Technologies to Manage Risk and Assure the Nutritional Benefits of Agricultural Development

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Food consumption declines with incomes in the wake of climatic shocks, especially for poorer households.

Such consumption declines have irreversible consequences for youngest household members.

Financial & agronomic technologies to manage risk are vital if we are to successfully link agriculture & nutrition.

Evidence shows that these risk reduction technologies can both stabilize consumption & crowd-in productive investment (risk reduction dividend).

Looking forward, need to explore these two risk management tools as strategic complements.
Accompanying these income drops are decreases in adult body mass, reflecting decreased food intake.

Female BMI falls more than male, but subsequently recovers.

Food Consumption Tracks Short-term Income Fluctuations, which can have irreversible consequences for the youngest & most vulnerable.

This drop in consumption significantly reduces growth of youngest children.

4 years later no evidence of subsequent catch-up or compensatory growth.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Estimated coefficient on period of observation being 1995–96 (drought cohort)</th>
<th>Asymptotic t statistics based on Huber-White standard errors</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children initially aged 12–24 months</td>
<td>-1.727</td>
<td>2.029**</td>
<td>222</td>
</tr>
<tr>
<td>Children initially aged 24–36 months</td>
<td>-0.745</td>
<td>0.910</td>
<td>209</td>
</tr>
<tr>
<td>Children initially aged 36–48 months</td>
<td>0.068</td>
<td>0.142</td>
<td>239</td>
</tr>
<tr>
<td>Children initially aged 48–60 months</td>
<td>-0.173</td>
<td>0.254</td>
<td>194</td>
</tr>
</tbody>
</table>
Food Consumption Tracks Short-term Income Fluctuations, which can have irreversible consequences for the youngest & most vulnerable, especially for the least well-off households

Average impacts disguise significant heterogeneity

Growth consequences for asset poor households double that of children in better-off households

These results hold even if focus in on below median households who have significant assets (1-2 oxen)
Consumption tracking short-term income stands at odds with (economists’) time-honored idea that consumption follows long-run average, or permanent income, not transitory income.

Why this surprising behavior?

- Proximate explanation is that poor households cannot borrow against future higher incomes to protect current consumption.
- And yet households can also accumulate private savings (assets) to defend consumption against short-term income shocks.
- Still, amongst the poorest we see significant consumption drops long before assets and savings are exhausted.
- Theories of poverty trap provide a coherent explanation.

Label this (understandable) behavior as asset protection—but note that protecting the assets of the current generation can come out the direct cost of the human capital (health & capabilities) of the next generation.

Inter-generational asset shifting might be a better term.
Consumption Smoothing or Asset Protection? Evidence from Zimbabwe

<table>
<thead>
<tr>
<th>Percentage households selling oxen by lagged number of oxen owned</th>
<th>Year observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero oxen owned one year ago</td>
<td>0</td>
</tr>
<tr>
<td>1–2 oxen owned one year ago</td>
<td>7.0</td>
</tr>
<tr>
<td>&gt;2 oxen owned one year ago</td>
<td>23.4</td>
</tr>
</tbody>
</table>
Consumption Smoothing or Asset Protection?
Evidence from Burkina Faso


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Technologies to Manage Risk

While the logic of asset protection that drives down food consumption is clear, so too are its long-term deleterious consequences and its role in the inter-generational transmission of poverty.

What then is to be done if we want to realize nutritional and human development gains of increased average income and food availability?

Two realms of promising innovation that aim to stabilize incomes of rural, food producing households:

- Financial instruments, specifically agricultural micro-insurance
- Stress resistant technologies that fluctuate less (e.g., drought tolerant maize; flood tolerant rice)

While these might appear as substitute mechanisms, emerging evidence suggests they may best be seen as complements.

Let’s look at each of these innovations in turn.
Drought insurance for pastoralists in Kenya launched in 2010
Index based on satellite measure of forage availability (NDVI)

Insurance had payout in October 2011 after a prolonged drought that sparked 30-40% livestock mortality
October 2011 survey asked insured and uninsured households how they had been coping with the drought prior to the payout/survey & how they anticipated coping after the payout/survey

Financial Technologies to Manage Risk
Kenyan pastoralists reduce dependence on costly coping strategies

- Without insurance, upwards of 80% of poor households had cut meals to twice per-day or less to manage drought.

What Impacts does insurance have in this context:

- Initially better off households (expected to be consumption smoothers) show:
  - Before Payout: No impact on consumption reduction nor on asset sales prior to payout
  - After Payout: 65 %-point reduction in asset sales after payout

- Initially worse off households (expected to be asset smoothers) show:
  - Before Payout: 30 %-point reduction in “meals reduced” prior to payout; No impact on asset sales
  - After Payout: 43 %-point reduction in “meals reduced” after payout; No impact on asset sales
Financial technologies that protect households against the worst consequences of droughts and other disasters should also alter the logic of savings and investment strategies (portfolios of the poor).

A ‘risk reduction dividend’ will take place if insurance changes household behavior in these realms, crowding in additional investment in profitable, but risky activities.

If this happens, microinsurance is a win-win, reducing damaging fluctuations while increasing mean income.

What does the evidence say about these behavioral changes?
Randomly offered some farmers insurance at variable prices
Other farmers offered a capital grant for purchasing inputs
Found that farmers offered insurance:
- Expand area cultivated by 15%
- Increase input use by 40%

Capital grants by themselves have little impact

Financial Technologies to Manage Risk
Risk reduction dividend: Cotton producers in Mali invest more when insured

- Designed a dual-scale index contract with radically lower basis risk
- Insurance offered to a random subset of villages—find that in insured villages:
  - Area planted to cotton increases by 40%
  - Matching increases in input investment & incomes (latter large but not statistically significant)
- Currently scaling up in Burkina Faso

An alternative approach to the risk problem is to breed crop varieties that are less sensitive to droughts & other environmental shocks.

Recently released submergence tolerant rice is a good example of this kind of risk reduction technology (variety survives flooding for up to 18 days).

Recent impact evaluation in Bihar, Odisha and West Bengal reveals that:

- Protected yields in severely flooded fields (25% higher)
- Spilled over and led to higher investment and yields overall
- More entrepreneurial savings & investment strategy

Similar logic underlies the Drought Tolerant Maize for Africa (DTMA) breeding efforts.

Impact evaluation soon underway (hopefully!)
Evidence shows that removing risk from agricultural production systems can pay multiple dividends:

1. Technology adoption & income growth
2. Stabilize food demand and avoid costly coping strategies

Yet each of the risk management strategies has its limitations:

1. Microinsurance is relatively expensive
2. Stress tolerant varieties fail in extreme conditions (floods greater than 18 days, or severe drought)

This observation suggests that dual approach may be optimal.
Complementary Technologies
Drought tolerant Maize & Index Insurance

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Conclusion

- Risk has long been known to make and keep people poor
- Recent innovations suggest solutions to this risk problem
- Best solutions may be a combination package of financial & agronomic technologies
- Solving this problem suggests that agricultural can realize its potential to improve nutrition & break the inter-generational transmission of poverty in the natural disaster-prone areas of Africa and South Asia
- To quote my former Wisconsin dean Molly Jahn, we must do better than offer technologies that offer “more tomatoes, most of the time”
Thank you!