Informal Insurance, Social Capital and Savings Access

Evidence from a lab experiment in the field

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BREAD

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Introduction

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- How do these factors interact?

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  2. Savings in autarky $\Rightarrow$ temptation to renege increases $\Rightarrow$ insurance may be crowded out.

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  - effects by social distance...

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- Understanding *why* social networks matter is confounded by endogeneity of risk-sharing partners:
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  - do social ties mitigate certain market failures?

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- Predictions of LC fit consumption and income data for some villages: Ligon et al.. 2002, Dubois et al.. 2008, Munshi and Rosenzweig 2009

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- 1 and 2 have different implications for theory, policy:
  - 1⇒write/test other models (perhaps non-neoclassical)
  - 2⇒modify/enrich the current model

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- Difficult to rule out without an experiment

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- $\Rightarrow$ players cannot use side transfers to guarantee a certain outcome

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- If behavior matches the model:
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    - estimate magnitude of LC's impact, social capital's role
- Framed field experiment can act as "pilot" to identify important interactions to test in real-life settings (Leider et al.. 2009)

Overview of results

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    - crowdout effect may be greatest where insurance initially works best

Overview of results, cont.

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Overview of results, cont.

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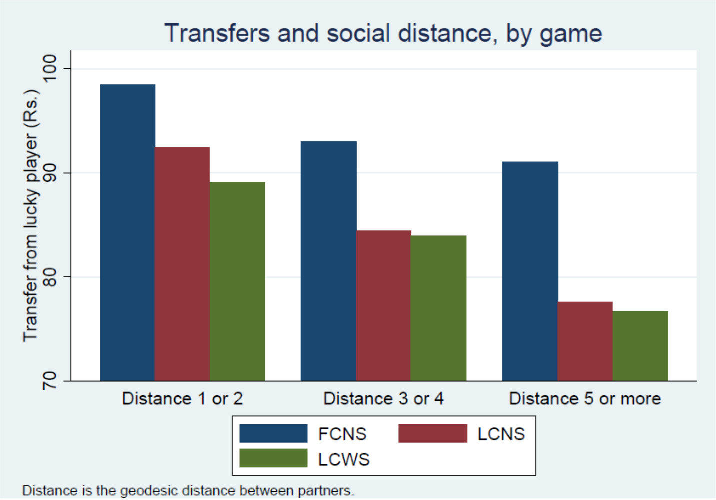
  - allows individuals to smooth risk that cannot be shared interpersonally
  - even those with bad luck see welfare gains from savings access in a LC setting
  - less socially connected households use and benefit from savings most

Overview of results, cont.



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- $\Rightarrow cov(\text{consumption, income}) > 0$

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- All $\Rightarrow$more risk-sharing with socially closer individuals when formal commitment is absent
- Reduced-form capturing all of these possibilities: reneging $\Rightarrow$ cost, depending on social distance to partner, γ_{ij} :

$$\begin{aligned} f &= f\left(\gamma_{ij}\right) \\ f'(\gamma) &< 0 \end{aligned}$$

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  - less interpersonal insurance is possible
- Participation constraints are less likely to bind when partners are socially close, *ceteris paribus*
- $\Rightarrow$socially close pairs should achieve better consumption smoothing, when commitment is absent

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Programming problems

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  - cost of reneging on a socially close partner may be greater
  - networks may facilitate punishments that don't rely on exclusion from insurance

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Goals of experiment

Replicate incentives to smooth risk and to think carefully about choices.

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  - measure incentives to smooth over time with smoothing variability of a one-shot lottery
- High stakes: expected earnings $\sim 1.5\times$ local NREGA (National Rural Employment Guarantee Act) daily wage.

