

Later, Not Lower

Price Rigidity and the Risk Smallholders Bear

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The premise

Price stabilisation is the organising premise of smallholder policy — fair-trade minimums, price floors, marketing boards — and each assumes **price risk is the risk worth insuring**.

- **It is evaluated on the thing it was built to move:** how far the price a farmer receives is held apart from the market. Never on *how much of a farmer's income risk price was to begin with*.
- The habit is general — diversification judged on an *annual* count of hungry months, seasonal credit and storage in the season they target (Fink et al. 2020; Basu and Wong 2015; Bryan et al. 2014). **Each is scored on its own outcome, none on the risk it left alone.**
- An outcomes-only evaluation cannot tell the difference: **it sees a smooth series and calls it insurance**. Telling them apart needs the *rule* — written down, not inferred — and voluntary participants who reveal what the promise was worth.

The question: when an institution promises smallholders a stable price, how much of their income risk has it taken on?

The shock the schedule was tested against



The world coffee price fell to a **twelve-year low in 2019** and then **tripled**. The cooperative's price schedule was **written on the left of that line and tested on the right of it** — the promise and its hardest test, in one panel.

The risk, decomposed — and where the rule points

A Tseltal cooperative group offers its members a price rule, and **writes it down**. That makes the target measurable, and the target is the smaller half.

component of coffee-revenue variance	share	poolable by a membership organisation?	what targets it
price , across years	11%	92% covariate — no	the price schedule , fixed before harvest
quantity , across years	89%	64% idiosyncratic — yes	nothing

The same organisation also runs a honey arm and a seasonal credit fund. Both address *within-year timing* rather than either component above, and both are treated in a companion paper; we set them aside here and return to them in backup.

Target selection, not calibration. The instrument is aimed at the component a mutual group cannot pool, and leaves alone the component it could.

► the other two arms

Why this setting can answer it

485 coffee smallholders, 2013–2026. (The same group runs a honey arm and a credit fund; both are a companion paper's subject.)

- ① **The price rule is observed, not inferred.** The board's written procedure, its schedule, every dated delivery, every payment by grade.
- ② **The risk decomposes on the same members** — price against quantity, covariate against idiosyncratic.
- ③ **The calendar is observed at the frequency that matters.** Every delivery is dated, so the harvest window — and each producer's position in it — is measured rather than assumed.
- ④ **Participation is voluntary and unenforced**, and **the state moved**: the world price hit a 12-year low in 2019 and then tripled. Members could react, and did.

What we find

- ① **The largest component of members' risk is the poolable one, and nothing is built for it.** Quantity is **89%** of the variance of coffee revenue, **64%** of it idiosyncratic — precisely the risk a mutual organisation exists to pool. It is reached only incidentally.
- ② **What it does target is a tenth, and it postpones rather than lowers it.** Price is **11%** of the variance, **92%** covariate and so unpoolable. Pass-through is **0.921** — in full, a season late; the schedule leaves variance $\approx 9\%$ *higher*, and the 2025 boom cost the typical member $\approx 3,600$ pesos. **And necessarily less than 11% of household income risk** — coffee is a sixth to a third of it.
- ③ **Members notice, and stay.** They time deliveries against the fixed schedule — **a price rise after picking buys 8 days of delay (2013–19, causal)** — and **the same 184 producers reverse that pattern after 2020.** **We report the reversal and do not claim to identify it.** Exit does not rise either way: they re-optimize rather than leave, and what they keep is a price *level*, not a smoother one.

What this paper adds

- ① **Target selection can be measured — if you observe the rule.** Price stabilisation is evaluated on whether income got smoother (Bellemare et al. 2013; Bellemare et al. 2021; Dragusanu et al. 2022); rigidity is inferred from price series (Nakamura and Steinsson 2008; Kaur 2019). We read the written rule, verify it in the payments, and score it against a decomposition of the risk it was meant to reach — Townsend's (1994) split applied to an *institution*. **And the institution is a mutual**, which aimed at the component it cannot pool.
- ② **An institutional price forecast, and its realised error.** The board fixes the schedule each September against a reference price, before any delivery. It alone explains **71%** of what members are paid; the remainder is forecast error, and the co-op-world wedge moves **−0.68** with the surprise. **Descriptive: thirteen harvests.** The forecasting literature elicits *individual* expectations (Rosenzweig and Udry 2013; Burlig et al. 2024); here the forecast is collective and the procedure is written down.
- ③ **What voluntary members reveal.** With participation unenforced, delivery timing is a revealed response to the rule, **identified off harvest dates set by elevation** — the quality analogue of Casaburi and Macchiavello's (2019) payment-timing argument (Macchiavello and Morjaria 2021).

What travels is not about this cooperative: the decomposition bounds what any price floor can reach.

Setting: a voluntary cooperative under no external price rule

- **Bats'il Maya**, the coffee arm of Yomol A'tel, a Tseltal cooperative group in Chilón, Chiapas.
- **485** smallholders, **2013–2026**. Median member delivers **181 kg** of green-equivalent coffee a year.
- The cooperative buys, processes and markets; members may also sell to local intermediaries (*coyotes*) — **side-selling is possible and unpunished**.
- **Not fair-trade certified; no minimum price binds it**. Organic earns a +5% step in the board's own procedure — beyond that, **nothing external requires the price rule it uses**.

What we observe

Every delivery, dated
Every quality sample
Every payment, by grade
The schedule

The board's written procedure

[▶ member profile 2017](#)[▶ member profile 2022](#)

Before the price cycle: coffee leaf rust took the harvest, 2014–15

The collapse, in the delivery record

harvest	tonnes	producers	median kg
2013	37.5	193	162.8
2014	26.6	219	80.4
2015	4.7	111	24.6
2018	41.9	252	104.9
2020	71.9	356	143.8

An 87% fall in two years. Among matched members the **median producer lost 93%** and **43% delivered nothing**. **And they returned:** of the **149** who delivered in 2013–14 but not 2015, **52% were back by 2016–18**.

The replanting, in the 2022 survey

holds. . .	share of 275	
Oro Azteca	41.5%	resistant
Catimor	27.6%	resistant
Bourbon	30.9%	susceptible
Caturra	23.3%	susceptible
any resistant variety	58.5%	

Members 60.2% vs. non-members 57.1% — $p = 0.70$. Replanting was a **regional** response, not a cooperative programme, so it is common to both groups. Resistant = catimor, Oro Azteca, robusta, tabi. **Whether the hardest-hit replanted more is suggestive only: 70.7 vs 58.5%, $p = 0.36$, $n=82$.**

The recovery is within-producer and finishes before the price boom begins. The same **123** producers run **25.5** kg in 2015, **125.1** in 2018 and **174.7** in 2020 — while the world price is still at a twelve-year low. **2019 is a hinge between two mechanisms:** rust recovery ends, relative price takes over.

Bats'il Maya: what the coffee arm is, and how far it reaches

what it does	buys, processes and markets members' coffee; sets a five-grade price schedule, fixed before the harvest and held for the season
how members are paid	a flat advance at delivery , before grading; settled afterwards at the member's own grade mix
reach	485 members deliver at least once; 223 in an average year; 2,904 producer-seasons, 2013–2025
enforcement	none — membership is voluntary, and a member may sell any part of the harvest to a private buyer instead

The same group runs a honey cooperative (Chabt'ic) and a credit fund (Comon Sit). Both target within-year timing and are the subject of a companion paper.

One instrument, posted in advance and **unenforced on both sides**. That is what makes the promise's value revealed rather than assumed — a member who stays is telling us something.

► all three instruments

The rule: a price fixed in September, on last year's quality

How the price is set

(the board's written procedure)

- 1 The board meets and agrees a base price.
- 2 +5% for organic certification.
- 3 +5% **or** +15% **for quality — from the sample taken in *the previous cycle*.**
- 4 Announced to members through the local collection manager.

How a member gets paid

(the cooperative's own description)

- 1 A quality sample is taken.
- 2 **It sets that member's price for *next year's harvest*.**
- 3 The member estimates production; a few receive an advance.
- 4 They deliver, and are paid.

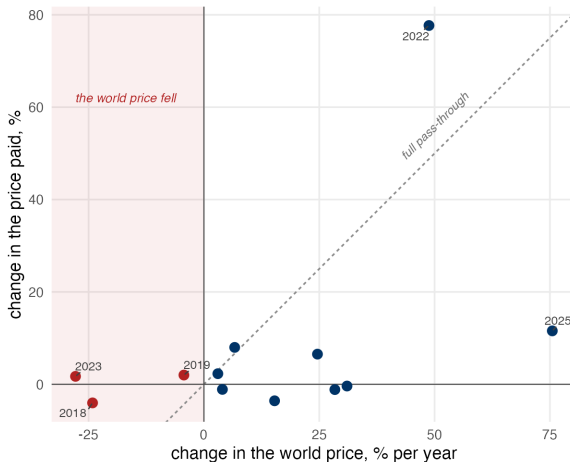
Two independent accounts, **same lag**: what a member is paid this year is a function of **quality they delivered last year**. The payment records agree — correlation with prior-cycle quality **0.59–0.73**, with current-cycle quality **0.17–0.40**. **And the commitment is deliberate**: the board's own workbook carries the market price *beside* its posted schedule (**not ignorance**); it reset harvest **2022** twice in one autumn (**not convening cost**); and **7 of 7 revisions fall September–December**, never inside the harvest

► quality lag, three ways

► transition event study

► two margins

Nobody made them do this, and it does not follow the market down



One point per harvest year, 2014-2025. Volume-weighted price actually paid to active members; both series observed, no intermediary margin assumed. Dashed line is one-for-one pass-through.

