Endogenous Insurance and Informal Relationships

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The Idea

- "Informal institution": multi-purpose relationships with peers vs. external, single-purpose entity
  - Characterize formation and composition
  - Interaction and evolution with "formal" institutions, policies
- This paper: informal insurance
  - Managing risk is a huge part of life: relationships fundamental to risk-sharing
  - Model of *endogenous matching* between heterogeneously risk-averse people who lack formal access
    - Ex ante: choose what risk to face
    - Ex post: choose how to smooth a given risk

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1Rosenzweig (88), Alderman and Paxson (92), Udry (94), Townsend (94)
Examples from the Literature

- **Households**: farmer with riskier income marries daughter to farther village (Rosenzweig and Stark (89))
  - relationships used to manage risk
  - risk prefs matter: "Heterogeneity in risk preferences does appear to jointly influence both realized profit variability and ex post income insurance arrangements."

- **Sharecropping**: landlords and farmers match
  - multi-purpose: mutual insurance provision on top of incentives (Stiglitz (74), Dubois (01))
  - negative-assortative in risk preference (Ackerberg and Botticini (02))

- **Risk-sharing/joint liability groups** (Attanasio et al. (12), Giné et al. (10))
  - positive-assortative in risk preference
**Short Overview**

- **Literature**: Network, group formation *exogenous*
  - Fix network links between agents: what is the extent of risk-sharing?
  - Fix a group of agents and a contracting environment: what risk-sharing arrangement results?

- **This paper**:
  - Understand which groups form in the first place
  - Choices within relationships also endogenous - insurance in eqm network vs. within one isolated group
  - Connection with outcomes such as income inequality, entrepreneurship, firm structure
  - Policy evaluation and design:
    - general eqm effects, precisely account for impact on and through informal institutions: *intro formal insurance*
    - policies affecting flexibility of network and choices: *sharecrop tenancy, wage laws*
Roadmap

- The Model
  - Setup
  - Sketch of Solution Approach
  - Main Results
  - Falsifiability
- Policy Evaluation
- Richer Group Formation
- Conclusion
The Model

The Population

- Two groups of agents, $G_1, G_2$, with CARA utility: $u_i(x) = -e^{-r_ix}$
  - $G_j = \{r^j_1, ..., r^j_N\}$, $j = 1, 2$, $r_i > 0$, $N \in \{2, 3, \ldots\}$ finite
  - Define: $R_i \equiv \frac{1}{r_i}$ risk tolerance of $i$
  - No distribution assumptions on $r$

- $r_1 \in G_1$, $r_2 \in G_2$ match and jointly choose\(^2\) (landowner-farmer, investor-entrepreneur):
  - riskiness of income distribution: project $p$ from a set $\Pi \subseteq \mathbb{R}_0^+$
  - riskiness of consumption stream: return-contingent sharing rule $s(Y_p)$, $Y_p$ return of project $p$ (no LL)

- **Extensions**: $|G_1| \neq |G_2|$, larger groups

\(^2\)WLOG: equiv to individuals choosing own income, then matching and sharing pooled income
Output and Risk

- A project $p \geq 0$ returns$^3$

$$Y_p = p + V(p)^{\frac{1}{2}} Y$$
$$Y \sim F(y), \Omega(Y) = (-\infty, \infty)$$
$$E(Y) = 0, V(Y) = 1$$

- $V(0) = 0$ (benchmark safe), $V(p) > 0$ for $p > 0$
- $V'(0) = 0$, $V'(p) > 0$ for $p > 0$: **higher $p = higher mean, higher variance**
- Project returns can be correlated across groups, but no scarcity, externalities

- Family of distributions includes Normal, Laplace, Logistic, GEV, etc. (skewed, symmetric)

$^3$See Wang (2013) for effect of moral hazard
Information and Commitment

- **Perfect information:**
  - All agents know the game (e.g. no disagreement about return distributions)
  - All agents know all risk types
  - Both members of a pair perfectly observe their realized output

- **Perfect commitment:**
  - A matched pair \((r_1, r_2)\) can commit *ex ante* to a return-contingent sharing rule \(s(Y_P)\) (subject only to resource constraint)

Imperfect info, commitment usually key theoretic characteristics of informal insurance; shut down to focus on endogeneity.
Equilibrium

- **Match function** $\mu(\cdot)$:
  - Distinct $r_1 \in G_1$ is matched with a distinct $r_2 \in G_2$
  - No blocks (stability)

- Optimal *sharing rule* and *project choice* in each match

- *Unique* eqm match pattern: the only match such that any change would lead to stability violation

- Match patterns
  - positive-assortative match (PAM): $i^{th}$ least risk-averse in $G_1$ with $i^{th}$ least risk-averse in $G_2$
  - negative-assortative match (NAM): $i^{th}$ least in $G_1$ with $i^{th}$ most in $G_2$
Summary: Solution Approach

- Non-transferable utility (NTU) difficult: different $r \Rightarrow$ additional output unit generates different increases in utility levels
- Derive a transferable utility (TU) representation of this problem
  - Focus on a hypothetical matched pair $(r_1, r_2)$: identify eqm sharing rule and project
  - Characterize eqm certainty equivalents (CE) as a function of group’s rep risk tolerance $R$, given these choices
  - Show transferability of a matched group’s summed CE (expected utility)
- Identify conditions under which CE exhibits increasing/decreasing differences in $R$
  - Re-express CE using cumulant-generating function of distribution of eqm project returns
Main Matching Results

- **Equilibrium matching when agents can only smooth income:** PAM, unique
  - Aligns with experimental finding of Attanasio et al. (12) and Gine et al. (10): agents are PAM when they can choose the riskiness of the gamble, but sharing rule is fixed at equal division.

