AREC 815: Experimental and Behavioral Economics

Social Pressure in Village Economies

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Social Pressure in Village Economies

“Whoever has a more mobile occupation, and less respect for tradition, tries to cover his tracks. In Dodoma, I once ran into a street vendor hawking oranges who used to bring these fruits to my house in Dar es Salaam. I was happy to see him, and asked him what he was doing here, five hundred kilometers from the capital. He had had to flee from his cousins, he explained. He had shared his meager profits with them for a long time, but finally had had enough, and ran. ‘I will have a few cents for a while,’ he said happily. ‘Until they find me again!’ ”

— Ryszard Kapuscinski (2002)

Motivation

- Transfers between households common in poor, rural communities
- Transfers are:
  - Mediated by kin networks
  - Enforced by social sanctions
- Many poor individuals face savings constraints
- Do social pressures to share distort incentives for investment?
  - Experiments allow us to observe the road (or the job) not taken

Overview

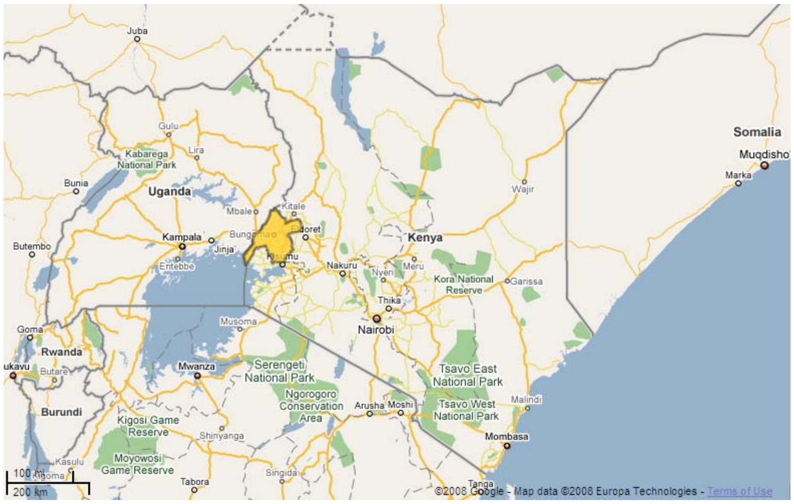
- Experiment in 26 rural, agricultural communities in Kenya
  - Introduce random variation in observability of income
  - Identify investments not made, WTP to keep income hidden
  - Stratified by gender; examine impacts for men, women separately
- Relate willingness to "pay" to hide income in experiment to direct observability of payouts by relatives, spouses attending game
- Estimate magnitude of social pressure "tax" parameter controlling for unobservable heterogeneity in risk preferences

Overview

- Experiment design and procedures
- Theoretical framework
- Testing the predictions of the model
- Estimating the extent of social taxation

Experimental Design and Procedures

Communities in the Sample



Communities in the Sample

Experimental Design

- Introduce exogenous variation in observability of income shocks
- Each subject receives an endowment — 80 or 180 Kenyan shillings
- Subjects decide how to divide endowment between savings and risky, but potentially (very) profitable investment
  - Savings cup: zero risk, zero return
  - Business cup: 50 percent chance of 400 percent return
- Subset of subjects chosen at random, required to announced investment amount and outcome to other participants

Experimental Design

Experimental Design

- **Private Treatment:** investment decisions, income private info
- **Public Treatment:** subjects obliged to announce amount invested, outcome of coin toss, investment income
- **Price Treatment:** subjects choose between public announcement, paying randomly chosen price to avoid it
  - Possible prices: 10, 20, 30, 40, 50, 60 Kenyan shillings
  - Buy out decisions occur **after** investment outcome realized
- Treatments randomly assigned **within** each village
- Announcements made after all individual decisions recorded

Structure of the Experiment

1: Subjects arrive at experiment

2: Explanation of game to all subjects

3: Individual decision-making phase

– Treatment assignment, exit price* revealed

– Subject makes investment decision

– Subject flips coin

– Subject decides whether to buy out*

4: Public announcements of investment returns

5: Subjects receive individual payouts in private

Time

Experimental Lab in the Field

Experimental Design: Treatment Assignment

	Private	Public	Price
Smaller Endowment	369	370	345
Larger Endowment	358	358	345

Random assignment of six treatments within villages

- Stratified by gender, education level
- Exit price randomly assigned to subjects in price treatments