A floor is not “above the market”. It is “does not follow the market down” — a conditional statement, so we condition on it.

	world	paid
2018	−24%	−4%
2019	−4%	+2%
2023	−28%	+2%

On the way *up* it climbs only part of the way to the dashed line.

And nothing required it: no fair-trade certification, no binding minimum.

► premium vs. local buyers

Data: every delivery, every payment, every grade

span	deliveries	producers	source
2013–2019	2,240	405	cooperative sampling records
2019–2024	2,297	293	annual collection workbooks
2024–2026	677	191	the cooperative's current system
total	≈5,200	485	2013–2026, continuous
2017, 2022 surveys	household income	180, 70 linked	coffee's share of household income

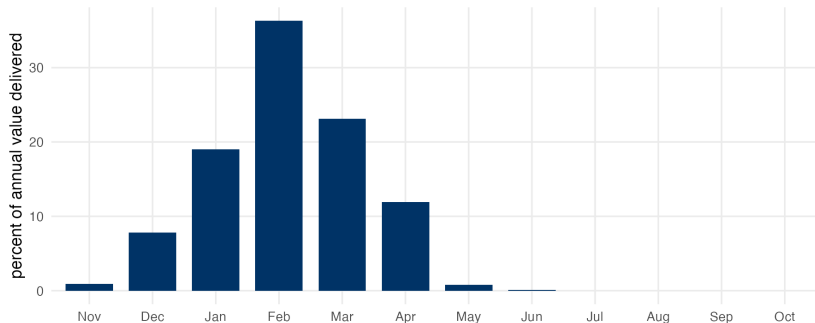
- Every delivery is **dated**; every delivery has a **quality sample**; every payment is broken out **by grade**. **485** producers deliver at least once; **223** are active in the average year.
- Plus the **schedule** itself and the **board's written procedure** — so the rule is **read**, not inferred from the price series.
- Producer identifiers verified across systems by name, not assumed (**170/180** exact; **90.9%** agreement); the survey links through the cooperative's own crosswalk.

▸ coverage

▸ a season

▸ coffee's share of income

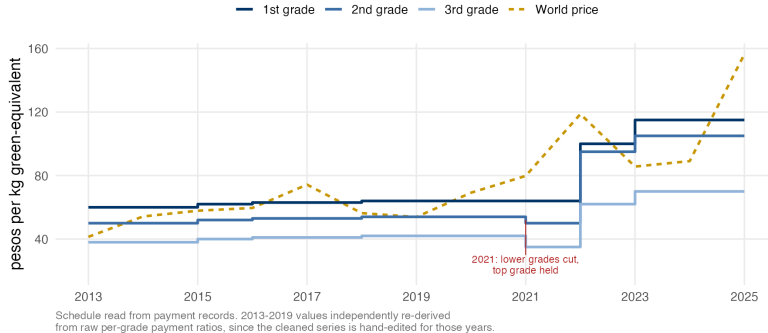
The harvest arrives in one window, and the window moves



98.1% of the annual value of coffee arrives December–April (36.3% in February); May–October delivers 0.9%. 2,240 dated deliveries, 2013–19. Where a producer sits in that window is set by elevation, not by price — which is what the design turns on.

► with honey and hunger

The rule in the data: seven changes in fourteen years



No revision has ever fallen during a harvest; frequency of change **4.3%**, implied duration $\approx$ **23 months**, against a world price that moves in nine months out of ten. Adjustment is **asymmetric** — **the top grade has never been cut**, and sat at or above the world price in **8 of 13 years**, while the lower two were cut in 2021 — and the quality premium compresses from **20% to 10%**.

Two pieces, two standings

piece	what identifies it	what we claim
Risk decomposition	variance accounting on $\approx 5,200$ deliveries; the rule is read, not inferred	Measurement. Idiosyncratic quantity share is an <i>upper bound</i> (residual holds delivery choice)
Delivery-timing response	harvest date set by elevation (+4.3 days/100 m), so the price path after a first delivery is as good as random within a year	Causal before 2020; descriptive after — that half fails a lead placebo ($t = 3.2$), halves under a day-of-season control, and its sample is selected. The regime itself: not identified

One measurement, one causal result, one regime contrast we do not price — the slides say which is which. The target-selection claim rests on the measurement; the timing result is what tells us members priced the promise and re-optimised against it.

▶ exogenous, not identified ▶ the other two arms

Design: the price path after a member's first delivery

Unit: producer i in harvest year t . Outcome: days from the *first* delivery of the season to the *second*. Shock: the log change in the world price over the thirty days *after* that first delivery.

$$\text{gap}_{it} = \beta s_{it}^{30} + \alpha_i + \gamma_t + \varepsilon_{it}$$

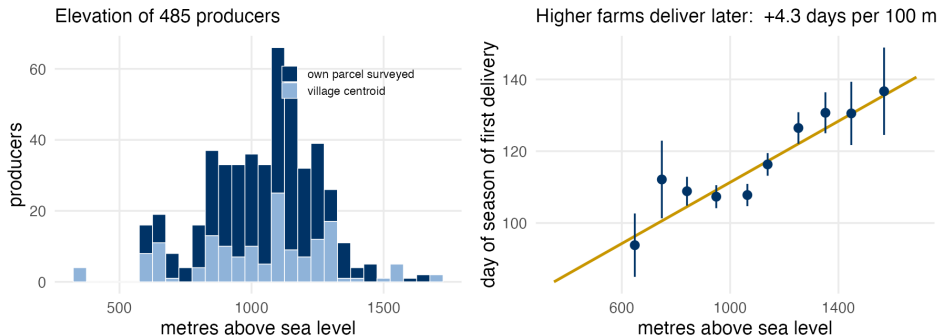
Where the variation comes from

Harvest date is set by **elevation**, not by price (next slide). Conditional on year, the price path a member faces after picking is as good as randomly assigned across members who start on different dates; **62%** of the shock's variance survives year effects.

- **Sample:** 1,351 producer-seasons with a second delivery — **42.5%** of member-years — **362** producers, 2013–2026. **This conditions on an outcome** — **55%** of member-years are a single delivery. **Tested:** the shock does *not* predict a second delivery pre-2020 ($p = 0.62$) but **does after** (-0.45 , $p = 0.02$).
- **Inference:** clustered on producer. **The shock is coarse** (3–7 distinct values a year), so we also report randomization inference ($p = 0.009$) and two-way clustering by producer and year ($p = 0.024$).
- **Estimated by price regime**, 2013–19 and 2020–25, and with a regime interaction on producers observed in both.

[▶ who is in the sample?](#)[▶ the outcome](#)[▶ variation by year](#)

First stage: elevation sets the harvest date, not the price path



Right panel residualised on harvest year and binned; 95% CI. Season day 1 = 1 October.

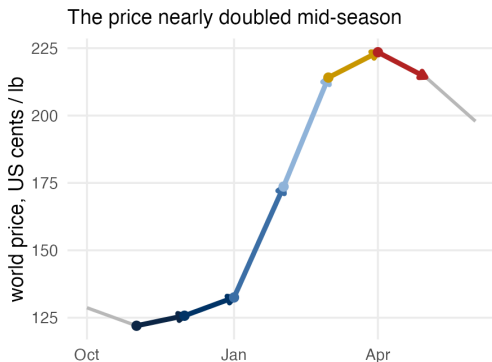
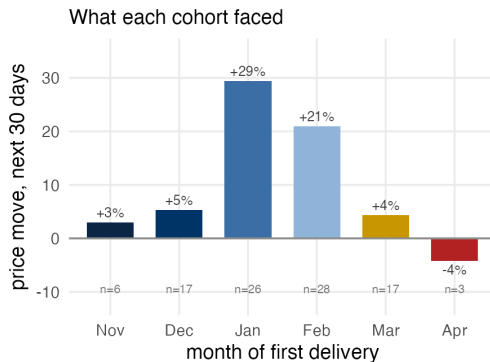
Coffee ripens later at altitude: **+4.3 days per 100 m** ($p < 0.0001$) — the p10–p90 elevation spread is **three weeks** of harvest timing, and the two sources agree (+4.48 own parcel, +3.99 village). **The placebo passes:** elevation predicts *when* a member delivers, not *what* price move follows ($p = 0.22$).

The shock is exogenous, and we can name it

- The rule was written across a decade of **low and falling** prices; from 2019 the market **tripled** and **the rule did not move**.
- The world coffee price is set on **international futures markets whose trading volume is many times physical world output**, and by **growing conditions in Brazil** — the 2018–19 trough followed several years of global surplus; the 2021 spike followed a severe Brazilian frost.
- **The cooperative's entire annual crop is about 60 tonnes** — against world output of roughly **10 million** tonnes. Six parts per million. There is no channel through which it affects the price it faces.
- Within each regime, then, the timing estimates are **causal**: harvest date is set by elevation, so the price path that follows is as good as randomly assigned.

