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Can insurance markets build resilience and reduce the cost of social protection? Theoretical hypotheses and empirical methods for moving forward

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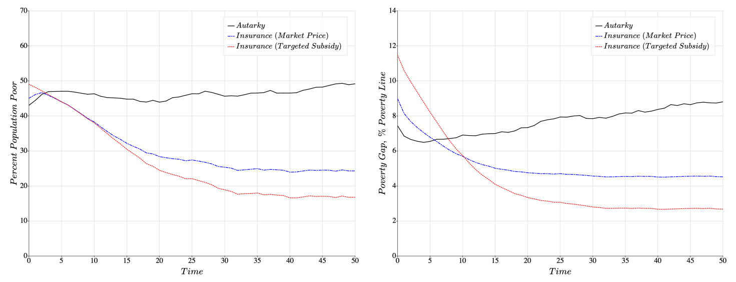
Theory of Insurance Markets & the Cost of Social Protection

- Quickly review key insights from the Janzen-Carter-Ikegami (2020) empirically-calibrated theoretical analysis
- The model assumes that households are forward looking & maximize expected stream of utility:
  - Face credit constraints and risk;
  - Have the option to purchase asset insurance that pays off in bad states of the world;
  - Have full trust and understanding of insurance; and
  - May face a poverty trap technology (focus here on poverty trap case only)

Theory of Insurance Markets & the Cost of Social Protection

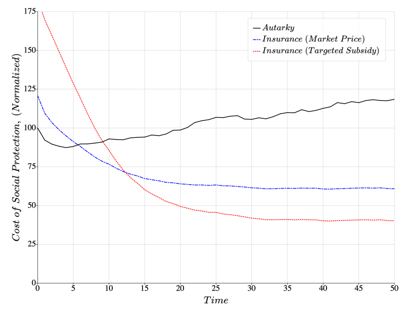
- The analysis highlights three avenues by which insurance can change poverty dynamics & reduce the cost of social protection:
  - By braking the downward economic descent of households, insurance can create a vulnerability reduction or *Resilience* effect
  - By enhancing investment incentives for poor and vulnerable households, insurance creates a *Resilience Dividend* effect
  - Because if can be offered with a partial subsidy, insurance can create a budget match effect that allows government expenditures to go further
- Together, these observations suggest insurance can alter poverty dynamics AND reduce total costs of social protection

Impacts on Poverty Dynamics



- Illustrate 3 policy scenarios:
  - Autarky (no insurance);
  - Insurance at market price generates improvements driven primarily by Resilience effect;
  - Insurance with targeted subsidy offers further improvement, driven primarily by Resilience Dividend effect.

Impacts on Social Protection Expenditures



- Under autarky, government reactively issues cash transfers to all poor households; Cost of social protection is the cost of these transfers
- Unsubsidized insurance market lowers the present value cost of social protection by almost 20%
- Under subsidy program, public expenditures are needed cash transfers plus cost of 50% insurance subsidy loosely targeted to poor and near poor households
- While more expensive the no subsidy program, this program has larger poverty reduction effects & reduces present value of social protection expenditures by 6% compared to autarky case

Aside on Insurance as a Form of Shock-responsive Social Protection

- Insurance is only one form of shock responsive social protection as governments can directly implement scalable or shock responsive social protection programs (see Kenya's HSNP-2 program)
- However, gains illustrated above depend on two things:
  - Reliability (only get Resilience dividend if protection is fully anticipated & trusted *ex ante*)
  - Speedy disbursals
- We have yet to see evidence if government programs can meet these criteria
- There is a related and important discussion on whether government (or NGO) provided scalable social protection should be financed with Sovereign insurance (e.g., ARC contracts) or funded from other fiscal sources. See Carter & Martínez-Sugastti (2023)

From Theoretical to Real World Resilience

- While the theory is suggestive:
  - Can insurance really bolster resilience in the real world
  - And, if it can, how do we empirically measure resilience in the first place?
- So is it possible to move these ideas from the safe confines of economic theory and actually implement them in the real world?