Theoretical Framework

Theoretical Framework

Subjects make a discrete choice between possible investment levels

$$b_j \in \{0, 10, 20, \ldots, m_i\}$$

Assumptions:

- Utility of investing b_j: $EV_{ij} = EU_{ij} + \varepsilon_{ij}$
  - ε_{ij} is an i.i.d. type 1 extreme value distributed preference shock
- Deterministic component of utility (EU_{ij}) takes CRRA form:

$$v_i(x) = \frac{x^{1-\rho_i}}{1-\rho_i}$$

- Proportional "tax" on observable income, $\tau \in [0, 1]$

Theoretical Framework

Investment decisions are stochastic:

$$P_{ij} = \frac{e^{EV_{ij}/\sigma_\varepsilon}}{\sum_{k=1,\ldots,J_t} e^{EV_{ik}/\sigma_\varepsilon}}$$

where σ_ε^2 is proportional to the variance of $\varepsilon_{ij} - \varepsilon_{ik}$

$\Rightarrow$ Highest EU investment level chosen with highest probability

We derive predictions by combining:

- Analytical results that hold for all values of ρ, τ, σ_ε
- Numerical results that hold at every point in a $\rho \times \tau \times \sigma_\varepsilon$ grid:
  - $\rho \in [0.001, 3]$, $\tau \in [0.001, 0.5]$, $\sigma_\varepsilon \in [0.001, 0.1]$

Public vs. Private Small Endowment Treatments

CRRA expected utility of investing b_j private treatment:

$$\underbrace{\frac{1}{2(1-\rho_i)}\left[(m_s - b_j)^{1-\rho_i} + (m_s + 4b_j)\right]^{1-\rho_i}}_{EV_{ij}} + \varepsilon_{ij}$$

CRRA expected utility of investing b_j public treatment:

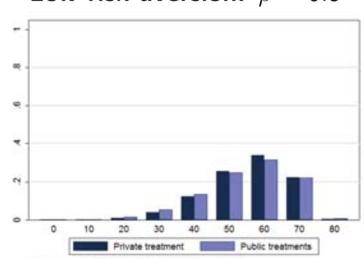
$$\underbrace{(1-\tau)^{1-\rho_i}\left(\frac{1}{2(1-\rho_i)}\left[(m_s - b_j)^{1-\rho_i} + (m_s + 4b_j)\right]^{1-\rho_i}\right)}_{EV_{ij}} + \varepsilon_{ij}$$

Implication: $EV_{ij}^{public \times small} = (1-\tau)^{1-\rho_i} EV_{ij}^{private \times small}$

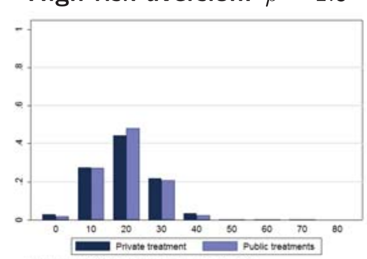
- For any individual, ordering of investment probabilities is the same
- Expected investment levels similar across treatments

Public vs. Private Small Endowment Treatments

Low risk aversion: $\rho = 0.5$



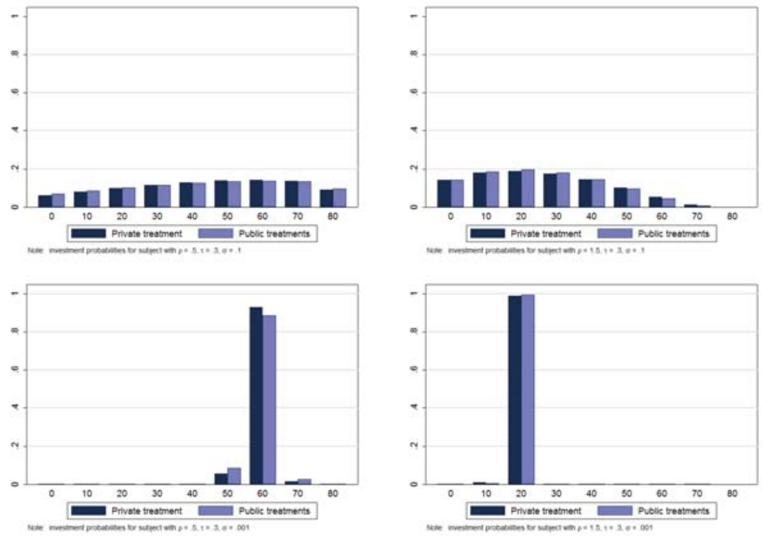
High risk aversion: $\rho = 1.5$



Conclusion: for moderate values of τ, we don't expect differences in investment levels between private, public small endowment treatments