Naming the shock is stronger than asserting that producers are price-takers.

One year, six price experiences: the variation, seen



Arrows mark each cohort's 30-day window. Same cooperative, same schedule, same year.

Harvest 2014: a Brazilian drought roughly doubled the world price *mid-season*. A member who picked in **January** saw **+29%** over the next month; one who picked in **April** saw **-4%**. Same cooperative, same schedule, same year — the only difference is **when their coffee ripened**.

► variation by year

What is not identified, and what could confound the reversal

alternative	status
Membership composition changed	Same 184 producers reverse; interaction $p < 0.0001$
COVID's direct effects (mobility, labour, health)	The flip is already present pre-pandemic: 164 of 169 first deliveries in 2020 precede 15 March, and that subsample gives -117.6 ($p < 0.0001$)
Sembrando Vida — federal transfers, begun 2019	Ruled out: 2 of 276 households participate. The programme, not transfers — transfers are a median 29% of members' income
Admissions stopped after 2018	Not a price response: 2023 had the panel's best spread and three entrants. It is administrative — a triennial admission rule. Orthogonal to a within-producer estimate

No identified estimate of the regime effect itself — one causally identified within-era response, one suggestive, and an account of why they differ. **The price falling behind is the treatment**, not a confound.

► exogenous, not identified

Pooling versus postponing

Pool it

Across **members**. Works when shocks are idiosyncratic — my bad year is your good year.

Requires cross-sectional diversification.

- **When the shock is covariate, pooling is unavailable** — it hits everyone at once, so there is nothing to diversify against.
- So institutions facing covariate risk can only **postpone**. And postponing **looks exactly like pooling** in normal times.

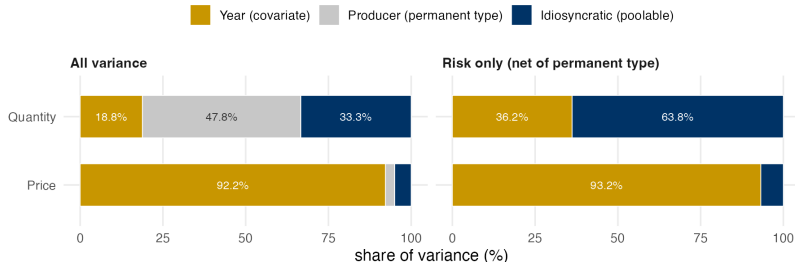
Postpone it

Across **time**. Pay a smooth price now, settle up later.

Requires only a balance sheet and a commitment.

The two diverge only in a large shock — which is also when it matters, and when members find out.

Price is a tenth of the variance, and that tenth is covariate



Log price and log quantity per producer-year, 2,904 producer-years, 485 producers, 2013-2025.
Permanent type is not risk, so the right-hand panel is the object a mutual insurer would price.

Price is 11% of the variance of coffee revenue; quantity is the rest. And the tenth being insured is **92% covariate** — which a mutual organisation cannot pool however hard it tries — while quantity is **64% idiosyncratic**, which it could. *“But you measure price after the schedule smoothed it.”* A tenth either way — **9.2%** at the cooperative’s own price, **11.8%** at the *unsmoothed world price*. *The idiosyncratic share is an upper bound*: the residual holds delivery choice as well as yield.

► dry years, low prices

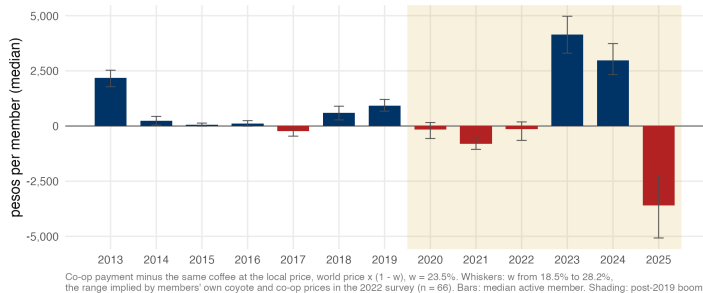
The schedule tracks the market across seasons, one commitment behind

- The board fixes the schedule each **September**, against the price on the table at that meeting, **before any of the season's deliveries**. That reference price alone explains **71%** of what members are paid ($\beta = 0.67$, s.e. 0.13, 13 harvests).
- **What is left over is forecast error, not absorption**. The gap between the cooperative price and the world price moves -0.68 with the September-to-realised surprise: when the market runs above what the board assumed, members fall behind it by almost exactly that much.
- **Sep 2022**: set against **118**, market fell to **86** — members ahead. **Sep 2024**: set against **120**, market ran to **156** — members **58 pesos/kg** behind.
- **Across seasons it keeps up** (long-run pass-through **0.921**); **within a season it does not move at all**, by construction.

The institution is a delay device, not a risk-pooling device — it commits in advance and settles the difference a season later. Measured on the board's own procedure, not inferred from a price series.

▸ the reduced-form pass-through

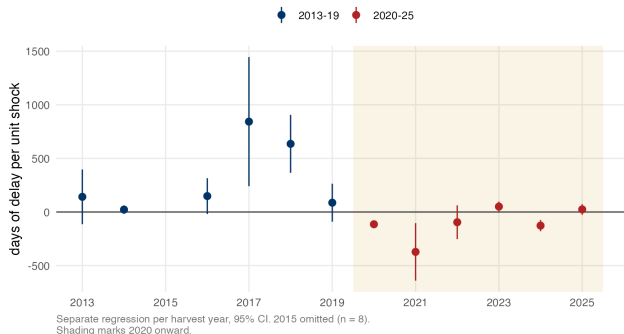
What staying loyal cost or paid, per member, each harvest



Gains when the market falls below the schedule, losses when it runs above. Paid the median member in **8** of **13** harvests; summed over 2013–25 the median member is **2,100** pesos ahead, and **84%** of members are ahead. Levels rest on one intermediary margin, measured once (2022).

Later, not lower, in pesos: the schedule pays members back in the busts for what it costs them in the booms — **+4,100** in 2023, **−3,600** in 2025.

Delivery timing responds to the price — and only the early half is identified



	coef.	days/sd
2013–2019	+99.0	+8.2
2020–2025	−72.3	−4.6
pooled	−12.6	n.s.

Six of six years positive before; four of six negative after. Omitted: 2015 (8 seasons), 2026 (partial).

Do not pool: the eras cancel and the full-panel estimate is -12.6 (10.7), $p = 0.24$. That is the wrong test, not a null result.

The 2013–19 estimate is causal; the post-2020 one is not — it fails a lead placebo (next slide), it halves under a day-of-season control, and its sample is selected. Note the trap: the later estimates are the *more precise* ones. Precision is not identification.

▶ the lead placebo ▶ drop-one-year

The flip is not composition: the same 184 producers

184 producers observed in both eras	coefficient	p
2013–2019	+93.7 (24.5)	0.0002
2020–2025	−65.7 (15.6)	< 0.0001
interaction $s30 \times post$	−149.5 (26.5)	< 0.0001

- **Not composition.** The same individuals reverse.
- Among these **184**, delivery frequency barely moves (2.47 → 2.66 per season), so it is not a change in how often they come.
- Six of six years positive before; **four of six** negative after.

This rules out composition, which is what it is for. It does not rescue the later half — the interaction inherits that era's identification problem, so read it as **a regime contrast among the same people**, not as an effect of the regime. **The volume half is weaker still** ($p = 0.074$ on the era interaction), so **“rescheduling then diversion” is a reading, not a result.**

Why the sign flips — and why we do not claim to know

The cooperative's price is fixed for the season and set on last year's quality. **Within a season it responds to none of the world price movement**, in either era. So the flip is not about what the cooperative pays *during* the season.

- **The reading we favour.** In a low, mean-reverting market a 30-day rise is noise, and holding coffee has option value against a known cooperative price $\Rightarrow$ **wait**. When the market runs above the schedule, the outside option is live $\Rightarrow$ **take the certain payment quickly and sell the rest elsewhere**.
- **But the price level does not order the years.** **2025** is the panel's most extreme boom — world price **156**, a **58-peso** wedge — and its coefficient is **positive** (+24); **2020**, at a middling price, is the most negative (−114). **The story does not fit its own best case.**
- **Something else changed at 2020.** Within-season the price turns *mean-reverting* (lead-shock correlation −0.44 against −0.21 before) — which is also when the placebo binds.

We report the flip and decline to price it. The same producers time deliveries against the schedule, and how they do it changed after 2020. **That the boom caused it, we cannot say.**

► the lead placebo

Nine-tenths of the variance, and nothing that targets it

- **Quantity is 89% of the variance of members' coffee revenue**, 64% of it idiosyncratic — the share a mutual organisation *could* pool. **An upper bound**: the residual holds delivery choice as well as yield. Weather is about 1% of it.
- **And coffee is not the household**: a median 16% of members' income in 2017 ($n = 180$), 30% in 2022 ($n = 70$) — **a bound across two waves, on two different instruments**.

