Development Economics

AEA Continuing Education Lectures

Lecture 2
Risk and Insurance

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Outline

- **Dealing with risk**
  - **Ex ante vs. ex post smoothing**
- Insurance
- Informal (communal) insurance

Dealing with Risk: Strategies

- Households face substantial production risk

- Ex-post smoothing
  - Accept that you will take the hit to income
  - Deal with fall-out: insurance, borrow, save, etc to manage consumption
  - Better able to deal with risk → more willing to take risk

- Ex-ante smoothing
  - Try to prevent income volatility
  - Alter income strategies to get smoother income to begin with
  - (Note: requires failure of separation)
  - Reduced variance may come at the expense of levels

- Consumption CAPM would guide choice of activities

Ex-ante Smoothing

- Potential examples

- Agriculture
  - Wait until monsoon realization to plant
  - Plant safer, but less profitable, crops (e.g. avoid cash crops)
  - Do not apply fertilizer (increases profits, but also volatility)
  - Send one family member to migrate to city
  - Drought-tolerant seed varieties

- Urban settings
  - Don't start capital intensive business
  - Mitigate re-investment in business
  - Lack of specialization in one income source
  - Do not adopt new products

Rosenzweig Udry (WP 2013)

- India Metereological Department: annual monsoon forecast
  - Variation across India in accuracy
- Places with high accuracy: 1/2 std dev increase in monsoon forecast increases planting-stage investments by 2/3
- Use high accuracy places to trace out "profit curve": profits under different investments given rainfall
- Conclude: expected profit-maximizing level of investment is three times the observed average investment
  - Heavily rainfall dependent

→ Farmers dramatically underinvest

Income is Diverse

Table 6: How the poor earn their money: Occupation

	Percent of Households that own land	Median Ares Of Land Owned	Percent of Households in which At Least One Member: Is Self Employed In Agriculture	Is Self Employed In Other	Works for a Wage or Salary in Agriculture	Works for a Wage or Salary in Other	Percent of HHs That Receive Income From Multiple Sectors
Living on less than $1 a day							
Rural							
Cote d'Ivoire	62.7%	300	37.2%	25.9%	52.4%	78.3%	72.1%
Guatemala	36.7%	29	64.4%	22.6%	31.4%	86.4%	83.8%
India - Udaipur	98.9%	60	98.4%	5.9%	8.5%	90.7%	94.0%
India - UP/Bihar		40	72.1%	40.2%	2.0%	18.9%	41.8%
Indonesia	49.6%	60	49.8%	36.6%	31.1%	34.3%	50.4%
Mexico	4.0%		4.9%	20.4%	2.8%	72.6%	13.2%
Nicaragua	50.4%	280	54.7%	11.6%	0.3%	42.8%	18.4%
Pakistan	30.4%	162	72.1%	35.5%	32.6%	50.8%	66.8%
Panama	85.1%	300	69.1%	17.7%	0.0%	0.0%	19.2%
Peru	65.5%	150	71.7%	25.2%			34.8%
South Africa	1.4%		0.0%	9.1%	27.9%	26.6%	0.4%
Tanzania	92.3%	182					
Timor Leste	95.2%	100	78.5%	12.0%			10.4%

Source: Banerjee Duflo 2007

- Income is extremely diverse (Lack of specialization, outside of agri)
- Even among landowners, labor income often important
- Just about everyone has some self-employment, but small scale

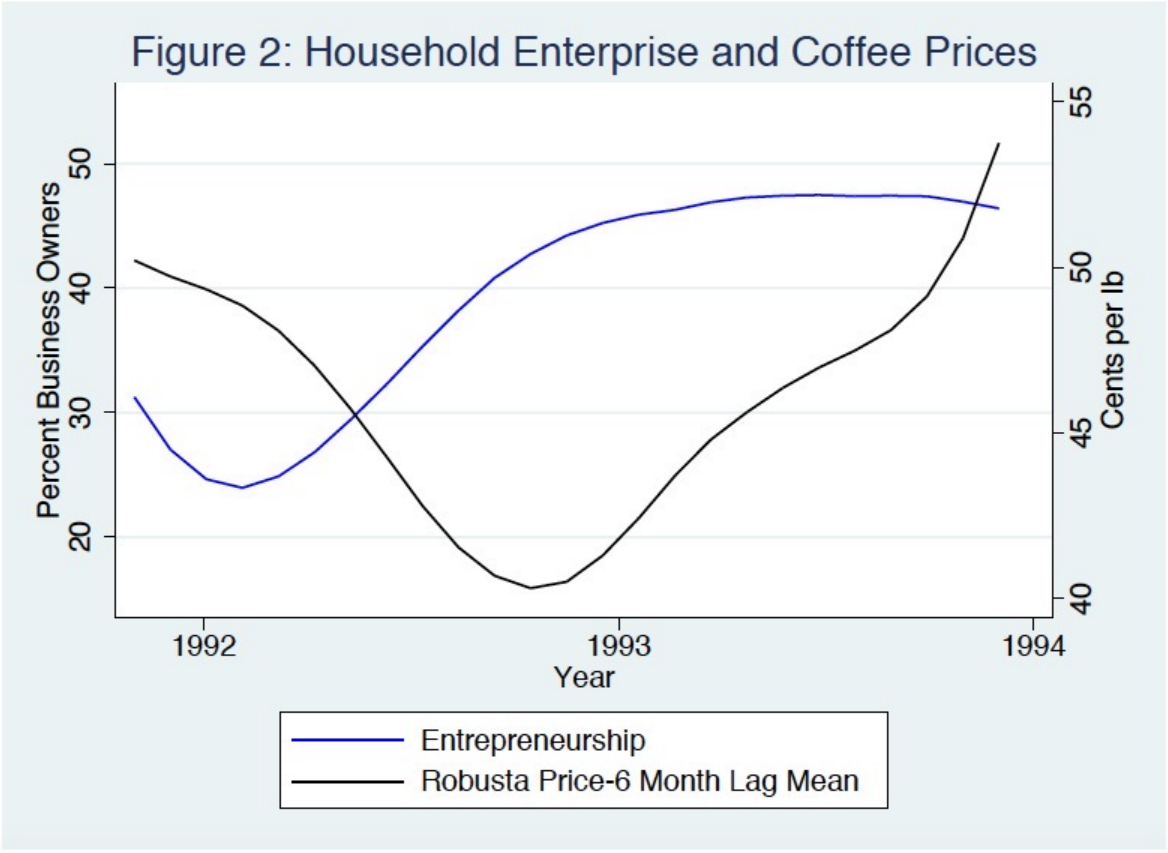
Adhvaryu, Kala, Nyshadham (2021)