Experimental protocol

Play 3 games (in random order):

- full commitment with no savings (FCNS)
- limited commitment with no savings (LCNS)
- limited commitment with savings (LCWS)

Experimental setup

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- Savings lost if game ends

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  - outcomes: level of transfers, savings; consumption variability; defection
  - mean consumption (almost) constant across treatments⇒consumption variability is a sufficient statistic for welfare
- If models fit, use results to sign ambiguous effects

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Network data

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- Collinearity$\Rightarrow$take undirected union: "social network"

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  - average 164 households in village; 50% completed network survey
  - can observe "friend of a friend of a friend," etc.

Setting

Network data

- Construct social distance between partners (social distance, reachability)
- Geodesic distance from i to j:

$$\gamma_{ij} = \min_{k \in \mathbb{N}} : \left[A^k\right]_{ij} > 0$$

- household i is *reachable* by household j ($\rho_{ij} = 1$) if $\exists$ any path from i to j:

$$\rho_{ij} = \mathbf{1}\left\{\gamma_{ij} < \infty\right\}$$

Setting

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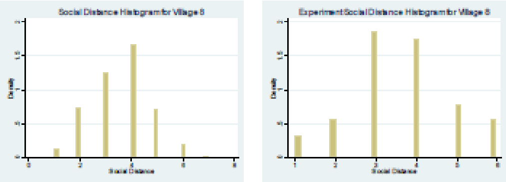

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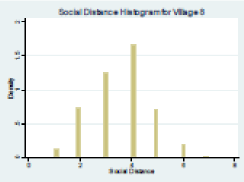

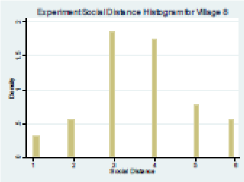

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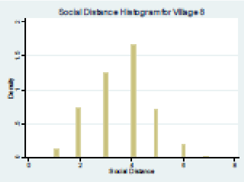

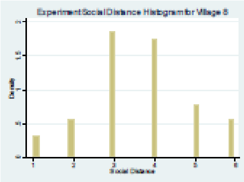

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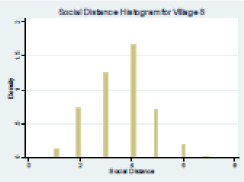
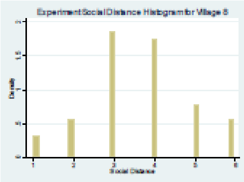
    - $\Rightarrow$ oversample the right tail.





Setting
Participants

- Average age is 30
- 56% of players are female
- Average education level is 7th standard
- 97% of pairs are reachable through the network ($\gamma_{ij} < \infty$)
- Among reachable pairs, average social distance is 3.5, median 4
  - "friend of a friend of a friend of a friend"

Game Play

Estimation

Average effects

- Outcomes at individual-game-round level:

$$\omega_{igr} = \alpha + D_g + X_g'\eta + \phi_i + Z_{ig}'\zeta + \varepsilon_{igr}$$

- Outcomes: consumption abs. deviations $|c_{igr} - \bar{c}_{ivg}|$, savings s_{igr}.
- D_g is game, Z_{ig} - network distance, X_{gr} - experimental controls (game order, etc.)
- For transfers τ_{igr}, defection d_{igr}, restrict sample to individual-game-round obs of "lucky" players.
- Cluster at village×game level, include individual-fixed effects ϕ_i.

Estimation

Effects by social distance

- Allow effects of limited commitment, savings to vary by social distance:

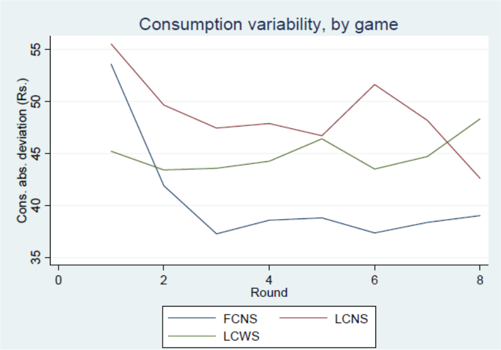
$$\begin{aligned}\omega_{igr} &= \alpha + \beta_1 D_g + \eta_1 \rho\rho_{ij} + \eta_2 \gamma_{ij} \\ &+ \delta_1 D_g * \rho_{ij} + \delta_2 D_g * \gamma_{ij} \\ &+ \phi_i + Z'_{ig}\zeta + \varepsilon_{igr}\end{aligned}$$

Do individuals smooth?