- **Equilibrium matching when agents can only smooth consumption:** NAM, unique
  - Aligns with theoretical finding of Legros and Newman (07), Schulhofer-Wohl (06), and Chiappori et al. (06), and the empirical finding of Ackerberg-Botticini (02), where income distribution was fixed but landlord–tenant pairs chose sharing rules
Equilibrium matching when agents smooth both income and consumption:

- $M(p) \equiv V'(p)$: "marginal variance cost" of increasing mean $p$
- $M''(p) > 0 \Rightarrow$ !NAM: marginal variance cost *convex*: intensely risky environment
- $M''(p) < 0 \Rightarrow$ !PAM: marginal variance cost *concave*: less risky environment
Main Matching Results

- **Corollary 1:**
  \[ M''(p) > (\leq 0) \iff \text{Sharpe ratio decreasing (increasing) in } p \iff \text{NAM}, \text{PAM} \]
  
  \[ \text{Recall: } SR = \frac{p}{\sqrt{V(p)}} \], reciprocal of coeff of variation

- **Corollary 2:**
  \[ M''(p) > (\leq 0) \iff \text{mean returns of eqm projects } p^*(R) \text{ concave (convex) in rep risk tolerance } \iff \text{NAM}, \text{PAM} \]
  
  Can use this to falsify theory with data on network links, risk attitudes, and mean incomes

- **Corollary 3:**
  \[ M''(p) > (\leq 0) \iff \text{individual income inequality minimized (maximized) } \iff \text{NAM}, \text{PAM} \]
  
  income inequality: variance, dispersion, max-min
Price Stabilization: Institutional Background

- Farmers face a lot of revenue risk when planting at beginning of season
  - Don’t know world price
  - Yield is risky
- Common government policy is to introduce price bands to stabilize prices
  - Venezuela: maize, sorghum, rice
  - Chile: rice, wheat
  - Ethiopia: bananas, grain
  - Colombia, Ecuador, Venezuela: Andean price band system
Policy in the Model

- **Setting**: crop portfolio with slightly higher mean profit comes at steep increase in variance cost
  - crops with higher mean world price face more volatility; crops with higher mean yield are more drought/input-sensitive
  - gov. wants to incentivize choice of more profitable crop portfolios

- **Policy**:
  - reduce revenue variance of each crop by reducing price volatility with price bands
  - reduce variance of a riskier crop by a larger amount: marginal impact of stabilizing crops with already stable prices is relatively small

- This changes the curvature of the mean-variance tradeoff across crop portfolios\(^4\)

- In particular, this could push \( M''(p) > 0 \) to \( M''(p) < 0 \)

\(^4\)See paper for a small model of this effect.
The Hypothetical Policy

- $M''(p) > 0 \implies M''(p) < 0$: NAM to PAM:

\[
V_{pre}(p) = p^{2.1} \quad (V''' > 0), \quad V_{post}(p) = p^{1.9} \quad (V''' < 0): \text{ want change in curvature, not levels, to isolate effect of accounting for endog}
\]

- Partnerships stay fixed at NAM $\Rightarrow$ each partnership is better off. **Strict Pareto improvement.**
Endogenous Network Response: Account for Change to PAM

- More risk-averse are harmed; less risk-averse are helped at their expense
- The most risk-averse agents are harmed the most: inequality exacerbated
- Comparing means of projects and expected utilities of partnerships pre- and post-:
Takeaway

- Least risk-averse abandon role as *informal insurer* in relationship with more risk-averse to join less risk-averse in *entrepreneurial* partnership
- Least risk-averse paired with each other can take advantage of decreased agg risk and start high mean projects
- But more risk-averse paired with each other cannot consumption-smooth $\rightarrow$ rely more on income-smoothing and take up very low-mean projects
  - Inequality increases
  - More risk-averse agents stuck on unprofitable projects
  - This happens despite perfect commitment contracting environment
- Can use empirically-testable conditions to identify environments which are at the "tipping point"
Extend the Model: Larger Groups

- Allow group size itself to be endogenous and look for coalitionally-stable equilibria. Then:
  - $M''(p) < 0 \Rightarrow \text{everyone matches in one big group ("maximal connectedness")}$
  - $M''(p) > 0 \Rightarrow \text{everyone matches in NAM pairs ("minimal connectedness")}$

- **Key points:**
  - Empirical test: different risk environments correspond to different network connectedness
  - NAM "small firms with heterogeneous composition", PAM "one big firm"
  - The price stabilization example can be done in this setting: the most risk-averse may still be much worse off
  - Rigidity in matching (e.g. limitations on group size) affect interaction between formal and informal institutions and welfare impact of policies
  - Contrasts with Genicot and Ray (2003), who find subgroup deviations
Takeaways

- Important to study the eqm network of groups, not just activity within a fixed, isolated group
  - Shows how the possibilities of other relationships determine composition of and choices made within eqm relationships
  - Shows how people endogenously switch between and assume different roles in the informal economy
  - Not just imperfect commitment, info - the constraint of having to use multi-dimensional relationships with peers who are also risk-averse shapes informal and formal activities

- Risk reduction policy:
  - Strict Pareto improvement if status quo relationships stay fixed
  - Endogenous network response: less risk-averse prefer entrepreneurship to being informal insurers
  - Most risk-averse harmed: inequality ↑, "innovation trap"

- Framework has applications beyond insurance: firm and investment structure, committees and governance, public goods