Table 1. Summary Statistics: Enterprise Activity, Demographic Characteristics, and Financial Resources

Number of household-year observations: 3533	All[a]		Stayers[b]		Switchers[c]		Copers[d]		Other switchers[e]	
Number of households	980		123		447		54		393	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Enterprise ownership and coffee farming										
1(Household has a business)	0.38	0.49	1.00	0.00	0.51	0.50	0.29	0.46	0.54	0.49
1(Farms coffee)	0.82	0.39	0.83	0.38	0.85	0.36	0.86	0.35	0.85	0.36
Enterprise activity										
1(Household has a merchant business)	0.60	0.49	0.59	0.49	0.61	0.49	0.64	0.48	0.60	0.49
Months business has been operating	3.89	1.91	4.55	1.74	3.52	1.91	2.73	1.93	3.58	1.89
1(Business assets owned)	0.73	0.44	0.87	0.33	0.65	0.48	0.44	0.50	0.67	0.47
1(Business assets bought or sold)	0.22	0.41	0.28	0.45	0.19	0.39	0.10	0.30	0.19	0.39
Input expenditure	3094	9727	5578	13731	1692	6026	502	1641	1783	6228
1(Household member helping with business)	0.36	0.48	0.42	0.49	0.33	0.47	0.28	0.45	0.33	0.47
1(Hired at least one worker)	0.17	0.38	0.26	0.44	0.12	0.32	0.11	0.32	0.12	0.32
1(Business had positive profit)	0.55	0.50	0.67	0.47	0.49	0.50	0.30	0.46	0.50	0.50
Number of weeks in self-employment	14.14	18.29	20.18	21.88	10.70	14.84	5.44	9.34	11.10	15.11

Adhvaryu, Kala, Nyshadham (2021)

"Self employment": Businesses creation in response to coffee price busts (ex-post smoothing)



Outline

- Dealing with risk

- **Insurance**
  - **The benchmark**
  - Self-insurance vs. insurance
  - Empirical applications

- Informal (communal) insurance

What is Perfect Insurance?

- Define states by s
- In each period, there is a probability π_s of state s
- Arrow Debreu securities: cost p_s, pay out 1 if state s
- Actuarially fair insurance: $p_s/\pi_s = 1$

Perfect Insurance Example

- Make \$100 per period, but 20% chance of 0 (E[y] = 80)
- π_s=0.2 → p_s=0.2 per unit of insurance
- Buy 100 units of A-D security (will pay out \$100 when state s)
- Pay premium of \$20 in each period

Period	1	2	3	4	5
Income realization	100	0	100	100	100
Premium	-20	-20	-20	-20	-20

Perfect Insurance Example

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Period	1	2	3	4	5
Income realization	100	0	100	100	100
Premium	-20	-20	-20	-20	-20
Payout	0	100	0	0	0
Total	**80**	**80**	**80**	**80**	**80**

- Perfect insurance: get exactly same amount in every period for sure
- Actuarially fair: get exactly E[y] (firm makes zero profit)
- Consumption is completely independent of state

Perfect Insurance

- New Euler equation under perfect insurance:

$$u'(c_{st}) = [\delta(1+r)]^{\tau} u'(c_{s',t+\tau})$$

- Notice: expectations operator is now gone
  - Looks like the deterministic version (no uncertainty)

- Equating MU across time AND across states

Very Little Formal Insurance

Table 11: Market for Insurance and the poor

	Percent of Total Households with Insurance:		
	Any Type	Health	Life
Living on less than $1 a day			
Rural			
Cote d'Ivoire			
Guatemala			
India - Hyderabad			
India - Udaipur			3.8%
India - UP/Bihar	9.2%	4.7%	3.8%
Indonesia	6.0%	3.9%	0.0%
Mexico		50.7%	
Nicaragua	0.0%	5.5%	
Pakistan			
Panama		0.0%	0.0%
Papua New Guinea			
Peru		5.6%	0.0%
South Africa	5.4%		
Tanzania			
Timor Leste			

Source: Banerjee Duflo 2007

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Self-Insurance vs. Insurance

Contrast "self"-insurance:

$$u'(c_t) = [\delta(1+r)]^{\tau} E_t [u'(c_{t+\tau})]$$

Versus insurance:

$$u'(c_{st}) = [\delta(1+r)]^{\tau} u'(c_{s',t+\tau})$$

What's the difference?

