The demand for insurance under limited trust

Experimental evidence from Kenya

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A puzzle

Risk, and its mitigation, are important sources of welfare losses in developing countries.

- Health and income shocks have long-lasting effects; risk mitigation leads to foregone opportunities; costs of participation in informal insurance networks may restrict investment opportunities.

So why is demand for both indemnity and index-based insurance products so low?

And why is this demand *particularly* low among individuals who are more risk averse?

Trust and insurance demand

We argue that limited trust in insurers—in particular, the fear that claims will not be paid in the event of a loss—can explain these outcomes, and suggests policies to improve outcomes.

To do so, we:

- develop a model that yields these stylized facts, and further testable predictions, in the demand for indemnity insurance;
- test predictions of this model by combining data & experimental variation from a RCT with an accompanying baseline laboratory experiment in the field.

We show that trust is a binding constraint, and is distinct from the problem of financial literacy.

Three contributions:

1. Extend theoretical work on other contracts and products to developing-country indemnity insurance
   - Doherty and Schlesinger (1990); Clarke (2011); Mobarak and Rosenzweig (2013).
2. Provide evidence of policy-relevant constraints to the uptake of financial products.
   - Strong price effects, no impact of financial literacy training, and scope for improvements in trust.
3. Shed light on the role of trust in financial sector deepening and economic development more generally.
   - Cross-country (Knack & Keefer 1995, Zak & Knack 2001) and historical (Nunn 2008, Nunn & Wantchekon 2011) evidence suggests importance.
   - But mechanisms range from political incentives (Easterly, Ritzen & Woolcock 2006) to contract enforcement costs (North 1990).
   - cf. Karlan (2005) on *trustworthiness* and microfinance borrower behavior.

2. A model of insurance demand under limited trust

Insurance demand with limited trust

A simple model

Consider decision to take indemnity insurance at premium cost π against risk that wealth, w, is reduced by fixed amount, c. Loss occurs with probability p.

- Expected utility without insurance is given by

$$W = (1 - p)u(w) + pu(w - c)$$

- If loss occurs, insurer may pay full compensation or default. Agent perceives probability of compensation as $q \in (0, 1]$:
  - a trust problem.
- Expected utility under insurance is then

$$\tilde{W} = (1 - p)u(w - \pi) + p\left[qu(w - \pi) + (1 - q)u(w - \pi - c)\right]$$

  - Under full trust ($q = 1$), actuarially fair insurance ($\pi = pc$), and concave utility, $\tilde{W} > W$.

Insurance demand with limited trust

Decision rule

More generally, insurance is accepted for $q > q^*$, where q^* solves $\tilde{W} = W$:

$$q^* = 1 - \frac{u(w-\pi) - [(1-p)u(w) + pu(w-c)]}{p\,[u(w-\pi) - u(w-\pi-c)]}$$

Proposition 1: for CRRA case, $q^*(R)$ initially decreasing, then increasing, in degree of relative risk aversion, R.

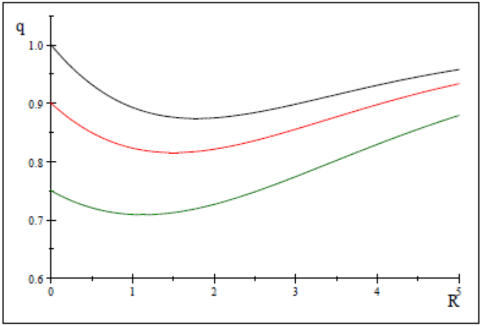


Figure 1: q^* locus for premium with 0% (black), 10% (red) and 25% (green) subsidy

Insurance demand with limited trust

Risk aversion and probabilistic choice

Suppose the probability of purchasing insurance is increasing in the resulting expected utility differential, $\Delta \equiv \tilde{W} - W$

- In general, this is a desirable property of empirical/stochastic choice models. We show that key results extend to the rescaled utility differential of Wilcox (2008, 2011).

Then, the key result of Proposition 1 goes through to this context:

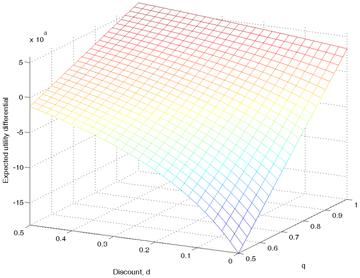
Proposition 2. For large values of R, the expected utility differential, Δ, is decreasing in R.

▸ Proof

Insurance demand with limited trust

Price and trust interactions

Individuals with little (subjective) trust in the insurer (low q) have lower demand, and are more responsive to changes in price.