Proposition

Risk-averse individuals prefer less to more consumption variation.

- Smoothing mechanisms (transfers and savings) should be used



Binding constraints–>less insurance

FCNS vs. LCNS

Proposition

When comparing full commitment no savings (FCNS) vs. limited commitment no savings (LCNS), if participation constraints bind, transfers will be lower under LCNS vs. FCNS.

- binding participation constraints reduce transfers and cause consumption variability

Savings access and insurance

Proposition

If participations constraints bind under LCNS, they will be tightened by the introduction of savings (LCWS), crowding out interpersonal insurance.

- $\Rightarrow$ transfers under LCWS will be lower than under LCNS
- Savings access $\uparrow$ value of reneging

Results

Transfers

- Transfers fall by 10% when commitment is removed (LCNS)
  - partially via reduction of promised transfers, partially via players reneging
- Overall fall in transfers due to savings is insignificant

	All rounds	Conditional on no defection
LCNS	-8.99***	-5.612***
	[1.56]	[2.05]
LCWS	-11.26***	-6.207***
	[1.71]	[1.90]
FC Mean	92.35	92.35
St. Dev.	36.3	36.3
N	6369	3845
Adj. R^2	.312	.335

Welfare impact of savings

LCNS vs. LCWS

Empirical question

Is average consumption smoothing better under LCNS or under LCWS?

- Which dominates on average?
  - savings' "pro-insurance" effect, allowing intertemporal smoothing
  - savings' "anti-insurance" effect, tightening participation constraints

Results

Consumption smoothing

- Outcome: consumption absolute deviations $\left|c_{igr} - \bar{c}_{ig}\right|$
- LC binds: consumption smoothing falls when reneging is possible
- Savings access increases welfare (LCWS vs. LCNS)

LCNS	8.87***
	[1.35]
LCWS	4.90***
	[1.37]
LCNS=LCWS	
F-stat (p-value)	10.17 (0.0019)
FC Mean / Std dev	40.9 / 32.1
N	12752

Distributional impact of savings

Empirical question

Do transfers fall differentially across the income distribution due to savings?

- Does savings' pro-insurance or anti-insurance effect dominate for those with "bad luck"?

Empirical question

Is consumption smoothing for those with low income realizations better or worse with access to savings?

- Does savings' pro-insurance or anti-insurance effect dominate for those with "bad luck"?

Transfers

By income level

- Split by terciles of in-game income
- Outcome: transfers received, regardless of income realization
- In middle tercile, LC does not reduce transfers; savings does crowd transfers out

Income percentile	0-33rd	33rd-66th	66th-100th
LCNS	-8.222*	-0.6178	-5.065***
	[4.644]	[1.079]	[1.256]
LCWS	-13.09***	-3.307***	-4.67***
	[3.879]	[1.224]	[1.453]
LCNS=LCWS F-stat	1.7563	7.146	0.1062
p-value	0.1882	0.0088	0.7451
FCNS Mean/Std dev	63.5/52.9	47.1/52.3	33.7/50.2

Consumption smoothing

By income level

- Split by terciles of in-game income
- Even those with "bad luck" gain from savings access in a LC setting

Income percentile	0-33rd	33rd-66th	66th-100th
LCNS	15.53***	4.004**	14.5***
	[3.163]	[1.907]	[2.439]
LCWS	9.968***	4.129**	5.564**
	[3.744]	[1.77]	[2.522]
LCNS=LCWS			
F-stat	3.255	0.0052	14.300
p-value	0.0743	0.9428	0.00026
FCNS Mean	39.7506	40.8573	40.7789
Std. Dev.	31.2281	31.8222	31.7478