Intuition - Example

- Suppose individual lives for 3 periods and faces the following (stochastic) income stream:

Period 1	Period 2	Period 3
10	0 with probability 1/2 20 with probability 1/2	10

- What will consumption be like under:
  - Autarky (savings only)?
  - Perfect credit markets?
  - Actuarially fair insurance?
  - Under what scenario is expected lifetime utility highest?

Key Distinction

- Insurance allows redistribution across states
  - Insurance makes you whole again
  - Shock realizations have no impact on consumption (or utility)

- Self-insurance only redistributes across time
  - The shock must be borne
  - Reallocate its impact across periods to mitigate utility loss

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Karlan, Osei, Osei-Akoto, Udry (QJE 2019)

- How much does risk constrain investment choices of farmers (vs. credit constraints)

- Randomize:
  - Cash grant
  - Insurance (vary price subsidy)
  - Both

Karlan, Osei, Osei-Akoto, Udry (QJE 2019)

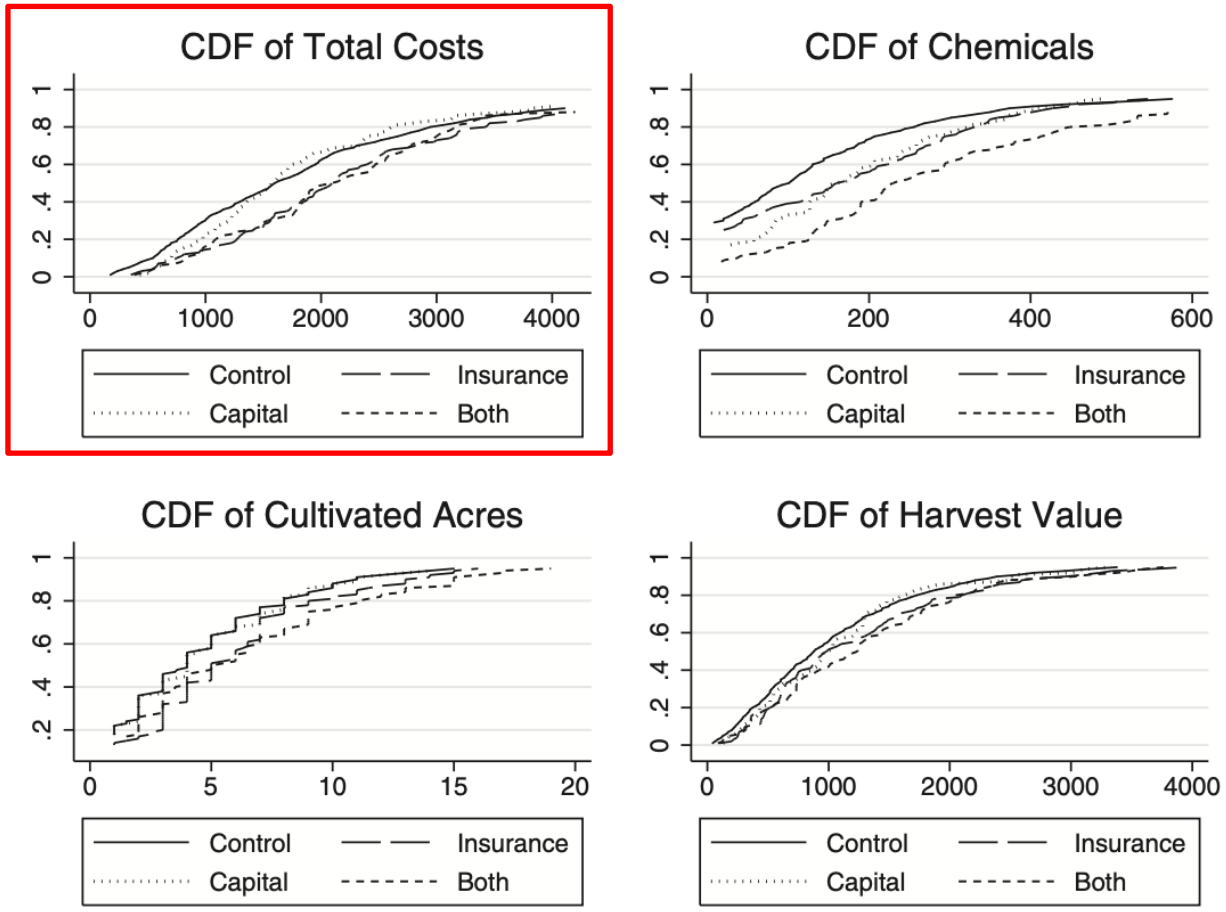

FIGURE I

Effect of Insurance and Cash Grants on Investment and Output

- "Both" and "insurance" arms similar
- "When provided with insurance against the primary catastrophic risk they face, farmers are able to find resources to increase expenditure on their farms"
- Liquidity constraints not as binding as assumed

Karlan, Osei, Osei-Akoto, Udry (QJE 2019)