Proposition 3. Let individuals have utility over net wealth $u(\cdot)$ that is concave and twice differentiable. Then, trivially, $\partial\Delta/\partial q > 0$ and $\partial\Delta/\partial\pi < 0$. Moreover, $\partial^2\Delta/\partial\pi\partial q > 0$.

Proof

Empirical predictions

We take three predictions of the model to data from the lab & field experiment:

Prediction 1. The probability of insurance purchase is either decreasing in risk aversion throughout or is so for sufficiently high risk aversion.

Prediction 2. Potential clients' trust in insurer has a positive effect on the probability that insurance is accepted.

Prediction 3. The probability of insurance purchase is more responsive to price for potential clients with low trust in the insurer.

3. Experimental design

The policy
Bima ya Jamii

We study insurance uptake in a population of Kenyan tea growers.

- *Bima ya Jamii* is a composite health insurance product, offered by CIC Kenya, comprising:
  - In-patient hospital cover (NHIF);
  - Funeral insurance;
  - Disability;
  - Lost income during hospitalization stays for principal member;

  without exclusions for prior conditions.
- Annual premium of KShs 3,650 (approximately USD 41)
- Marketing was undertaken in Wananchi tea centres from April to September of 2010.

Field experiment: factorial design

We study experimental variation along two dimensions:

- At level of tea-collection centre, cluster-randomized assignment to control, marketing only, marketing + financial education.
- Individuals in treatment centres randomly allocated vouchers of 0, 10%, or 20% of premium, with probabilities of 1/3.

	Individual premium vouchers		
Centre-level treatment	No discount	10% discount	20% discount
Control (60)	597	0	0
Marketing only (30)	105	90	102
Marketing + study circles (30)	108	91	100

Notes: Table displays number of survey respondents, by centre-level treatment arm and discount voucher received. Number of tea centres assigned to each centre-level treatment reported in parentheses.

Baseline lab experiments

To test theory, use data from lab-type ('artefactual field') experiment conducted in the field at baseline.

Trust game (Berg et al. 2002) provides a proxy for individuals' trust in others.

Gamble-choice game (Holt and Laury 2002) provides a measure of tea farmers' risk aversion.

Measuring trust

Trust is measured using the trust (aka 'investment') game of Berg, Dickhaut, and McCabe (1995).

'Sender' has an opportunity to allocate some or all of KShs 200 to a 'Receiver'. Any amount sent is tripled. Receiver decides how much, if any, to send back.

We define Senders as exhibiting low trust if they send less than half of the stake to the Receiver—this characterizes 52 percent of the sample.

Details

Measuring attitudes toward risk

The game:

- In a series of 6 tasks, subjects choose between two lotteries (Holt & Laury 2002; Barr 2007; Harrison et al. 2010)
- Each tasks consists of two lotteries, a 'risky' choice with payoffs of (300,0) and a 'safe' choice with payoffs of (100,50).
- Probability of winning the larger prize is the same in each lottery within a given task, and varies from 0.3 to 0.8 across tasks.

We use these choices to estimate coefficients of relative risk aversion for each participant, following Harrison et al. (2010)

- Mean CRRA in our sample estimated at 0.50—cf. Harrison and coauthors' estimate of 0.54.
- Results robust to using simple counts of risky choices).

Each participant plays gain- and loss-framed variations.

Further details

Survey characteristics

Household survey data show Wananchi tea farmers are a population with high potential for insurnace:

They are poor, but not at the extremes of poverty.

- Household monthly consumption is valued at KShs 38,335 (USD 562)

They have some access to informal insurance networks—average borrowing capacity is KShs 10,282—and some experience with foraml insurance (36 percent).

Average household medical expenditure in the past year is KShs 2,676, while the subjective probability of hospitalization and subjective expectation of hospitalization costs are substantially higher (47 percent and KShs 43,298, respectively).

4. Results: Insurance adoption

Empirical results

Here we present main empirical results. A preview:

- Demand is sensitive to price but unaffected by financial literacy training.
- Consistent with theory...

1. Demand for insurance is decreasing in measured risk aversion (Prediction 1)
2. Demand for insurance is lower among low-trust individuals (Prediction 2)
3. The probability of insurance purchase is more responsive to price for potential clients with low trust in the insurer (Prediction 3).

