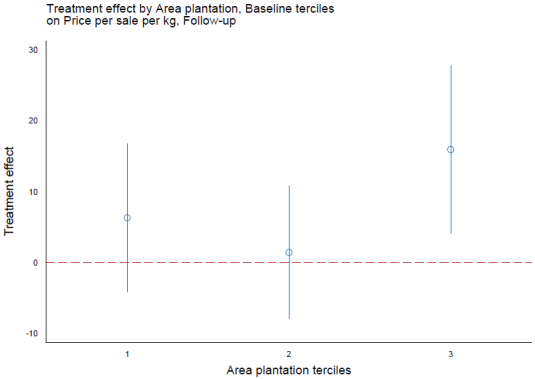
Treated producers tend to sell more to itinerant traders...



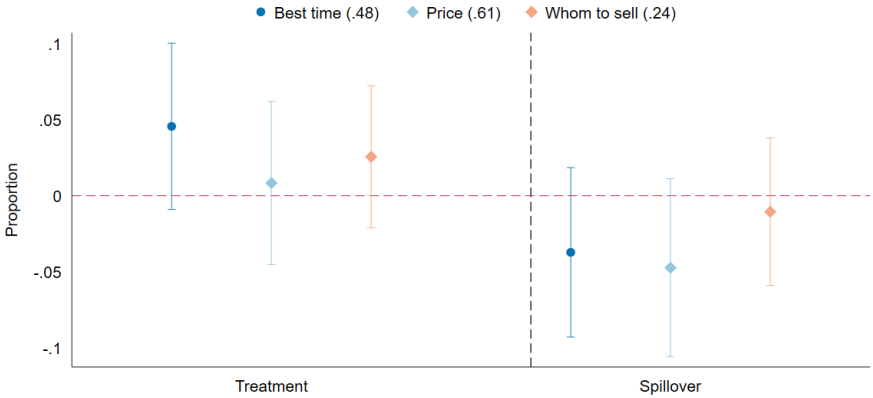
95% confidence intervals displayed
Control mean in 2020 is .43 for local buyers, .43 for itinerant, .04 for market
Control mean in 2020 is .5600000000000001 for local buyers, .39 for itinerant, .01 for market

