Economics Letters 211 (2022) 110235

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Inequality and risk management: Evidence from a lab experiment in Ghana

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ARTICLE INFO

Article history:
Received 19 July 2021
Received in revised form 18 November 2021
Accepted 11 December 2021
Available online 24 December 2021

JEL classification:
D63
D91
O15

Keywords:
Inequality
Fairness
Risk-management
Experimental games

ABSTRACT

Wealth inequality has been growing throughout the world in recent decades. In this article, I explore the impact of inequality on risk-management decisions in a developing country context. I use a lab-in-the-field experiment that introduces exogenous variation in inequality to investigate the impact of inequality on risk-sharing and insurance uptake decisions. I find that inequality does influence formation of risk-sharing agreements and demand for insurance.

1. Introduction

Wealth inequality remains high in developing countries and has increased globally over the past four decades (Piketty and Saez, 2003; Alvaredo and Gasparini, 2015; Dabla-Norris et al., 2015; Saez and Zucman, 2016; Alvaredo et al., 2017). Significant inequality may influence individual behavior in ways that impact economic development. In fact, inequality appears to erode trust, reduce social and civic participation, and can lead to aspiration failures (Zak and Knack, 2001; Alesina and La Ferrara, 2002; Jordahl, 2007; Corak, 2013; Piketty et al., 2014; Bartling et al., 2015; Genicot and Ray, 2017). I add to this literature by exploring how inequality may influence risk-management.

Risk management is an essential component of economic development as it allows households to avoid poverty traps, smooth consumption, and make the kinds of investments necessary to escape poverty. However, rural communities in developing countries continue to face considerable risks and are unable to fully manage these risks using the tools available to them (Townsend, 1994; Fafchamps and Lund, 2003; Dercon, 2005; Banerjee and Duflo, 2007). Risk can impact intra-community inequality by influencing asset and wealth dynamics, and expose households to poverty traps (Carter and Barrett, 2006; Barrett et al., 2007; Carter and Lybert, 2012; Barrett and Carter, 2013; Thiede, 2014). Inequality may also influence households' ability to manage risk by influencing individual preferences for engaging in risk-sharing networks.

I investigate the impact of inequality on risk-sharing and insurance decisions using a lab-in-the-field experiment in Ghana. The experiment places participants in anonymous pairs and provides each with an initial endowment to be invested in a risky project. Then, participants have an opportunity to manage risk through either risk-sharing or full insurance. The experiment is played with equality and inequality of initial endowments between partners. The inequality is a purely exogenous change in player 2's initial endowment; no change is made to player 1's endowment or to the terms of the risk-sharing offer. Inequality of initial endowments is a proxy for inequality of wealth. In this context, rational choice theory predicts that inequality should have no effect on risk-management decisions. However, I find that an increase in a partner's wealth leads to a reduction in acceptance rates for risk-sharing offers and an increase in adoption of full insurance. Therefore, I demonstrate evidence of a purely behavioral response to inequality that influences risk-management decisions.

The results of the experiment contribute to the literature in two ways. I am among the first to evaluate the impact of inequality on risk-management decisions (Gallenstein, 2021). Moreover, I make important contributions to the literature connecting inequality and economic development (Zimmerman and Carter, 2003; Genicot and Ray, 2017) as well as the literature on the behavioral impacts of inequality more broadly (Fehr, 2018).

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https://doi.org/10.1016/j.econlet.2021.110235
0165-1765/

The remainder of this article is organized as follows. In Section 2, I present a simple model and a set of hypotheses. In Section 3, I describe the experiment. I present the results in Section 4 and conclude in Section 5.

2. Theoretical model

Here, I present a simple model of risk-management decisions. An agent i is anonymously partnered with another agent j and both begin with an initial endowment (wealth), ω_i and ω_j, respectively. Both agents invest this endowment in a risky project that returns $\alpha\omega$ if successful and 0 otherwise ($\alpha = 3$ in the experiment). A success occurs with probability p ($p = 0.7$ in the experiment). There are four possible outcomes: Success–Success(SS), Success–Fail(SF), Fail–Success(FS), and Fail–Fail(FF) occurring with probability $p_{SS} = p^2$, $p_{SF} = p(1-p)$, $p_{FS} = (1-p)p$, and $p_{FF} = (1-p)^2$, respectively. Agent i has the opportunity to share risk with agent j through a fixed risk-sharing agreement defined by a transfer set $T = (\tau_i, \tau_j)$, where τ_i is the transfer from i to j in the SF state and τ_j is the transfer from j to i in the FS state. Moreover, agent i may choose to fully insure, i.e., guarantee an income of $\alpha\omega - \pi$ at the cost of a premium π.