Definition & Measurement of Economic Resilience

- Economic resilience is the ability to manage a shock with "minimal" compromise of current & future economic well-being
- While this definition is imprecise, it does suggest measuring resilience by looking at the degree to which shocks compromise current and future well-being
- From this perspective, resilience measurement requires two things:
  - Observation of the time path of economic well-being during and after a shock; and,
  - A counterfactual measure of what current & future well-being *would have been* without a shock
- Propose here a resilience measure based on these two elements that can be implemented using longitudinal living standards data such as that generated by LSMS, field experiments, etc.
- Show that this measure can be used to answer the policy demand to see if efforts to promote resilience generates a demand for measures that can determine if indeed "an ounce of prevention is worth a pound of cure."

Economics of Sensitivity to Shocks

- The empirical measurement of resilience has unfortunately been distracted by a large-ish literature intent on measuring resilience "capacities" without a conceptually founded measure of resilience itself
- Fortunately, there is a literature that explore the impact of shocks on households' consumption and asset holdings over time that suggests ways of measuring resilience.
- Alloush & Carter (2023) build on that literature and suggest a coherent measure of resilience
- After reviewing that measure, we will illustrate its use to gauge the Resilience & Resilience Dividend Effects of an insurance intervention in Mozambique & Tanzania

A Resilience Metric that Measures What We Mean

- Using a dynamic programming model, we create a simulated data set of 10,000 households observed over 14 seasons
- Households are heterogeneous, endowed with different levels of productive capital and different levels of entrepreneurial skill
- We initially assume that all households are converging toward the same equilibrium income level by building up their assets
- Advantage of this approach is that we randomly introduce shocks so that we can clearly defined resilience with a counterfactual measure based on the time path of those not shocked.

A Resilience Metric that Measures What We Mean

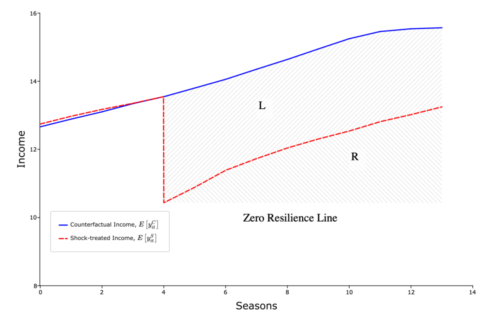
- In season 4, a random sample of 50% of the households in the data set are "treated" with a severe shock that destroys between 40% and 60% of their productive assets:
  - Denote the average or expected income of these shock-treated households in year t as $E\left[y_{it}^{S}\right]$
- The other 50% of households serve as the counterfactual of what current and future well-being would have been without the shock
  - Denote the average or expected income in year t of these control households as $E\left[y_{it}^{C}\right]$
- Can estimate these objects using a standard shock-sensitivity regression framework:

$$y_{it} = (1 - Post_t) \times \left(\sum_{t=1}^{T} \beta_t^c d_t + \beta_t^S \left(S_i \times d_t \right) \right) +$$

$$Post_t \times \left(\sum_{t=1}^{T} \beta_t^c d_t + \beta_t^S \left(S_i \times d_t \right) \right) + \varepsilon_{it}$$

where S_i is binary variable indicating assignment to the shock treatment

Graphical Measure of Resilience



- Graphically, define average resilience as:

$$\bar{R} = 1 - \left(\frac{L}{L+R}\right)$$

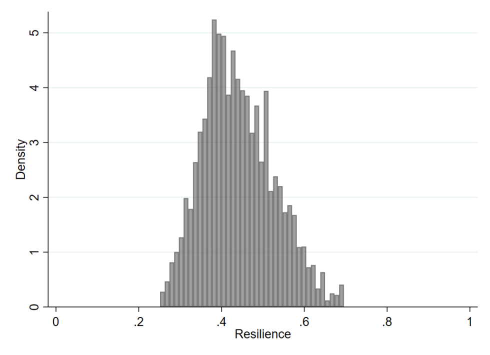
- Note that this measure captures the fraction of the initial income loss that is mitigated
- $\bar{R} = 0$ for a household that never recovers from the shock ($R = 0$), and will approach 1 for a household that recovers immediately ($L = 0$)
- In this case, resilience measure $\bar{R}$ =43%