Producers with larger production benefit more



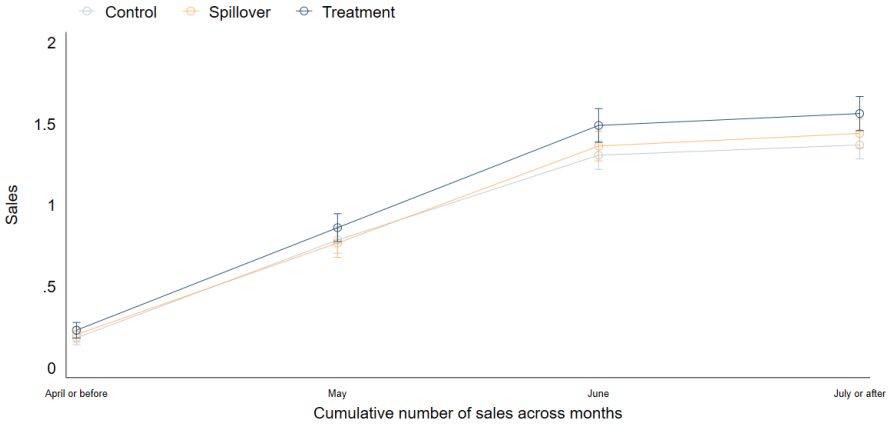


Treated producers seek advice on the best time to sell

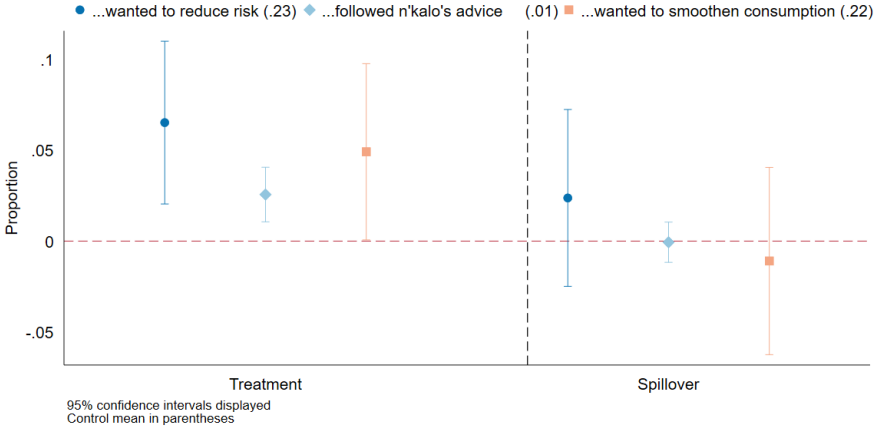


95% confidence intervals displayed
Control mean in parentheses

Treated producers sell more frequently

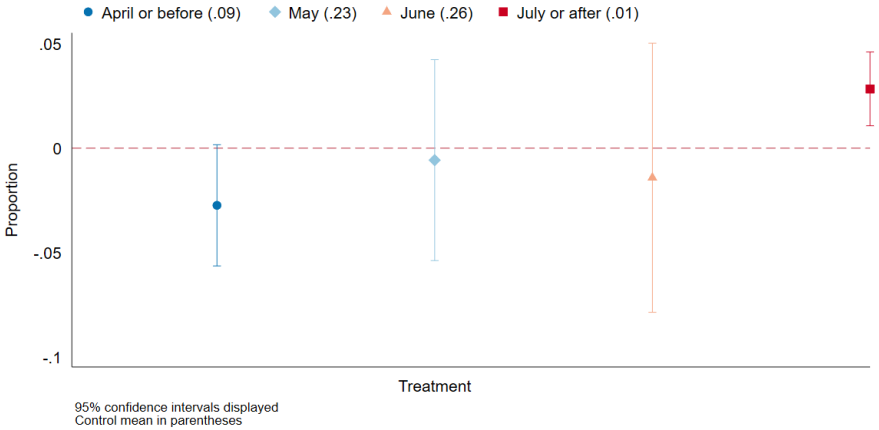


Producers sold more than once because they...