Agent i will accept a risk-sharing offer iff

$$\Delta_{RS} = p_{SS}U(\alpha\omega_i) + p_{SF}U(\alpha\omega_i - \tau_i) + p_{FS}U(\tau_j) - pU(\alpha\omega_i) \geq 0 \quad (1)$$

Agent i will choose insurance over risk-sharing or autarky iff

$$\Delta_{I,RS} = U(\alpha\omega_i - \pi) - p_{SS}U(\alpha\omega_i) + p_{SF}U(\alpha\omega_i - \tau_i) + p_{FS}U(\tau_j) \geq 0 \quad (2)$$

and

$$\Delta_{I,A} = U(\alpha\omega_i - \pi) - pU(\alpha\omega_i) \geq 0 \quad (3)$$

Using this expected utility model, and given T is fixed, wealth inequality between i and j does not influence the risk-management decisions of i as neither decision is a function of j's wealth; I will refer to this observation as the prediction of a rational model of risk-sharing.

Wealth inequality may influence risk management if agents have fairness preferences over the risk-sharing agreement (Barr and Genicot, 2008; Ligon and Schechter, 2012; Gallenstein, 2021). Let η represent fairness preferences and assume agents receive utility from sharing risk that is a function of the agents' endowments and the transfer set: $f(\omega_i, \omega_j, T)$. I assume that $f(\omega_i, \omega_j, T) = \frac{\frac{\tau_j}{\alpha\omega_j}}{\frac{\tau_i}{\alpha\omega_i}} - 1$, where agent i gains(loses) utility when the risk-sharing offer is favorable(unfavorable) relative to the agents' initial endowments.[1] Now, agent i will share risk iff

$$\Delta_{RS} = p_{ss}U(\alpha\omega_i) + p_{sf}U(\alpha\omega_i - \tau_i) + p_{sf}U(\tau_j) - pU(\alpha\omega_i) + \eta\left(\frac{\tau_j\omega_i}{\tau_i\omega_j} - 1\right) \geq 0 \quad (4)$$

It is trivial to see that the derivative of Δ_{RS} with respect to partner wealth is negative ($\frac{\partial\Delta_{RS}}{\partial\omega_j} = -\eta\frac{\tau_j\omega_i}{\tau_i\omega_j^2} < 0$). This implies that an increase in the partner's wealth will make sharing risk less attractive and insurance relatively more attractive.

Based on these observations, I state two hypotheses:

Hypothesis 1. An exogenous increase in the partner's initial endowment will (a) decrease risk-sharing and (b) increase uptake of insurance.

Hypothesis 2. An exogenous decrease in the partner's initial endowment will (a) increase risk-sharing and (b) decrease uptake of insurance.

3. Experimental design and data

To identify the impact of inequality, I implement a laboratory experiment among rural Ghanaian households following the structure of the theoretical model. Here, I discuss the sample and experimental design.

3.1. Sample design

The sample for the experiment is composed of 158 individuals from twelve rural communities in the Upper East Region of Ghana. Individuals participate in one of ten, 16-person, experimental sessions lasting one hour each. Participants are volunteers who respond to verbal invitations made within the sample communities.[2] The sample consists largely of individuals from rural, semi-subsistence, farming households. These households use rain-fed production systems in the unimodal tropical savanna climate of northern Ghana and face notable climate-related agricultural risks (Acheampong et al., 2014). I present descriptive statistics for the sample in Appendix Table A.2.

3.2. Experimental design

The experiment involves one experimental game with four treatments, played in a random order to limit ordering bias. In each treatment, each participant is provided with an initial endowment of Ghana Cedis (GH¢), where participants are randomly assigned to receive either GH¢4 (low-wealth individuals or LWIs) or GH¢8 (high-wealth individuals or HWIs). The initial endowment is invested in a risky project that yields three times the endowment if successful and GH¢0 if unsuccessful. Success is determined by a draw of a colored ball from a bag which contains seven success balls and three failure balls; the expected value of the lottery is GH¢8.4 (GH¢16.8) for LWIs(HWIs).[3] Participants are anonymously paired with another participant in the room for each treatment; partner identities are not revealed during or after the experiment.