Defection

Social capital, limited commitment, savings

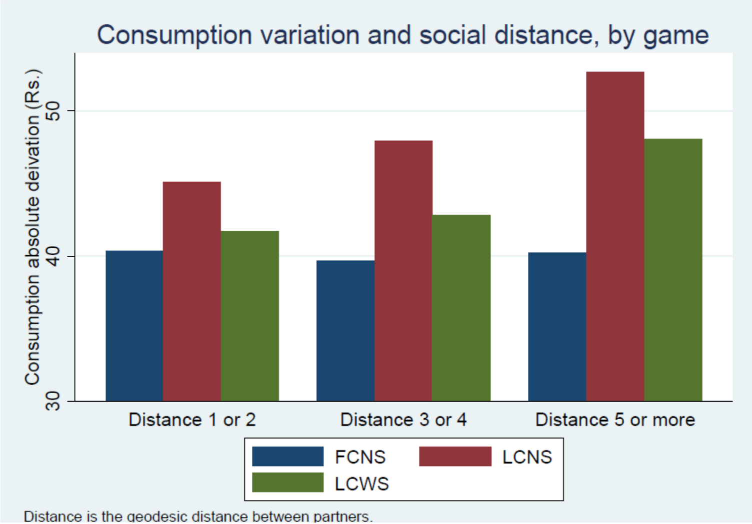
Proposition

Under LCNS, average transfers are lower and consumption smoothing is worse, the more socially distant the pair.

- Participation constraints are more likely to bind.

Effects of social distance

Consumption smoothing



LC impact by social distance

Consumption smoothing and transfers

	Transfers	Cons. Dev.
Lim. comm. (β)	-31.77**	33.00***
	[13.94]	[12.34]
Reachable	-25.02***	17.05*
	[7.705]	[5.99]
Distance	-0.3402	-0.2454
	[1.115]	[.8771]
Lim. commXReachable	34.46**	-34.51***
(δ_1)	[15.04]	[12.38]
Lim. commXDistance	-2.996*	2.744***
(δ_2)	[1.618]	[1.024]

- For non-connected pairs, LC $\downarrow$ transfers by Rs. 32 (β); $\uparrow$ cons dev by Rs. 30
- For closest pairs, LC does not change transfers or cons dev: $\beta + \delta_1 + \delta_2 \approx 0$

Use of savings and social distance

Proposition

Socially distant pairs use savings more than socially close pairs.

- Use of savings$\Rightarrow$ participation constraints bind.

Use of savings and social distance

- Omit individual FEs

	Savings
Distance	.8311***
	[.3224]
Distance=1 mean	23.57
Std. dev	24.76
N	4211

- Socially farther pairs use savings more: 1 unit of distance $\Rightarrow$ Rs. 0.83 more savings

Savings impact by social distance

Empirical question

How does the degree to which interpersonal transfers are crowded out by savings access vary with social distance?

- Opposite effects:
  - Crowdout mitigated by social capital (via sanctions other than insurance exclusion)
  - More social capital$\Rightarrow$ more insurance to crowd out

Financial network only

Savings impact by social distance

Consumption smoothing

	Cons. Dev.
LC w/ savings	-.3133
	[14.41]
Reachable	-14.20
	[13.29]
Distance	1.339
	[.8598]
LC w/ savingsXReachable	-4.631
(δ_1)	[15.55]
LC w/ savingsXDistance	-.0823
(δ_2)	[.9407]

- On net, savings access does not reduce cons. smoothing more for distant pairs, reflecting offsetting use of savings

Do other network moments matter?