Back

...and barter later, when the terms of trade are better



With spillover

Outline

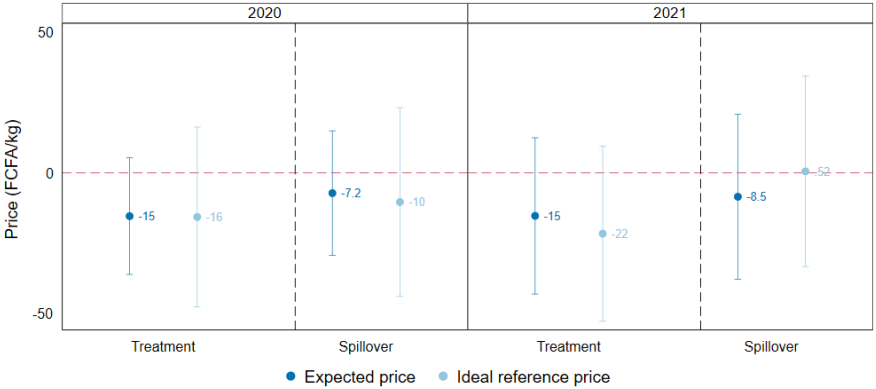
Conceptual framework

Design details

Extra results

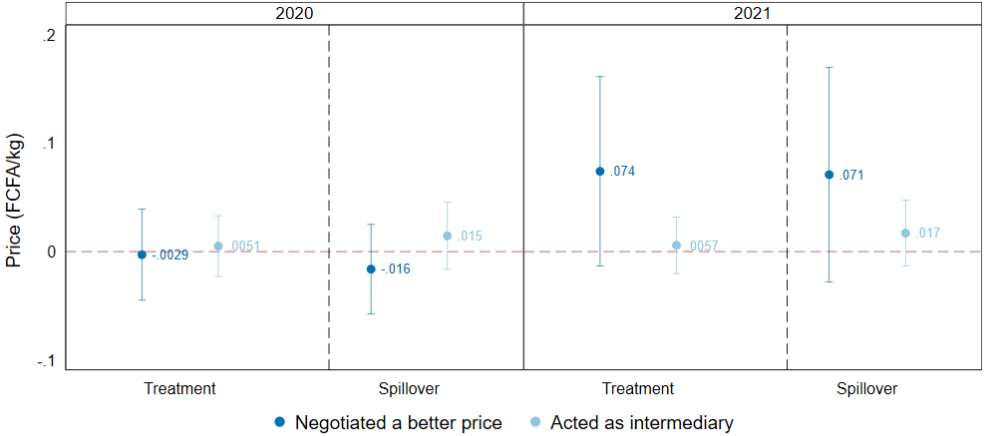
Discussion

More realistic priors? Future expectations go down



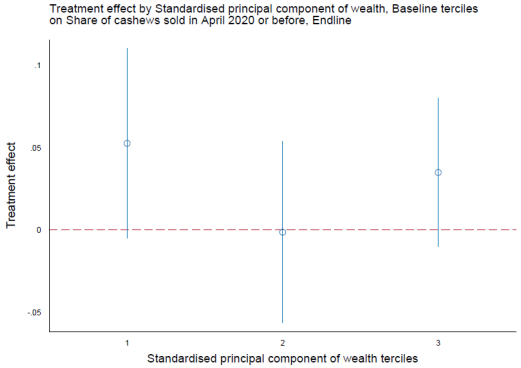
95% confidence intervals displayed
Control mean for: expected price 512.48 in 2020 and 664.05 in 2021
Control mean for: ideal reference price is 697.85 in 2020 and 815.13 in 2021

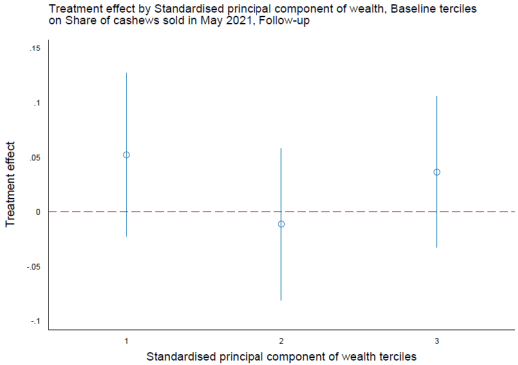
Producers negotiated a better price...



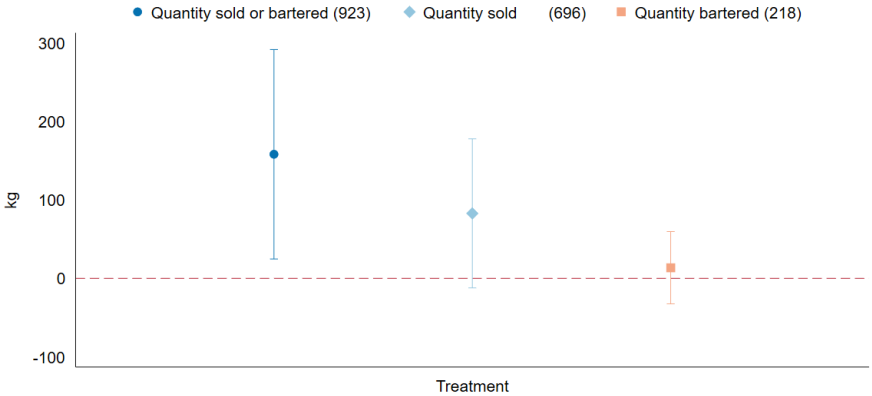
95% confidence intervals displayed
Control mean for: negotiated a better price .14 in 2020 and .46 in 2021
Control mean for: acted as intermediary .07 in 2020 and .06 in 2021

Producers with less assets start selling earlier





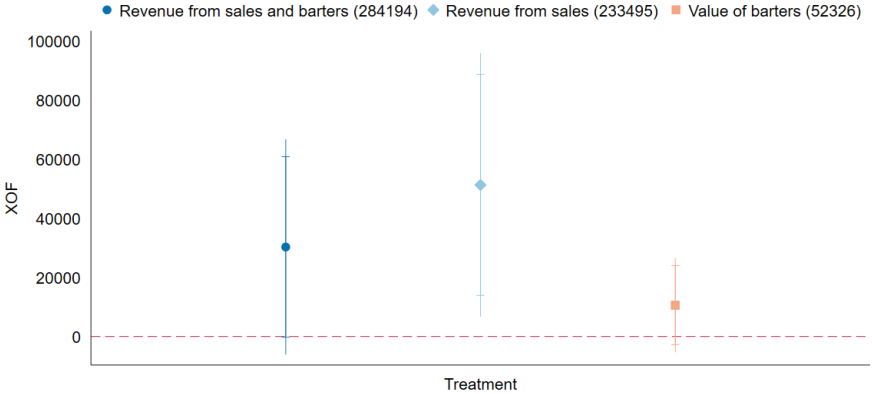
But by selling more...