Prior to making draws to determine their incomes, participants have the opportunity to make a risk-management decision. In all treatments, the participants can choose to share risks with their partner based on a risk-sharing offer defined by a set of transfers for the SF (transfer from player 1 to player 2) and FS (transfer from player 2 to player 1) states.[4] The risk-sharing offer is defined by the research team, randomly assigned, and does not vary between equality and inequality treatments.[5] Each

1 An alternative model for how wealth inequality may influence risk-sharing is based on inequality aversion (Fehr and Schmidt, 1999), which I explore in Appendix A.6. I find that the experimental results are not consistent with inequality aversion driving the impact of wealth inequality on risk-sharing.

2 The sample is not representative of the region, which limits external validity. However, it is common for laboratory experiments to utilize non-representative, volunteer samples for similar work (Cappelen et al., 2007; Jakiela and Ozier, 2016; Fehr, 2018). In Appendix Table A.3, I compare the sample to statistics from the 2019 Ghana Living Standards Survey and find some comparability with rural farmers in Ghana.

3 \$1 was roughly GH¢5.64 at the time of the experiment. In Appendix A.1, I discuss how the experimental inequality compares to real wealth inequality in the sample. For context, the agricultural daily wage in the area was roughly GH¢10.

4 Each treatment included two rounds: (a) the participant provides a risk-sharing offer, and (b) the participant receives a risk-sharing offer (generated by the research team). Here, I analyze the acceptance decision made in response to risk-sharing offers provided in (b). Further details on (a) and analysis of those decisions are provided in Appendix A.5.

5 The possible risk-sharing offers were (reported as transfer pairs $T = (\tau_i, \tau_j)$ in GH¢): LWIs - (2,4), (4,4), (6,4), (6,8), (8,8), (10,8); HWIs - (4,4), (8,4), (12,4), (12,8), (16,8), (20,8). In Appendix Figure A.1, I present simulation evidence that the results are not driven by these specific offers.

Table 1
Impact of inequality on risk-sharing and insurance. Table 1 presents the impact of inequality on the decision to accept risk-sharing offers (Model 1) and to purchase insurance (Model 2). Each model includes inequality and its interaction with a dummy for high wealth. Moreover, each model includes individual fixed effects.

Variable	Model 1 Accept	Model 2 Insurance
Inequality	−0.089**	0.111**
	(0.041)	(0.047)
Inequality* High Initial Endowment	0.140***	−0.072
	(0.051)	(0.063)
Constant	0.513***	0.63***
	(0.013)	(0.016)
Individual Fixed Effects	YES	YES
R^2	0.05	0.04
Individuals	158	158
N	316	316

$p < 0.1^{*}$, $p < 0.05^{**}$, $p < 0.01^{***}$ Clustered robust standard errors at individual level. Data in Model 1 comes from rounds without the option to choose insurance and data in Model 2 comes only from rounds with the option to choose insurance.

participant can choose to accept or reject the stated offer. In half the treatments, each participant also receives the opportunity to fully insure the risk, such that for those with GH¢4(8), "insurance" locks in an income of GH¢6(12). The experiment also introduces inequality in half of the treatments. Inequality is implemented by changing each participant's partner to another participant, again anonymously, with the opposite initial endowment. Therefore, under equality, LWIs(HWIs) are paired with LWIs(HWIs), but under inequality, LWIs(HWIs) are paired with HWIs(LWIs). At the beginning of each round, participants are informed of their initial endowment and the initial endowment of their partner. All decisions are made in private with an enumerator behind a privacy station.[6] The treatments are summarized as: (1) equality of initial endowments without insurance, (2) equality of initial endowments with an insurance option, (3) inequality of initial endowments without insurance, (4) inequality of initial endowments with an insurance option.

To incentivize the experiment, I use a random lottery incentive mechanism whereby, participants are paid their full earnings, net of any risk management decisions, for a randomly chosen round. At the time of the payout, if a participant chose to share risk in the round randomly chosen for payout, their partner's outcome draw in that round is revealed so that the final payout can be determined.

4. Empirical analysis

I use the following individual-fixed-effects model to evaluate the impact of inequality on the decision to accept the risk-sharing offer and to choose insurance:

$$Y_{i,t} = \beta_0 + \beta_1 I_t + \beta_2(\bar{W} * I)_{i,t} + \upsilon_i + \epsilon_{i,t} \quad (5)$$

$Y_{i,t}$ is the acceptance or insurance decision for person i in treatment t, I_t indicates inequality, $\bar{W}_i$ indicates a high initial endowment, and υ_i is the individual component of the error term. The fixed effect allows the model to rely entirely on within-person variation, therefore controlling for any differences between participants and controlling for different exogenous risk-sharing offers. The results are presented in Table 1.