Reduced-form treatments and interactions

	(1)		(2)	
voucher, 10%	0.0726**	(0.03)	0.0622	(0.05)
voucher, 20%	0.112***	(0.04)	0.127**	(0.06)
study circles	-0.0180	(0.04)	-0.0141	(0.05)
voucher, 10% $\times$ study circles			0.0205	(0.07)
voucher, 20% $\times$ study circles			-0.0296	(0.08)
Constant	0.129***	(0.03)	0.127***	(0.04)
Obs	623		623	
H_1: p-value	0.569			
H_2: p-value			0.764	

Notes: Linear probability model. Dependent variable $= 1$ if respondent completed application. Explanatory variables defined as indicators for treatment arms and their interactions. Robust standard errors, clustered by tea-collection center. Test statistics for hypotheses that (H_1) coefficient on voucher of 20 percent is twice coefficient on voucher of 10 percent; and (H_2) interaction effects are jointly insignificant.

Risk, trust, and price in insurance demand

	(1)	(2)	(3)
price	-3.043***	-3.022***	-2.499**
	(0.89)	(0.88)	(1.02)
low trust	-0.425**	-0.431**	-0.856***
	(0.18)	(0.19)	(0.23)
R_{gain}	-0.866**	-0.950**	-0.864**
	(0.38)	(0.42)	(0.38)
R^2_{gain}		-2.405	
		(2.10)	
price × low trust			-3.444*
			(1.88)
study circles	-0.114	-0.124	-0.109
	(0.17)	(0.17)	(0.17)
Observations	458	458	458

Notes: Probit coefficients reported. Dependent variable equals unity if respondent purchased Bima ya Jamii insurance policy. Robust standard errors reported, clustered at tea-centre level. Controls for individual characteristics include logs of household asset values, household size, and respondent age, as well as indicators for the gender of the respondent and whether any household member has post-primary education.

5. Alternative hypotheses: Can a risk confound explain these results?

Trusting behavior and the risk confound

Sender behavior in the trust game may be influenced by other factors—chiefly concerned with risk preferences (Ben-Ner and Putterman 2001, Schechter 2007)

Three reasons to believe the results are consistent with our theory:

1. Trusting and risk-taking behaviors are not correlated in our sample. ▸ More
2. Main results are robust to a range of risk measures (gain vs loss-frame, frequency of risky choices in each) and functional forms. ▸ More
3. If low trust is really just capturing high risk aversion, why are low-trust individuals less likely to purchase insurance at any given price?
   - $\Rightarrow$ Limited trust!

6. Discussion

Discussion

Simple model of insurance demand with limited trust in insurers suggests perceived enforceability of indemnity contracts may impede development of these financial products.

- By contrast, little traction with financial literacy training.

This model is supported by our data and explains stylized facts of observed insurance demand beyond this experiment.

Policies to increase trust particularly urgent:

- This disproportionately excludes those whose poverty makes them more averse to the risk of insurer default:
- precisely those who would stand to gain most from insurance.

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Proof of Proposition 2

We approximate expressions involving terms in x^{1-R} by using only the terms with the lowest values for x.

Differentiating Δ with respect to R then gives:

$$\frac{d\Delta}{dR} < \tilde{p}u(w-\pi-c)\left(\frac{1}{1-R} - \ln(w-\pi-c)\right)$$

$$-pu(w-c)\left(\frac{1}{1-R} - \ln(w-c)\right).$$

Since $\tilde{p} < p$ and $u(w-\pi-c) < u(w-c) < 0$ (provided $R > 1$) a sufficient condition for the right hand side to be negative is

$$\frac{1}{1-R} - \ln(w-\pi-c) > \frac{1}{1-R} - \ln(w-c)$$

and this is true since $\pi > 0$.

Back

Proof of Proposition 3

Proposition. Let individuals have utility over net wealth $u(\cdot)$ that is concave and twice differentiable, and define Δ as the expected utility differential (with versus without insurance).
Then $\partial\Delta/\partial c < 0$, and $\partial^2\Delta/\partial\pi\partial q > 0$.

Proof.
Differentiation of Δ yields

$$\frac{\partial^2\Delta}{\partial\pi\partial q} = p\left(u'(w-\pi-c) - u'(w-\pi)\right),$$

where $u'(\cdot)$ denotes the first derivative of the utility function. By the strict concavity of $u(\cdot)$, this is strictly positive. □

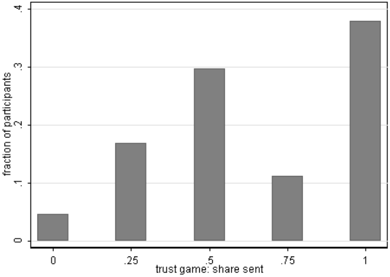
Back

Measuring trust

Trust is measured in a laboratory setting by a trust game (Berg, Dickhaut & McCabe 1995, Barr 2003).