95% confidence intervals displayed
Control mean in parentheses

▸ With spillover

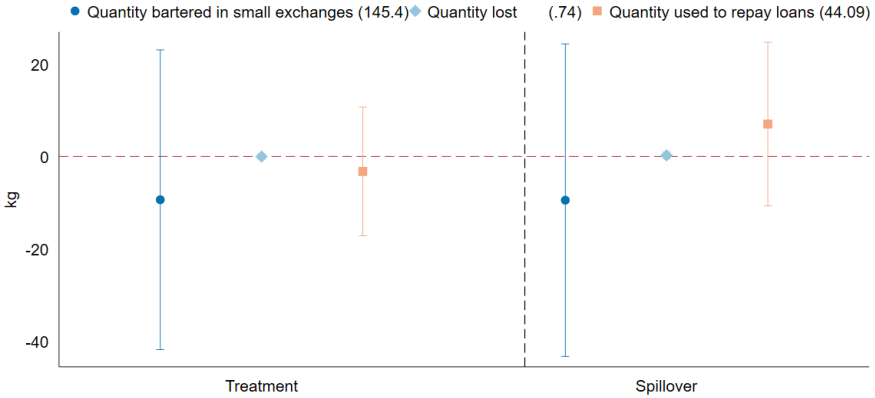
..treated producers make slightly more revenue



90% and 95% confidence intervals displayed
Control mean in parentheses

▸ With spillover ▸ Table

Difficult to fully account for extra quantity sold



95% confidence intervals displayed
Control mean in parentheses

Between-village spillovers: discussion

SUTVA not holding despite sampling aimed to maximise minimum distance across any two villages.

Number of treated producers within a 0-5km is uncorrelated to other observable variables after controlling for the number of study villages within the same radius.

Check

Instrumenting for demeaned number of treated producers after simulating the village-level random assignment marginally increases point estimates (Borusyak and Hull, 2021). Working on correct standard errors.

Heterogeneous effects consistent with between-village spillovers

Effects on **prices** are higher for producers living:

- *farther away from regional capitals* (relative to untreated producers in comparably remote villages),
- in *smaller villages* than for those living in larger ones.

We also pre-specified other dimensions of heterogeneity, but do not find consistent patterns.

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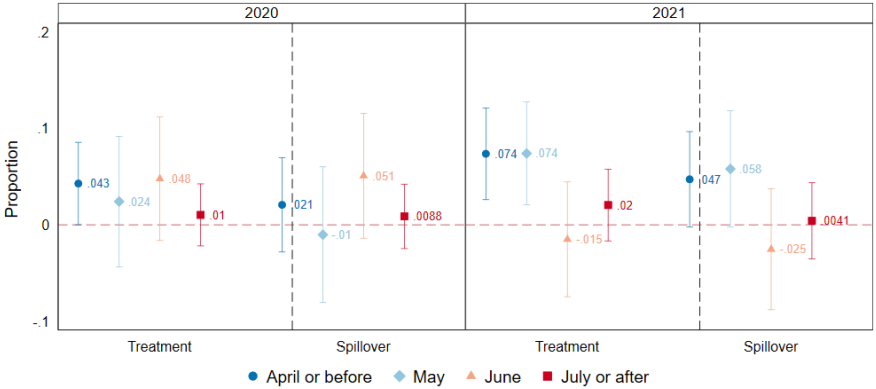
We also pre-specified other dimensions of heterogeneity, but do not find consistent patterns.