Network centrality

- Other aspects of individuals' network position may affect their ability to sustain cooperative behavior

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- when paired with peripheral individuals, central individuals
  - may fear reputational punishment less
  - may expect to interact less frequently with the peripheral partner outside the game
- Focus on eigenvector centrality: best captures importance when information percolates through a network along the edges

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Network centrality

Proposition

Limited commitment will bind more, lowering transfers, the greater the relative eigenvector centrality of the high- vs. the low-income realization player.

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Access to savings will crowd out transfers to a larger extent the greater the relative eigenvector centrality difference of the two players.

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- More central individuals fear reputational punishment less
- $\Rightarrow$more tempted to default when income is high, ceteris paribus

Do other network moments matter?

Network centrality and LC

	Transfers	Cons. Dev.
LCNS	-31.07**	33.28***
	[13.3]	[12.25]
LCNSxE. Vector	-1.67*	.804*
centr. diff.	[.9425]	[.4696]
LCNSxReachable	34.57**	-35.01***
	[14.47]	[12.29]
LCNSxDistance	-3.243**	2.813***
	[1.613]	[1.022]
Control for main effects (evec, reach, dist)?	Y	Y

Do other network moments matter?

Network centrality and savings

	Transfers	Cons. Dev.
LCWS	-4.981	0.3465
	[16.83]	[14.39]
LCWSxE. Vector	-1.562**	0.4189
centr. diff.	[.7697]	[.5257]
LCWSxReachable	1.033	-4.062
	[16.81]	[15.13]
LCWSxDistance	0.5912	-0.0542
	[1.262]	[.9024]
Control for main effects (evec, reach, dist)?	Y	Y

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  - use of savings⇒consumption does not become more variable on net

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  - Distant pairs use, and benefit from, savings more

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- LC matters more, and savings' crowdout is greater, when partners differ in relative centrality (i.e., importance).
- If more central individuals are more likely to learn about and adopt technologies which raise incomes (cf Banerjee at al. 2012), growth may have negative spillovers to the less-central via reduced insurance.

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- Dynamic incentives matter⇒experiments that shut down these incentives may mis-measure levels of risk sharing and effects of frictions

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  - social norms

Programming problem, no savings

$$V^1\left(V^2\left(s_t\right)\right) = \max_{\tau^1(s_t),\{V^2(s_{t+1})\}_{s\in S}} \left\{ \begin{array}{c} u\left(y^1\left(s_t\right)-\tau^1\left(s_t\right)\right) \\ +\beta\mathbb{E}_{s_{t+1}} V^1\left(V^2\left(s_{t+1}\right)\right) \end{array} \right\} \tag{1}$$

s.t.

$$\lambda : u\left(y^2\left(s_t\right)+\tau^1_t\left(s_t\right)\right)+\beta\mathbb{E}_{s_{t+1}} V^2\left(s_t\right) \geq V^2\left(s_t\right), \forall\ s_t \in S \tag{2}$$

$$\phi_{2t} : V^2\left(s_t\right) \geq V^2_{A,NS}\left(s_t\right), \forall\ s_t \in S \tag{3}$$

$$\phi_{1t} : V^1\left(V^2\left(s_t\right)\right) \geq V^2_{A,NS}\left(s_t\right), \forall\ s_t \in S \tag{4}$$

Autarky without savings

$$V^i_{A,NS}(h_t) = u\left(y^i(s_t)\right) - f\left(\gamma_{ij}\right) + \beta \mathbb{E}_{h_{t+1}} V^i_{A,NS}(h_{t+1}) \quad (5)$$

where

$$\begin{aligned} f &= f(\gamma) \\ f(\gamma) &\geq 0, \forall \gamma \\ f'(\gamma) &< 0 \end{aligned} \quad (6)$$

Therefore,

$$\frac{\partial V^i_{A,NS}(h_t)}{\partial f\left(\gamma_{ij}\right)} < 0$$

Effect of social ties

$\phi_{it} \equiv$ Lagrange multiplier on i's time t participation constraint. Taking expectations over the possible states of nature at t:

$$\frac{\partial \mathbb{E}_{t-1}\phi_{it}}{\partial f(\gamma_{ij})} < 0. \tag{7}$$