Individual Resilience

- Define individual resilience as:

$$R_i = \left(\frac{\sum_{t=4}^{14} \left(y_{it}^T(y_{i0}, \alpha_i) - y_{i4}^T(y_{i0}, \alpha_i) \right)}{\sum_{t=4}^{14} \left(\hat{y}_{it}^C(y_{i0}, \alpha_i) - y_{i4}^T(y_{i0}, \alpha_i) \right)} \right)$$

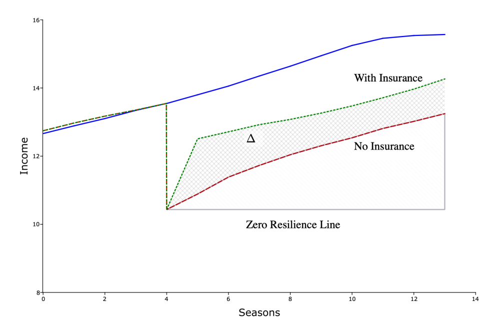
where $\hat{y}_{it}^C$ is the matched counterfactual estimate for person i.
In our simulated data, we use exact matching



Evaluating a Resilience-promoting Intervention

- The government buys every household a catastrophic insurance policy with the following characteristics:
  - Insurance pays nothing for shocks that destroy less than 40% of household assets
  - Insurance pays half the value of any losses over 40%
- Using the probabilities in our underlying model, we can calculate the actuarially fair price of this insurance policy
- In the analysis to follow we assume that the policy is marked up 25% over the actuarially fair price
- We ignore behavioral consequences of insurance (but see Janzen *et al.*, 2021)

Impact of Resilience-promoting Intervention



- Note that area Δ is the average resilience gain.
- For each individual i we can calculate the discounted present value of this resilience gain, which simply the difference between $\tilde{R}_i$ with and without insurance. Summing these across individuals gives the total social benefit

Measuring the Efficacy & Cost-effectiveness of Intervention

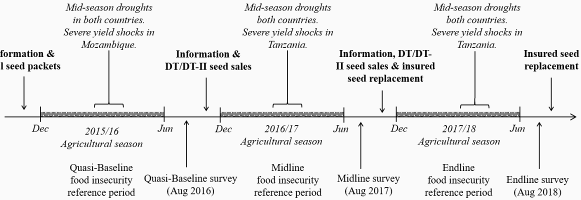
- To measure the cost of the intervention, we assume that the government has been buying the contract for the entire population for a decade. Given that the severe loss events happen about 5% of the time, this gives a fair representation of the cost of the insurance program relative to its benefits (with half the population receiving a shock once in 10 years)

	No Poverty Trap		**Poverty Trap**	
	Autarchy	*Catastrophic Insurance*	*Autarchy*	*Catastrophic Insurance*
Mean Resilience	43%	70%	41%	72%
Benefit Cost Ratio	1.8		2.2	

- In other words, accounting for the cost of money, every dollar spent promoting resilience through insurance returns $1.8 in benefits
- Let's transition to a real world example

Using this Resilience Metric to Evaluate a Real World Resilience Intervention

- Boucher et al. (2023) report on an experiment designed to study the impact of a bundle featuring a genetic technology (drought tolerant maize) and a financial technology (fail-safe index insurance) on small holder farmers in Mozambique & Tanzania
- Study was spatially diversified, within and between countries, to maximize the probability of observing the impact of climate shocks on farmers and the efficacy of the technology bundle



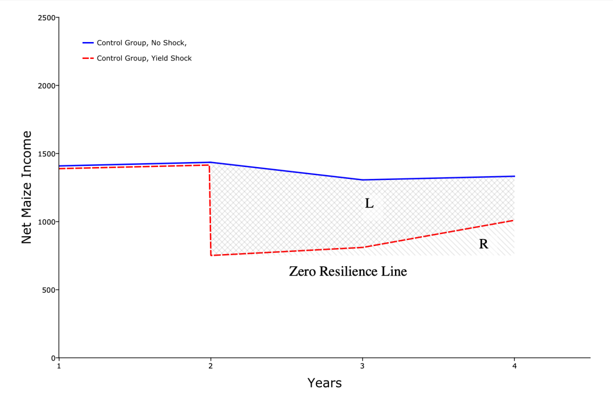
Identifying the Impact of Shocks & Counterfactuals