Exposure is uncorrelated to observables

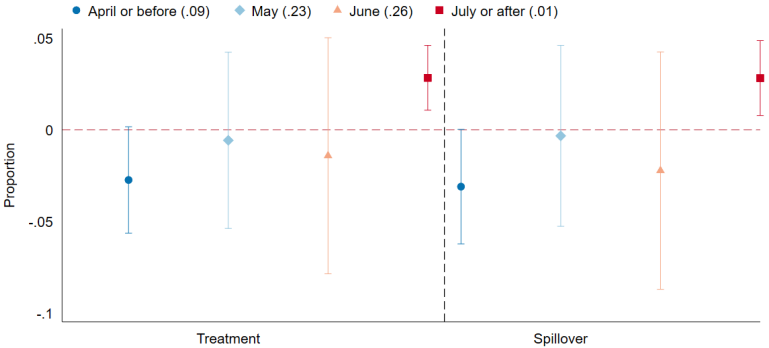
	Treated producers within 0-5km	Treated producers within 0-5km	Treated producers within 0-5km	Treated producers within 0-5km
Villages within 0-5km	3.0868***	3.0790***	3.0868***	3.0790***
	(0.1646)	(0.1680)	(0.1642)	(0.1670)
Number of cashew producers in the village	-0.0050	-0.0052	-0.0050	-0.0052
	(0.0044)	(0.0044)	(0.0043)	(0.0043)
Number of cashew buyers in the village	0.0027	0.0015	0.0027	0.0015
	(0.0264)	(0.0263)	(0.0261)	(0.0260)
Road distance in km to nearest sector capital	-0.0031	-0.0024	-0.0031	-0.0024
	(0.0074)	(0.0074)	(0.0069)	(0.0069)
Road distance in km to nearest region capital	0.0006	0.0004	0.0006	0.0004
	(0.0031)	(0.0032)	(0.0030)	(0.0031)
Road distance in km to the capital	0.0012	0.0014	0.0012	0.0014
	(0.0025)	(0.0026)	(0.0024)	(0.0025)
Distance in km to the nearest primary road	0.0064	0.0068	0.0064	0.0068
	(0.0069)	(0.0071)	(0.0063)	(0.0065)
Distance in km to the nearest secondary road	-0.0111	-0.0149	-0.0111	-0.0149
	(0.0290)	(0.0293)	(0.0282)	(0.0284)
1 if female		0.1825		0.1825
		(0.1356)		(0.1341)
Age		0.0003		0.0003
		(0.0024)		(0.0024)
Household size		-0.0034		-0.0034
		(0.0057)		(0.0057)
Years of education		0.0045		0.0045
		(0.0108)		(0.0107)
1 if Kriol is the most spoken language at home		0.0591		0.0591
		(0.0767)		(0.0733)
1 if cashew is the main source of income		0.0218		0.0218
		(0.0818)		(0.0787)
1 if faces storage limitations		0.0160		0.0160
		(0.0716)		(0.0704)
Minimum age of trees		0.0138*		0.0138*
		(0.0073)		(0.0072)
Max age of trees		0.0033		0.0033
		(0.0037)		(0.0036)
1 if trees were plagued		-0.0042		-0.0042
		(0.0780)		(0.0756)
1 if sells other crops		0.0043		0.0043
		(0.0938)		(0.0935)
Index of trust (Anderson 2008)		-0.0053		-0.0053
		(0.0283)		(0.0274)
Index of food security (Anderson 2008)		0.0649**		0.0649**
		(0.0315)		(0.0304)
Regression type	Cluster at village-level	Cluster at village-level	Conley	Conley

Timing of sales



95% confidence intervals displayed
Control mean in 2020 is .15 in April or before, .51 in May, .49 in June, .07 after
Control mean in 2021 is .17 in April or before, .49 in May, .64 in June, .12 after