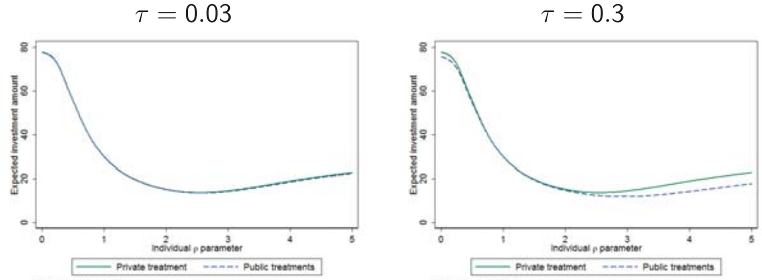
Public vs. Private Small Endowment Treatments

Low risk aversion: $\rho = 0.5$ **High risk aversion:** $\rho = 1.5$



Public vs. Private Small Endowment Treatments

$\tau = 0.03$ $\tau = 0.3$



Conclusion: for moderate values of τ, we don't expect differences in investment levels between private, public small endowment treatments

Public vs. Private Large Endowment Treatments

In the public treatment, subjects can make 100 shillings of endowment income unobservable by investing no more than 80 shillings:

$$H_{ij} = (m_{large} - m_{small}) \cdot \mathbb{1}\{b_j \leq m_{small}\}$$

Prediction 1

For $\tau \in (0, 0.5)$ and $\rho_i > 0$,

- the probability investing 80 shillings or less is strictly higher, and
- the probability of investing exactly 80 shillings is weakly higher

in the public large endowment treatment than in the private large endowment treatment.

True for all values of ρ_i, and consequently also true for populations of heterogeneous individuals randomly assigned to experimental treatments

Investment Decisions in Price Treatments

Subjects assigned to price treatments make two decisions:

- How much to invest in the business cup
- Whether to pay to avoid the public announcement

⇒ Investment decisions depend on beliefs about the exit decision

- Three possible optimal plans for when to pay to avoid announcement

We assume forward-looking subjects perceive expected utilities as:

$$EU_{ij} = \max\left\{EV_{ij}^{never}, EV_{ij}^{heads}, EV_{ij}^{always}\right\} + \varepsilon_{ij}$$

Investment Decisions in Price Treatments

Prediction 2

For $\tau \in (0, 0.5)$ and $\rho_i > 0$, both

- the probability investing no more than 80 shillings and
- the probability of investing exactly 80 shillings

are weakly higher in the price large endowment treatment than in the private large endowment treatment.

Suggests data from public and price treatment can be pooled in analysis

Paying to Avoid the Public Announcement

Given payout x_i, utility of paying to avoid public announcement is:

$$\frac{1}{1-\rho_i}(x_i - p)^{1-\rho_i} + \zeta_{i0}$$

Utility of making the announcement is:

$$\frac{1}{1-\rho_i}\left[(1-\tau_i)x_i + \tau_i H_{ij}\right]^{1-\rho_i} + \zeta_{i1}$$

Probability of paying to avoid public announcement is:

$$P_i^{exit} = \frac{1}{1 + e^{\left(\left[(1-\tau)x_i + \tau H_{ij}\right]^{1-\rho_i} - (x_i - p)^{1-\rho_i}\right)/[(1-\rho_i)\gamma]}}$$

when we assume that ζ_{i0}, ζ_{i1} are distributed EV1 (independent of ε_{ij} terms) and γ^2 is proportional to the variance of $\zeta_{i0} - \zeta_{i1}$

Paying to Avoid the Public Announcement

Implication: probability of paying is 1/2 if and only if

$$\frac{\left[(1-\tau)\,x_i+\tau H_{ij}\right]^{1-\rho_i}}{1-\rho_i}=\frac{(x_i-p)^{1-\rho_i}}{1-\rho_i}$$

Proposition 2

Let z_i denote subject i's **observable payout** — her gross payout x_i minus H_{ij}, the 100 shillings hidden from view if a subject receives the large endowment and then chooses an investment level of no more than 80 shillings. For all i,

$$P_i^{exit}\geq\frac{1}{2}\Leftrightarrow\tau\geq\frac{p}{z_i}.$$

The expected proportion of subjects choosing to pay to avoid the public announcement is greater than one half for values of p and z_i such that $\tau\geq p/z_i$ and less than one half otherwise.