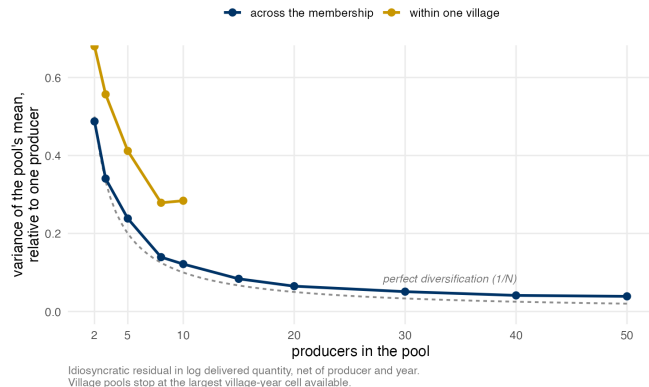
The heaviest instrument addresses a tenth of coffee-revenue variance, and coffee is a sixth to a third of income. The largest component — idiosyncratic quantity risk, precisely what a membership organisation could pool — has no instrument built for it.

What the price schedule delivers, against what it was aimed at

instrument	targets	share of risk	delivers	costs
price schedule	price, across years	11% of variance, 92% covariate	pass-through 0.921, a season late; variance $\approx 9\%$ higher	$\approx 3,600$ pesos/member in 2025
(none targets it)	quantity, across years	89%; 64% idiosyncratic — the poolable part	the honey arm and the credit fund reach it only incidentally (companion paper)	—

The instrument targets the smaller component, passes it through in full one season late, and raises income variance while doing it. The larger component — the one a membership organisation could actually pool — has nothing built for it.

Could anyone pool it? Yes — but not a village



- **Exposure genuinely differs** — residual sd **0.39** to **0.96**, p10 to p90 (**$2.5\times$**), against a permutation null $p < 0.001$.
Not a size effect.
- **But it is not fully idiosyncratic**: **27%** of it is common within a **village-year**, **20%** within a region-year.
- $\Rightarrow$ **across the membership, pooling tracks $1/N$** . Within a village it stalls near a quarter of individual variance by $N = 10$ — and the average village-year has only **5.8** members to pool.

The cooperative is the right body to pool this, and a village is not — **485** members across **10** regions diversify a shock that is a quarter village-common. **What is missing is not diversification** ▶ what IS this risk? ▶ index insurance?

External validity, and the policy version

- **Postponing and pooling differ, measurably** — if you observe the rule. Pass-through **0.921** says this institution absorbed nothing; an outcomes-only study would have seen a smooth price and called it insurance.
- **Voluntary participation reveals the difference.** Members did not exit; they *re-optimised at the margin*.
- **“One cooperative”** — but **the decomposition is measured on members**, so it bounds what *any* price floor can reach.
- **Later, not lower — applied to the right object.** The schedule delays price *information*, which members do not need. What they lack is *money* later in the year: paid in February, hungriest in July. Members elsewhere pay for that deferral (Casaburi & Macchiavello 2019).

The policy version: paying out part of the harvest value in the lean months re-targets an instrument the cooperative already runs at the largest within-year gap, at no pooling cost — and the monthly measure is what it takes to evaluate it.

Conclusion

The question: when an institution offers smallholders instruments against income risk, which of that risk do they reach?

- 1 **The price instrument reaches a tenth of the risk, and delays it.** Price is **11%** of coffee-revenue variance, **92%** covariate; pass-through **0.921**, one season late; variance left $\approx$ **9%** higher. Members notice: the same **184** producers flip from waiting to diverting when the state moves.
- 2 **The largest component — idiosyncratic quantity, the one a mutual organisation could pool — is targeted by nothing** and reached only incidentally.

Target selection, not calibration. The instrument is aimed at the component a mutual group cannot pool, and leaves alone the component it could. **Later, not lower** — and later is not what the risk required.

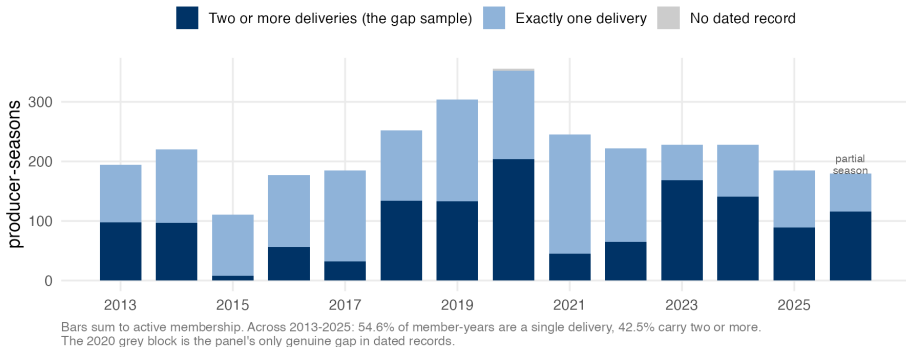
Next steps

- 1 **Household income, not coffee revenue.** Coffee is a sixth to a third of measurable household income, so the price share falls and the claim sharpens — but only as a *bound*. **The decomposition itself cannot be redone on these data:** income is cross-sectional in both waves, so its variance is not identified. That needs a second wave of the same instrument, not more work on these two.
- 2 **Commit to timing instead of to price.** The cooperative already separates *when* it pays from *what* it pays — a flat advance at delivery, settled afterwards. It fixes the price in September and lets the timing fall where it may. **Would enlarging and moving that advance be worth more to members than holding the price fixed?** That is a counterfactual on an instrument the cooperative already operates, and it can be priced against its own balance sheet.
- 3 **One question to the partner.** Does the group offer anything at all against *yield* risk — an advance against a shortfall, in-kind support, insurance? Nothing in the records shows one, and that is the cell the paper says is empty.
- 4 **Test the quantity residual directly.** Elevation $\times$ weather is the only within-year exposure variation the data offer; exploratory, against the placebo standard the other exposure designs failed.

The first two are the paper's; the rest are its scope. **Reactions on any of them are welcome.**

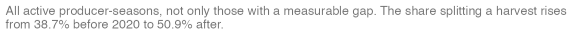
► three framings

Backup: how much of the panel can we use?



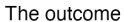
Not a records problem: **55% of member-years are a single delivery**, so there is no gap to measure. Only 2020 has a real gap in dated records. And since splitting a harvest is itself a timing choice, we test it — the shock does **not** predict a second delivery before 2020 ($p = 0.62$), but **does after** (-0.45 , $p = 0.02$).

◀ back to the panel



◀ back to the panel

Backup: the outcome, and what bounds it



Binned means with 95% CI, bins of 15 season-days with at least 10 observations. Season day 1 = 1 October.

Mean **35** days, so the **9-day** response is **a quarter of the average gap**. But it compresses as the season runs out, and month of first delivery is the identifying variation — so we control for day-of-season: **+99** → **+98**, and **+97** with month fixed effects.

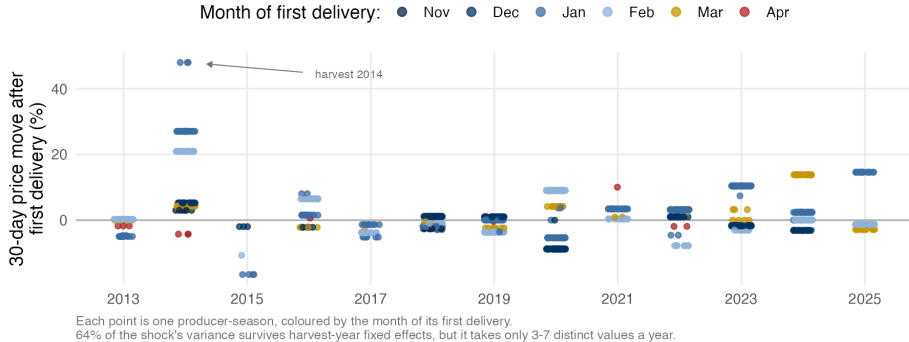
[◀ back to design](#)

Backup: exogenous is not the same as identified

- **No selection**: nothing about which members experience the boom is chosen.
- **But the regime has no cross-sectional variation**. Every member enters it on the same date. With only time-series variation in the treatment, the regime is observationally equivalent to anything else that breaks at the same moment.
- We tried to manufacture cross-sectional exposure — using each member's own predetermined price as their distance from the market — and **it failed**: two proxies for the same concept gave opposite signs.

So the burden is co-timed alternatives, which can be named and met one at a time.

Backup: where the timing result has variation



And 2014 is not special — every year has this spread. **62%** of the shock's variance survives harvest-year fixed effects. **It is coarse** (3–7 distinct values a year), hence randomization inference ($p = 0.009$) and two-way clustering (**0.024**).

Backup: four things we tried that did not work

- **Credit / liquidity.** 438 seasons with an active loan; the reversal is the same size with and without ($p = 0.40$). The pre-committed 2013–19 test gives the *predicted* sign (a 37% smaller response when indebted) but $p = 0.21$ **with an MDE of 83% of the base effect — underpowered, not refuted.**
- **The incentive channel.** Not estimable — the return to quality is a year-level variable with six distinct values in fourteen years.
- **Exposure design, twice.** Placebo of the same magnitude; sign reverses across two proxies.
- **A second commodity as external validity.** Honey's annual delivery series is a time trend (corr. 0.814) and the behavioural test is flat, so it cannot replicate the reversal. **It enters instead as a timing instrument** (Results, block B).