In Model 1, I find that inequality reduces risk-sharing for LWIs for whom inequality implies an exogenous increase in partner wealth; this supports Hypothesis 1.a. I find the opposite effect on HWIs, for whom inequality implies a reduction in partner wealth, supporting Hypothesis 2.a.[7,8] In Model 2, I find that an exogenous change in partner wealth leads to an increased likelihood of choosing full insurance. This is consistent with Hypothesis 1.b but not 2.b. The result may stem from reduced attractiveness of risk-sharing in the context of inequality, which makes insurance more attractive.

5. Conclusion

In this article, I present results from a lab experiment exploring the impact of inequality on risk-management decisions. I find that an exogenous change in a partner's initial endowment leads to a change in willingness to share risks; thus refuting the rational model. I also find that inequality increases demand for insurance.

These results have important implications. They demonstrate that inequality can have a behavioral impact on risk-management and adds to the limited literature on behavioral consequences of inequality (Genicot and Ray, 2017; Fehr, 2018; Gallenstein, 2021). In light of the importance of risk management for development (Barrett et al., 2007; Carter and Lybert, 2012; D'Exelle and Verschoor, 2015; Gallenstein et al., 2021), these results suggest it may be important to study inequality in developing communities. In fact, risk-sharing may be constrained when members of a community experience an increase in wealth. Demand for costly formal insurance may also increase under inequality, suggesting that agents begin to prefer managing risks on their own when inequality is present; this implies that inequality may lead to greater anti-social behavior (Abbink and Sadrieh, 2009; Abbink et al.). Finally, these results show that addressing inequality could improve communities' ability to manage risk effectively.

The extant literature on the implications of inequality for preferences suggests that inequality may constrain pro-social behaviors related to trust and civic participation (Alesina and La Ferrara, 2002; Gustavsson and Jordahl, 2008; Lancee and Van de Werfhorst, 2012; Bartling et al., 2015). My results suggest inequality may also constrain pro-social behavior in regards to risk-sharing (at least when others' wealth increases). Therefore, these results may be indicative of a broadly applicable behavioral response to inequality and imply that growing inequality could impact risk-sharing elsewhere. Future research should explore the impact of inequality on risk-management in other contexts to identify potential variations across cultures and locations.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

I would like to thank the U.S. Agency for International Development and especially the Feed the Future Innovation Lab for Market Risk and Resilience based at the University of California

6 Anonymity and privacy should ensure results are not affected by social perceptions. Supporting this intuition, in Appendix Table A.7, I report heterogeneous treatment effects by social capital variables and find no variation in the effects.

7 Appendix Table A.7 shows heterogeneous treatment effects for the acceptance outcome variable. Across six variables accounting for wealth, religion, and social capital in the session, there are heterogeneous treatment effects for one, cattle ownership. Results suggest that the differential impact of inequality on HWIs is smaller for those with higher levels of cattle ownership.

8 Note that estimating the impact on HWIs directly (rather than an interaction terms as presented in Table 1) produces a coefficient of 0.051 with a p-value of 0.101.

at Davis for generously supporting this research, [Grant Number RUCA# A14-0028-004]. I would also like to thank Eric Acheampong, William Alale, Richard Alebina, Samuel Asitanga, Thomas Debura, and Anthony Abanga for their diligence and integrity implementing the experimental field work.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2021.110235.