Summary of Predictions and Results

1. The probability of investing (i) no more than 80 shillings and (ii) exactly 80 shillings is higher in the public and price large endowment treatments than in the private large endowment treatment.
2. The probability of paying to avoid the public announcement is above (resp. below) 0.5 when τ is greater than (resp. less than) the ratio of the randomly-assigned exit price to one's observable income.
3. The expected investment level is similar in the public and private small endowment treatments for small to moderate values of τ.

Results: Investment Decisions

The Probability of Investing 80 Shillings or Less

We estimate OLS regressions of the form:

$$Y_i = \alpha + \beta PublicTreatments_i + X_i'\gamma + \eta_v + \epsilon_i$$

where:

- Y_i is a binary outcome of interest: $Y_i \in \{LTE80_i, EX80_i\}$
- $PublicTreatments_i$ is an indicator for public and price treatments
- X_i is a vector of individual characteristics
- η_v is a village fixed effect
- ϵ_i is a conditionally mean-zero error term

Logit specifications (always) yield similar results!

The Probability of Investing 80 Shillings or Less

Sample:	— Women Only —		— Men Only —	
Specification:	**OLS**	**OLS**	**OLS**	**OLS**
	(1)	(2)	(3)	(4)
Panel A: Dep. Var. = Indicator for Investing 80 Shillings or Less				
Public or price treatment	0.096**	0.109***	-0.025	-0.018
	(0.041)	(0.042)	(0.052)	(0.052)
Panel B: Dep. Var. = Indicator for Investing Exactly 80 Shillings				
Public treatments	0.214*	0.246*	0.058	0.051
	(0.129)	(0.136)	(0.144)	(0.153)
Village FEs	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes
Observations	644	644	417	417

Robust standard errors in parentheses. *** indicates significance at the 99 percent level; ** indicates significance at the 95 percent level; and * indicates significance at the 90 percent level. OLS specifications reported; logit and probit results are nearly identical. Sample restricted to subjects receiving the larger endowment. A constant is included in all specifications. Even-numbered columns include controls for all variables that are not balanced across genders plus controls for marital status and household size.

Impacts on Investment Levels

Dep. Var. = Amount Invested in Business Cup

Sample:	— Women Only —		— Men Only —	
Specification:	**OLS**	**OLS**	**OLS**	**OLS**
	(1)	(2)	(3)	(4)
Public or price treatment	−5.243*	−6.128**	2.554	2.255
	(2.816)	(2.802)	(3.939)	(3.890)
Village FEs	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes
Observations	644	644	417	417

Robust standard errors in parentheses. *** indicates significance at the 99 percent level; ** indicates significance at the 95 percent level; and * indicates significance at the 90 percent level. OLS specifications reported; logit and probit results are nearly identical. Sample restricted to subjects receiving the larger endowment. A constant is included in all specifications. Even-numbered columns include controls for all variables that are not balanced across genders plus controls for marital status and household size.

Channels of Social Pressure

Hypothesis: pressure to share income exerted by family members

"There is one thing in Africa: we have a family. The family is elastic. There is the little brother of your mother, of your father... Everyone with a problem, and you are condemned to help. Saving is difficult because there are always problems. You have to squeeze your heart before putting money in your savings account."