- Basic ANCOVA regression approach:

$$
\begin{aligned}
y_{ist} = & \left[\beta_1^y d_{ist} + \beta_2^y z_{ist}\right] + \left[\beta_3^y d_{is(t-1)} + \beta_4^y \left(d_{is(t-1)} \times E_t\right) + \beta_5^y z_{is(t-1)} + \beta_6^y \left(z_{is(t-\right.\right. \\
& S_{is} \times \left[\delta_0^y + \delta_E^y E_t + \delta_1^y d_{ist} + \delta_2^y \left(d_{ist} \times E_t\right) + \delta_3^y \left(d_{is(t-1)} \times E_t\right)\right] + \\
& I_{is} \times \left[\gamma_0^y + \gamma_E^y E_t + \gamma_1^y \left(z_{is(t-1)} \times E_{ist}\right)\right] + \\
& \left[\alpha_0^y y_{is0} + \alpha_E^y E_t + \alpha_1^{y\prime} x_{is0} + \nu_s^y\right] + \varepsilon_{ist}^y
\end{aligned}
$$

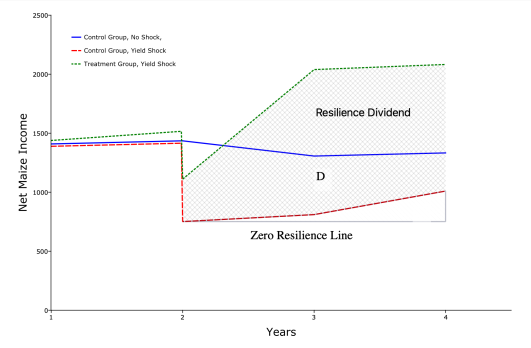
- Using this regression, we can identify a series of predicted outcomes under predicted treatments and exposure to different shocks.

Resilience Measurement for Experimental Control Group



- Immediate impact or a "composite" shock caused a drop of farmer net income from maize from $1500 to about $700
- Recovery is slow, with reduced investment at the intensive and extensive margins the year following the shock
- The resilience measure $\bar{R} = 18\%$, assuming linear recovery trajectory in the post-survey year

Gains from the Genetic/Financial Technology Bundle



- Resilience rises from 18% to 82% (using control group as counterfactual)
- If we value the resilience dividend, we find a benefit-cost ratio of 6.5, where this number comes from assuming that the technology is purchased for 5 years before the shock occurs, and the technology is paid for another 5 years after the shock
- Clearly an ounce of prevention can pay!

Conclusion

- While some prior approaches to resilience measurement seem to confuse resilience with poverty and income distribution dynamics, we have shown here that it is possible to create a resilience measure that captures the what we mean by economic resilience
- The method is also robust to poverty trap dynamics
- Subject to the usual identification concerns, this measure can be used to explore the determinants of resilience and, or measure the impact of interventions on resilience
- A combination controlled/natural experiments illustrates the large resilience gains from a risk management intervention based on insurance
- Many real world challenges to assure that index insurance is really up to the task, but see my discussion tomorrow morning on insurance quality for WB Disaster Risk Finance series

For Further Reading

- Alloush, Mo and Michael Carter (2023). "On the Definition and Estimation of Economic Resilience using Well-identified Counterfactuals," Working Paper, UC-Davis.
- Boucher, S., M.R. Carter, T. Lybbert, J. Malacarne, P. Marenya and L. Paul (2023). "Bundling Genetic and Financial Technologies for More Resilient and Productive Small-scale Farmers in Africa," *NBER Working Paper no. w29234* (revised).
- Carter, Michael R. and Marcos Martínez-Sugastti (2023). "The Economics of Sovereign Index Insurance in Low and Middle Income Countries," Working Paper, UC-Davis
- Janzen, Sarah, Michael R Carter and Munenobu Ikegami (2021). "Can insurance alter poverty dynamics and reduce the cost of social protection in developing countries?" *Journal of Risk and Insurance* 88:293-324.