One that did work: drought earns a place as a *control* — the volume response barely moves with rainfall, so the post-2019 decline is not a smaller harvest.

The reversal is **robustly measured and unexplained**. We can say what it is *not*.

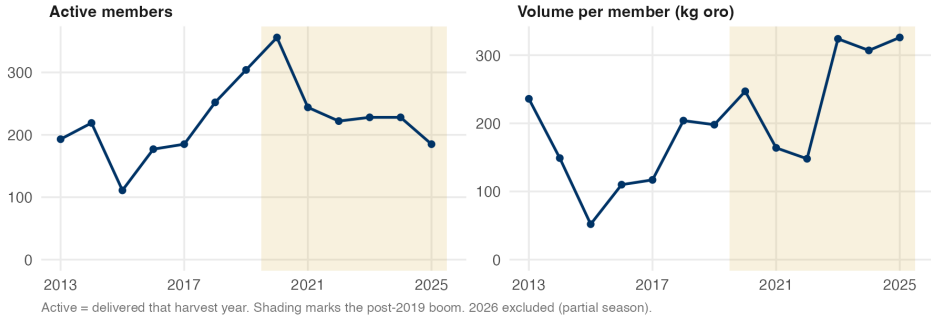
[◀ back to the toolkit](#)

Backup: the price floor, in detail

- 1 Price risk is **a tenth** of the variance of members' coffee revenue, and **92.2%** of that tenth is **covariate** — the part a mutual organisation cannot pool however hard it tries.
- 2 It does not *absorb* even that tenth. Long-run pass-through is **0.921**: the price signal arrives in full, just late.
- 3 And the schedule does not reduce that variance — it **raises** it by about **9%**, because it pays more precisely when a member has more. (Positive in all 18 specifications tried.)
- 4 In the 2025 boom the commitment cost the typical member **≈3,600 pesos** (2,200–5,100 across the margin's range). **The 2023→2025 swing, −62.7 MXN/kg, needs no margin.**
- 5 **And the price premium is small.** A median of +2.5% over the local alternative — on the cooperative's own estimate of the intermediary markup, not the +16% once carried (backup). **Whatever brings members in, it is not the price.**

A floor addresses about a tenth of the risk, passes 92% of that tenth through anyway, and leaves revenue variance higher. The problem is not calibration.

Backup: membership shrank — through the entry margin



Membership peaked at **356** in 2020 and fell to **185** by 2025 — but the panel *opens* at **193**, so this is a fall from a peak. **And it is not exit**: leaving is at its lowest in 2022–23. The fall is on the **entry** margin — admissions stopped after 2018. **Why, we do not settle here**: two partners give opposite accounts and the roster cannot separate them (backup). **That is a separate paper**. What members *did* do is get bigger: **247** → **326** kg each (+32%).

Backup: the food-insecurity item, and what it is not

- **One select-multiple item, verbatim** (KoboToolbox form, 2022): *“Durante el año pasado, ¿en qué meses usted no tuvo suficiente comida para alimentarse usted o alimentar a su familia? Puede seleccionar más de uno.”* Twelve month boxes, January first; expanded to twelve binaries per household.
- **It is FANTA’s MAHFP question 2** (Bilinsky and Swindale 2010, v.4: *“which were the months in the past 12 months during which you did not have enough food to meet your family’s needs?”*), which Anderzén et al. (2020) use in this region — *minus the final step of counting the months*. **Three departures**: no screening question; the month list is *shown*, not recalled unprompted; “el año pasado” rather than an explicit trailing twelve months. **Not a validated experience scale (FIES, HFIAS, ELCSA)**.
- **Retrospective recall, one interview** (71/123/81 in June/July/August 2022). Read as a trailing window, “August” is 2021 for a June interview and 2022 for an August one: reported August insecurity **35.2%** vs. **58.0%**. **Read as calendar 2021, the window does not move** — wave × month controls absorb either reading. A separate *“¿sentía hambre?”* item is about that morning (**30.5%** yes).
- **Ten enumerators; recorded beekeeper share 3%–33%**, not geographic ($F = 2.17$, $p = 0.024$): measurement error in the *treatment*. Hence the enumerator × month controls.

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel.

[◀ back to the panel](#)

Backup: robustness on the 2013–19 half

	coefficient	p
All years (published)	+99.0 (22.2)	< 0.0001
Drop 2013	+102.9	< 0.0001
Drop 2014	+303.2	< 0.0001
Drop 2017	+91.1	< 0.0001
Drop 2018	+77.0	0.0006
Drop both 2017 and 2018	+69.6	0.0015

The early-era result is not driven by any single year.

Backup: the quality lag, three ways

- **Written:** the board's procedure sets the quality premium from *"la calidad en el muestreo del ciclo anterior."*
- **Partner:** "the price depends on the previous year's sampling; transition producers get a flat rate."
- **Measured:** a producer's delivery price correlates with their own prior-cycle top-grade share at 0.73 / 0.67 / 0.59 across three cycles, against 0.40 / 0.27 / 0.17 contemporaneously; 0.56 independently in the later system.

Scope caveat. The lag is documented and measured from 2021–22 onward. For 2013–2019 no posted price exists in any file we have — only the settled, grade-weighted price, which is contemporaneous by construction. So the paper scopes the cross-sectional margin to the later era.

Backup: the price premium is small, on the co-op's own benchmark

Local buyers pay **the world price less a markup, flat across quality** — and the cooperative records its own estimate of that markup, *Margen intermediario*, in the price workbook. **That is the benchmark to use:** a partner's field estimate, not a calibration.

window	vol-wtd	median	yrs above
2013–2025	+1.6%	+2.5%	8/13
2013–2018 (<i>markup never revised</i>)	+9.2%	+2.6%	5/6
2019–2025 (<i>revised retroactively</i>)	−0.3%	−9.5%	3/7

Caveat. The 2013–18 volume-weighted figure leans on 2013 alone (+45%); the median is the honest centre. From 2019 the markup is **vintage-dependent** — revised retroactively, so any post-2019 figure needs its vintage recorded.

A median of about +2.5% — not the +16% once carried, which implied a markup of **28.2%** against a recorded 13.5–24.2%. **Whatever brings members in, it is not the price.**

[◀ back to the floor](#)

Backup: why admissions stopped — two accounts, not one

Asked independently, two cooperative staff give **opposite** answers:

source	account	margin it implies
Commercial	“producers became more price-sensitive ”	Demand — fewer wanted in
Certification	the <i>mesa directiva</i> capped intake to protect the organic share; admissions now every three years	Supply — fewer were let in

- **Both can be true**, and the records cannot adjudicate: with **no waitlist and no applications**, a closed intake year and a year without applicants are **the same observation**.

This paper makes no claim about why admissions stopped — that is a companion paper. Here the decline is setting, not result.

◀ back to membership

Backup: the beekeeper $\times$ month interactions

	coef	s.e.
Feb	+0.032	(0.030)
Mar	+0.005	(0.037)
Apr	-0.044	(0.049)
May	-0.034	(0.059)
Jun	-0.049	(0.073)
Jul	+0.015	(0.082)
Aug	+0.055	(0.083)
Sep	+0.081	(0.064)
Oct	+0.041	(0.030)
Nov	+0.018	(0.024)
Dec	+0.022	(0.024)

- Producer FE; January omitted; clustered on producer; $N = 3,300$.
- Joint test, all eleven: $F = 0.558$, $p = 0.862$; with interview-wave $\times$ month absorbed, $p = 0.838$, same three months negative.
- Window fixed from the income data (honey $>$ coffee) before the outcome was examined; most negative of all 220 windows — **a rank, not a p-value**.
- Randomization inference, pooled Apr–Jun, 275 permuted producers: two-sided $p = 0.12$.
- **Late-season reversal** (Aug–Oct positive) falls where neither income exists — what a timing mechanism would produce; n.s.

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel.

Backup: isn't the honey result just selection? — it cuts both ways

Non-beekeepers were asked how interested they would be in keeping bees. The **32** who *want* bees and have none are the informative group:

	want bees, have none (32)	beekeepers (54)
median income excl. honey (MXN)	9,600	13,600
hungry months per year	1.91	1.67

- **Annual margin:** aspirants are poorer and hungrier by *more* than the annual beekeeper gap (-0.18): adoption is limited by resources; the annual comparison is biased *toward* a benefit.
- **Seasonal margin:** among non-beekeepers alone, high interest predicts food insecurity *in April–June specifically*, $+0.131$ (0.061); $+0.080$ under enumerator controls. What draws a household to bees is a lean-season problem in the honey months, so the seasonal comparison is *attenuated*.

The two margins point opposite ways and we cannot net them. Hence “descriptive” rather than “biased upward.”

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel.