- Delegate and one randomly selected ordinary member play the role of 'trustee' (Player 2); all other survey respondents randomly allocated to play with one of these (as Player 1).
- Player 1 is allocated KShs 200 (approx USD 2.67 at the time), which she can divide between herself and an equally endowed Player 2. Any amount sent to P2 is tripled. P2 then decides how much to return to P1.
- P2 plays by strategy method, with P2 payoffs determined by randomly pairing them with one of the four P1s with whom they play.

Trust game results



- Note the 50% share is modal response in other contexts (see, e.g., Barr 2003 in Zimbabwe); players in our game exhibit relatively high trust.
- We define individuals as displaying 'low trust' if they send less than half of their endowment to the receiver—this characterizes 52 percent of the sample.

◂ Back to trust game overview

Estimation of CRRA coefficients

- EUT with deterministic choice implies that all individuals change their decisions (at most) once as the probability of winning each lottery decreases.
  - 55% of sample exhibit consistent, weakly risk-averse choices.
  - Consequently we estimate CRRA coefficient R by maximum likelihood (see, e.g., Harrison et al. 2010), as follows:

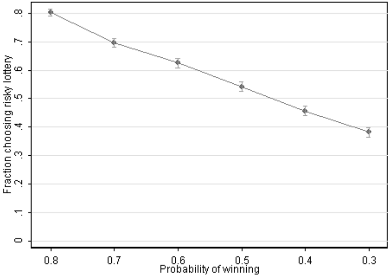
1. For individuals who choose either all safe or all risky lotteries, we choose R so that they are just indifferent in the last lottery.
2. For all others,
   - Given CRRA utility, calculate expected utility: $EU_1(R), EU_0(R)$ for risky, safe lotteries respectively.
   - Embed in Wilcox's 'contextual' stochastic choice model:

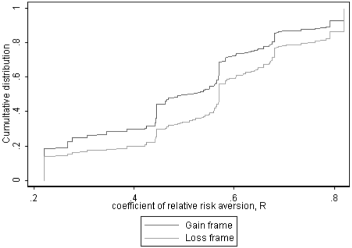
$$D = \mathbf{1}\left\{ \frac{EU_1(R) - EU_0(R)}{u(\bar{x}; R) - u(\underline{x}; R)} + e \right\}, \qquad (6.1)$$

     where $e \sim (N, \sigma_e)$, and $u(\bar{x}; R), u(\underline{x}; R)$ are utility of highest/lowest payoffs resp.; D indicates choice of risky lottery.
   - Wilcox's rescaling ensures that probability of choosing risky lottery is decreasing in R (not true of probit or logit choice!).

Measuring risk attitudes

Gamble-choice outcomes and risk preferences





From set of observed decisions, we estimate coefficient of relative risk aversion for each individual by maximum likelihood.

- Assume CRRA utility of form $u(x) = x^{1-R}/(1-R)$
- Wilcox's (2008, 2011) 'contextual' scaling for stochastic choice.

Go back

Trusting and risk-taking behavior are uncorrelated in the lab

	Low trust	High trust	*p*-value
R_{gain}	0.48	0.50	0.16
	(0.19)	(0.20)	
R_{loss}	0.55	0.56	0.87
	(0.19)	(0.19)	

Notes: Table reports means and standard deviations for alternative measures of behavior in Holt and Laury gamble-choice game, by level of trust. R_{gain}, R_{loss} give fitted coefficient of relative risk aversion from gain- and loss-frame gamble-choice tasks, respectively. *p*-values from test of equality in means, with standard errors clustered by experimental session.

Back

Results are robust to alternative risk measures and functional forms

	R_{gain}	R_{loss}	F_{gain}
Probit coefficients			
price	0.24	-2.53	-0.76
	(1.78)	(1.79)	(1.58)
low trust	-1.10***	-1.05***	-1.05***
	(0.28)	(0.26)	(0.28)
price$\times$ low trust	-5.19***	-4.36**	-4.35**
	(2.01)	(1.84)	(2.05)
Marginal effects			
high trust: $\partial \mathrm{E}[Y]/\partial\pi$	0.06	-0.65	-0.18
	(0.43)	(0.46)	(0.39)
low trust: $\partial \mathrm{E}[Y]/\partial\pi$	-0.67**	-0.91***	-0.67**
	(0.30)	(0.34)	(0.32)
Observations	453	453	453

Each column controls for a fourth-order polynomial in a measure of risk aversion, and its interaction with price. These are the fitted coefficient of relative risk aversion from the gain-frame (column 1) and loss-frame (column 2) HL series, and the fraction of safe lotteries chosen in the gain-frame HL series (column 3). Back