Social pressure from kin network outside household:

- Baland-Guirkinger-Mali (2007), Hoff-Sen (2006), Platteau (2000)

Pressure to share with spouse:

- Ashraf (2009), Robinson (2008), Anderson-Baland (2002)

Channels of Social Pressure

We disaggregate impact of public treatments by whether kin present:

$$\begin{aligned} Y_{ivt} =& \alpha + \beta_1 KinPresent_i \\ & + \beta_2 Public \times KinPresent_i + \beta_3 Public \times NoKinPresent_i \\ & + X_i' \gamma + \eta_v + \varepsilon_{ivt} \end{aligned}$$

where $Y_i \in \{LTE80_i, EX80_i\}$ is a binary outcome of interest

Then estimate analogous specifications for spouse presence:

- If kin are simply passing info to husbands, impact of having husband present should be at least as large as the kin$\times$public effect

Channels of Social Pressure

Dep. Var. = Invested 80 Shillings or Less

Specification:	**OLS** (1)	**OLS** (2)	**OLS** (3)
Close kin attended game	-0.245*** (0.09)	-0.299*** (0.11)	.
Close kin at game × public	0.418*** (0.109)	0.42*** (0.109)	.
No close kin at game × public	0.069 (0.045)	0.043 (0.075)	.
Close kin in village, but not at game	.	-0.066 (0.087)	.
Close kin in village (not at game) × public	.	0.041 (0.095)	.
Spouse at game	.	.	-0.055 (0.121)
Spouse at game × public	.	.	0.202 (0.144)
No spouse at game × public	.	.	0.100** (0.044)
Observations	642	642	642
R^2	0.117	0.118	0.107

Robust standard errors in parentheses. *** indicates significance at the 99 percent level; ** indicates significance at the 95 percent level; and * indicates significance at the 90 percent level. OLS specifications reported; logit and probit results are nearly identical. Sample restricted to women receiving the larger endowment. A constant is included in all specifications. All specifications include village fixed effects, controls for all variables that are not balanced across genders, and controls for marital status and household size.

External Validity: Variation Across Villages

Two measure of extent of women's income hiding:

- Difference in fraction of women investing no more than 80 shillings
- Difference in fraction of women investing exactly 80 shillings

Measure of community-level outcomes:

- Indicators: HH durable assets, skilled/formal employment, wages from employment, indicator for using fertilizer in last year

Relate extent of hiding to community-level outcomes:

$$Y_v = \alpha + \beta Hiding_v + X_v'\zeta + \varepsilon_v$$

External Validity: Variation Across Villages

Dep. Var.: *Specification:*	**HH Assets** **OLS** (1)	**Formal Job** **OLS** (2)	**Wages** **OLS** (3)	**Fertilizer** **OLS** (4)
Income hiding ($LTE80$)	-0.043	-0.05**	-2.758*	-0.027
	(0.116)	(0.023)	(1.669)	(0.213)
R^2	0.222	0.339	0.423	0.36
Income hiding ($EX80$)	-0.312**	-0.096***	-6.024***	-0.504**
	(0.129)	(0.024)	(1.799)	(0.244)
R^2	0.394	0.546	0.58	0.472
Additional Controls	Yes	Yes	Yes	Yes
Observations	26	26	26	26

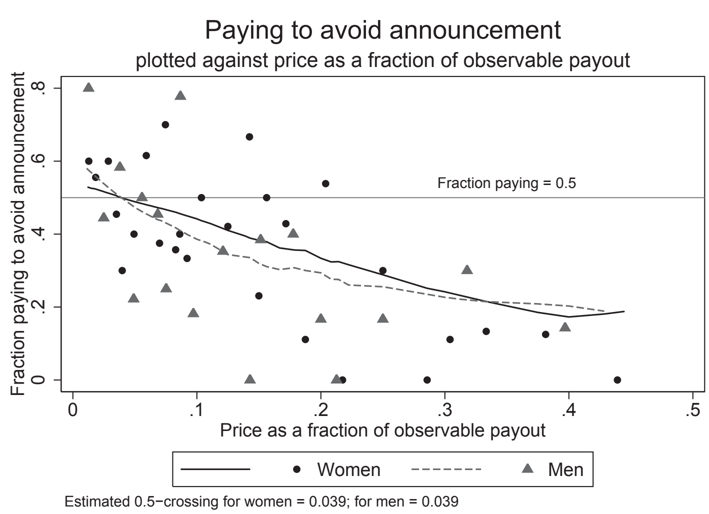
Standard errors in parentheses. *** indicates significance at the 99 percent level; ** indicates significance at the 95 percent level; and * indicates significance at the 90 percent level. Sample includes one observation per village. A constant is included in all specifications. **HH Assets** is the average of the log value of durable assets owned by households. **Formal Job** is the fraction of participants with formal, skilled, and/or professional employment. **Wages** is the average of wages received from paid work over the last month in US dollars; wages are set to zero for subjects with no paid employment. **Fertilizer** denotes the fraction of households engaged in agricultural that used fertilizer over the previous twelve month period. All specifications include controls for the distance to the nearest paved road and the mean education level, mean number of close relatives, and mean number of community groups across all experimental subjects from a given village.