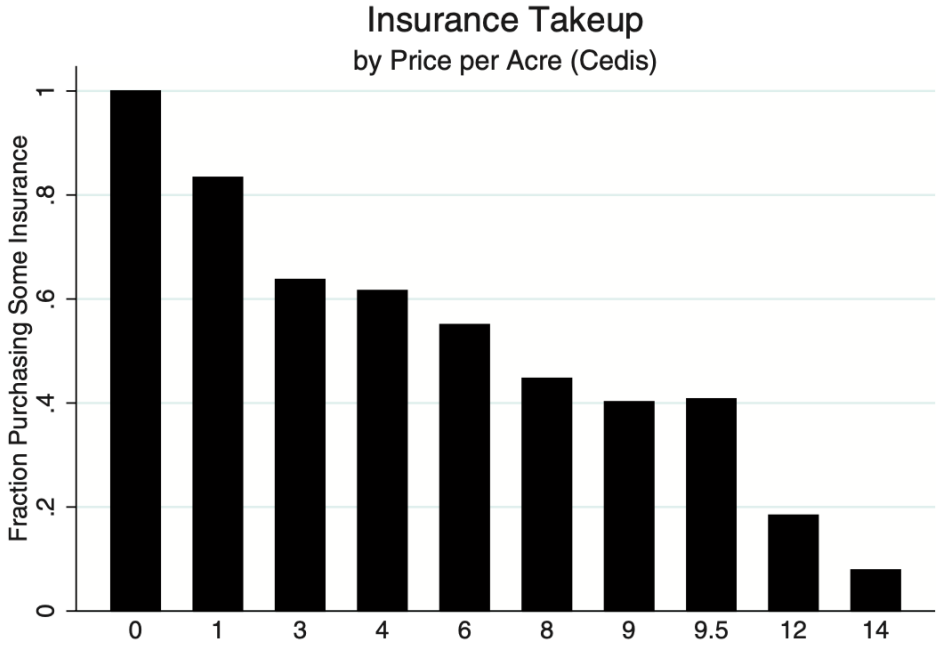

FIGURE II

Insurance Take-up

- High willingness to pay for index rainfall insurance
  - Take-up of 40-50% of actuarially fair insurance
  - Conditional on take-up, cover 60% of land
- Contrast with previous literature (Cole et al. 2012, Casaburi Willis 2017)
- Hindrances to take-up: basis risk, trust, recency bias

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- Dealing with risk
- Insurance
- **Informal (communal) insurance**
  - **Communal insurance: benchmark**
  - Townsend test
  - Empirical applications
  - Limits to informal insurance
  - Social (kin) taxes

Communal Insurance

- Suppose many households in one village
- Stand in for formal insurance: villagers insure each other
  - As before, uncertainty from income shocks
  - What will risk sharing in village look like?
- To see this clearly: shut down individual intertemporal smoothing (no saving or borrowing)

Communal Insurance

Household utility: $U_i = \sum_{t=1}^{T} \delta^t \sum_{s=1}^{S} \pi_s u_i(c_{ist})$

Aggregate village utility: $\sum_{i=1}^{N} \lambda_i U_i$

subject to: $\sum_{i=1}^{N} c_{ist} = \sum_{i=1}^{N} y_{ist} \; \forall s, t$ and $c_{ist} \geq 0 \; \forall i, s, t$

where:

π_s =probability of state s

λ_i =pareto weight of household i in village

y_{ist} =earnings realization of HH i in state s in period t

- What does the budget constraint imply about which shocks matter?

Communal Insurance

- Key prediction under perfect risk sharing:

$$\frac{u_i'(c_{ist})}{u_j'(c_{jst})} = \frac{\lambda_j}{\lambda_i} \; \forall i, j, s, t$$

- What is the interpretation?
  - The only risk faced by the household is the risk faced by the community as a whole
- How does this condition differ from:
  - Formal insurance?
  - Self-insurance?

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Townsend test

- Recall: $\frac{u_i'(c_{ist})}{u_j'(c_{jst})} = \frac{\lambda_j}{\lambda_i} \; \forall i, j, s, t$

- Basic test

$$c_t^{*j} = \alpha^j + \beta^j \bar{c}_t + \delta^j \tilde{A}_t^j + \zeta^j X_t^j + u_t^j$$

  - What is the prediction on: β ?

  - What is the prediction on: ζ ?

Townsend test

$$c_t^{*j} = \alpha^j + \beta^j \bar{c}_t + \delta^j \tilde{A}_t^j + \zeta^j X_t^j + u_t^j$$

- Aggregate vs. idiosyncratic shocks
- Measurement error
- c vs. u'(c)

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Empirical applications

- Angelucci and Degiorgi (2009): Mexican transfer program Progressa
  - Transfers from eligible to ineligible households