[◀ back to beekeeping](#)

Backup: does honey reach the quantity cell? The test

Across years (13–14 years; descriptive)

cor(SPEI, honey volume), four definitions	+0.13 to +0.23
cor(SPEI, mean log coffee)	+0.27
cor(log coffee, log honey) same, detrended	+0.53 ($p = 0.06$) +0.23

Within dual producers (21 with ≥ 4 years of both; 166 producer-years)

log honey on log coffee, producer FE	+0.13 (0.06), $p = 0.05$
+ year FE	−0.02 (0.09), $p = 0.85$

- **Weather is not a detectable driver of either crop**; SPEI is 91–98% village-covariate, so year effects absorb 97% of it.
- **Honey and coffee fail together in the year component and not otherwise**. Diversification into honey therefore reaches the *idiosyncratic* quantity cell — an uncorrelated second stream — and not the *covariate* one.
- **Borrowing tracks the covariate shock**: loans per year −0.68 with coffee volume ($p = 0.02$, $n = 11$), −0.39 with SPEI. 2015: 103 loans, 79 in May–August; 2016: 125.
- **Caveats**: 13 years; honey is annual and trends up; the loan series ends 2023. Script: `honey_spei_test.R`.

[◀ back to nine-tenths](#)

Backup: “doesn’t the floor help exactly when the harvest fails?”

year	SPEI	world price	mean log kg
2013	−0.68	41	5.18
2014	+0.27	54	4.63
2015	−0.88	58	3.34
2016	−0.31	60	4.19
2017	−0.80	74	4.24
2018	−0.88	56	4.81
2019	−1.11	54	4.79
2020	−0.30	69	5.07
2021	+0.49	80	4.46
2022	+0.06	119	4.53
2023	−0.19	86	5.42
2024	−0.76	89	5.33
2025	+1.43	156	5.33

- **At the year level, yes.** $\text{cor}(\text{SPEI}, \log \text{ world price}) = +0.68$ over 13 years: dry years here have been low-price years, so the market price *amplifies* the covariate quantity shock and a fixed price cushions it. Two time series, thirteen points, and the 2025 wet-and-expensive year does much of the work.
- **At the producer level, no.** Median $\text{cor}(\text{own log quantity}, \log \text{ world price}) = -0.03$ across 276 producers with ≥ 5 years; 51% negative. No hedge in either direction.
- **And the cushion is small:** price is a tenth of revenue variance, and the covariate quantity shock is mostly *not* weather — lagged world price explains more of the year component ($R^2 = 0.33$) than SPEI (0.07). 2015 was rust as much as drought. Script: drought_role.R.

Backup: the retired portfolio result, with its condition

- On the acopio panel, a producer who holds honey alongside coffee has about **45%** lower revenue variance than one who does not — the number that once closed the coffee paper.
- **Retired 2026-08-06** because (i) it is conditioned on the **20** producers who both keep bees *and* deliver to Chabtic, now visibly about half of adopters; (ii) honey's annual series is a time trend (corr. 0.814), so nothing about it can be identified off the price cycle; (iii) it changes the unit of analysis from the organisation to the household.
- It is the only number in the project that speaks to the *quantity* cell, which is why it is here and not in the body.

Backup: the three candidate framings

field	what leads	what it would cost us
Ag econ	the decomposition — careful measurement of an observed rule	Nothing. Takes the paper as it stands
Development	the decomposition, but on household income	Item 1 — go and get the 2017/2022 surveys
Finance	the reversal — the cooperative as an uncompensated option writer , the boom as that option exercised against it	Work we have not done. The short position is never made explicit, let alone priced

Not equally live. The deck argues the first two; **the option reading is ours, not the data's** — if nobody reaches for it unprompted, that is evidence in itself.

◀ back to the closing slide

Backup: a suggestive mechanism result

New members spend three years in “transition” on a *flat* price (verified: $T0 \rightarrow T1 \rightarrow T2$, a clean cliff at tenure 4), then move onto the quality-contingent schedule — an administratively assigned change in whether quality is priced at all.

event time	estimate	p
−2	−0.007 (0.030)	0.81
0 (switch year)	+0.003 (0.019)	0.88
+1	+0.043 (0.021)	0.048
+2	+0.042 (0.030)	0.15

Against 160 never-switchers. Clean pre-trends; nothing at the switch; about +4pp top-grade share the following year. **Suggestive only** — MDE is 35% of a standard deviation.

Backup: two margins of the same staleness

margin	what moves	what the stale price does	how we measure it
cross-section	a member's own quality changes	still pays last year's grade	pay departs from realised value, 21.8% per unit of quality change ($t = 8.3$)
time	the world price triples	the schedule does not move	members reverse how they sell, interaction -149.5 ($p < 0.0001$)

Opposite welfare signs. Cross-sectionally the stale price *insures* — a member whose quality collapses is still paid last year's rate. In time it *taxes* — a member whose market tripled is still paid last September's schedule.

Cut from the main body: the cross-sectional margin is the quality paper's question. Kept here because the unification is the cleanest statement of what a stale price does.

[◀ back to the rule](#)

Backup: what a referee will say

- ① The share is coffee revenue, not household income. ✓ **Answered** — coffee is a median **30%** of measurable household income ($n = 70$; **16%** in 2017, $n = 180$), so the bound holds: necessarily less than **11%** of household income risk. It makes the claim *stronger*. Detail and caveats on *bk-householdshare*.
- ② The headline is descriptive; what we identify is timing. ✓ **Answered by the deck's order** — the decomposition leads, the reversal is evidence that members notice.
- ③ “They chose this” inverts easily. ✓ **We claim deliberate commitment** — the market price sits in the same sheet as the schedule, the board reset **2022** twice in one autumn, and **7** of **7** revisions land before the harvest. **Not the motive**: advance commitment could serve administrative legibility as easily as stabilisation. **Ask 3**.
- ④ We attack the target and offer no alternative. **Open — and the number changed**. Pooling cuts variance **47%** but cannot be priced *large*: **+4.3%** choice-weighted, **+0.0%** at exactly risk neutrality, against an upper bound assuming perfect pooling and no administrative cost.

Two of the four are closed. What remains is intent (3) and placement (4) — and (4) is the field question the closing slide asks open.

Recovered from the pre-toolkit deck. **Corrected 2026-09-17**: it read “pooling is worth **−9.6%** at rev **+1.6%**”
a Jensen artifact that does not survive a peso-denominated construction

[◀ back to the conclusion](#)

Backup: do they migrate? Internally and seasonally — one US trip in 626 households

2017 module (626 households, roster $\times 10$)

- **18.4%** had a member leave to work last year (115 households, 149 trips); **5.6%** have one living permanently outside
- members **15.1%** vs. non-members **19.8%** — χ^2
 $p = 0.20$, indistinguishable

2022 exit survey (275)

- **30%** worked for pay in another Mexican city, median **3,000** pesos
- no destination, no permanence, no US item

Where the 149 trips went

destination	trips	%
Cancún / peninsula	52	34.9
Sonora	31	20.8
Sinaloa	4	2.7
United States	1	0.7
other	61	40.9

The Yucatán tourist economy and the northwest agro-export belt — **domestic seasonal labour, not international migration.**

A household margin, not a cooperative one — the widest response to quantity risk, sitting entirely outside the group's instruments. **It cannot be estimated here:** 2022 records neither destination nor permanence, and neither wave links to the delivery panel except through the **94** crossref households.

◀ back to the untargeted nine-tenths

Backup: the household's own buffer stock — members hold more, and run it down at the same rate

2017 module (626 households)

Sold an animal in the last year

	median TLU	holds cattle	sold
members (192)	0.28	12.5%	25.0%
non-members (434)	0.20	3.2%	24.2%
$p < 0.001$		$p = 0.91$	

species	holders	% who sold
cattle	38	44.7
pigs	128	32.0
poultry	564	20.9
horses	47	4.3

Monotone in store of value: horses are transport, and are not sold.

Self-insurance across time — the household's version of what the schedule does with a payment rule, reaching the quantity risk nothing else targets but thinly: the median household holds 0.20 TLU, which is poultry. And measured in a trough — harvest 2017 ran at a third of normal volume with the wedge at −33.9, its third worst in thirteen years, so stocks are already drawn down. Counts only: a fifth of price responses are on a different scale.

◀ back to the untargeted nine-tenths

Backup: coffee's share of household income — a bound, not a measurement

Why a bound. With $Y = C + O$, price risk contributes $0.112 \text{ var}(C)$, so its share of $\text{var}(Y)$ is $0.112 \times \text{var}(C)/\text{var}(Y) < 0.112$ for *any* other source with variance of its own — **no estimation needed**. **Income is cross-sectional in both waves, so $\text{var}(Y)$ is not identified: there is no point estimate to report.**

Median share of measurable household income

What the 2022 number rests on

	share	n
2017, members	16%	180
2022, members	30%	70
2017, non-members	9%	389
2017, all growers	10%	569

2017 is the EFT baseline's purpose-built module (Ag + Gov + Extra, exact on 626 rows). 2022 is constructed: the co-op's harvest-2021 settlement over crop sales + off-farm + other milpa + Sembrando Vida. **Was 36% in earlier versions of this deck** — a frozen multi-year snapshot whose vintage did not match the survey. `coffee_income_share.R`.