FOCs (2), (4) and (3) yield the relationship between i and j's marginal utilities, as a function of i's relative bargaining power λ_{it} :

$$\lambda_{it} = \frac{u'(y_{jt} + \tau_t^j)}{u'(y_{it} + \tau_t^i)} \tag{8}$$

and updating rule for the multiplier on i's time t promise-keeping constraint:

$$\lambda_{i,t+1} = \lambda_{it}\left[\frac{1+\phi_{i,t+1}}{1+\phi_{j,t+1}}\right] \tag{9}$$

Effect of social ties

Ratio of i and j's time $t+1$ marginal utility:

$$\frac{u'(y_{j,t+1} - \tau^i_{t+1})}{u'(y_{i,t+1} + \tau^i_{t+1})} = \frac{u'(y_{jt} + \tau^j_t)}{u'(y_{it} + \tau^i_t)} \left[\frac{1 + \phi_{i,t+1}}{1 + \phi_{j,t+1}} \right] \tag{10}$$

- The more often i or j have binding participation constraints, the more each player's consumption $c_{it} = y_{it} + \tau^i_t$ is expected to vary.

Effect of social ties

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- When participation constraints are more binding, less interpersonal insurance is possible
- Players will on average transfer less to each other under limited commitment when they are more socially distant
- Consumption is more variable under limited commitment when partners are more socially distant

Programming problem, with savings

$$V^1\left(V_t^2\left(s_t\right)\right) = \max_{\tau^1(s_t),\left\{V_{t+1}^2(s_{t+1})\right\}_{s\in S}} \left\{ \begin{array}{c} u\left(y^1\left(s_t\right)-\tau^1\left(s_t\right)\right) \\ +\beta\mathbb{E}_{s_{t+1}} V^1\left(V_{t+1}^2\left(s_{t+1}\right)\right. \end{array}\right.$$

s.t.

$$\begin{aligned}
\lambda &: u\left(y^2\left(s_t\right)+\tau_t^1\left(s_t\right)\right)+\beta\mathbb{E}_{s_{t+1}} V_t^2\left(s_t\right) \geq V_t^2\left(s_t\right), \forall\ s_t \in S & (12)\\
\beta\phi_t &: V_t^2\left(s_t\right) \geq V_{A,S}^2\left(s_t\right), \forall\ s_t \in S & (13)\\
\beta\mu_t &: V^1\left(V_t^2\left(s_t\right)\right) \geq V_{A,S}^2\left(s_t\right), \forall\ s_t \in S & (14)\\
\psi_1 &: y^1\left(s_t\right)-\tau_t^1\left(s_t\right) \geq 0, \forall\ s_t \in S & (15)\\
\psi_2 &: y^2\left(s_t\right)+\tau_t^1\left(s_t\right) \geq 0, \forall\ s_t \in S & (16)
\end{aligned}$$

Autarky with savings

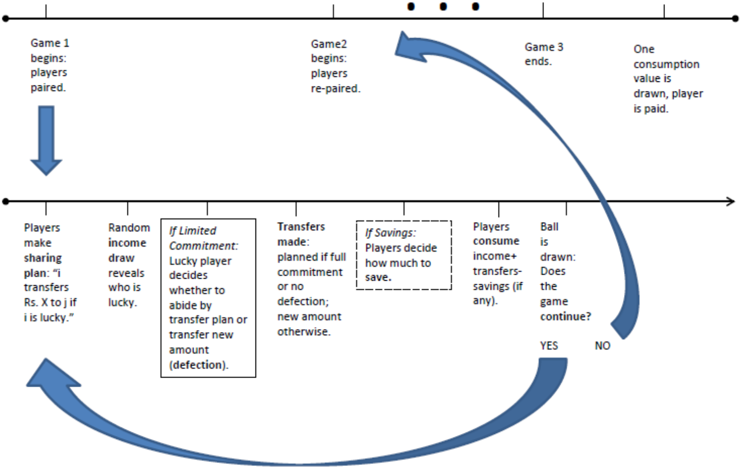
$$V_{A,S}^{i}\left(h_t, z_{t-1}^{1}\right) = \max_{z^i(h_t)} \left\{ \begin{array}{c} u\left(z_{t-1}^{i} + y^{i}\left(s_t\right) - z_t^{i}\left(h_t\right)\right) - f\left(\gamma\left(i,j\right)\right) \\ +\beta \mathbb{E}_{h_{t+1}} V_{A,S}^{i}\left(h_{t+1}, z_t^{1}\right) \end{array} \right. \tag{17}$$