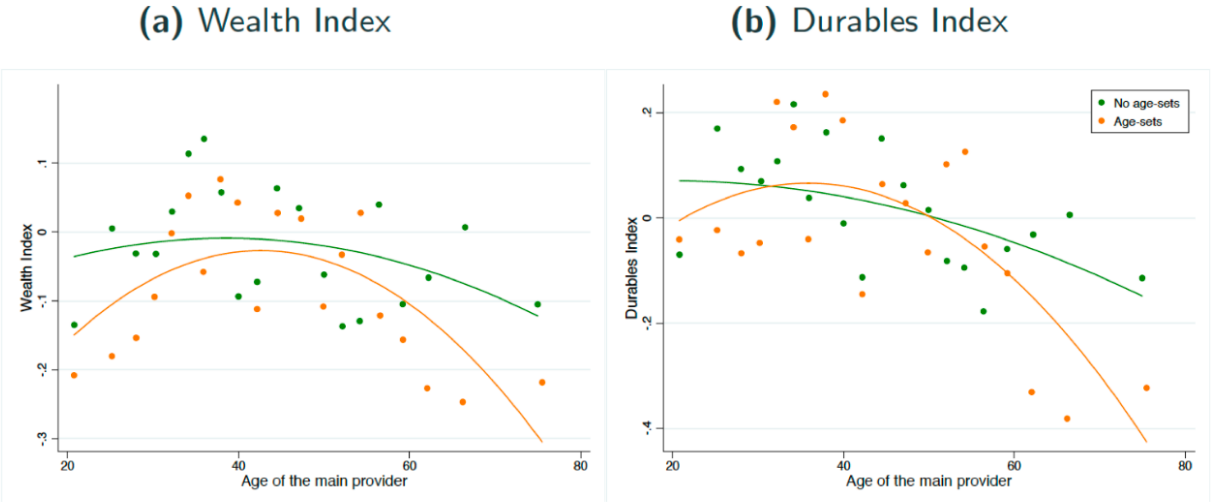
- Moscona Seck (2023): Kin set vs. age set societies
  - Age set: networks structured around people in same age cohort (initiated together)

Dependent Variable:	(1)	(2)	(3)	(4)	(5)
	Log Total Consumption Spending				Total Cons. Spending
	Panel A: Full Sample				
Share Cohort Eligible * $\mathbb{I}^{\text{Treat}}$ * $\mathbb{I}^{\text{Age Set}}$	0.258	0.339	0.279	0.287	2,481
	(0.107)	(0.101)	(0.0976)	(0.105)	(966.9)
Share Cohort Eligible * $\mathbb{I}^{\text{Treat}}$ * $\mathbb{I}^{\text{Kin}}$	-0.00613	0.00364	0.0218	0.0315	-815.3
	(0.0761)	(0.0798)	(0.0799)	(0.0799)	(619.9)
p-value, $\gamma_1 = \gamma_2$	0.0550	0.0116	0.0528	0.0619	0.0052
Mean at baseline	7.40	7.40	7.40	7.40	9276.93
R-squared	0.471	0.628	0.682	0.684	0.673
Observations	713	646	646	643	643

Empirical applications

- Angelucci and Degiorgi (2009): Mexican transfer program Progressa
  - Transfers from eligible to ineligible households

- Moscona Seck (2023): Kin set vs. age set societies
  - Age set: networks structured around people in same age cohort (initiated together)
  - More inequality across generations (young and old earn less – worse outcomes)



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  - **Limits to informal insurance**
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Barriers to Informal Insurance

- Moral hazard: effort is unobservable
  - [E.g. Rogerson 1985, Phelan Townsend 1991, Phelan 1998, Ligon 1998, Attanasio Pavoni 2011]

- Limited commitment: cannot commit to remaining in insurance agreement
  - E.g. Coate Ravallion, Thomas Worrall 2002, Ligon et al. 2002, Morten 2019

- Hidden income: income is not observable
  - E.g. Thomas Worrall 1990, Jakiela Ozier 2016, Goldberg 2017, Kinnan 2022
  - Empirical evidence that people desire to hide income from "social tax" / "kin tax" literature

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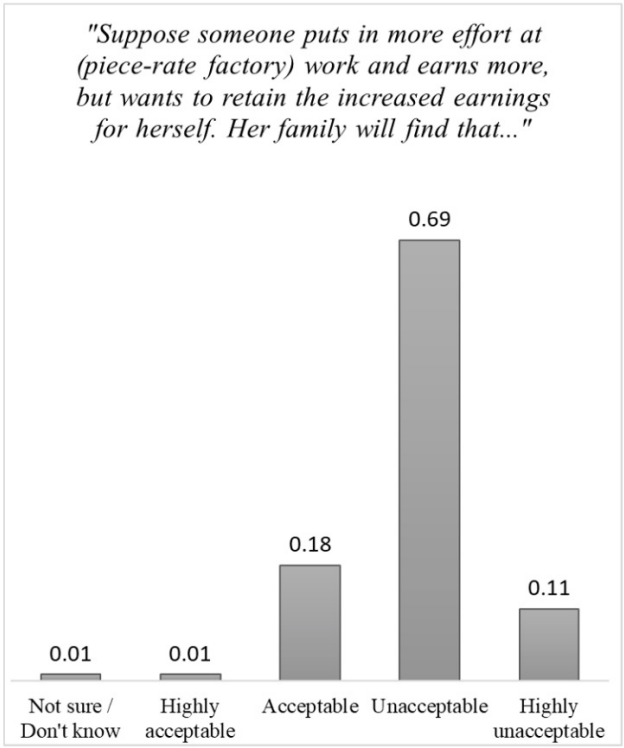
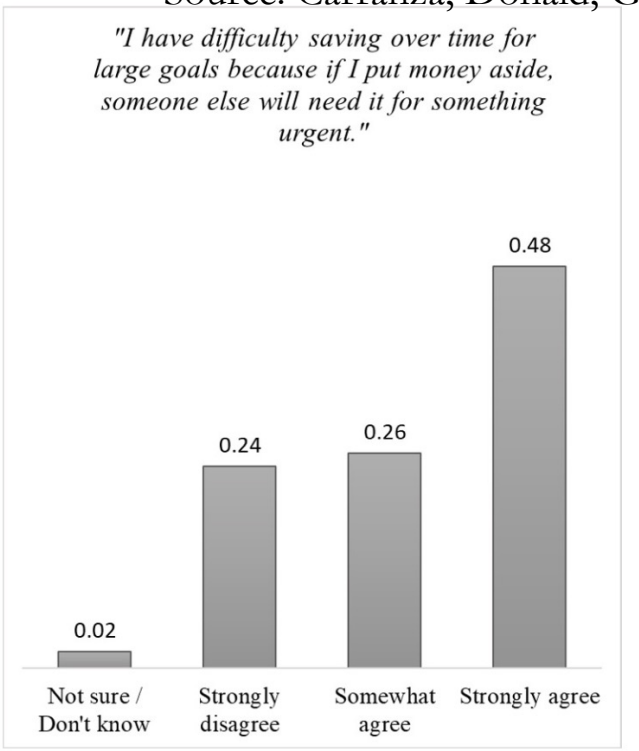
Social taxes