2020 results: Timing of barters

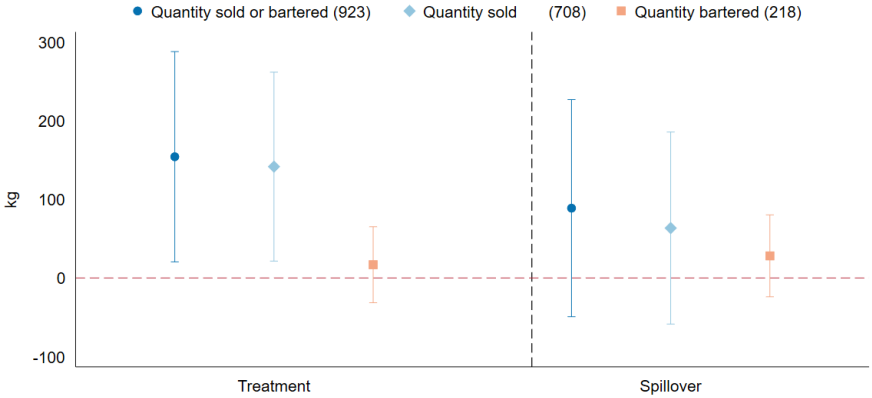


95% confidence intervals displayed
Control mean in parentheses

Results: quantity sold and exchanged

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
Total quantity sold	708.21	141.75**	63.53	78.21
	(855.14)	(61.11)	(62.11)	(54.72)
	1622	[0.05]*	[0.45]	[0.38]
Number of sales	1.49	0.21***	0.07	0.14**
	(1.01)	(0.06)	(0.06)	(0.06)
	1693	[0.00]***	[0.45]	[0.10]*
1 if exchanged cashew for rice	0.56	-0.01	-0.03	0.03
	(0.50)	(0.03)	(0.03)	(0.03)
	1706	[0.85]	[0.45]	[0.59]
Total quantity exchanged	217.70	19.62	20.91	-1.30
	(323.48)	(24.38)	(25.70)	(23.10)
	1681	[0.53]	[0.45]	[0.96]
Share of quantity sold over quantity exchanged and sold	0.73	0.02	0.02	0.00
	(0.32)	(0.02)	(0.02)	(0.02)
	1604	[0.53]	[0.45]	[0.96]
Loans:				
1 if borrowed money or rice	0.31	0.02	0.03	-0.01
	(0.46)	(0.03)	(0.03)	(0.03)
	1702	[0.65]	[0.57]	[0.75]
Implicit price of loans per kg of cashews	58.96	12.62**	3.30	9.33
	(142.79)	(5.49)	(6.13)	(5.79)
	1645	[0.09]*	[0.59]	[0.41]
Total quantity paid for loans	44.09	-3.23	7.00	-10.24
	(106.88)	(7.08)	(8.99)	(8.11)

But by selling more...



95% confidence intervals displayed
Control mean in parentheses

Results: prices and revenue

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
Price per kg	295.71	2.07	2.33	-0.26
	(104.36)	(3.46)	(3.35)	(3.30)
	1587	[0.55]	[0.49]	[0.94]
Value of all sales and exchanges	287785.22	61876.32**	44172.78*	17703.54
	(315352.77)	(25318.49)	(26625.26)	(22487.00)
	1521	[0.05]**	[0.20]	[0.57]
Value of all sales	233494.84	51335.03**	24128.93	27206.10
	(292721.24)	(22677.17)	(23273.58)	(19950.57)
	1591	[0.05]**	[0.40]	[0.57]
Value of exchanges	52325.81	10597.78	16866.04*	-6268.26
	(88037.41)	(8099.23)	(9701.49)	(7302.75)
	1636	[0.25]	[0.20]	[0.57]

Notes: producer-level intention-to-treat (ITT) estimates reported in columns 2 and 3. Columns 4 tests for differences in parameters obtained in previous two columns. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects and the baseline value of the outcome when it was available. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted ***p***-values. Sharpened ***q***-values controlling the false discovery rate across outcomes within each family are shown in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations across all groups.

..treated producers make slightly more revenue

90% and 95% confidence intervals displayed
Control mean in parentheses

The impact on prices is positive for producers in remote villages

	Control (1) Mean (SD) Total obs.	(2) Treat. * Low	(3) Treat. * Med.	(4) Treat. * High	(5) (3) - (2)	(6) (4) - (2)	(7) (4) - (3)
Price per sale per kg	303.79	0.11	-3.53	**10.82***	-3.64	10.71	14.35**
	(85.32)	(4.39)	(4.44)	(6.42)	(5.74)	(7.00)	(7.12)
	1587	[0.98]	[0.86]	[0.19]	[0.70]	[0.25]	[0.18]
Total quantity sold	674.53	179.51***	9.53	26.15	-169.98*	-153.37*	16.62
	(555.58)	(63.84)	(69.94)	(81.23)	(89.53)	(92.52)	(98.63)
	1625	[0.01]**	[0.95]	[0.75]	[0.24]	[0.47]	[0.87]
Number of sales	1.52	0.26***	0.10	0.24***	-0.16	-0.03	0.13
	(0.90)	(0.08)	(0.09)	(0.09)	(0.12)	(0.12)	(0.11)
	1693	[0.01]***	[0.95]	[0.05]**	[0.29]	[0.81]	[0.87]

Notes: producer-level heterogeneous treatment effect. Stars on the coefficient estimates reflect unadjusted ***p***-values. Sharpened q-values controlling the false discovery rate across outcomes within each family are shown in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean and standard deviation for the omitted group in the control group and in the bottom tercile of road distance in km to nearest region capital; and total number of observations across all groups.