Therefore,

$$\frac{\partial V_{A,S}^{i}\left(h_t, z_{t-1}^{1}\right)}{\partial f\left(\gamma\left(i,j\right)\right)} < 0. \tag{18}$$

Back

Experimental timeline



LC impact by social distance

	Financial network only	
	Transfers	Cons. Dev.
Lim. comm. (β)	-18.12***	19.98***
	[6.45]	[5.93]
Reachable	6.306	4.091
	[7.172]	[4.675]
Distance	-0.5509	-0.4076
	[.6684]	[.5209]
Lim. commXReachable	17.72**	-20.38***
(δ_1)	[8.786]	[6.414]
Lim. commXDistance	-1.721	1.924**
(δ_2)	[1.165]	[.8086]

- For non-financially connected pairs, LC $\downarrow$ transfers by Rs. 18 (β); $\uparrow$ cons dev by Rs. 20
- For financially-closest pairs, LC does not change transfers or cons dev: $\beta + \delta_1 + \delta_2 \approx 0$

Savings impact by social distance

Financial network only

	Cons. Dev.
LC w/ savings	-4.11
	[4.552]
Reachable	-17.02***
	[5.641]
Distance	1.358*
	[.7345]
LC w/ savingsXReachable	3.08
	[6.299]
LC w/ savingsXDistance	-0.6699
	[.8096]

- On net, savings access does not reduce cons. smoothing more for financially distant pairs

Uninsurable risk

Proposition

If players share risk due to insurance motives, realizations of the initial endowment should not be insured.

- information revealed before the insurance contract is "signed" cannot be insured
- the high endowment individual should consume Rs. 30 more than the low endowment individual
- sharing of endowments gives a bound on non-insurance motives

Is the endowment insured?

- Players receiving high endowment (Rs. 60 vs. Rs. 30) consume Rs. 29.24 more

High endowment	29.24**
	[13.93]
No comm.	-3.235
	[15.91]
No commXHigh end.	-6.334
	[18.5]
Reachable	4.929
	[61.04]
Distance	15.84
	[17.91]
LC mean	909.22
Std. dev	150.03
N	1222

Eigenvector centrality

- The eigenvector centrality of a household in a village corresponds to the ith entry of the eigenvector which corresponds to the maximal eigenvalue of the adjacency matrix representing the network.
- It is the solution to

$$A(G)\xi = \lambda\xi$$

  where $\lambda(G)$ is the maximal (magnitude) eigenvalue
- ξ delivers the centrality value.

Defection

Empirical question

Does defection occur when individuals make informal agreements to share risk?

Empirical question

If defection is observed, what type of punishment do individuals use?

Response to defection

- Punishment occurs but is mild relative to GT; similar for close and distant pairs

Defection	-10.73**
1 Period Ago	[5.075]
Defection	-8.315**
2 Periods Ago	[3.727]
Defection	-6.714
3 Periods Ago	[4.778]
Defection	0.0999
4 Periods Ago	[3.34]
Reachable	-0.0368
	[18]
Distance	0.1502
	[2.052]
Defection rate	23%
N	884
Adjusted R^2	0.4638

Response to defection