- Informal insurance: implemented in society through rules of thumb
- Norms for redistribution strong within family groups and networks
  - Especially sub-Saharan Africa (Platteau)

Source: Carranza, Donald, Grosset, Kaur 2023



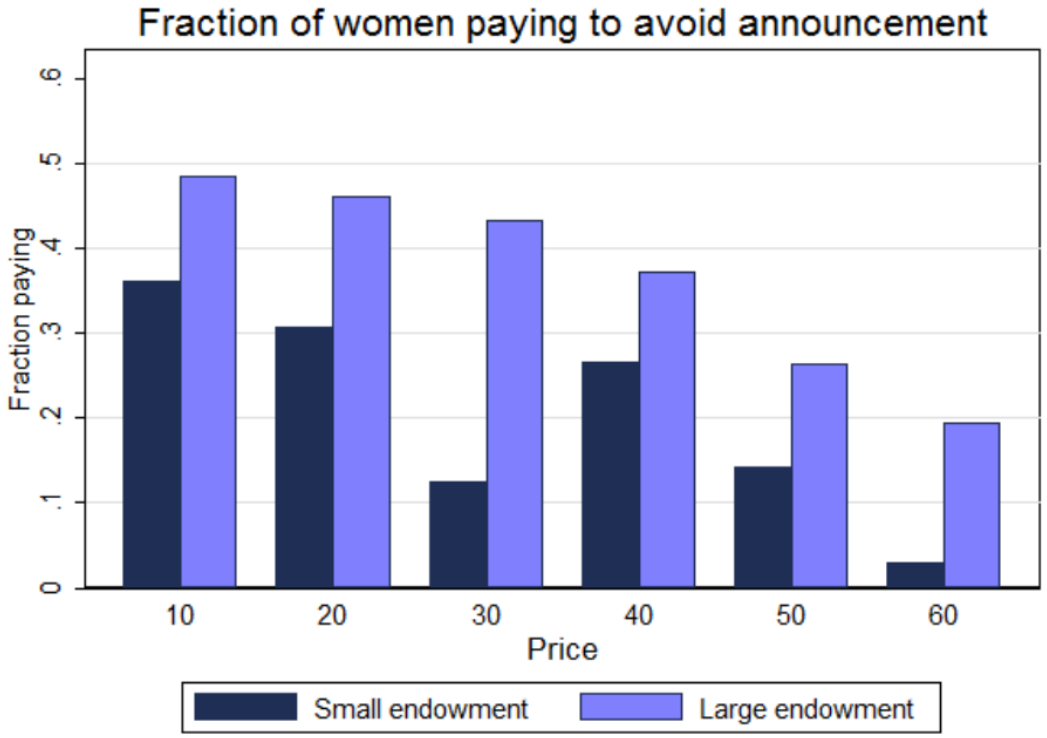
(C) Transfer norms



(D) Inability to save

Jakiela Ozier (ReSTUD 2015)