- **The vintage is testable, not chosen:** coffee income nests inside reported crop sales for **91%** of households at harvest 2021, against **61%** (2020) and **70%** (2022). The survey's "last year" is calendar 2021.
- **6 of 80 report coffee above all their measured income** — dropped, not repaired.
- **Admin and self-report agree only loosely:** delivered kg against self-reported harvest, **0.55** in logs, admin **0.41**× — a unit gap, and some of the crop leaves through the coyote.
- **2017 fieldwork spanned two calendar years**, so its "el año pasado" is not one year.
- **"Income" is only what the instrument asks:** no remittances, livestock or subsistence.

A sixth to a third, on two instruments a price boom apart — so **11%** of coffee-revenue variance comfortably overstates the household bound.

◀ back to what we find

▶ outside the co-op: ENIGH

Backup: coffee's share of income outside the cooperative

ENIGH (INEGI's household income survey) asks **the same questions every round**. Chiapas households that sold coffee; weighted medians, 95% CI resampling ENIGH's sampling units.

Coffee's median share of household income

	share	95% CI	n
<i>ENIGH, Chiapas coffee sellers</i>			
2020	16%	15–22	168
2022	27%	17–36	162
2024	15%	10–21	148
<i>Our members</i>			
2017 (EFT)	16%		180
2022 (exit survey)	30%		70

Coffee (code 037) sales over current income, crop business gross, imputed rent excluded. Net-income version 14%, 21%, 12%. Rural (<2,500) 16%, 22%, 13%. enigh_coffee_share.R.

What it shows

- **Coffee is a minority of income for Chiapas growers generally** — about a sixth in ordinary years. The bound does not rest on our sample.
- **The 2022 rise is the boom, not the questionnaire:** one instrument rises to **27%** in 2022 and falls back by 2024.
- **Members look like the average grower: 16%** against **16%**, **30%** against **27%** — inside the interval.

What it does not

- **Not our members** — most ENIGH coffee households are outside the cooperative.
- **No point before 2020:** the 2016 and 2018 releases have no crop-level table.

About a sixth, a quarter in the boom — on one instrument, outside the cooperative. Our members sit where Chiapas coffee growers do.

◀ back to members' share

Backup: who is a member? 2017, in the trough

The year: harvest 2017 at **a third of normal volume** two years after the rust collapse, SPEI -0.8 , wedge -33.9 **MXN/kg** — third worst in thirteen years, the peso having fallen while the schedule did not move.

Income, MXN/yr (626 households: 192 / 434)

	mem.	non	p
TOTAL	11,700	9,400	0.368
coffee sales	3,000	1,000	0.000
transfers	5,400	5,400	0.043
other agric.	0	0	0.318
off-farm	0	0	0.929
<hr/>			
	<i>share of income</i>	mem.	non
Composition	from coffee	36%	17%
	from transfers	38%	73%

The buffer

	mem.	non	p
livestock, TLU	0.28	0.20	0.000
sold an animal	25.0%	24.2%	0.908
value when sold	2,337	1,600	0.179
% of that hh's	24.7%	12.9%	
income			
buys maize	54.7%	44.9%	0.030
sent away to work	15.1%	19.8%	0.196

Crop income: $_c$ series ($\times 10$ unit fix). Transfers annualised from receipt frequency. Livestock priced per head, with $\text{PrecioPorUno} \leq 50$ read as pesos/kg and scaled by a weight calibrated within species (pigs 59 kg, cattle 212 kg).

The same income, from different places. Totals are indistinguishable; members earn from *coffee*, non-members from *transfers*. They hold more buffer and draw it at the same rate — but each sale is worth more, and does more work. **A profile of one moment, not an effect of membership.**

◀ back to the setting

Backup: who is a member? 2022, in the boom

The year: the co-op paid **79.1** against a world price of **118.7** MXN/kg oro — wedge **−39.6**, and the regime in which members divert. “Member” here = the household holds a membership (`coop_member_hh`, 128 of 275). Several adults per household sat the survey separately, so the narrower “is the registered member” variable (`coop_member`, 96) is a different comparison.

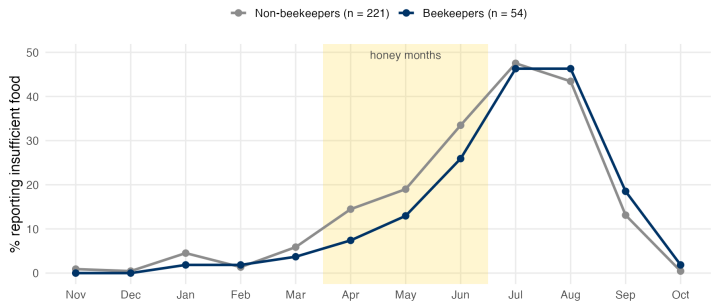
	mem. (128)	non (147)	p
livestock TLU	0.75	0.35	0.000
income (MXN)	15,000	10,050	0.004
years in coffee	20	10	0.000
worked away	28.1%	32.0%	0.574
hungry months	2	2	0.479
land (ha)	3.00	3.00	0.033

Where the coffee goes — the margin 2017 cannot see

	mem.	non	p
total sold (kg)	240	240	0.888
to the co-op (kg)	180	100	0.000
to a coyote (kg)	30	70	0.001
% routed to co-op	88%	55%	0.000
sells any to a coyote	59%	71%	

They grow the same and route it differently. Total sold is *identical*; membership is a marketing channel, not a scale difference — and **59% of members still sell some outside**. Different sample and instrument from 2017: read the two as profiles, never as a panel.

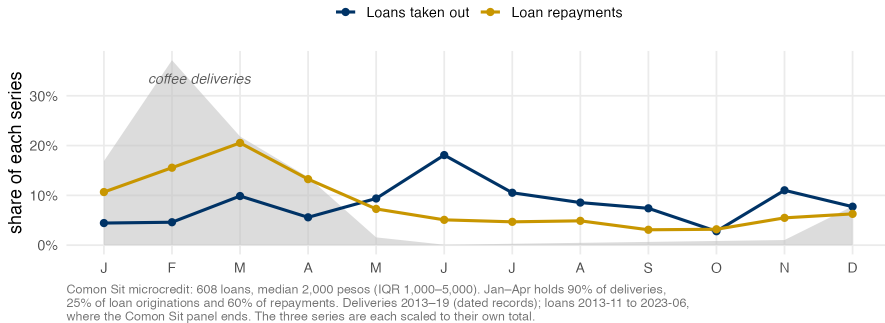
Backup: the lean-season gap, by beekeeping status



93% of reported hungry months fall April–September; both groups peak near 46% in July–August. The gap opens in the honey months and closes by the peak — what an income arriving April–June and spent by July would produce, and also what selection on a lean-season problem would produce.

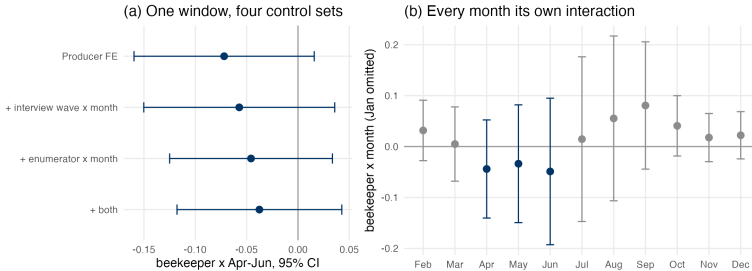
Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel.

Backup: the credit fund and the lean season



Borrow through the lean season, repay out of the harvest — the months in which borrowing rises are the months in which food insecurity does. Yet the two arms are institutionally separate. **48%** of deliveries are made by a producer carrying an active loan, and **not one of 2,297 deliveries carries a debt deduction**. Median loan **2,000** pesos against median coffee revenue of **3,900**, and **dear: 4%** a month, **60%** a year.

Backup: beekeepers — 3.8 pp, and not significant



Raw, 7 pp less in April–June against a seasonal rise of 9 pp; absorbing interview timing and enumerator **halves it to 3.8 pp** (s.e. 4.1) — the number to carry. April–June are the **only negative months**, and the most negative of all **220** windows. **No month significant; joint $p = 0.86$; randomization $p = 0.12$; annual count unaffected.** Consistent everywhere, significant nowhere.

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas*

(companion paper). Estimates re-derived for this deck from the survey panel.

- ▶ month-by-month table
- ▶ selection
- ▶ what the item is

Backup: the honey instrument's reach

- Among honey households, honey is a median **41% of household income** — 10,262 MXN against **13,550** from everything else — so this is not a marginal supplement.
- But the *instrument* is the honey cooperative, and its reach is narrower than adoption: about a **quarter** of coffee members keep bees, and **about half of those never deliver to Chabtic** (12 of 23 in the linked survey; **to be re-run on a same-year definition**).
- Chabtic paid **55 MXN/kg** in 2022 against a private-buyer **40**, and sat above the alternative in **11 of 14** years. **Whatever keeps half the honey outside, it is not the price.**
- The retired portfolio result (holding honey: revenue variance **-45%**) is conditioned on the **20** who both keep bees *and* deliver — **backup only**.

Adoption is a household portfolio choice; participation is the instrument. The organisation reaches the timing gap through a quarter of members, and half of them route around it.

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel. [▶ the rest](#)

Backup: do the other two arms reach the quantity cell?

Neither is built for it; both touch it incidentally. Full treatment in the companion paper.