The impact on prices is larger for producers in smaller villages

	Control (1) Mean (SD) Total obs.	(2) Treat. * Low	(3) Treat. * Med.	(4) Treat. * High	(5) (3) - (2)	(6) (4) - (2)	(7) (4) - (3)
Price per sale per kg	300.26	6.41	4.03	-4.21	-2.38	**-10.63***	-8.25
	(92.22)	(4.57)	(6.41)	(4.81)	(7.12)	(6.19)	(7.51)
	1587	[0.21]	[0.53]	[0.51]	[0.74]	[0.35]	[0.88]
Total quantity sold	700.63	129.67*	79.24	41.78	-50.43	-87.89	-37.46
	(739.32)	(67.46)	(67.03)	(82.52)	(88.00)	(100.42)	(96.80)
	1625	[0.28]	[0.58]	[0.62]	[0.99]	[0.38]	[0.76]
Number of sales	1.59	0.08	0.26***	0.30***	0.19	0.22*	0.04
	(1.00)	(0.09)	(0.08)	(0.09)	(0.12)	(0.12)	(0.12)
	1693	[0.49]	[0.01]***	[0.00]***	[0.56]	[0.15]	[0.76]

Notes: producer-level heterogeneous treatment effect. Stars on the coefficient estimates reflect unadjusted p-values. Sharpened q-values controlling the false discovery rate across outcomes within each family are shown in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean and standard deviation for the omitted group in the control group and in the bottom tercile of road distance in km to nearest region capital; and total number of observations across all groups.

Effects from intermediary surveys

	(1) Control	(2) Treatment	(3) p-value (1) - (2)	(4) N
1 if intermediary was interviewed in 2021	0.42	0.47	-0.05	
	(0.50)	(0.50)	[0.39]	304.00
1 if made any purchase	0.85	0.83	0.02	
	(0.36)	(0.38)	[0.71]	136.00
Number of producers with whom they exchanged	4.23	6.32	-2.09	
	(6.47)	(10.21)	[0.16]	131.00
Quantity purchased	10626.15	11823.76	-1197.62	
	(17849.26)	(16001.22)	[0.70]	136.00
Purchase price	314.63	316.10	-1.46	
	(51.53)	(39.39)	[0.88]	114.00
Resale price	395.00	382.71	12.29	
	(71.06)	(81.00)	[0.57]	53.00
Margin	74.17	65.57	8.60	
	(67.37)	(78.32)	[0.68]	53.00
1 if made any exchange	0.56	0.60	-0.04	
	(0.50)	(0.49)	[0.66]	136.00
Quantity of cashews obtained from exchanges	2749.68	3145.35	-395.67	
	(4103.98)	(5085.62)	[0.63]	132.00
Quantity of rice exchanged for cashews	2545.21	2967.53	-422.32	
	(3942.35)	(4702.57)	[0.58]	133.00

Notes: Column 1 reports the mean in control villages for outcomes related to the 2020 trading season. Column 3 reports the mean in treatment villages. Outcome variables are listed on the left. The data comes from a survey of village-based intermediaries. Due to logistical issues it was not possible to interview an intermediary in every village. Standard deviations are reported in parentheses. Columns 3 reports the difference between columns 1 and 2 and the p-value from a t-test of equality between the means of intermediaries in treatment and control villages in brackets.

Effects from transaction diaries

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
Average price from the diary	310.96	3.92	-8.94	12.85**
	(59.06)	(6.14)	(5.97)	(5.81)
	448	[0.52]	[0.54]	[0.11]
Number of sales from the diary	3.00	-0.26	-0.16	-0.10
	(2.45)	(0.27)	(0.26)	(0.20)
	523	[0.44]	[0.67]	[0.62]
Total quantity sold from the diary	1022.76	259.82	-89.52	349.34
	(1856.30)	(235.80)	(203.95)	(235.91)
	462	[0.44]	[0.67]	[0.19]
Total value of sales from the diary	338145.95	85771.11	-29425.56	115196.68
	(775014.25)	(81123.21)	(68545.01)	(74244.75)
	463	[0.44]	[0.67]	[0.19]
Timing:				
1 if sold cashews within two days of a message	0.46	-0.02	-0.00	-0.02
	(0.50)	(0.05)	(0.06)	(0.06)
	514	[0.87]	[1.00]	[0.89]
1 if sold cashews in April 2020 or before	0.27	-0.03	0.01	-0.04
	(0.44)	(0.05)	(0.05)	(0.05)
	514	[0.87]	[1.00]	[0.89]
1 if sold cashews in May 2020	0.58	0.01	-0.01	0.02
	(0.50)	(0.06)	(0.06)	(0.06)
	514	[0.87]	[1.00]	[0.89]
1 if sold cashews in June 2020	0.54	0.10*	0.04	0.06
	(0.50)	(0.06)	(0.06)	(0.05)
	514	[0.47]	[1.00]	[0.89]