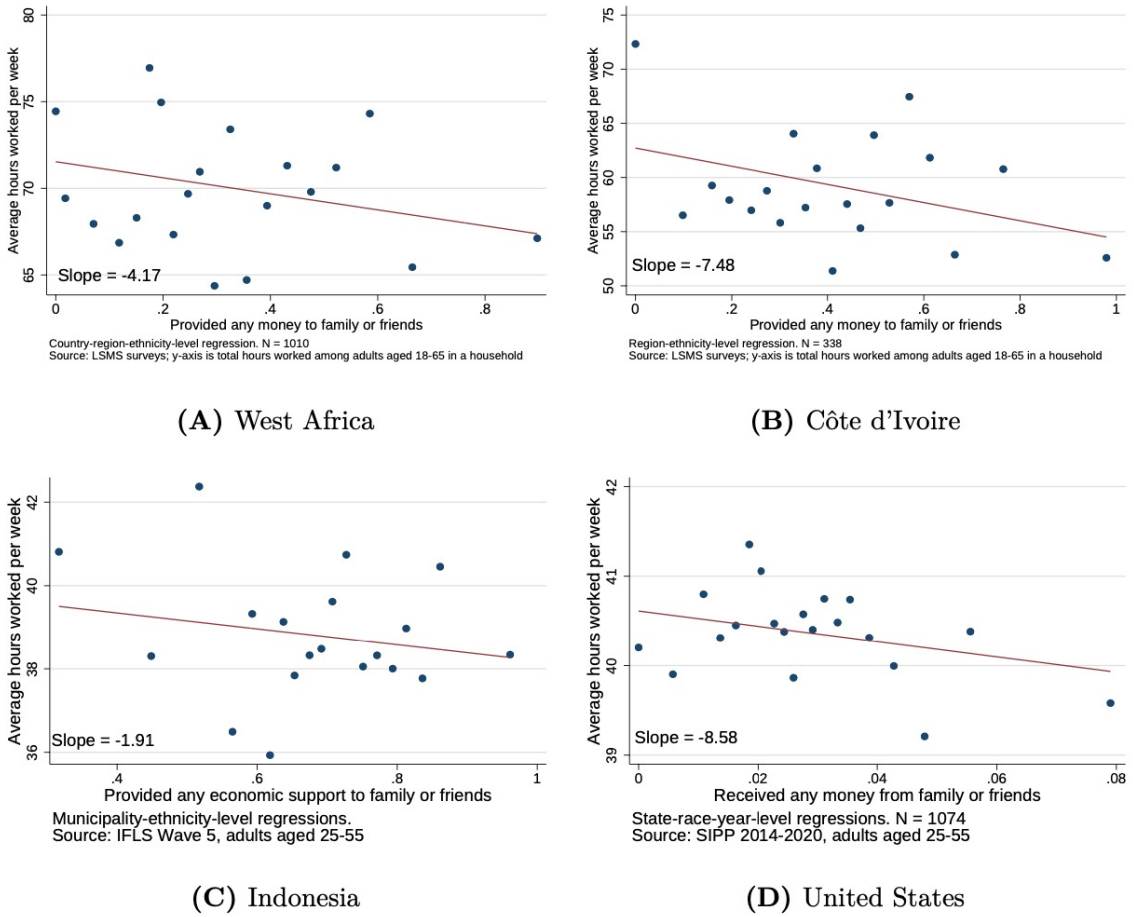
- Are people willing to forego money to hide income from network?
- Bring people into lab in Kenya, randomize endowment
- Effects driven by women with relatives in the experimental session



Carranza Donald Grosset Kaur (2023)

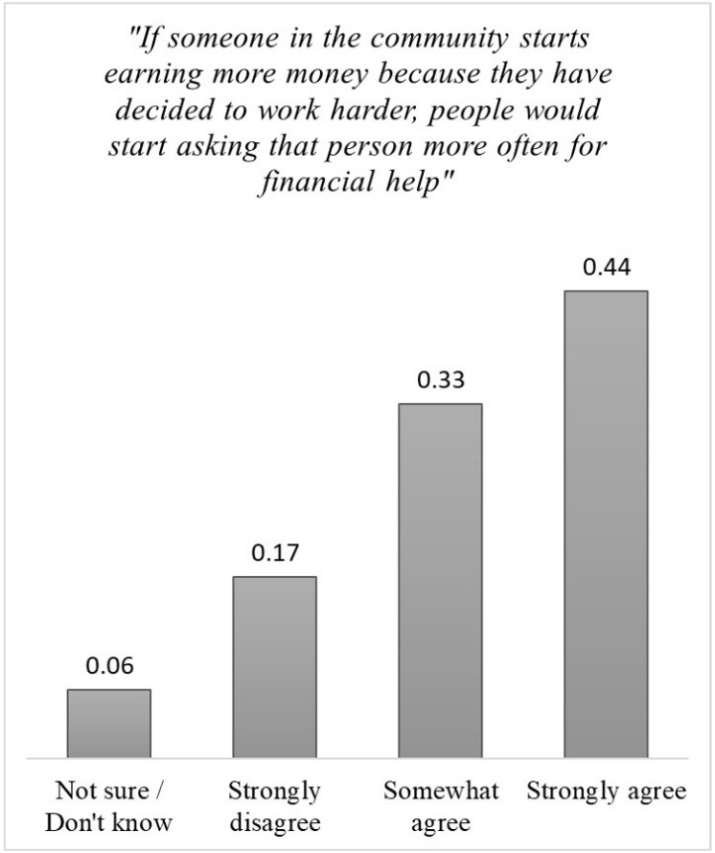
- Does social tax lower the incentive to work and earn money?