Results: Paying to Avoid the Public Announcement

Paying to Avoid the Public Announcement

	Small Budget	Large Budget	Entire Sample
Able to Pay	0.832	0.986	0.909
Buys Out	0.247	0.350	0.303
Income Fraction Paid	0.201	0.124	0.153

Paying to Avoid the Public Announcement



Estimating the Extent of Social Taxation

Estimating the Extent of Social Taxation

Impact of τ on investment depends on risk aversion

- Individual ρ_i parameters are unobserved
- We only observe the distribution of choices in private treatments

Assume ρ is distributed normally with mean μ_ρ and variance σ_ρ^2

$$P_{ij} = \int \left(\frac{e^{EV_{ij}(\rho)/\sigma_\varepsilon}}{\sum_{k=1,\ldots,J_t} e^{EV_{ik}(\rho)/\sigma_\varepsilon}} \right) f(\rho)\, d\rho.$$

- Simulate the integral following methods described in Train (2003)
- Results robust to alternative functional form assumptions

▸ Likelihood Function

Estimating the Distribution of ρ Parameters

Write the CRRA utility function as

$$v(x|\rho_i) = \frac{1}{\eta_i} x^{1-\rho_i},$$

where $\eta_i = 900^{1-\rho_i} - 10^{1-\rho_i}$ (see Goeree et al (2003))

Standard CRRA formulation leads to different scales for EV_{ij}

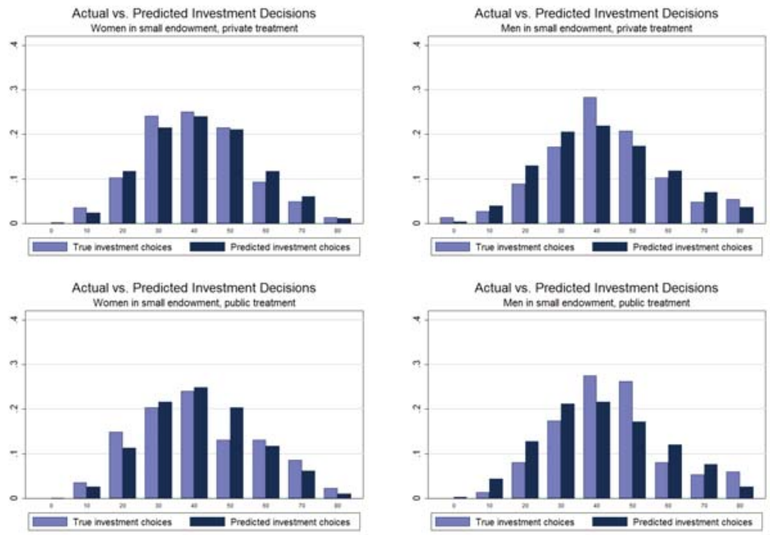
- Von Gaudecker et al (2011) propose replacing EV_{ij} with CE
- Wilcox (2008) proposes contextual utility: scaling factor varies across subjects, depends on each individual's choice set

Estimating the Distribution of ρ Parameters

Scaling:	**QRE**	$1-\rho$	**CE**	**CU**
	(1)	(2)	(3)	(4)
Panel B: Women in Private Treatments				
μ_ρ	0.7562***	0.7972***	0.7589***	0.7617***
	(0.0163)	(0.0150)	(0.0158)	(0.0163)
σ_ρ	0.1994***	0.2355***	0.2011***	0.2046***
	(0.0170)	(0.0115)	(0.0154)	(0.0167)
Panel B: Men in Private Treatments				
μ_ρ	0.7747***	0.8168***	0.7836***	0.7762***
	(0.0233)	(0.0215)	(0.0234)	(0.0232)
σ_ρ	0.2657***	0.2811***	0.2681***	0.2647***
	(0.0225)	(0.0126)	(0.0221)	(0.0217)

Standard errors (calculated using the inverse Hessian) in parentheses. Estimates generated using data from private treatments only. CE estimation is done by replacing expected utilities with certainty equivalents in the likelihood function. CU is identical to (1) except that subjects in the small endowment treatment have their utilities scaled by $400^{1-\rho} - 10^{1-\rho}$.