Effects on placebo outcomes

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
1 if filled the sale diary well	0.31	-0.03	-0.04	0.01
	(0.46)	(0.03)	(0.03)	(0.02)
	1719	[0.54]	[0.51]	[0.53]
1 if is extremely risk averse	0.35	-0.00	0.03	-0.03
	(0.48)	(0.03)	(0.03)	(0.03)
	1627	[0.89]	[0.51]	[0.51]
1 if trusts most people	0.38	0.06**	0.01	0.04
	(0.49)	(0.03)	(0.03)	(0.03)
	1712	[0.12]	[0.65]	[0.34]

Notes: producer-level intention-to-treat (ITT) estimates reported in columns 2 and 3. Columns 4 tests for differences in parameters obtained in previous two columns. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects and the baseline value of the outcome when it was available. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted p-values. Sharpened q-values controlling the false discovery rate across outcomes within each family are shown in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations across all groups.

Effects on bargaining

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
Number of succesful bargains	0.14	-0.00	-0.02	0.01
	(0.37)	(0.02)	(0.02)	(0.02)
	1690	[0.89]	[0.44]	[0.57]
1 if acted as intermediary	0.07	0.01	0.01	-0.01
	(0.26)	(0.01)	(0.02)	(0.02)
	1713	[0.89]	[0.44]	[0.57]
Number of potential buyers that made offers	2.91	0.08	0.30***	-0.21**
	(1.82)	(0.09)	(0.10)	(0.10)
	1671	[0.89]	[0.01]***	[0.12]

Notes: producer-level intention-to-treat (ITT) estimates reported in columns 2 and 3. Columns 4 tests for differences in parameters obtained in previous two columns. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects and the baseline value of the outcome when it was available. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted p-values. Sharpened q-values controlling the false discovery rate across outcomes within each family are shown in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations across all groups.

Effects on other marketing decisions

	Control (1) Mean (SD) Total obs.	(2) Treatment	(3) Spillover	(4) Treat. vs. spillover
1 if delayed sales because expected price to raise	0.79	-0.01	-0.01	0.00
	(0.41)	(0.02)	(0.02)	(0.02)
	1703	[0.73]	[0.82]	[0.96]
1 if sped up sales because expected price to drop	0.27	0.04	0.03	0.00
	(0.44)	(0.02)	(0.02)	(0.03)
	1694	[0.34]	[0.47]	[0.96]
1 if sold most to local buyer	0.43	-0.02	0.04	-0.06*
	(0.50)	(0.03)	(0.03)	(0.03)
	1622	[0.73]	[0.47]	[0.45]
1 if sold most to itinerant buyer	0.43	0.04	0.01	0.04
	(0.50)	(0.03)	(0.03)	(0.03)
	1622	[0.34]	[0.82]	[0.77]
1 if sold most directly to a market	0.04	-0.02**	-0.02	-0.01
	(0.20)	(0.01)	(0.01)	(0.01)
	1622	[0.16]	[0.47]	[0.80]
1 if sold to or close to Senegal	0.01	0.00	-0.00	0.00
	(0.11)	(0.01)	(0.01)	(0.01)
	1693	[0.73]	[0.82]	[0.86]

Notes: producer-level intention-to-treat (ITT) estimates reported in columns 2 and 3. Columns 4 tests for differences in parameters obtained in previous two columns. Outcome variables are listed on the left and described in detail in the pre-analysis plan. The unit of observation is the individual producer. All models control for the randomisation triplet fixed-effects and the baseline value of the outcome when it was available. Standard errors are in parentheses and are clustered at the village-level. Stars on the coefficient estimates reflect unadjusted p-values. Sharpened q-values controlling the false discovery rate across outcomes within each family are shown in brackets. * denotes significance at 10 pct.; ** at 5 pct.; and *** at 1 pct. level. Column 1 displays the control mean; standard deviation; and total number of observations across all groups.

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