Figure 1: Motivational Evidence: Redistribution and Hours Worked

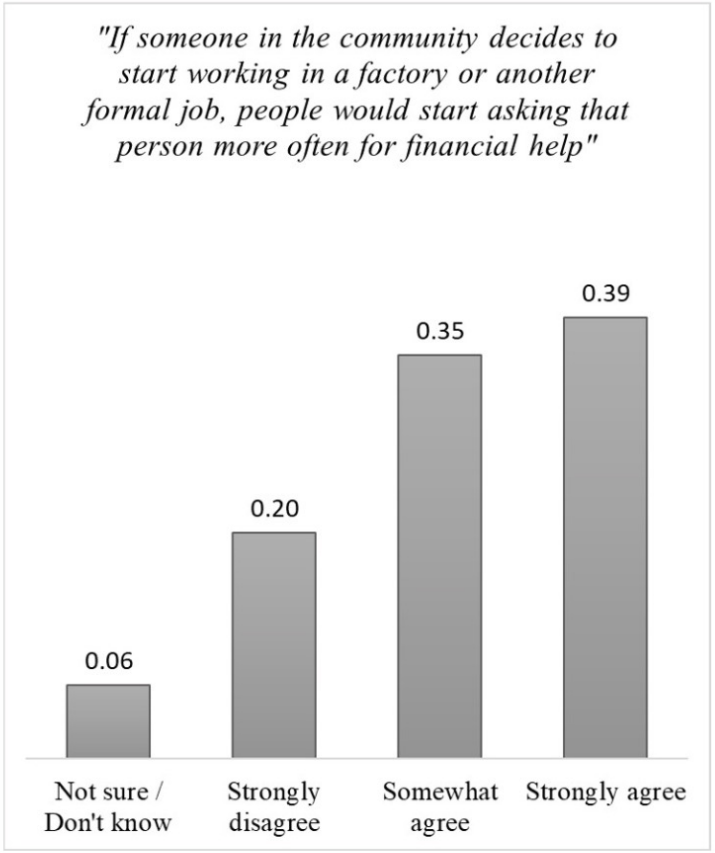


Carranza Donald Grosset Kaur (2023)

- Workers think that higher labor supply will increase transfer requests



(A) Requests on labor income

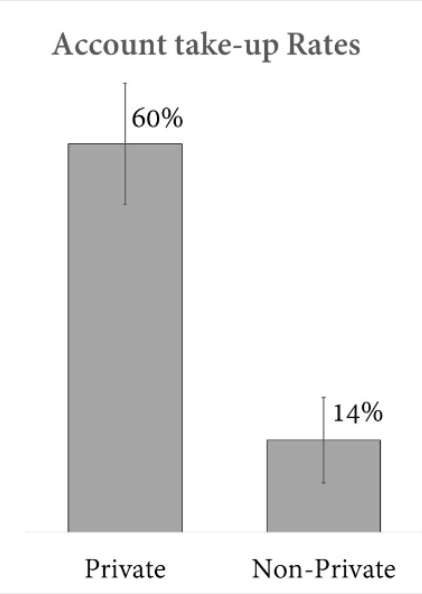


(B) Requests after employment

Carranza Donald Grosset Kaur (2023)

- Full-time piece rate workers at cashew processing plants, Cote D'Ivoire
- Offer blocked savings account: money directly deposited (3-9 months)
- Vary whether account existence & unblock date known to network

1. Higher demand for Private accounts



Means and 95% CIs. N = 317 workers.
SEs clustered at the worker level.

77% lower demand for Non-private accounts (relative to Private) ($p<0.001$)

→ Account is much less desirable as a savings vehicle when existence known to network

Carranza Donald Grosset Kaur (2023)

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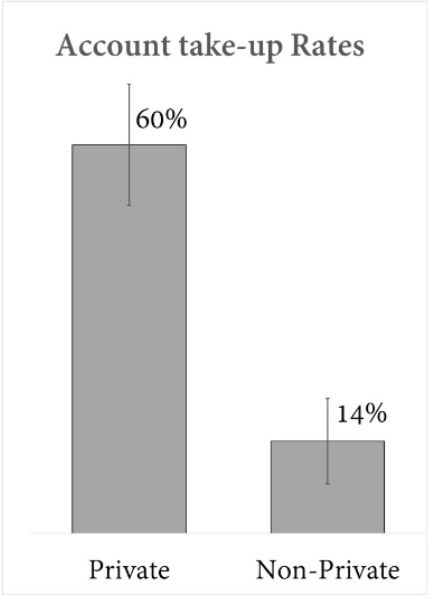

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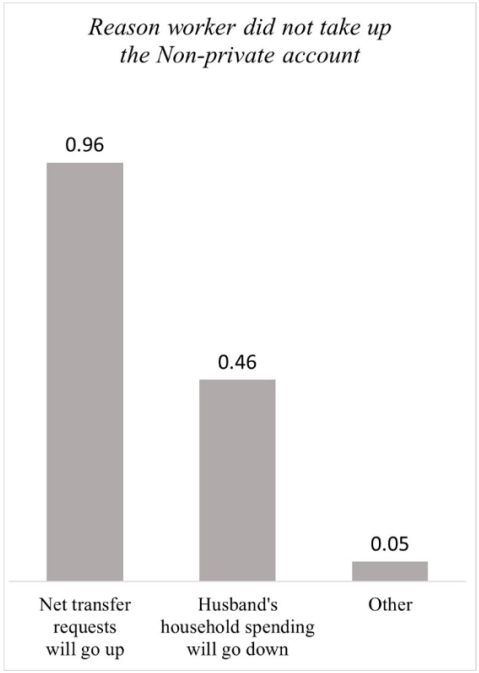

Carranza Donald Grosset Kaur (2023)

- Full-time piece rate workers at cashew processing plants, Cote D'Ivoire
- Offer blocked savings account: money directly deposited (3-9 months)
- Vary whether account existence & unblock date known to network

2. Private accounts substantively raise labor supply

	Earnings (1)	Attendance (2)
Private account	175.9**	0.0622**
	(69.68)	(0.0273)
Control mean	1546.7	0.64
N: worker-days	137678	137678
N: workers	474	474

Notes: Regressions include worker and day FE. Standard errors clustered by worker.

Offering access to Private account:

- 11.4% increase in total earnings and output (p=0.012)
- 9.7% increase in attendance (p=0.022)