Estimating the Distribution of ρ Parameters



Parameters to Be Estimated

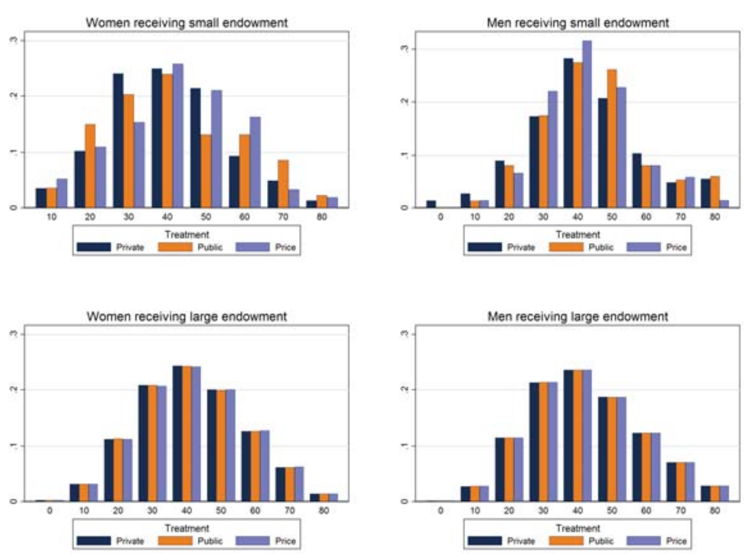
Parameter	Description
μ_ρ	Mean of distribution of CRRA coefficients
σ_ρ	SD of distribution of CRRA coefficients
σ_ϵ	SD of logit error term $(\varepsilon_{ij} - \varepsilon_{ik})$ governing investment decisions
τ	Level of social pressure to share income
γ	SD of logit error term $(\zeta_{ij} - \zeta_{ik})$ governing exit (buy out) decisions

Parameter Estimates

Sample:	— **Women Only** —		— **Men Only** —	
	(1)	(2)	(3)	(4)
μ_ρ	0.7498***	0.7488***	0.7555***	0.7557***
	(0.0108)	(0.0107)	(0.0131)	(0.0132)
σ_ρ	0.2000***	0.1992***	0.2385***	0.2391***
	(0.0116)	(0.0115)	(0.0125)	(0.0125)
σ_ϵ	0.0125***	0.0125***	0.0101***	0.0102***
	(0.0011)	(0.0011)	(0.0012)	(0.0012)
τ	0.0432***	0.0450***	0.0267*	0.0234*
	(0.0124)	(0.0113)	(0.0139)	(0.0134)
γ		0.0588***		0.0623***
		(0.0088)		(0.0122)
Obs.	1298	1298	847	847

Model parameters estimated via mixed logit maximum likelihood. Standard errors (calculated using the inverse Hessian) in parentheses.

Does the Model Fit the Data?



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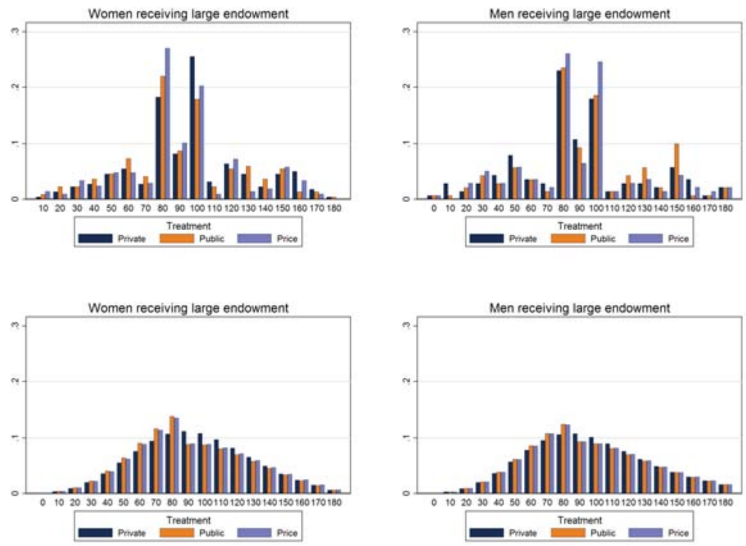
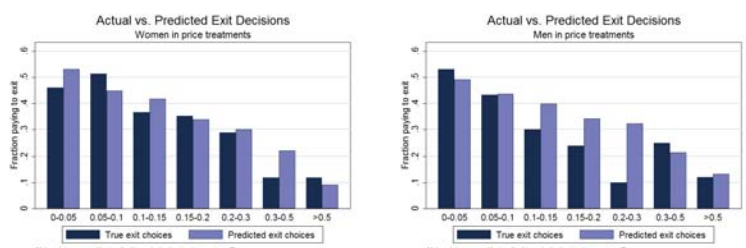