- **Honey reaches the idiosyncratic part, incidentally.** Within the 21 producers who deliver both, log honey on log coffee is +0.13 ($p = 0.05$) with producer effects and -0.02 ($p = 0.85$) with year effects too: the harvests co-move in their year component (+0.53) and are uncorrelated idiosyncratically. A second stream that does not fail with the first — for a quarter of members.
- **The credit fund reached the covariate part, ex post.** Loans per year run -0.68 against coffee volume ($p = 0.02$, $n = 11$): **103** in the 2015 rust-and-drought trough, **79** in May–August, **125** in 2016, against **27–59** in ordinary years. **Eleven years; possibly a programme response to rust.**

Incidental reach is not targeting. Honey is a household's own portfolio choice, available to a quarter of members; the credit fund absorbed a covariate shock *ex post*. Neither conditions on the shortfall itself — which the cooperative never observes.

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel.

Backup: one organisation, three instruments

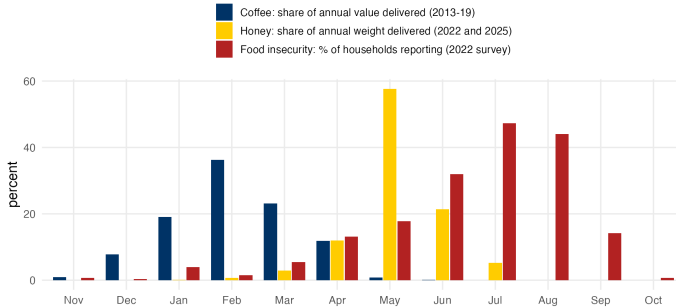
	Bats'il Maya (coffee)	Chabtic (honey)	Comon Sit (credit)
what it does	buys, processes, markets; five-grade price schedule fixed before harvest	promotes beekeeping; buys honey at a posted annual price	lends through the lean season; repaid out of the harvest
reach	485 members deliver at least once; 223 in an average year	29 deliverers in the panel. <i>About a quarter of coffee members keep bees; about half of those sell elsewhere[†]</i>	251 borrowers; 48% of coffee deliveries by a member with a live loan

† Of 86 surveyed households active as coffee members in 2022: 23 keep bees, 14 have ever delivered to Chabtic, 12 of the 23 never have. Different windows (2022 self-report vs. 2012–25 deliveries); to be re-run on a same-year definition.

Three instruments, one organisation, all voluntary. **Adoption and cooperative participation are different objects**, and the honey arm's reach is the smaller of the two.

[◀ back to the setting](#)

Backup: coffee pays in February; hunger peaks in July



98.1% of the annual value of coffee arrives December–April (36.3% in February); May–October delivers **0.9%**. Food insecurity runs from under **5%** of households to **47.3% in July**. Honey is **57.7% in May alone** — **185** dated deliveries across two seasons, April–June **91%** of weight in both.

Honey material: Storer, Pitts, Anttila-Hughes & Boyd, *Sweet and Timely Income? Beekeeping and Seasonal Food Insecurity in Chiapas* (companion paper). Estimates re-derived for this deck from the survey panel. [◀ back to the harve](#)

◀ back to the harvest window

Backup: all three instruments, side by side

instrument	targets	share of risk	delivers	costs
price schedule	price, across years	11% of variance, 92% covariate	pass-through 0.921, a season late; variance $\approx$ 9% higher	$\approx$ 3,600 pesos/member in 2025
honey coop	timing, within year	the Apr–Jun months	3.8 pp less food insecurity in those months (n.s., descriptive); nothing annually	a quarter of members; half sell outside
credit fund	timing, within year	June peak, for food	median loan 2,000 vs. revenue 3,900; no debt deduction ever	separate from the harvest
(none targets it)	quantity, across years	89%; 64% idiosyncratic	honey reaches the idiosyncratic part; credit absorbed the covariate part ex post	—

The heaviest instrument targets the smallest component and passes it through; the two aimed at the calendar reach it partly; the largest poolable component has none. (Nulls, floor detail, backup.)

[◀ back to the scorecard](#) [▶ four nulls](#) [▶ floor in detail](#)

Backup: what *is* the idiosyncratic quantity risk?

Residual log delivery volume, two-way demeaned (producer and year). It is **36%** of the variance of log volume.

What it is not. Share of the residual explained:

SPEI	1.3%
coffee area	1.9%
rainfall	0.8%
temperature	0.7%
plant count	0.1%
elevation, drought	<0.05%

Not rust — roya was **2014–15**, a year effect, already in the between-year share. **Not biennial bearing** — alternate bearing would be negative at lag 1; AR(1) is **+0.285**, decaying (AR(2) +0.06). **Not the outside option** — residual sd **0.663/0.659** either side of 2020.

What it looks like. Lumpy and episodic: 12.4% of producer-years move by more than one log point (a factor of 2.7), and the top 5% of deviations carry 29.6% of the variance. Not smooth continuous variation.

Does the credit fund reach it? No. Lending is counter-cyclical against the *aggregate* shock (corr -0.66 with total volume, **11** years) but flat against a producer's *own* shortfall: $P(\text{loan})$ on the residual is -0.001 (se **0.009**) same-year, $+0.001$ (**0.007**) lean-season, -0.014 (**0.009**) next-year. **All within 1.6 se of zero.**

The one direct handle. The 2017 survey asks harvested and sold separately: **63%** sell $\geq$ **95%**, **13%** under half. But $\text{var}(\log \text{ sold})$ **0.898** $<$ $\text{var}(\log \text{ harvested})$ **0.952** — a retention margin, **not an amplifying one**.

The risk is illegible — and that is plausibly *why* the cell is empty: a mutual can only pay out on a shortfall it can verify. Unobservable to us $\neq$ unobservable to them — a partner question. [back to nine tables](#)

[◀ back to nine-tenths](#)

Backup: what about index insurance?

- **Index insurance pays on a shared shock** — rainfall, or an area yield — so it never has to observe the farm (Carter et al. 2017; Jensen and Barrett 2017). That is its strength and its limit: **it reaches only the covariate part of quantity risk**.
- **Here that part is the minority**. 64% of quantity variance is idiosyncratic, and to an index all of it is **basis risk**. Weather indices explain about **1%** of it (SPEI **1.3%**, rainfall **0.8%**); even a village area-yield index reaches at most the **27%** common within a village-year.
- **An index and a mutual are complements**: the group pools what is idiosyncratic, the index covers what the group cannot (Mobarak and Rosenzweig 2013). **Here the cooperative does neither for quantity** — its one instrument is aimed at price.
- **Demand is the other hurdle**. Guatemalan coffee co-op members show low demand for rainfall index insurance in lab games (McIntosh et al. 2019); where demand is strong, it follows payouts and is tempered by basis risk and trust (Karlan et al. 2014).

Index insurance is the right tool for the shared part of quantity risk, and here that part is small. What is left is what a membership organisation exists to pool — if it can verify it.

[◀ back to pooling](#)

Backup: the reduced-form pass-through, and why it is not the headline

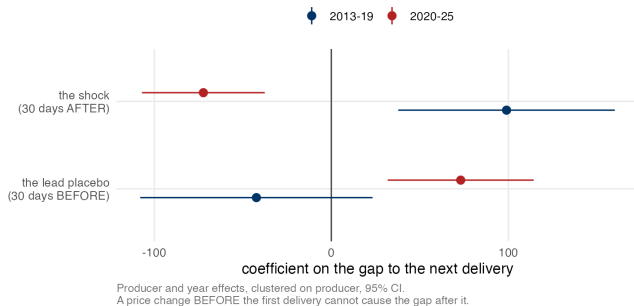
Pass-through of the world price into the schedule	contemporaneous	lagged	long run
Coffee, top grade	0.372	0.549	0.921

- **Essentially full pass-through — just late.** The cooperative does not absorb price movement; it postpones it.
- The same is true on the quality margin: the posted price is a year stale, and the settlement trues up to current grades.

Why this is backup and not the headline. It is $\log P_t^{co} = \beta_0 \log P_t^w + \beta_1 \log P_{t-1}^w$ on **12 annual observations**, and the board *commits in September*, so regressing its committed price on the *contemporaneous* realised price is partly mechanical — the world price is autocorrelated. **Do not describe the rule as a moving average or a distributed lag:** those are artifacts of this specification, not of the procedure. **The September reference price is the better-founded version of the same claim** and leads instead.

[◀ back to the schedule](#)

Backup: the lead placebo, and why it demotes the later half



The test. The price change in the **30 days before** a member's first delivery cannot cause the gap to the delivery that follows it. If it predicts the gap, the design is picking up something other than the shock.

2013–19 passes: the lead is -42.3 (**33.5**), **not significant**, and the shock barely moves when both are included ($+99.0 \rightarrow +98.2$).

2020-25 fails: the lead is **+73.1 (21.0)**, $t = 3.5$ — comparable in size to the shock itself (-72.3) and opposite in sign.

Not collinearity: 80% of the shock's within-year variance is orthogonal to the lead after 2020 (100% before).

The same standard we applied elsewhere. An earlier exposure design in this project was retired for failing this test: **we reach the same verdict on our own headline for the later era.**

[◀ back to the timing result](#)