References

Abbink, Klaus, Mascler, David, Mirza, Daniel, 2011. Inequality and Riots - Experimental Evidence, CIRANO-Scientific Publications No. 2011s-10.
Abbink, Klaus, Sadrieh, Abdolkarim, 2009. The pleasure of being nasty. Econom. Lett. 105, 306–308.
Acheampong, Ernest Nti, Ozor, Nicholas, Owusu, Eric Sarpong, 2014. Vulnerability assessment of northern ghana to climate variability. Clim. Chang. 126, 31–44.
Alesina, Alberto, La Ferrara, Eliana, 2002. Who trusts others? J. Public Econ. 85 (2), 207–234.
Alvaredo, Facundo, Gasparini, Leonardo, 2015. Chapter 9 - recent trends in inequality and poverty in developing countries. In: Atkinson, Anthony B., Bourguignon, François (Eds.), Handbook of Income Distribution. In: Handbook of Income Distribution, vol. 2, Elsevier.
Alvaredo, Facundo, et al., 2017. Global inequality dynamics: New findings from WID.world. Amer. Econ. Rev. 107 (5), 404–409.
Banerjee, Abhijit V., Duflo, Esther, 2007. The economic lives of the poor. J. Econ. Perspect. 21 (1), 141–167.
Barr, Abigail, Genicot, Garance, 2008. Risk sharing, commitment, and information: An experimental analysis. J. Eur. Econom. Assoc. 6 (6), 1151–1185.
Barrett, Christopher B., Carter, Michael R., 2013. The economics of poverty traps and persistent poverty: Empirical and policy implications. J. Dev. Stud. 49 (7), 976–990.
Barrett, Christopher B., et al., 2007. Poverty traps and climate risk: Limitations and opportunities of index-based risk financing. SSRN Electron. J..
Bartling, Björn, Weber, Roberto A., Yao, Lan, 2015. Do markets erode social responsibility?. Q. J. Econ. 130 (1), 219–266.
Cappelen, Alexander W., et al., 2007. The pluralism of fairness ideals: An experimental approach. Amer. Econ. Rev. 97 (3), 818–827.
Carter, Michael R., Barrett, Christopher B., 2006. The economics of poverty traps and persistent poverty: An asset-based approach. J. Dev. Stud. 42 (2), 178–199.
Carter, Michael R., Lybert, Travis J., 2012. Consumption versus asset smoothing: testing the implications of poverty trap theory in Burkina Faso. J. Dev. Econ. 99, 255–264.
Corak, Miles, 2013. Income inequality, equality of opportunity, and intergenerational mobility. J. Econ. Perspect. 27 (3), 79–102.
Dabla-Norris, Era, et al., 2015. Causes and Consequences of Income Inequality: A Global Perspective. International Monetary Fund, USA.
Dercon, Stefan, 2005. Risk, poverty and vulnerability in Africa. J. Afr. Econ. 14 (4), 483–488.
D'Exelle, Ben, Verschoor, Arjan, 2015. Investment behavior, risk sharing and social distance. Econ. J. 125, 777–802.
Fafchamps, Marcel, Lund, Susan, 2003. Risk-sharing networks in rural Philippines. J. Dev. Econ. 71, 261–287.
Fehr, Dietmar, 2018. Is increasing inequality harmful? Experimental evidence. Games Econ. Behav. 107, 123–134.
Fehr, Ernst, Schmidt, Klaus M., 1999. A theory of fairness, competition, and cooperation. Q. J. Econ. 114 (3), 817–868.
Gallenstein, Richard A., 2021. Does inequality impede risk management? Evidence from a lab-in-the-field experiment in Ghana, SSRN Working Paper, no. 3886803.
Gallenstein, Richard A., et al., 2021. The impact of index-insured loans on credit market participation and risk-taking. Agric. Econ. 52 (1), 141–156.
Genicot, Garance, Ray, Debraj, 2017. Aspirations and inequality. Econometrica 85 (2), 489–519.
Gustavsson, Magnus, Jordahl, Henrik, 2008. Inequality and trust in Sweden: Some inequalities are more harmful than others. J. Public Econ. 92 (2), 348–365.
Jakiela, Pamela, Ozier, Owen, 2016. Does Africa need a Rotten Kin theorem? Experimental evidence from village economies. Rev. Econom. Stud. 83 (1), 231–268.
Jordahl, Henrik, 2007. Inequality and trust. SSRN Electron. J..
Lancee, B., Van de Werfhorst, H.G., 2012. Income inequality and participation: a comparison of 24 European countries. Soc. Sci. Res. 41 (5), 1166–1178.
Ligon, Ethan, Schechter, Laura, 2012. Motives for sharing in social networks. J. Dev. Econ. 99, 13–26.
Piketty, T., Saez, E., 2003. Income inequality in the United States, 1913–1998. Q. J. Econ. CXVIII (118), 1–41.
Piketty, Thomas, Saez, Emmanuel, Stantcheva, Stefanie, 2014. Optimal taxation of top labor incomes: A tale of three elasticities. Am. Econ. J.: Econ. Policy 6 (1), 230–271.
Saez, Emmanuel, Zucman, Gabriel, 2016. Wealth inequality in the United States since 1913: Evidence from capitalized income tax data. Q. J. Econ. 131 (2), 519–578.
Thiede, Brian C., 2014. Rainfall shocks and within-community wealth inequality: Evidence from rural Ethiopia. World Dev. 64, 181–193.
Townsend, Robert M., 1994. Risk and insurance in village India. Econometrica 62 (3), 539–591.
Zak, Paul J., Knack, Stephen, 2001. Trust and growth. Econ. J. 111 (470), 295–321.
Zimmerman, Frederick J., Carter, Michael R., 2003. Asset smoothing, consumption smoothing and the reproduction of inequality under risk and subsistence constraints. J. Dev. Econ. 71 (2), 233–260.