Does the Model Fit the Data?



Parameter Estimates: Kin Presence

Sample:	Women	Men
	(1)	(2)
μ_ρ	0.750***	0.760***
	(0.011)	(0.013)
σ_ρ	0.199***	0.241***
	(0.011)	(0.012)
σ_ϵ	0.013***	0.010***
	(0.001)	(0.001)
$\tau_{no\ kin\ present}$	0.043***	0.027*
	(0.012)	(0.015)
$\tau_{kin\ present}$	0.080**	-0.011
	(0.032)	(0.022)
γ	0.058***	0.062***
	(0.009)	(0.012)

Model parameters estimated via mixed logit maximum likelihood. Standard errors (calculated using the inverse Hessian) in parentheses.

Simulating Entrepreneurship Decisions

- Simulate simple, two-period model of Banerjee et al (2011)
- i decides whether to invest in a microenterprise which yields:

$$A\left(K_i - \underline{K}\right)$$

where K_i is the amount that i invests

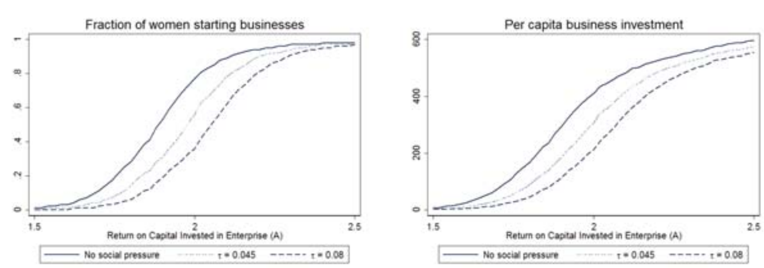
- Thus, i chooses K_i to maximize

$$\frac{1}{\eta_i}\left(y_i - K_i\right)^{1-\rho_i} + \delta\frac{1}{\eta_i}\left(y_i + (1-\tau)A\left(K_i - \underline{K}\right)\right)^{1-\rho_i}$$

Simulating Entrepreneurship Decisions

- Assume villages of 50 percent poor, 50 percent non-poor households
  - Income of poor (non-poor) 800 (1500) shillings per period
  - Based on 30^{th}, 70^{th} percentiles of rural Ugandan income dist'n
- Risk preferences heterogeneous, drawn from our estimated dist'n
- $\underline{K} = 100$, individual decisions based on 100 shilling increments

Simulating Entrepreneurship Decisions



Conclusions

- Experimental subjects reduce their income to keep it hidden
  - Reduced investment levels in profitable projects
  - Impacts concentrated among women hiding income from kin
  - Estimate average "kin tax" just over four percent
- Income hiding in experiment associated with village outcomes
- Additional questions: welfare impacts, non-lab hiding mechanisms, implications for savings behavior and research on "self control"

Likelihood Function

Standard likelihood function for discrete choices:

$$L_t = \prod_{i \in I_t} \prod_{j \in J_t} \left[\int \left(\frac{e^{EV_{ij}/\sigma_\varepsilon}}{\sum_{k=1,\ldots,J_t} e^{EV_{ik}/\sigma_\varepsilon}} \right) f(\rho)\, d\rho \right]^{y_{ij}}$$

Same LL (with different equations for EV_{ij}) for each treatment:

$$LL_t = \sum_{i \in I_t} \sum_{j \in J_t} y_{ij} \ln \left[\int \left(\frac{e^{EV_{ij}/\sigma_\varepsilon}}{\sum_{k=1,\ldots,J_t} e^{EV_{ik}/\sigma_\varepsilon}} \right) f(\rho)\, d\rho \right]$$

Return to Talk